

Excavation and Rehabilitation Management Plan

Proposed Hard Rock Quarry,
“Shenton Ridge”
Lot 501 Coalfields Road
Wellington

Shire of Harvey

August 2013



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Lot 501 Coalfields Road
Wellington



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SUMMARY

B and J Catalano have excavated crushed laterite duricrust and gravel from Lot 501 for a number of years and wish to expand their operations by re-opening a small hard rock quarry near the gravel operations to complement the products that can be provided.

Granite hard rock is a valuable community resource and has the capacity to provide an alternative resource to the Bunbury Basalt.

The proposed hard rock quarry is to extract 50 000 to 100 000 tonnes of hard rock per year.

The pit and processing area have been selected to be low in the landscape below the ridge lines to provide screening from the closest dwellings. The closest dwellings are 2.3 kilometres away.

By using sight lines and field observations it is felt that the operation will not be visible from dwellings.

Rock will be extracted by drill and blast with an excavator. A 35 tonne haul truck will take the resource to the processing area where a mobile crushing plant will be used to produce a range of products and a number of stockpiles.

Access will use the same roads as those for the operating gravel pit on Lot 501.

Planning Approval of 20 years is sought to provide long term security, combined with an Extractive Industries Licence with a minimum of at least 5 years.

This document aims to be a practical document that describes the operations and the onsite management. The methods used have been developed by Catalano who have thoroughly researched and investigated the operational and environmental issues.

Catalano makes commitments, continues to use the described procedures and management, and where necessary, changes the procedures when ongoing research or new methods suggest that there are better ways of doing things.

Project Summary

ASPECT	CURRENT DISTURBANCE	FINAL DISTURBANCE
Area of excavation	Current 02. hectares	10 hectares estimated at 20 years.
Processing Infrastructure. Product stockpiles, laydown and related areas	Nil	4.0 hectares
Roads, dams and related infrastructure etc	0.5 hectares	0.5 hectares
Revegetation	Nil	1.0 hectares
Hard Rock extraction	Nil Gravel extraction is licensed.	50 000 – 100 000 tonnes per year
Estimated reserve		1.3 plus million tonnes based on the concept quarry plan.
Life of project		20 plus years
Dewatering requirements		Nil
Maximum depth of excavations	5 metres	20 – 30 metre face

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1.0 OVERVIEW

1.1 Background

Purpose

B and J Catalano have excavated crushed laterite duricrust and gravel from Lot 501 for a number of years and wish to expand their operations by re-opening a small hard rock quarry near the gravel operations to complement the products that can be provided.

Granite hard rock is a valuable community resource and quarries have operated in the area discontinuously for many years.

Currently no granite hard rock is extracted from the Darling Scarp with the closest quarries being in the Southern Metropolitan Area. Basalt is available at Gelorup but there are some purposes for which granite is more commonly used, such as sealing aggregates.

A resource close to the Bunbury Regional area therefore provides an additional product for community use, which has the potential to reduce transport costs and impacts from other current sources.

The granite was examined by C F Swindells in 1982. A copy of the Engineering Geology Report on the hard rock is attached as Appendix 1.

Proponent

The proponent is B and J Catalano, a transport and road making materials supplier specialising in manufactured gravels.

Clients of B and J Catalano include Main Roads, City of Swan, City of Belmont, the Shires of Busselton, Chittering, Northam, Donnybrook, Busselton, Harvey and Augusta-Margaret River, to name a few.

The postal address of B and J Catalano is:

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South West Highway
Brunswick Junction, WA 6530

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Fax 08 9726 1575

1.2 Location, Ownership and Agreements

Lot 501 is located on the Coalfields Road approximately 8 km east from South Western Highway and 23 km from Collie.

The site is described as

Lot 501, Coalfields Road, Wellington

Diagram 26892
Volume 2530 Folio 854

Owner C D Catalano, 227 Old Coast Road, Australind WA
B R Catalano, South West Highway, Brunswick Junction WA

1.3 What has been undertaken at the Site

The original pit lies low down in the landscape 2.6 km south of Coalfields Road.

A small excavation was opened a number of years ago, but was not proceeded with at the time. It is proposed to re-open the pit.

A gravel crushing operation is approved for the land north of the hard rock quarry and has operated for four years through approval from the Shire of Collie.

1.4 Approvals

The excavation, management and rehabilitation of the quarry will require a number of approvals that will be subject to Planning Consent and Extractive Industries Licence, both issued by the Shire of Harvey, and other licences.

A summary of the approvals required are listed below.

- **Western Australian Planning Commission**

Responsible for State Planning and the Planning Framework.

Planning Consent is now required by the Western Australian Planning Commission under the *Greater Bunbury Region Scheme 2007*, following the enactment of the Greater Bunbury Region Scheme which was enacted on 17 October 2007.

Lot 501 lies near the eastern edge of the GBRS area.

However under *Planning Instrument 402 of the Planning Development Act 2005* the consent under the Greater Bunbury Region Scheme is delegated to the local Authority.

- **Shire of Harvey**

Planning Consent under the Shire of Harvey Town Planning Scheme is required. This includes approval under the GBRS under delegated authority.

An Extractive Industry Licence from the Shire of Harvey will be required.

- **Commonwealth of Australia**

There are no matters of National Significance on site that require approval under the *EPBC Act 1999*.

2.0 PLANNING AND SOCIAL ISSUES

2.1 Uses of the Hard Rock and Alternative Resources

Hard rock resources are essential for our modern community. The hard rock is crushed and processed into a range of high strength products that cannot be substituted by any other materials.

The products manufactured include;

- Aggregates for road base
- Aggregate for asphalt
- Seal coats for roads
- Railway line ballast
- Aggregate for drainage
- Coastal work

2.2 Importance of this Quarry

Quarries are needed because the community demands hard rock products for development.

As noted above, there is no other nearby granite hard rock quarry so re-opening the existing pit will provide such a resource to the Bunbury Regional area therefore saving on transport impacts for such product.

2.3 Planning Policies and Land Zonings

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

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

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

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

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

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

With respect to the supply of hard rock, the overarching document is the;

- State Planning Policy 1.0 State Planning Framework.

Complementing this are a number of Relevant State Planning Policies as listed below.

A number of Regional Policies and Schemes are applicable to the Wellington Region as listed below.

The Shire of Harvey Town Planning Scheme 1.

The Shire of Harvey has no Local Planning Strategy.

The Shire of Harvey has no Extractive Industry Local Law.

The relevant policies have been considered with respect to application for a hard rock quarry. The proposed quarry complies with, or is compatible with, all policies, strategies and schemes.

A summary of each of the relevant policies, strategies and schemes is provided below.

2.3.1 State Government Policies and Planning Schemes

STATE PLANNING POLICY 1.0, STATE PLANNING FRAMEWORK POLICY

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

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

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

These are considered in turn.

A number of other key State Government Policies are also relevant to the local regional planning.

- *State Planning Strategy, 1997*
- *Bunbury – Wellington Region Plan (WAPC 1995)*
- *Greater Bunbury Region Scheme, 2007*
- *Greater Bunbury Strategy (draft) 2011*
- *Basic Raw Materials Demand and Supply Study for the Bunbury – Busselton Region draft 2012*

- **State Planning Policy 2.0, Environment and Natural Resources Policy**

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

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

In addition to recognising the importance of protecting air quality, soil and land quality, water and wetlands and landscapes, the importance of Basic Raw Materials to the community is identified with reference to *SPP 2.4 Basic Raw Materials, State Gravel Strategy 1998* and *State Lime Strategy 2001*. See Section 2.1 of this management plan.

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

Part of Section 5.7 states;

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

Planning strategies, schemes and decision making should:

- ii. *Identify and protect important basic raw materials and provide for their extraction and use in accordance with State Planning Policy No 10 (2.4); Basic Raw Materials.*
- iii. *Support sequencing of uses where appropriate to maximise options and resultant benefits to community and the environment.*

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

- **State Planning Policy 2.4, Basic Raw Materials**

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

Section 3.4 is very specific in explaining that basic raw materials need identification and protection because of increased urban expansion and conservation measures, (3.4.1), (3.4.2) and (3.4.4). Sections 3.4.5 and 3.4.6 recognise that environmental and amenity matters need to be considered.

There are specific provisions in Section 6.2 Local Planning Scheme Provisions, such as;

No support for the prohibition of extractive industries in zones that permit broad rural land uses.

Providing an appropriate P, D or A use.

Not precluding the extraction of basic raw materials on land which is not identified as a Priority Resource Location, Key Extraction Area or Extraction Area (6.4.2).

Currently the Department of Planning and Department of Mines and Petroleum are reviewing and updating the basic raw materials policy over the whole Swan Coastal Plain and near areas, including Bunbury to Augusta. This mapping does not extend onto the Darling Scarp.

The Geological Survey of WA has produced new mapping identifying Strategically Important Basic Raw Materials. Gravel resources on Lot 501 are recognised in this mapping but hard rock is not recognised.

- **Basic Raw Materials Demand and Supply Study for the Bunbury – Busselton Region draft 2012**

In August 2012, the Department of Planning and the WAPC released the draft *Basic Raw Materials Demand and Supply Study for the Bunbury – Busselton Region*.

The document is used to determine the future requirements for the various basic raw materials in the local urban developments and the Bunbury – Busselton Region. It predicts that by 2021 an additional 8706 dwellings will be required in the region.

Further the Study lists, with contingencies, the demand for hard rock by the year 2021 of 6.74 million cubic metres of hard rock and by the year 2030 a total volume of 8.96 million cubic metres.

Lot 501 is not identified as a hard rock quarry site in the draft document, but gravel extraction on Lot 501 is identified by the Western Australian Geological Survey as a Significant gravel resource area. It makes sense to utilise other resources from such nominated land.

- **State Planning Policy No 2.5, Agricultural and Rural Land Use Planning,**

SPP 2.5 Agricultural and Rural land Use Planning predominantly deals with the continued rural use of suitable land and its protection for the future. The policy deals with recognising significant agricultural land, land fragmentation and land use through zonings, and Special Control Areas.

Lot 501 is zoned Rural under both the Greater Bunbury Region Scheme and the Shire of Capel Town Planning Scheme No 7. The area is compromised as an agricultural area because of small land holdings, proximity of urban spread, existing extractive industries protected by planning policies and lower land capability for agriculture.

However SPP 2.5 is relevant because the subject land is zoned Rural, and Rural land is the only land use Zone from which basic raw materials can be extracted. Section 5 Policy Measures, (5.1)(i)(d) states “*identify and protect key natural resources, including water and its dependant ecosystem, vegetation, minerals and basic raw materials*”.

The Policy Objectives provide for the “*prevention of land and environmental degradation during the extraction of basic raw materials*” (Section 4(4)(d)).

The position is clearly put in Section 5.4.3 Mineral and Basic Raw Material Resource Areas.

- i. Town Planning schemes should make provisions for the protection of basic raw materials, mineral and energy resources identified in the local planning strategy.*
- ii. Town planning schemes should include provisions for the extraction of basic raw materials, mineral and energy resources. These provisions should include the development of appropriate local policies and requirements, particularly buffer requirements, that the extraction industries will be subject to: sequential land use proposals; and environmental management activities.*
- iii. These activities should be regarded as generally acceptable, subject to assessment on their individual merits in rural areas.*

Basic raw materials are recognised in the Greater Bunbury Region Scheme, 2007, and by the Department of Mines and Petroleum as being a strategic resource for the growth and sustainability of the Bunbury Region.

- **State Planning Policy No 4.1, State Industrial Buffer Policy**

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

This is discussed further in Section 2.11 Surrounding Landuses and Buffers of this document.

State Planning Strategy, 1997

The Western Australian Planning Commission (WAPC) released the *State Planning Strategy in 1997*. It comprises a range of strategies, actions, policies and plans to guide the planning and development of regional and local areas in Western Australia and assists in achieving a coordinated response to the planning challenges and issues of the future by State and Local Governments.

The State Planning Strategy contains the following five key principles. These are:

- **Environment & resources:** to protect and enhance the key natural and cultural assets of the State and to deliver to all Western Australians a high quality of life which is based on sound environmentally sustainable principles.
- **Community:** to respond to social changes and facilitate the creation of vibrant, accessible, safe and self-reliant communities.
- **Economy:** to actively assist in the creation of regional wealth, support the development of new industries and encourage economic activity in accordance with sustainable development principles.
- **Infrastructure:** to facilitate strategic development of regional Western Australia by taking account of the special assets and accommodating the individual requirements of each region.
- **Regional Development:** to assist the development of regional Western Australia by taking account of the special assets and accommodating the individual requirements of each region.

The provision of granite hard rock provides construction materials to achieve sustainable development of the Greater Bunbury Regional Centre.

The resource is strategically located close to the Bunbury Regional Centre and therefore continuing to source hard rock from the quarry provides for significantly reduced transport costs, impacts and greenhouse gas emissions.

This is recognised by the State in the key regional planning document, *Greater Bunbury Region Scheme 2007*, in which the resource is identified, and studies have been conducted on the required buffers which have been implemented to protect and permit the staged use of the resource.

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

- **Bunbury – Wellington Region Plan (WAPC 1995)**

The *Bunbury – Wellington Region Scheme 1995*, sought to provide a regional planning framework up until the year 2011. This plan reflected the land use proposals and future land use and zoning including open spaces and major road proposals of the regional area.

The policy incorporated the *Greater Bunbury Structure Plan* that will in turn be superseded by the *Greater Bunbury Structure Plan 2011-2031+* which forms part of the Greater Bunbury Strategy (see below).

The *Bunbury – Wellington Region Scheme 1995* was divided into a number of precincts that show Lot 501 as Rural Zone.

The documentation is incorporated into the *Greater Bunbury Land Release Plan 2002*.

- **Greater Bunbury Region Scheme, 2007**

The Greater Bunbury Region Scheme was enacted on 1 October 2007. Under the Scheme Lot 501 is zoned Rural. The Rural Zone is, in addition to providing sustainable agriculture, conservation of natural resources “*including water, flora, fauna and minerals*”, to provide a “distinctive rural landscape”.

The existing quarry forms part of the local amenity and therefore there will be no change to the amenity of the area apart from the pit eventually extending further north with earlier excavated areas being progressively rehabilitated.

On page 59 of the draft *Greater Bunbury Structure Plan 2011-2031+*, it is stated that the Department of Planning will review State Planning Policy 2.4, Basic Raw Materials in order to inform a review of the Greater Bunbury Region Scheme – Minerals and Basic Raw Material Policy.

In August 2012, the Department of Planning and the WAPC released the draft *Basic Raw Materials Demand and Supply Study for the Bunbury – Busselton Region*.

See also Section 2.1 Uses of the Hard Rock and Alternative Resources.

Greater Bunbury Strategy 2013

The Greater Bunbury Strategy 2013, which incorporated *the Draft* Greater Bunbury Structure Plan 2011-2031+ is released to direct planning for the anticipated growth within the Greater Bunbury Area within the next 20+ years.

The Greater Bunbury Strategy encompasses the Bunbury – Wellington Region Scheme (1995) which will become extinct.

It recognises a number of sustainability criteria that among other things “Demonstrates most efficient/suitable use of land by avoiding Productive resource lands – extractive industries, mining and forestry”. In addition it seeks to maintain environmental sustainability across expansion fo the urban area, and the Greater Bunbury Region.

The document seeks to integrate all facets of planning for the future, whilst at the same time minimising impacts on the environment and helping make for sustainable future living. Among othre matters it recoimmends to reassess the need for and protection of local basic raw materials.

The *Greater Bunbury Strategy 2031*, shows Lot 501 as rural land.

2.3.2 Local Government Policies and Planning Schemes

- **Shire of Harvey Town Planning Scheme Number 1**

The *Shire of Harvey Town Planning Scheme 1* lists the site as occurring in the Rural Zone. Extractive Industries are an “SA” use within that zone. Approval under Town Planning Scheme 1 is normally granted with a number of conditions as is the case for the current approval.

2.4 Current Land Zonings

Lot is zoned “General Farming” under the Shire of Harvey TPS.

2.5 Current Land Use

The local area has been used for the extraction of hard rock in the past and is currently used for gravel extraction and crushing.

The remainder of the land is used for grazing.

Surrounding land uses are predominantly grazing, conservation or forestry.

2.6 Current Environmental Status

The status of the resource area, ahead of excavation, is pasture with scattered trees dropping down to a small tributary of the Collie River.

2.7 End Use

The end use of the quarry will be an amphitheatre landform with a return to pasture with native vegetation on steeper slopes.

2.8 Responsible Authorities

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

Shire of Harvey

- Has responsibility for local roads in the area.
- Issues Development Approval under the Town Planning Scheme (TPS 1).
- Issues and oversees the Extractive Industries Licence.
- The various approvals are normally issued with conditions, for a concurrent time frame or are approved at the same time.

Department of Mines and Petroleum

- Controls the safety and methods of excavation through the *Mines Safety and Inspection Act 1994 and Regulations 1995*. Manages SRS safety registration system.
- Covers the health and safety of workers.
- Provides data and mapping identifying the Strategic Basic Raw Materials.

Department of Parks and Wildlife

- Oversees all significant environmental impacts.
- Responsible for flora and fauna.

Department of Environment Regulation

- Licenses crushing and screening plants used in the processing of hard rock.

Department of Water

- Issues guidelines for water quality management for extractive industries.
- Oversees usage of water.

- Oversees protection of groundwater and water courses.

Western Australian Planning Commission

- Responsible for overseeing State Planning Policies.
- Provides land use policies for the protection of Basic Raw Materials.
- Provides planning consent under the Greater Bunbury Region Scheme.

Main Roads

- Responsible for construction and maintenance of main roads.

Department of Aboriginal Affairs

- Oversees the *Aboriginal Heritage Act 1972-1980*.

2.9 Aboriginal Sites

The Department of Aboriginal Affairs database was searched on 12 June 2013. No sites are recorded for Lot 501.

The nearest site is the Collie River and tributaries that are listed as a Waugal Site, Ngaarngungudditj Walgu Complex.

Aboriginal Heritage - Applicable Legislation / Policies <i>Aboriginal Heritage Act 1972-1980</i>
Commitments to Aboriginal Management <ul style="list-style-type: none">• 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.

2.10 Community Consultation

The proposed quarry will be advertised during the processing of the application.

There are no near residences with dwellings being over 2 km from the site and as far as is known only one dwelling from which the operations will be seen.

2.11 Surrounding Landuses and Buffers

- **Nearby Sensitive Premises**

The existing land uses of the area surrounding the quarry have not changed within the time the gravel excavation has been operating.

The land to the east, north and south is pasture with mainly grazing activities. Forest lies to the east and plantation forest to the west. Gravel extraction has been approved on Lot 501 for the past 4 years.

The only nearby dwellings are isolated and a significant distance from the site. There is a cluster of sensitive premises to the south west.

The closest dwellings are;

Dwelling to south Lot 28	2800 metres from pit 3500 metres from crusher	Will probably be able to see the pit and the crushing area
Dwelling to north east Lot 23	3200 metres from pit 2480 metres from crusher	Generally located behind ridge
Dwelling to the west Lot 17	2690 metres from pit 2530 metres from crusher	Generally located behind ridge
Sensitive premises to the south west Lot 29	2800 metres from pit 3500 metres from crusher	The pit appears to be located behind the landform. The processing area is higher but also appears likely to be protected by landform

There have been some initial community concerns with respect to the gravel crushing operation. These relate to erosion and have now been addressed through contouring and pasture establishment.

- **Buffers**

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

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

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

EPA guidance "Separation Distances between Industrial and Sensitive Land Uses", June 2005 lists the generic buffers for hard rock quarries as 1 000 metres depending on the extent of processing. A generic buffer relates to the distance at which there are unlikely to be any impacts without further investigations. It 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.

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.

The proposed quarry complies with the generic buffers with minimum distances of 2500 metre separations.

Section lines have been drawn, noise modelling has been conducted, blast and dust management plans have been developed.

The other important consideration is that the pit is proposed to operate below natural ridge lines. The adjoining hills will provide significant noise and visual screening which make this operation quite different to other hard rock quarries, which often have faces above natural ground level.

On the other hand the processing area is higher in the landscape and measures are recommended to minimise dust, noise and visual impacts from that operation.

The requirement for buffers mainly relates to dust and noise. Distances to the closest sensitive premises remain sufficient for the mitigation of noise and dust, and rarely to never are there any complaints relating to these parameters.

The main concerns of local residents are likely to relate to blasting, crusher noise and visual management. These have been specifically addressed in addition to the other issue that local people raise which is dust and water quality.

The Planning Report from the Council consideration of the gravel pit raised a number of issues from local people. These issues are summarised below. All have been considered and addressed within this proposal.

- Water quality of the dam as a potable water source to the south west.
- Erosion and stormwater issues related to the initial gravel extraction operations.
- Request for complaints procedures.
- Consideration of the "Resource Enhancement" wetlands that lie on the northern end of Lot 501.
- Pre and post development stormwater should be maintained.

3.0 PHYSICAL AND BIOLOGICAL ENVIRONMENT

3.1 Geology and Geomorphology

The site lies on the western side of the Yilgarn Plateau approximately 8 km from the edge of the Darling Scarp. The plateau at this point consists of portion of dissected plateau remnants running down to valley floors related to the Collie River System.

The elevation of the plateaus at this location are 280 - 300 metres AHD with the tributary floors 160 metres and 60 metres for the Collie River to the south.

The whole site is underlain by the Granitoid rocks of the Boddington Terrane of Archaean age (Wilde 2001). The Boddington Terrane consists of granitic migmatites which have granitic composition but have lineations and some gneissosity, generally trending north.

The geology is described in the geological assessment of the resource, Swindells 1982 attached as Appendix 1.

Overlying the granite is the remnants of an ancient Tertiary weathering plateau which is represented by the laterite gravel and duricrust that caps the higher ridges and forms the gravel resource.

In more recent times the plateau has been dissected and the granitoid basement exposed on the valley sides.

3.2 Soils

The soils overlying the weathered granite are generally thin brown loam soils over light coloured and mottled local clay and clay subsoils.

On the upper slopes gravel is added to the surface soil horizons by colluvial action by washing from the gravelly plateau.

There is no evidence of soil salinity and none would be expected on this site with high winter rainfall and drainage.

The regional soils have been mapped as part of the Wellington – Blackwood Land Resources Survey.

The upper parts of the site are shown as HRi, Hester System, "*Hester ironstone gravel ridges have mainly gravels*".

The lower slopes are shown as BL4, Balingup System, "*Balingup moderate slopes have relief of 80 – 120 metres and gradients of 15 – 35%*".

Acid Sulfate Conditions

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

Potential acid sulfate conditions most commonly form under current or past estuarine conditions, peaty conditions, and may also result from weathering of some geological formations and situations which contain sulfides.

Overall, at risk areas are geologically a minor occurrence, but in some situations can be important, and lead to acidic polluting conditions developing.

Acid conditions can form if soils containing pyrite are exposed to the air, allowing sulfuric acid to be formed. The soils most at risk are normally saline/estuarine soils, gley soils, peat and some organoferricretes.

There has been an increased interest in acid sulfate soils since the release of WAPC Planning Bulletin 64. WAPC conducted mapping of mainly coastal parts of south western Western Australia. Lot 501 lies outside the WAPC mapping.

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 Regulation. 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.

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

Potential acid sulfate conditions most commonly form under reducing conditions, under current or past estuarine conditions, peaty conditions, some organoferricretes, and may also result from weathering of some geological formations and situations which contain sulfides. Carbon is normally required and a lack of oxygen is always required to create the reducing conditions.

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.

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 site has been visited by Lindsay Stephens of Landform Research on two occasions, lastly on 19 December 2012 during which the site was mapped.

The site is elevated and the soils oxidised with no evidence of reducing conditions or other risk factors and none would be expected in this geological environment.

The main risk will come from the potential for sulfides to be present in the hard rock. Sulfides weather to very characteristic stainings and bodies such as gossans. No evidence of sulfides or their weathered products are found in the surface rocks or the existing earlier excavations. The presence of sulfides can negatively impact on hard rock aggregates so such rocks are not used.

No peat or organic matter is intersected in the pit, or is present in the faces or floor.

Therefore the risk of acid sulfate conditions is minimal to nil and would only occur if significant sulfides were exposed during excavations. That situation does not occur in other hard rock quarries, cuttings and other such rocks in the south west. Such situations only occur in mines where the sulfides form extractable ores for base or other metals.

3.3 Description of the Resource

The granitic rocks are described by Swindells 1982 which are appended to this report.

The resource is a light coloured fresh mica rich granitic gneiss that is highly suitable for aggregates as discussed by Swindells. A trial blast was conducted by Swindells.

The rock was tested by Swindells and found to vary in mean uniaxial strength from 100 +/- 40 Mn/m² for fresh granite to 95 +/- 40 Mn/m² for quartz rich gneiss with much lower results for the micaceous banding.

Micaceous bands of lower strength will be selected and sorted during excavated.

The rock has curved surfaces suggestive of large scale sheet joints that are often steeply dipping and broadly normal to the foliation and gneissosity.

3.4 Climate

The climate is Mediterranean with warm summers and cool moist winters.

Data is recorded at the Collie.

Temperatures are relatively mild, and extremes above 40° Celsius in summer and below 2° Celsius in winter are uncommon.

The temperatures range from maxima of 15.5 degrees C in winter to 30.5 degrees C in summer, with minima ranging from 4.2 degrees C in winter to 13.2 degrees C in summer.

The area receives a mean annual precipitation of 932.6 mm with peak rainfall from May to August when 69% of the annual rainfall is received. The driest months are during summer when the monthly rainfall averages 13.9 – 17.4 mm. The wettest months June and July receive over 170 mm of rainfall.

The mean daily evaporation records are not recorded locally but normally exceed precipitation in all but the main winter months.

Relative humidity in the area is high, with the mean humidity ranging from 60 - 91% at 9.00 am, to 37-66% at 3.00 pm. Early morning dews and fogs are not frequent, and are confined to the wetter months of the year.

Summer morning winds can be moderate to strong east to south easterly with afternoon sea breezes from the south to south west. In winter the winds tend to be lighter and more variable depending on the winter pressure systems. There are some strong northerly winds prior to winter storms from the north to north west.

3.5 Hydrogeology

The proposed pit lies on the northern valley side of the Collie River, 1.8 km to the south. A small tributary of the Collie River runs east west, 200 metres to the south.

A dam and small overflow drainage line lies 100 metres to the east.

A drainage line lies to the west of the proposed pit. The location of the pit has been selected to sit between these two drainage lines in a location that is able to mitigate any impact on them.

Other hard rock quarries have been excavated near watercourses with no impacts on the water quality through the use of detention basins, bunding and water management. Hanson Red Hill Quarry sits near Susannah Brook and has been approved with a 50 metre setback to the brook, although the pit does not approach as close as that.

Boral Orange Grove Pit has a creek to the north which is also provided with a setback of 50 – 100 metres. A drainage line runs through the approved pit and stockpile areas and drains to a constructed detention basin before release of excess water downstream.

WA Bluemetal Quarry at Whitby also lies near a significant watercourse. Water collects in the pit and processing area, is directed to three detention basins with the overflow directed to Manjedal Brook. A setback of approximately 100 metres is applied to Manjedal Brook from WA Bluemetal operations.

The proposed pit complies with the setbacks used for other hard rock quarries.

There are no water courses that will be impacted on by the pit or proposed processing area.

Hard rock is tight and has some fractures. The elevation of the proposed pit is well above creek elevation so the water table will not be intersected. There may be some minor perched or trapped water occurring in fractures of the hard rock.

3.6 Flora

The site of the proposed pit is cleared.

There are, behind the pit, some minor *Darwinia citriodora*, three *Xanthorrhoea preissii*, and one *Grevillea wilsonii*. Clumps of Marri tree (*Corymbia - Eucalyptus citriodora*) also occur on site.

The drainage lines which will be retained are being colonised by *Taxandria linearifolia* regrowth.

3.7 Fauna

The reduced vegetation with a predominance of pasture will result in a reduction in the number of fauna. The shrubs will be providing some habitat.

Whilst no fauna study has been conducted, native fauna will living in the *Taxandria linearifolia* thickets outside the proposed facilities and associated with the Marri Trees.

The amount of fauna is anticipated to be limited because of the continuous grazing on site.

Frogs and other wetland species will be present associated with the drainage lines.

3.8 Wetlands

Hill et al, 1996, *Wetlands of the Swan Coastal Plain*, Volume 2b, Water and Rivers Commission and Department of Environmental Protection, record parts of three Paluslope wetlands well to the north of the proposed pit and processing area.

These are related to *Taxandria linearifolia* regrowth. When the land was covered by forest not all these area are likely to have been present because of the greater evapotranspiration. With land clearing and reduced evapotranspiration, wetter soils developed in valleys, and these areas were rapidly colonised by *Juncus* and *Taxandria*.

This can be seen west of the proposed pit where *Taxandria* is colonising pasture in areas where it did not naturally occur.

Much of these identified wet areas are therefore probably not original. Interestingly the drainage lines to the east and west of the pit have much greater amounts of *Taxandria* and yet are not listed by Hill et al 1996. These areas are related to drainage lines and therefore also wetlands.

No Hill et al 1996 wetlands lie near the site, being some 500 metres away.

4.0 EXCAVATION MANAGEMENT

Gravel extraction has been taking place from Lot 501 for four years.

The proposed hard rock operations will be linked in with the gravel production and the same mobile crushing and processing plants will be used.

At times some of the products from the two operations may be blended to make different construction materials.

Site Selection

The following parameters have been considered in the selection of the operational site. Where possible any identified adverse effects have been mitigated or minimised in the selection of the site.

The site was considered, inspected, and the best methods of extraction and processing that will lead to the least potential impacts was selected. The location, method of extraction, haul road, processing area and landform were considered.

The aim was to minimise impact by selecting a hard rock quarry on land with existing approvals for extraction and in a location from which hard rock had previously been extracted.

Lot 501 is nominated as a Regionally Significant Gravel Resource by the Western Australian Geological Survey.

The potential for landform shielding of blast, noise and dust was considered by placing the processing and pit as low as possible in the landform. Sections have been drawn and noise modelling conducted. Views from the disturbance footprints were trialed to see if the closest dwellings could be seen.

The processing area has been located with a base elevation of 240 metres AHD with the intervening plateau remnants and hills at 260 – 280 metres AHD to the west where the dwelling is high in the landscape and 220 to the south where the dwellings are low in the landscape.

The base of the pit is selected as being 190 metres with the top of the face being 220 metres AHD.

Design of the pit

The following parameters have been considered in the design of the pit and the processing/stockpile areas.

Where possible any identified adverse effects have been mitigated or minimised in the design of the operations.

The staging and progress of the pit is designed to use the walls of the pit to increase screening.

The processing area can utilise bunding to provide additional screening as required.

Project Summary

ASPECT	CURRENT DISTURBANCE	FINAL DISTURBANCE
Area of excavation	Current 02. hectares	10 hectares estimated at 20 years.
Processing Infrastructure. Product stockpiles, laydown and related areas	Nil	4.0 hectares
Roads, dams and related infrastructure etc	0.5 hectares	0.5 hectares
Revegetation	Nil	1.0 hectares
Hard Rock extraction	Nil Gravel extraction is licensed.	50 000 – 100 000 tonnes per year
Estimated reserve		1.3 plus million tonnes based on the concept quarry plan.
Life of project		20 plus years
Dewatering requirements		Nil
Maximum depth of excavations	5 metres	20 – 30 metre face

4.1 Extraction Methods

The methods of extraction will be the same as any hard rock quarry.

The processes to prepare the processing area and the pit are similar.

Preparation of the pit

The working area at the existing pit is already established, but will be reformed to make a more level surface and to incorporate detention basins and surface water management features.

1. Topsoil will be stripped from the area under development and where possible spread directly onto an area to be rehabilitated, or stored in a separate dump for later use. This is normally undertaken during drier months where possible to minimise soil and overburden sticking to mobile plant. The topsoil will be used to provide a substrate for rehabilitation.
2. Topsoil is relatively thin and in the order of 100 mm.
3. Overburden will then be stripped and used to form the screening bunds and level operational areas along the south and east.
4. Both the pit and the processing areas will be cut on the upslope side with the overburden pushed to the south to form a level operational working area.
5. The subsoils across the pit and operational area will be included in the overburden as well as the substandard rock, as the pit is opened to expose the fresh hard rock. The subsoils vary from 1 – 4 metres. Weathered and subgrade rock varies from 2 to 4 metres in thickness.

6. The overburden will be used to repair and level the existing operational area at the eastern edge of the pit.
7. A one metre high perimeter bund will be formed for safety purposes and the floor of the operational area will be sloped to direct surface water to a collection area with associated detention basins.
8. The construction work will be completed using a bulldozer, excavator and loaders to extract and move overburden.
9. Some substandard rock is likely to have to be blasted to enable it to be moved to create an operational face of ten metres high. The initial face may be only 5 metres high.

Hard Rock Excavation

The following is conceptual as changes may need to be made when the pit is opened because of changes and patterns to the quality of the rock.

All operations on a quarry fall under the requirements of the *Mines Safety and Inspection Act 1994*, which determines the nature of the excavation, operations, faces, vehicles and all operational procedures. All designs and operations will comply with the Act.

A Registered Quarry Manager must be either on site or within easy reach of site and all work is under the supervision of that manager. The operations will be registered under the SRS safety system of the Department of Mines and Petroleum.

Like all operating mines and quarries officers from the Department of Mines and Petroleum will inspect the site regularly to ensure compliance with the *Mines Safety and Inspection Act 1994*. The officers are based at Collie. The design of the pit is summarised below. The figures attached to the main report should be consulted in relation to the location and design of the pit.

1. The pit will be operated with a series of northern faces and three x 10 metre operational benches. The height of the benches will depend on the mobile plant used and may eventually go to two x 15 metre benches if plant, safety and efficiency dictates that.
2. Initially a northern face of 5 – 10 metres, will be established from the existing operational area. The elevation will be approximately 210 m AHD.
3. A 210 metre bench will enable the pit to be cut back to the north because the top of the spur is at an elevation of 220 – 222 metres AHD. The first bench and northern face will be cut to the northern extremity of the pit.
4. This will take a floor east west across the spur. From there the excavation face will be worked north to near the northern end of the existing operational area.

5. A new bench and northern face will then be formed at an elevation of 200 metres AHD, cut to the northern extremity with a bench retained for future access and stability.
6. The next bench will be 190 metres AHD. After the 190 m bench, which is anticipated to take more than ten years, excavation will then jump back to the north in another sequence of benches.
7. A haul road will be formed to each bench and up the hill to the processing area.
8. Small bunds will be constructed on the tops of the faces at the edges of benches to prevent surface water run off into the pit and for safety.
9. Blast holes will be drilled by a percussion drill fitted with dust extractor and collector systems.
10. The amount of drilling will depend on the frequency of blasts and can vary depending on the nature of the rock to be removed, and operational considerations for safety, product requirements and potential blast impacts.
11. Sequential blasting techniques are to be used to make each blast effectively a series of small explosions. This will be enabled through the use of millisecond delays on the blast pattern, which lifts and breaks the rock rather than throwing it.
12. The timing of each blast will depend on the nature of the rock to be removed, operational considerations for safety, product requirements and potential blast impacts, and the contracts won.
13. See the Blast Management Plan attached as Appendix 2.
14. As granitoid rock is well jointed it is anticipated to readily break into small enough fragments for use without the need of further breaking. However there are some locations where the joint pattern is much wider spaced and these areas will require closer holes to break the rock to small enough sizes to form the raw feed to the crusher.
15. The rock broken by each blast will fall in a heap at the base of the face being excavated.
16. A front end loader or excavator will be used to load the broken rock into off-highway dump trucks for transport to the crusher along the haul road. Normally an excavator is used because it has a longer reach and can operate more safely on benches.
17. At times a rock breaker may be required to break oversize rock to enable it to be fed to the primary crusher. The rock breaker will be used in the pit or near a ROM pad established at the primary crusher.
18. The processing area will be located up slope as there is a larger area for processing and stockpiles. It will also not require road trucks to use the main access road.

19. A multi wheel drive haul truck will be used to take the rock from the pit up the access road which will form a haul road to the ROM pad. From there the haul truck will either load the primary crusher directly or dump the rock on the ground to form a surge pile.
20. The haul truck will have a capacity of 35 tonne or similar and transported the rock to the processing plant along the central dedicated haul road.
21. The haul road will remain unsealed so that it can be modified from time to time as quarrying progresses, and unsealed roads provide better grip for haul trucks.
22. The haul road gradient will be retained to the lowest practical angle to reduce truck noise, fuel usage and increase safety. The road system has edge bunding, rock barriers and marking with used tyres. The haul road gradient will be 8 – 10 %. The existing access road is around 8.5% so it will be formed to a haul road without significant changes to the gradient.
23. All haulage routes and other roads are to be continually damped down in drier conditions when the quarry is being worked, as required, to minimise dust generation. A dedicated water truck will retained for this purpose, as it is for the approved gravel operations.
24. All vehicles on site and proposed for the hard rock operation will be fitted with efficient silencers and monitored to assess the noise levels. Reversing beepers are fitted as required for safety. Low frequency beepers are used to reduce sound carry because they do not have the same potential to transmit noise over long distances. High frequency beepers will not be used.
25. All vehicles on site will be installed with flashing lights.
26. For rehabilitation, and following completion of any parts of the excavation, the faces are to be backfilled with overburden and the brow broken down.
27. The final profile of the benches/faces will be to *Mines Safety and Inspection Act 1994* as explained in documents such as *Guidelines on Safety Bund Walls Around Abandoned Open Pits (DMP 1991)*. Backfill and rehabilitation of any completed faces will continue progressively as each section of the quarry face is completed.
28. Additional information on land clearing and reinstatement is contained in Section 7.0, Closure and Rehabilitation Program.
29. As the site will make water from rainfall and seepage, water management is an integral part of the excavation process. Water shed from the pit is to drain to detention basins prior to use for dust suppression and/or release to the natural drainage lines.
30. No dewatering to the environment is anticipated.

Preparation of the processing area

1. Topsoil will be stripped from the area under development and where possible spread directly onto an area to be rehabilitated, or stored in a separate dump for later use. This is normally undertaken during drier months where possible to minimise soil and overburden sticking to mobile plant. The topsoil will be used to provide a substrate for rehabilitation.
2. Topsoil is normally relatively thin at an average of 200 mm.
3. Overburden will then be stripped and used to form the screening bunds and level operational areas along the south and east.
4. The subsoils across the operational area lie above substandard rock. The subsoils extend to depths of 5 plus metres. The upslope edge of the processing area will be formed by cutting into the slope by some 5 metres and pushing out the soils and overburden to form a level working area. This will form a working area some 100 metres by 200 metres around slope.
5. Additional processing areas will be formed upslope from this to provide greater working area. This will be formed into a horseshoe to take the primary crusher with a screening bund located along the south eastern side to provide visual and noise protection to the most sensitive dwelling to the south.
6. Perimeter bunding approximately 1 metre high will be placed around the edge of the flat area for safety and water management. Surface water will be directed back to the hill slope to detention basins.
7. An area for the primary crusher will be formed whereby it is cut into the slope which provides screening to the south, to the closest and most exposed dwelling.

4.2 Processing Plant

1. Processing will take place on the processing area proposed to the north of the pit.
2. As noted earlier the operation of the quarry will initially use mobile crushing plant the same or similar plant to that used for the approved gravel crushing operations.
3. In the future a fixed crushing plant may replace the mobile crushing and screening plant depending on the contracts won and economics of such a change.
4. As new technology becomes available it will be used to maximise efficiency, safety and minimise potential environmental impact.
5. The processing cycle will use a primary mobile crusher together with secondary and tertiary crushers but these will be mobile, followed by sizing screens and product washing facilities as required to produce the various grades of aggregate.

6. The crushing plant will be licensed through the Department of Environment Regulation.
7. Blending of products will be undertaken during processing, enabling products to be mixed to order. This reduces the stockpiles by allowing products to be crushed on demand.
8. Various products will be held in stockpiles in the south, with road trucks accessing the stockpiles from the access road and returning, in a manner that does not conflict with the haul truck route.
9. A rubber tyred loader will be used to load each road truck. The loads will either be covered or wetted down as required to prevent material from being dislodged during transport.
10. A weighbridge is located on site for the gravel operations and this will be used for the hard rock products.
11. All crushers, screens and stockpiles will be sprayed with water or enclosed where possible to reduce the emission of dust from all parts of the crushing plant. Even with mobile crushing and processing plant, efficient dust suppression can be achieved, with mobile plant becoming increasingly common.
12. Water used in production of washed aggregates is to be recycled through sediment trapping facilities.

4.3 Pit Design and Staging

1. The pit design is outlined above under Hard Rock Excavation. The speed at which the pit progresses will depend on the contracts won.
2. The staging is therefore not certain at this stage, but initially it is anticipated that 50 000 – 100 000 tonnes of product will be produced in the first few years.
3. The progress of the pit will proceed in the various benches outlined above and in the figures. The initial pit will last for ten years at the anticipated rate of extraction.
4. The base floor elevation is proposed to be 190 metres AHD rising up hill with the edges of the pit daylighting out to become as compatible as possible with the adjoining natural land surface.
5. As each bench is opened the batter slopes of any completed preceding stage will, when practicable, be rehabilitated depending on future land use, apart from working access roads and active floor and potentially benches.
6. At some point in the future expansion to the north and deepening will be considered.

4.4 Hours of Operation

The quarry and processing operate to the *Environmental Protection (Noise) Regulations 1997*. Quarrying is normally restricted to daylight hours, with processing and transport during daylight and at other times as required.

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

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

Transport hours of operation for the Shenton Ridge pit are proposed to be 6.00 am to 6.00 pm Monday to Saturday inclusive, excluding public holidays.

Crushing drilling and blasting is proposed to be 7.00 am to 5.00 pm Monday to Saturday exclusive of Public Holidays.

4.5 Machinery and Equipment

The operations are proposed to use mobile crushing equipment as discussed above under 4.2 Processing Plant.

A fixed crusher may be used at some point in the future if the number of sales warrants it.

A weighbridge is located on site for the gravel operations and this will also be used for hard rock sales.

Photographs of typical mobile plant are attached.

All support facilities such as maintenance will be located at the adjoining Gravel operations.

The types of equipment proposed to be used:

- Mobile primary, secondary and tertiary crushers with related screens and conveyor belts. These will be moved across the site as excavation progresses.
- 35 tonne off-road dump truck for internal transport of rock from the pit to the crusher.
- Rubber wheeled loaders.
- Excavator and ancillary mobile plant.
- Track mounted percussion drill and compressor.
- 20 tonne water truck for dust suppression.

4.6 Stockpiles

The stockpiles and processing are to be located in the dedicated area to the north of the pit.

The stockpiles are to be installed with sprinklers and water canon during the drier months and as appropriate. See Figures 14 and 17.

4.7 Access and Transport

Access to Lot 501 will continue to be from Coalfields Road and then down the main access road used by the gravel operations. The proposed hard rock quarry is 2 km from Coalfields Road.

A lockable gate is maintained on Coalfields Road, combined with normal farm fencing round the perimeter of Lot 501.

A range of road trucks and trailers are used to transport gravel product from the site and the same vehicles will also transport hard rock products

There may be a small increase in truck traffic from the combined operations.

During normal operations the truck traffic from both quarries will include;

- 6 – 8 wheel trucks that can carry 12 – 15 tonnes,
- semi-trailer trucks with a load capacity of 20 – 25 tonnes,
- truck and dogs with a capacity of 40 – 50 tonnes and
- occasionally road trains with a capacity of 50 - 55 tonnes.

The majority of product will be carried in normal road trucks and not road trains. Which vehicles are used depends on the transport operator, the distance to the destination of the product and the nature of the contract that is being supplied.

A few points are relevant to truck transport and show that the use of smaller trucks does not necessarily benefit the community.

- All trucks are able to operate legally on the roads used and are regulated by Main Roads and the Shire on lesser roads.
- The trucks proposed have operated in the same manner during the operation of the quarry to this point in time.
- Whilst larger trucks are physically longer on the road, to carry the same load less truck movements are required. That is, the public will meet less trucks, as shown that a semi trailer carries the same load as two rigid trucks and one truck and dog load can replace up to four rigid truck loads.

- The transport of material is the greatest cost of aggregate over longer distances with costs being 20 to 30 cents per tonne per kilometre travelled. The cheaper costs occur when larger trucks are used and all costs are reflected in the construction of developments and are ultimately borne by the community.
- Larger trucks are more fuel efficient per tonne of material carried, and therefore have significantly lower greenhouse gas emissions per tonne.

As an illustration, for the anticipated average truck combination of a truck and dog at 45 tonnes per laden movement, to transport 50 000 tonnes of hard rock annually will require 1111 truck movements or 4 trucks per day on average if transport on most available days is used.

In reality this is not likely because transport is normally to fill contracts. On some days more truck movements will be used, and on other days lesser or no movements could take place.

4.8 Workforce

Between 3 and 6 persons are anticipated to be employed on site when the site is operating, depending on the rate of production and the extraction cycle. For example drilling is not likely to be continuous.

4.9 Water Use

Water used in the pit and the processing areas for product washing and dust suppression will be sourced from the same source as the water for the gravel production. That is from the farm dams in the north of Lot 501 and from the proposed detention basins.

This water, when used on the hardstand areas, will drain to the central drain along the access road to the sump on the northern side of the access road and then return to the detention dams as part of the recycling process. This will reduce the total volumes of water required and maintain the efficiency of production and environmental management.

Water is used for dust suppression and the washing of aggregates as required.

This has included the use of the water from the pit for all wetting down and dust suppression, which is a better use of that water. Water from the sump in the base of the northern pit is at times directed into the lake in the old pit in the south.

4.10 Safety

Safe practices are employed to protect both the workers in the quarrying and processing operations and the general public. The quarry and processing plant is covered by the *Mines Safety and Inspection Act 1994 and Regulations 1995* and operates in accordance with that Act and Regulations.

All quarries are required to have a Project Management Plan in place with which this document provides the required information. Quarries must also be registered on the Department of Mines and Petroleum SRS system for inputting and communicating safety data and have an appointed Mine Manager. Catalano has all these procedures in place for the gravel operations and these will be extended to the hard rock.

Fences and lockable gates are maintained around the perimeter of the operation with lockable gates.

Safety of workers has an ongoing major role in the excavation of hard rock.

A number of site personnel hold Senior First Aid Certificates, and/or Workplace First Aid Certificates.

Excavation Safety - Applicable Legislation / Policies
<ul style="list-style-type: none">• <i>Mines Safety and Inspection Act 1994 and Regulations 1995.</i>
Commitments to Safety Management
<ul style="list-style-type: none">• B and J Catalano is committed to maintaining a safe working environment• Safety Management procedures are implemented prior to commencement.• All workers are provided with site induction and necessary training prior to entering the site.

4.11 Fire

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

The cleared areas of the farm and the stocked pasture form a natural firebreak. The main fire risk comes from an external fire in the surrounding vegetation, impacting on the quarry. As such the fire risk is no greater than a rural property and is normally less because of the better access, equipment on site and water supplies.

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

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 taken in quarries to minimise fire risk and these are used wherever possible.

- The excavation area forms a natural firebreak. The access roads, and water available from the on site dams that is available for fire fighting, increases the fire management.
- Restriction of vehicles to operational area, particularly on high fire risk days.
- Use diesel rather than petrol powered vehicles.
- Maintenance of perimeter fire breaks as required.
- The fire risk is addressed and maintained through the Safety Management Plan.
- Provision of an emergency muster area, communications and worker induction and training.
- The site is secured from unauthorised access.
- Compliance with the *Mines Safety and Inspection Act 1994 and Regulations 1995*.
- Regular inspections of all plant are made and normal maintenance carried out.
- Fire extinguishers are provided at strategic positions and in the working vehicles.
- Emergency evacuation procedural drills are held regularly.

Fire Management - Applicable Legislation / Policies
<ul style="list-style-type: none">• <i>Bush Fires Act 1954.</i>• <i>Shire of Harvey Bylaws.</i>
Commitments to Fire Management
<ul style="list-style-type: none">• B and J Catalano will ensure the quarry operates to the standards in the <i>Mines Safety and Inspection Act 1994 and Regulations 1995</i>.• B and J Catalano will ensure the quarry complies with the local fire safety requirements and operates in compliance with normal rural fire practise and restrictions.

5.0 PHYSICAL ENVIRONMENTAL MANAGEMENT

5.1 Visual Management

The site of the hard rock quarry has been selected because of the resource of the hard rock and the existing pit on that location, in addition to the buffers available to the nearest dwellings.

The design of the pit has taken into account the potential visual impacts.

The potential for landform shielding of blast, noise and dust was considered by placing the processing and pit as low as possible in the landform. Sections have been drawn and noise modelling conducted. Views from the disturbance footprints were trialed to see if the closest dwellings could be seen. See attached sections.

The processing area has been located with a base elevation of 240 metres AHD, with the intervening plateau remnants and hills at 260 – 280 metres AHD to the west where the dwelling is high in the landscape. The intervening ridge provides visual and noise screening.

The base of the pit is selected as being 190 metres with the top of the face being 220 metres AHD.

The ridge to the south is at an elevation of 220 metres to the dwellings that are low in the landscape and are shielded by the ridge.

On this site, because of the sloping land and its orientation, rather than screening tree belts which will be less effective some screening bunds will be used where possible to minimise visual and noise screening. Any bunds will be constructed from overburden removed from ahead of excavation. Topsoil is to be recovered and spread on the overburden to provide pasture cover. Finally trees and shrubs will be planted in strategic locations although their ability to provide screening will be limited.

The main visual risk is to the dwelling to the south. It is felt that this is the only dwelling from which the operations may be visible. That dwelling is 2.8 km from the proposed pit and 3.5 km from the proposed location of the crusher. The dwelling to the west is at a distance of 2530 metres. Other dwellings are well protected by the landform.

WAPC 2007, *Visual Landscape Planning in Western Australia* has been viewed and the project considered against that document. The relevant section is Part Three, pages 144 to 152 of the Guideline.

This document recommends a visual impact assessment which has been completed using contours and sections, in addition to site observations and aerial photography. The context of the visual impact has been reviewed to try and maintain the undulating countryside and rural nature of the land.

The potential visual impacts have been identified and relate to the dwelling to the south. Other sites for which the pit and operations may be visible are rural land with no dwellings.

The location of the pit has been considered to try and use landform screening.

Revegetation and tree belts will be used where possible as will be rehabilitation of the completed areas as soon as practicably possible.

The main impacts will be the faces of the pit which will be grey in the landscape when compared to the surrounding pasture and trees. The main impact will be from the dwelling to the south at a distance of 2.8 km and from rural farmland.

As the pit will head north it will not be possible to rehabilitate the northern face. It will be possible to rehabilitate the eastern and western faces progressively.

This will use brown coloured overburden to hide the grey rock and then tree planting and revegetation.

Below is a list of ideal visual management activities that are proposed to minimise visual impacts.

OPERATIONAL PROCEDURES	COMMITMENTS ON ACTIVITIES CONDUCTED ON SITE
<ul style="list-style-type: none"> • Locate exposed features behind natural barriers and landform. 	<ul style="list-style-type: none"> • The quarry has been located low in the valley out of site of all dwellings but perhaps one dwelling. • The sightlines to the key dwellings have been reviewed and the disturbance areas selected to provide maximum screening • The dwellings from which it may be possible to view the operations around or between ridges have been investigated with section lines and on site contour examination. • The quarry location is too small for processing and stockpiling of product so that function has been located up slope. • It is possible that the stockpile and processing area will be visible from the dwelling 2.8 km away, but the formation of the processing area has been designed to minimise visual exposure by the use of bunding and tree planting.
<ul style="list-style-type: none"> • Operate from the floor of the pit below natural ground level. 	<ul style="list-style-type: none"> • The pit is to be worked at a location low in the landscape, well below the level of the surrounding hills. • The pit will progress north into the hill. • See above for the processing and stockpile area.
<ul style="list-style-type: none"> • Avoid breaks in the skyline due to workings and haul roads. 	<ul style="list-style-type: none"> • The facilities have been located low in the landscape to prevent any breaks in the skyline.
<ul style="list-style-type: none"> • Push overburden and interburden dumps into positions where they will not be seen or can form screening barriers. 	<ul style="list-style-type: none"> • Vegetated screening bunds are proposed around the stockpile and processing area which is anticipated to be the only part of the operation that might be visible from one dwelling.
<ul style="list-style-type: none"> • Construct screening bunds and plant tree and shrub screens to reduce visual impact. 	<ul style="list-style-type: none"> • This is proposed where possible. See above.
<ul style="list-style-type: none"> • Stage workings and progressive rehabilitation to provide visual protection of later activities. 	<ul style="list-style-type: none"> • This is proposed. • All completed areas will be rehabilitated as soon as practicable.

<ul style="list-style-type: none"> Cover barriers and landscaping with forms, colours and textures compatible with the natural environment. 	<ul style="list-style-type: none"> Landscaping and rehabilitation incorporates vegetated buffers and cover. Fixed plant is to be painted in colours that will minimise visual impact providing safety can be maintained. On mobile plant normally a dark yellow colour is used for visual safety.
<ul style="list-style-type: none"> Adopt good house cleaning practices such as orderly storage and removal of disused equipment or waste. 	<ul style="list-style-type: none"> Catalano maintains a tidy work environment on all their operations. Waste is regularly removed off site to an approved waste facility. Where possible usable materials will continue to be recycled.
<ul style="list-style-type: none"> Provide progressive rehabilitation of all completed or disturbed areas. 	<ul style="list-style-type: none"> This is proposed. Areas not required will be revegetated with additional screening vegetation.
<ul style="list-style-type: none"> Minimise the amount of ground used at any one time. 	<ul style="list-style-type: none"> The amount of ground used will be minimised to that needed for proposed and future operations. Clearing and overburden stripping is to be restricted to the ground immediately required.
<ul style="list-style-type: none"> Install fences and gates which are compatible with the style of the area. 	<ul style="list-style-type: none"> Gates and fences have been in place since the opening of the gravel excavation quarry. Fences are rural fences without solid colour to blend with the perimeter vegetation. The entrance is well formed with imposing gates and bitumen access road.
<ul style="list-style-type: none"> Minimise offsite impacts of night lighting. 	<ul style="list-style-type: none"> No night operations are proposed. Some security lighting is used, which is directed away from sensitive views, roads and premises. There may be times when maintenance is required.
<ul style="list-style-type: none"> Paint and maintain buildings exposed, plant and equipment with low impact colours. 	<ul style="list-style-type: none"> Fixed plant is to be painted in a colour sympathetic to the operations, either as a colour that “presents well” or blends with the environment. On mobile plant normally a dark yellow colour is used for visual safety.
<ul style="list-style-type: none"> Locate roads and access to prevent direct views into the site 	<ul style="list-style-type: none"> There are no changes proposed to the access roads for the gravel operations. The only access road is from Coalfields Road.
<ul style="list-style-type: none"> Locate buildings, plant and stockpiles in areas of low visual impact and maintain appropriate size. 	<ul style="list-style-type: none"> The facilities have been designed to be located low in the landscape, visually protected from all but one dwelling which may be able to see the processing area from a distance of 2.8 km.

Light Overspill

It is not normally proposed that the facility will operate at night. The only lighting that might be required at night could be security lighting. Security lighting is located to minimise light visibility from roads and neighbours.

There may be times when maintenance is required at night during busy operations.

Visual Management - Applicable Legislation / Policies

- None applicable

Commitments to Visual Management

- B and J Catalano is committed to management of visual impact and will implement the measures outlined

5.2 Noise Management

General Noise Regulation

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

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

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

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

The 10% and 1% “time above” allowances also apply at night and on Sundays and Public Holidays to any representative assessment period.

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

A recent decision of the State Administrative Tribunal determined that where an extractive industry operates the premises boundary is taken as the lot boundary. This can alter the influencing factors and the allowable noise limits at sensitive premises. See Bushbeach Holdings Pty Ltd and City of Mandurah {2013} WASAT 139.

Influencing factors that raise the allowable noise levels are activities such as external industrial noise, some nearby land uses and busy roads. These are not relevant currently for this site as there are no nearby busy roads or industrial properties.

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

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.

These actions are routinely used by Catalano where applicable and as the opportunity presents to minimise noise on all their operational sites.

In addition to using the noise management techniques listed above, wherever practicable, Catalano will have site specific management procedures that are outlined below.

Herring Storer Acoustics considered operational and processing noise and found that the operations comply with the *Environmental Protection (Noise) Regulations 1997*. See Appendix 3.

Catalano will comply with the *Environmental Protection (Noise) Regulations 1997*.

Occupational Noise

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.

As part of its commitments, Catalano continues to be pro-active with its worker safety awareness at its gravel operation on site and this will be expanded to the hard rock operations;

- by providing all necessary safety equipment such as ear protection,
- identifying sections of the plant where hearing protection is required, as well as,
- conducting induction and educational programs for its staff.

The operating noise levels around the site are regularly monitored by independent consultants in accordance with the *Mines Safety and Inspection Act 1994*, and the results communicated to the Department of Mines and Petroleum (DMP).

All staff are provided with comprehensive ongoing training on noise protection as part of Catalano's commitment to occupational health and safety.

The DMP conducts Occupational Noise Audits of quarrying operations and no doubt this will be extended to this site.

Warning signs will be used to identify areas of potential noise.

Drilling and Blasting

A Blast Management Plan has been prepared and is attached as Appendix 2.

In summary the following methods are likely to be used.

A section of face is to be pattern drilled and then blasted with explosives as required. Millisecond delays are used on all blasts to reduce both the air blast overpressure and the ground vibration.

All drilling equipment will be fitted with noise suppression features and regularly checked to ensure compliance with all safety standards.

No explosives are to be kept on site. They will be brought to site as required by the explosives contractor.

Consultants will design the blasts in conjunction with Catalano staff, and the same consultants will monitor each blast and provide written documentation to the company.

The blast holes are to be located in the patterns and spacings combined with blast design using various combinations of airdecks, charging and stemming to produce the best outcome with the least impact. The blasts will then be fired with millisecond delay detonators to reduce noise and ground vibration.

At the time of each blast the weather conditions are to be recorded. The main weather conditions of concern are the wind speed and direction, and the possibility of a temperature inversion in the atmosphere which has the potential to reflect blast noise downwards. To minimise these features the shots are fired, wherever possible, around midday, when temperature inversions have broken up and when the wind is most commonly from the south west, blowing away from the main settled areas to the west of the quarry.

Drilling, blasting and excavation will be below natural ground level, with the perimeter bund walls adding to the shielding of adjoining properties. Where possible blasting is to be carried out when the weather conditions are suitable, normally around 1.00 pm.

It is anticipated that blasting will be in the order of two times per year, although in a particular year up to four blasts may be conducted.

The Shire of Harvey and the nearest residences will be rung prior to each blast as a matter of courtesy.

Potential blast impacts consist of air blast overpressure, ground vibration and fly rock.

The nature of the blast in terms of the degree of fracturing of the rock to be moved, the orientation of the face, the size of the blast and the weather conditions can all influence the potential impact of a blast. Therefore it is not uncommon for each blast to appear different in character.

Sometimes it is difficult for residents to distinguish between air blast or ground vibration because both can make windows rattle under certain conditions. The Statutory Blast limits are set at levels that will not lead to structural impacts but yet may still be heard.

Changes to the blast levels of air blast overpressure and ground vibration, received at a particular sensor, depend on which face is being excavated.

With continued progress of the pit, and the orientation of the face, it can be expected that when the face is fired, airblast will have a greater tendency to travel south and ground vibration will have a greater tendency to travel north.

The current Environmental Protection (*Noise Regulations 1997*) state that no blast should exceed 125 dB with nine in every 10 consecutive blasts required to be below 120 dB. These criteria are currently subject to revision by the DER, which will generally reduce the allowable limits by 5dB in line with national guidelines and those used in other states.

Ground vibration is controlled by Australian Standard AS 2187.2 which lists a maximum vibration of 10mm/sec for dwellings and 25mm/sec for certain commercial and industrial premises.

Ground vibration is often set in Western Australia at 5mm/s with only one in every 10 consecutive blasts being permitted above that level. The Australian Standard for dwellings is 10mm/s for which no blast is to exceed.

A consultation program will be implemented prior to blasting as outlined in the Blast Management Plan in Appendix 2.

Crushing and Screening Rock

The crusher used in the trial will be a mobile plant with three stages. The stage likely to create noise will be Stage 1 which has been provided with bunding and screening to minimise noise carry.

Like all parts of the operations the processing has to operate under the *Environmental Protection (Noise) Regulations 1997*.

Herring Storer Acoustics considered operational and processing noise and found that the operations will comply with the *Environmental Protection (Noise) Regulations 1997*. See Appendix 3.

Truck Movements

Truck movements are discussed in 4.7 Access and Transport.

Complaints

A complaints register will be maintained and all complaints from blasting or other activities will be investigated.

Summary of Noise Management

OPERATIONAL PROCEDURES	COMMITMENTS ON ACTIVITIES CONDUCTED ON SITE
<ul style="list-style-type: none"> Comply with the <i>Environmental Protection (Noise) Regulations 1997</i>. 	<ul style="list-style-type: none"> Catalano will maintain compliance. Blasting relating to airblast criteria at sensitive premises is considered in Appendix 2. Herring Storer Acoustics found that the operations can comply with the <i>Environmental Protection (Noise) Regulations 1997</i>. See Appendix 3.
<ul style="list-style-type: none"> Comply with the provisions of the <i>Mines Safety and Inspection Act 1994 and Regulations 1995</i>. 	<ul style="list-style-type: none"> Catalano is regularly inspected at their existing operations by the DMP and found to be in compliance.
<ul style="list-style-type: none"> Maintain adequate buffers to sensitive premises. 	<ul style="list-style-type: none"> The closest dwellings are over 2 km from the pit and processing areas, well in excess of the buffers to most operating quarries.
<ul style="list-style-type: none"> Locate exposed features behind natural barriers and landform. 	<ul style="list-style-type: none"> The landform provides screening. The pit is located low in the landscape. The crushing area is located behind ridges in relation to all but one dwelling which is at a distance of 2.8 km from the pit.
<ul style="list-style-type: none"> Operate from the floor of the pit below natural ground level. 	<ul style="list-style-type: none"> Operations are proposed to be low in the landscape, shielded by intervening ridges.
<ul style="list-style-type: none"> Push overburden and interburden dumps into positions where they can form screening barriers. 	<ul style="list-style-type: none"> Vegetated screening bunds are to be formed around the processing area where possible to add additional protection to the south in the direction of the only potentially visible dwelling.
<ul style="list-style-type: none"> Design site operations to maximise the separation and protection from sensitive premises. 	<ul style="list-style-type: none"> The closest dwellings are over 2 km away and all but one is protected by the landform. The shape of the pit and method of operation have been designed to ensure landform protection is maximised.
<ul style="list-style-type: none"> Maintain all plant in good condition with efficient mufflers and noise shielding. 	<ul style="list-style-type: none"> Catalano has new modern equipment that is maintained in good condition and replaced from time to time.
<ul style="list-style-type: none"> Maintain haul road and hardstand surfaces in good condition (free of potholes, rills and product spillages) and with suitable grades. 	<ul style="list-style-type: none"> The access road and crossover used for gravel extraction will continue to be maintained in good condition. Outside Lot 501 all normal transport routes are sealed.
<ul style="list-style-type: none"> Implement a site code outlining requirements for operators and drivers. 	<ul style="list-style-type: none"> Catalano maintains site induction and training for all personnel.

<ul style="list-style-type: none"> • Shut down equipment when not in use. 	<ul style="list-style-type: none"> • This is normal policy.
<ul style="list-style-type: none"> • Scheduling activities to minimise the likelihood of noise nuisance. 	<ul style="list-style-type: none"> • There are no changes proposed to the normal operational hours from the gravel operations, which have not resulted in any complaints in recent years.
<ul style="list-style-type: none"> • Fit warning lights, rather than audible sirens or beepers, on mobile equipment wherever possible. 	<ul style="list-style-type: none"> • Lights or low frequency beepers are to be used rather than beepers. • The design and shape of the pit maximise noise screening.
<ul style="list-style-type: none"> • Use transport routes that minimise community disruption. 	<ul style="list-style-type: none"> • The access road and crossover used for gravel extraction will continue to be maintained in good condition. Outside Lot 501 all normal transport routes are sealed.
<ul style="list-style-type: none"> • Avoid the use of engine braking on product delivery trucks in built up areas. 	<ul style="list-style-type: none"> • Engine brakes are discouraged unless required for safety such as descending large hills on main roads.
<ul style="list-style-type: none"> • Minimise and conduct at the least disruptive times, non day to day activities such as vegetation, topsoil or overburden stripping on exposed ridgelines. 	<ul style="list-style-type: none"> • There are no changes proposed to the normal operational hours from the gravel operations, which have not resulted in any complaints in recent years for noise other than blasting.
<ul style="list-style-type: none"> • Provide a complaints recording, investigation, action and reporting procedure. 	<ul style="list-style-type: none"> • A complaints recording procedure is proposed to cover all site activities.
<ul style="list-style-type: none"> • Conduct training programs on noise minimisation practices. 	<ul style="list-style-type: none"> • Catalano conducts site induction and training to all personnel.
<ul style="list-style-type: none"> • Provide all workers with efficient noise protection equipment. 	<ul style="list-style-type: none"> • All noise protection personal equipment is provided to staff.
<ul style="list-style-type: none"> • BLASTING PROCEDURES 	
<ul style="list-style-type: none"> • Blasting is conducted to the; • <i>Mines Safety and Inspection Act 1994 and Regulations 1995.</i> • Environmental Protection (<i>Noise Regulations 1997</i>). • AS 2187.2. 	<ul style="list-style-type: none"> • A Blast Management Plan has been prepared and is attached as Appendix 2. • A DER Licence will be required for the crushing and screening of rock

<p>Noise Management - Applicable Legislation / Policies</p> <ul style="list-style-type: none"> • <i>Environmental Protection (Noise) Regulations 1997.</i> • <i>Mines Safety and Inspection Act 1994 and Regulations 1995.</i> • <i>Australian Standard AS 2187.</i> • DER Licence L4593/1983/13.
<p>Commitments to Noise Management</p> <ul style="list-style-type: none"> • Catalano is committed to minimising noise emissions and will implement the measures outlined above. • Herring Storer found that the proposed operations comply with the <i>Environmental Protection (Noise) Regulations 1997.</i> • Catalano will comply with the <i>Environmental Protection (Noise) Regulations 1997.</i>

5.3 Dust Management

Environmental Dust

Dust has the potential to be generated during most phases of the quarrying and crushing operation, particularly during summer. In winter the frequent rains greatly reduce the potential dust emissions. The main risk is from the crushing and tipping processes and from vehicle movements. Occasional one off dust is produced from blasting approximately two times per year.

Dust may impact on onsite workers. Dust also has the potential to be visually intrusive and travel to adjoining properties if not managed.

Dust management has been an integral part of the extraction and processing of gravel from the existing approved quarry on Lot 501 and will be an essential part of the proposed hard rock quarry.

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 Regulation Guidelines, November 1996*. These are still in place but are incorporated into the *DER 2011 Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and other Related Activities*.

The *DER in 2008* released a *draft Guideline for the Development and Implementation of a Dust Management Plan*.

The category of dust risk is included in *DER 2011 Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and other Related Activities*. This document is not really applicable to mining because it is to be used to assess the mitigation required based on no mitigation.

However the document can also be used to determine the risk of potential dust impacts of earthworks such as clearing and the removal of overburden and rehabilitation, which only occurs about once per year when the pit is being expanded or moving forward. These risks are summarised under the Table titled Dust Management Actions below.

Dust mitigation measures are maintained on a regular basis and updated as necessary.

The management of environmental and occupational dust requires the same techniques and actions. If occupational dust is managed, then there will be minimal risk of dust impacting on the external or onsite environment.

Occupational Dust

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

Catalano provides induction and protective equipment for all persons on site.

The dust management procedures used on site comply with these guidelines.

Dust Management

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

Catalano uses a number of management actions to minimise dust generation during production and transport of gravel products and similar actions will be used for the extraction and production of hard rock.

A dedicated water truck is retained on site for the wetting down of roads and other dust suppression activities.

Loads on trucks that have the potential to generate dust are covered or wetted down.

The drill, when used, will be provided with efficient skirts around the drill bits and is installed with dust extraction systems.

Dust generated during processing is managed by dust suppression sprays that are installed throughout the crushing and screening plants where practicable such that water does not clog the process. These sprays also moisten the material moving along the conveyor belts as required. All dust covers and suppression equipment are maintained and regularly serviced.

All stock piles that could generate dust will be sprayed from portable sprinklers and "water canon" to keep them moist when conditions occur that might generate dust lift off.

Water will continue to be sourced from the dam located on Lot 501. Water will also be collected from the sump in the base of the proposed pit. As the pit is enlarged the volume of water collected will increase.

Wherever possible, blasting is proposed to be used when the atmospheric conditions are favourable, to reduce dust carry. Dust from each blast can occur for a few minutes.

Dust generated from earthworks will be closely monitored and managed.

Normally the stripping of overburden and topsoil and their subsequent use in rehabilitation is undertaken during the wetter months to reduce the generation of dust when gravel is being extracted and this method will be applied to the hard rock.

Completed sections of the quarry will be rehabilitated as soon as practical to reduce the area of open ground and help reduce wind speed.

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

A record of all dust complaints will be retained as it is at all Catalano operations.

Dust Management Actions

ACTIVITY	POSSIBLE RISK SEVERITY and FREQUENCY	OPERATIONAL PROCEDURES	COMMITMENTS ON ACTIVITIES CONDUCTED ON SITE	RISK AFTER MANAGE MENT
GENERAL				
Legislation	----	<ul style="list-style-type: none"> Comply with the provisions of the <i>Mines Safety and Inspection Act 1994 and Regulations 1995</i>. 	<ul style="list-style-type: none"> Catalano will continue to comply with the Act and Regulations and use similar dust management to that used for gravel extraction and processing on Lot 501. 	----
Buffers	----	<ul style="list-style-type: none"> Maintain adequate buffers to sensitive premises. 	<ul style="list-style-type: none"> The buffers to the nearest residences are a minimum of 2.8 km. At that distance there is no risk that dust will travel to dwellings. 	----
Landform	----	<ul style="list-style-type: none"> Locate activities behind natural barriers, landform and vegetation. 	<ul style="list-style-type: none"> The selection and design of the pit and processing areas has been chosen to provide the best screening available based on landform and site management. Excavation is to be conducted low in the landscape. The processing and stockpile facilities are to be located below the ridge lines at maximum distances to dwellings. 	----
Landform	----	<ul style="list-style-type: none"> Work below natural ground level. 	<ul style="list-style-type: none"> See above 	----
		<ul style="list-style-type: none"> Push overburden and interburden dumps into positions where they can form screening barriers. 	<ul style="list-style-type: none"> This will be used where overburden is available to form extensions and screening to the processing area. 	----
Staging	----	<ul style="list-style-type: none"> Design operational procedures and staging, to maximise the separation to sensitive premises. 	<ul style="list-style-type: none"> The location has been selected on the basis of maximum buffer distance. 	----
Pit design	----	<ul style="list-style-type: none"> Design the excavation to provide enhanced landform and constructed dust screening. 	<ul style="list-style-type: none"> See above 	----
Screening/ Vegetation	----	<ul style="list-style-type: none"> Use landscape screening, wind breaks and tree 	<ul style="list-style-type: none"> Tree planting is to be undertaken following land restoration to minimise dust 	----

		belts.	transfer in certain areas such as the processing area.	
MANAGEMENT				
Occupation	----	<ul style="list-style-type: none"> Provide air conditioned closed cabins on plant 	<ul style="list-style-type: none"> These are used on all sites for operational mobile plant. 	----
Monitoring	----	<ul style="list-style-type: none"> Provide monitoring and supervision of the processing and other practices on site. 	<ul style="list-style-type: none"> A monitoring system is in place for gravel extraction and is proposed. see below “Trigger Conditions”. 	----
Trigger conditions	----	<ul style="list-style-type: none"> Trigger conditions are used to determine when additional dust management is required. 	<ul style="list-style-type: none"> Most dust generated from processing and vehicle movements has a very large visible component. Lesser risks emanate from excavation and land clearing. The trigger for dust management is the generation of visual dust. The quarry manager and leading hands are ultimately responsible for site supervision of dust. They travel around the operations and pit frequently and are in two way radio contact with all mobile plant. All operators on site are instructed to be vigilant to dust generation and management and report any excessive dust or potential dust management issues. When trigger conditions are detected and/or alerted relevant action is taken. This can include additional water suppression, modification of procedure, delay until more favourable conditions are present, use of alternative equipment etc. 	----
Adverse weather	Moderate - Uncommon	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Rare adverse conditions are more likely to occur on summer mornings. In winter, stronger winds are normally associated with rain and therefore carry a reduced dust risk although pre-frontal winds can be strong and blow towards the south. This policy is used to minimise impact on adjoining land holders. 	Low
Equipment failure	Low - Uncommon	<ul style="list-style-type: none"> In the event of dust management not being able to be achieved through equipment failure 	<ul style="list-style-type: none"> This is used on site for gravel excavation and is committed to. 	Low

		operations will cease until full capability is restored.		
Training	----	<ul style="list-style-type: none"> Conduct training programs on dust minimisation practices. 	<ul style="list-style-type: none"> Catalano has existing on site induction to inform all personnel of the dust risk and management. 	----
Complaints	----	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> A record of all dust complaints is maintained for the gravel operation. All complaints relating to dust are to be investigated immediately. A record of complaints is to be maintained. 	
Monitoring	----	<ul style="list-style-type: none"> Provide a Monitoring procedure to minimise dust generation. 	<ul style="list-style-type: none"> For gravel extraction dust monitoring is conducted on site at all times by all operators and the quarry manager. This response is instantaneous and does not rely on monitoring equipment, which normally has time delays associated with it. The amount and source of dust is observed before any dust monitoring could trigger. Treatment is therefore more effective and targeted. When a significant source of dust is noticed it is dealt with by temporary or permanent changes to procedures and equipment or the treatment using water. The same will be used for hard rock production. 	----
EARTHWORKS				
Land Clearing	Low - Once per year.	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Normally the stripping of overburden and topsoil and their subsequent use in rehabilitation will be undertaken in the drier months when the soils are still moist enough to suppress dust but not wet. This is necessary to minimise the risk of dust generation and the spread of dieback spores if present although dieback is unlikely to be a significant issue considering the cleared nature of the site. Completed sections of the quarry are to be rehabilitated as 	Low

			soon as practical to reduce the area of open ground.	
Overburden removal	Low - Once per year	<ul style="list-style-type: none"> Schedule activities such as overburden stripping on exposed ridgelines at times when the materials are less likely to blow or during suitable wind conditions. 	<ul style="list-style-type: none"> See above. 	Low
Land restoration	Low - Once per year.	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> See Land Clearing above. 	Low
EXCAVATION				
Drilling	Low - One drill frequently used.	<ul style="list-style-type: none"> Ensure the drill is provided with dust extraction systems and shielding. 	<ul style="list-style-type: none"> Drilling will be used to prepare blast holes. The drills to be used are installed with skirts and dust extraction and collection systems. The operator sits in an enclosed air conditioned cab. 	Low
Blasting	Moderate - High - Monthly	<ul style="list-style-type: none"> Dust can be generated from each blast. 	<ul style="list-style-type: none"> Dust from blasting is generated as a one off event that normally takes a minute or two for the dust to settle. Windy conditions can cause any dust to potentially travel further but in turn help to break up the dust quicker. Blasts are normally fired at 12.30 pm using millisecond delays to lift rather than throw the freed rock. The timing of the blast is to allow any windy conditions or temperature inversions to dissipate. Blasts are to be delayed if adverse weather conditions are predicted or encountered. All blasts are to be designed by consultants and are monitored by those consultants. 	Low
Excavation	Low - Low level continuous activity	<ul style="list-style-type: none"> Excavate from the face using techniques that minimise the crushing of dry matter. 	<ul style="list-style-type: none"> The floor of the pit will be formed on aggregate with less fines that is less likely to generate as much dust. A water truck is to be used as required to wet down the loading areas. 	Low
Loading at	Low	<ul style="list-style-type: none"> Ensure that products 	<ul style="list-style-type: none"> This is conducted concurrently 	Low

Face	- Low level continuous activity	to be loaded are moist and that the hardstand on which the loading occurs is wetted down or moist.	with excavation using an excavator to collect and load rock broken from the blasting. <ul style="list-style-type: none"> The rock excavated and loaded are relatively large blocks of 300 – 500 mm diameter with few fines. See excavation above. 	
Haulage	Moderate - Medium level continuous activity	<ul style="list-style-type: none"> Maintain haul road and hardstand surfaces in good condition (free of potholes, rills and product spillages) and with suitable grades. 	<ul style="list-style-type: none"> The haul roads are to be maintained in good condition, as they are for the existing gravel operation. They are currently graded and continuously watered by dedicated water truck as required in the drier months. 	Low
		<ul style="list-style-type: none"> Reduce the length of the internal roads by maximising internal servicing efficiency. 	<ul style="list-style-type: none"> The haul roads have been designed to reduce travel distance to save maintenance costs and time and to maintain efficiency and minimize greenhouse gas emissions. 	
		<ul style="list-style-type: none"> Providing speed management on hardstand and the road network. 	<ul style="list-style-type: none"> This is used. 	
		<ul style="list-style-type: none"> Provide air conditioned closed cabins on plant. 	<ul style="list-style-type: none"> All vehicles are air conditioned. 	
		<ul style="list-style-type: none"> Treat access roads, hardstand and stockpile transport and loading areas with dust suppression sealant, water or seal coat. 	<ul style="list-style-type: none"> A dedicated water truck is maintained on site now and used as required during the drier months. The same truck will be used for hard rock production. 	
PLANT - PROCESSING				
Hardstand traffic	Low - Low key ongoing activities	<ul style="list-style-type: none"> Maintain hardstand surfaces in good condition (free of potholes, rills and product spillages) and with suitable grades 	<ul style="list-style-type: none"> The hard stand areas will be restricted in area. They will be able to be watered by the dedicated truck as required. 	Low

Processing	Moderate - Continuous	<ul style="list-style-type: none"> • Treat processing areas with water sprays, shields and dust extraction. 	<ul style="list-style-type: none"> • Crushing operations are to be watered or protected as required to suppress dust. • Dust covers and equipment shields are maintained on all static plant and mobile plant operated by Catalano where it is practicable to do so. • Continuous visual monitoring of dust is proposed. • Some product may be washed when required to minimise fines in the product and the stockpiles. • Water sprays are proposed as required and practicable on the primary hopper, crusher and various conveyors as needed. • Regular emptying of any dust collection devices and the renewal of any filter devices is used at all Catalano operations. 	Low
Mobile and static plant Operation	Moderate - Continuous	<ul style="list-style-type: none"> • Maintain all plant in good condition. 	<ul style="list-style-type: none"> • Catalano uses modern equipment that is maintained in good condition including the maintenance of dust minimisation measures. • Faults are to be repaired promptly. 	Low
		<ul style="list-style-type: none"> • Ensure mobile and static plant is provided with dust extraction, shielding or filtration systems or wetting down as appropriate. 	<ul style="list-style-type: none"> • Operators are instructed to visually monitor dust, report and treat any visible dust. • Regular emptying of any dust collection devices and the renewal of any filter devices is programmed. • Dust management and monitoring forms part of the site induction programs. • See Processing above. 	
Loading and Stockpile Creation	Moderate - Continuous	<ul style="list-style-type: none"> • Shut down equipment when not in use. 	<ul style="list-style-type: none"> • Catalano use this policy to save fuel and maintenance costs in addition to noise minimisation. 	Low
		<ul style="list-style-type: none"> • Limit drop heights from conveyors and dump trucks. 	<ul style="list-style-type: none"> • This is used. It is a good safety and site management procedure. • Fixed and mobile stackers are used in combination with haul trucks. The stackers minimise road traffic 	

TRANSPORT				
Road condition	Low - Frequent	<ul style="list-style-type: none"> Maintain access roads in good condition (free of potholes, rills and product spillages). 	<ul style="list-style-type: none"> The access road is gravel and is well maintained. The same road is used for the approved gravel operations. Catalano maintains speed restrictions for safety and site management both on all internal haul roads and the access road. 	Low
		<ul style="list-style-type: none"> Water and/or treat access roads and paved areas using a water tanker or sprinkler system. 	<ul style="list-style-type: none"> See above. Internal roads are regularly watered as often as necessary to minimize dust generation. A dedicated water truck is retained on site and used when dust lift off is a potential hazard. 	
Road Transport	Low - Frequent	<ul style="list-style-type: none"> Wet down or cover loads on trucks that are likely to blow during transport. 	<ul style="list-style-type: none"> Trucks are covered or wetted down prior to exiting the site for the gravel operation and the same is proposed for hard rock. 	Low
		<ul style="list-style-type: none"> Implement a site code outlining requirements for operators and drivers. 	<ul style="list-style-type: none"> A site code and induction system is used. 	
		<ul style="list-style-type: none"> Maintain road trucks in a clean condition. 	<ul style="list-style-type: none"> Catalano road trucks are modern and are maintained in a clean condition. Individual contractors are required to do likewise. 	
		<ul style="list-style-type: none"> Avoid spillages on roads and clean up promptly. 	<ul style="list-style-type: none"> Catalano has a policy of covering or wetting down loads and instruct drivers to report and clean up spillages. Most trucks are fitted with automatic or mechanical covers. 	Low
		<ul style="list-style-type: none"> Ensure that during loading, product does not become lodged on the sides of trucks from where it can fall off during transport. 	<ul style="list-style-type: none"> This forms part of proposed normal operational procedures on all Catalano operations. 	
		<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> This forms part of proposed normal operational procedures on all Catalano operations. 	

STOCKPILES				
Stockpiles	Moderate - Frequent	<ul style="list-style-type: none"> Wet down stockpiles using water canon or sprinklers as required. 	<ul style="list-style-type: none"> These are to be used as required on the stockpiles in drier conditions. 	Low
		<ul style="list-style-type: none"> Locate stockpiles behind bunds/ windbreaks or other screening barriers 	<ul style="list-style-type: none"> The stockpiles are to be located away from Coalfields Road behind the brow of the ridge. The stockpile area has been selected to provide some landform screening. 	
		<ul style="list-style-type: none"> Reduce the height of stockpiles. Low flat stockpiles are less likely to be disturbed by wind than high conical ones. 	<ul style="list-style-type: none"> The height of stockpiles is to be maintained at manageable levels that remain sheltered from the prevailing winds. 	
		<ul style="list-style-type: none"> Wash crushed products where necessary. 	<ul style="list-style-type: none"> Products are to be washed as required to remove fines or as requested in contracts. 	
		<ul style="list-style-type: none"> Locate coarser products around fine materials to assist wind protection of the finer products that are more likely to blow or contain greater amounts of dust. 	<ul style="list-style-type: none"> This will be used as required, but as the products are washed is not normally necessary. 	
		<ul style="list-style-type: none"> Provide bunding, fencing and windbreaks around stockpiles and along the tops of bunds. 	<ul style="list-style-type: none"> Tree belts and bunds are to be used around the perimeter of the processing and screening area to reduce wind and provide visual screening. 	

Greenhouse Gas

Over the years trucks have become more efficient with respect to greenhouse gas emissions, particularly with the use of truck and trailer and road train configurations.

The internal design of the operations has been selected to minimise the haulage route to save energy use and potential impacts.

Granite products supplied to the Bunbury Region and as far north as Pinjarra will potentially save transport costs and greenhouse gas emissions because the Shenton Ridge site is more strategically placed when compared to other granite quarries.

Dust Monitoring

At all Catalano sites, including the existing operations at Shenton Ridge, the effectiveness of dust suppression is monitored visually, at all times during site activities. The same methods will be used for hard rock production.

Most dust generated from processing and vehicle movements has a very large visible component. Lesser risks emanate from excavation and land clearing.

The trigger for dust management is the generation of visual dust. The quarry manager and leading hands are ultimately responsible for site supervision of dust.

They travel around the operations and pit frequently and are in two way radio contact with all mobile plant.

All operators on site are instructed to be vigilant to dust generation and management and report any excessive dust or potential dust management issues.

When trigger conditions are detected and/or alerted, relevant action is taken. This can include additional water suppression, modification of procedure, delay until more favourable conditions are present, use of alternative equipment etc.

Dust levels at the existing gravel operations are low with little difference between summer and winter or between the intervals of analysis.

A personal (occupational) dust monitoring program is in place, as per Department of Mines and Petroleum specifications.

High Impact Audits of occupational dust are also completed by Department of Mines and Petroleum from time to time.

Catalano provides induction and protective equipment for all persons on site.

<p>Dust Management - Applicable Legislation / Policies</p> <ul style="list-style-type: none">• <i>Guidance for the Assessment of Environmental Factors, EPA, March 2000.</i>• <i>Land development sites and impacts on air quality, DEP, 1996.</i>• <i>Department of Environmental Protection Guidelines, November 1996 and DEC 2008, A guideline for the development and implementation of a dust management plan.</i>• <i>DER 2011 Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and other Related Activities.</i>
<p>Commitments to Dust Management</p> <ul style="list-style-type: none">• B and J Catalano will take the necessary steps to manage and contain dust by implementing and maintaining the Dust Management Plan.

5.4 Hydrology - Water Management

Background

The protection of water, whether groundwater or surface water, is an important part of the management of quarries.

The extraction of gravel and hard rock is a clean operation similar to sand excavation in the nature of the risk to groundwater. No chemicals are used apart from normal lubricants and blasting materials.

The Shenton Ridge site is elevated and is well drained with good potential for water management.

Water management has been designed into the selection of the site and the operations that are proposed.

Dewatering of the proposed pit is not anticipated to be required because the collected water will be used for dust suppression.

There are water courses to the west and east of the operations. These are provided with 50 metre setbacks which is the same distance used for the Boral Orange Grove Pit and at Hanson Red Hill in the Perth Metropolitan Area.

Guidance for the design of operations to manage 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.*

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

- *Overview*
- *Minesite water quality monitoring*
- *Minesite stormwater*
- *WQPN 28 Mechanical servicing and workshop (2006)*
- *Mine dewatering*
- *WQPN Landuse Compatibility in Public Drinking Water Source Areas (2004)*
- *WQPN 15 Extractive Industries near sensitive water resources. (Not strictly relevant to the site but the methodology is useful).*

A water monitoring program is proposed. See the end of the Water Management Section.

Potable water is brought to the site. All support facilities and ablutions are to be located at the existign gravel operations, although approved serviced portable systems may be used from time to time.

The management actions considered in the above documents are incorporated into the onsite management procedures where appropriate.

An approved waste water system is in place.

5.4.1 Hydrology

See Section 3.5 Hydrogeology.

The proposed pit lies on the northern valley side of the Collie River, 1.8 km to the south. A small tributary of the Collie River runs east west, 200 metres to the south.

A dam and small overflow drainage line lies 100 metres to the east.

A drainage line lies to the west of the proposed pit. The location of the pit has been selected to sit between these two drainage lines in a location that is able to mitigate any impact on them.

The design of the pit and the processing and storage area have been designed so that no surface water will impact on the pit or proposed processing area.

Management of Surface Water Quality

Water quality in the area needs to be maintained to protect the water flowing onto adjoining properties and because the area forms the edge of the catchment for water resources of this portion of the Swan Coastal Plain.

The proposed pit has characteristics that are no different to those of other hard rock quarries on the Darling Scarp.

Other hard rock quarries have been excavated near watercourses with no impacts on the water quality through the use of detention basins, bunding and water management. Hanson Red Hill Quarry sits near Susannah Brook and has been approved with a 50 metre setback to the brook, although the pit does not approach as close as that.

Boral Orange Grove Pit has a creek to the north which is also provided with a setback of 50 – 100 metres. A drainage line runs through the approved pit and stockpile areas and drains to a constructed detention basin before release of excess water downstream.

WA Bluemetal Quarry at Whitby also straddles a drainage line. Water collects in the pit and processing area, is directed to three detention basins with the overflow directed to Manjedal Brook. A setback of approximately 100 metres is applied to Manjedal Brook from WA Bluemetal operations.

The watercourses to the east and west of the proposed pit will be unaffected by the pit. The eastern pit, which will accept water from the processing and stockpile area will act as a sediment trap for water, prior to entry to the natural creeklines to the south. See Figures 2, 3 and 4. The wetlands are shown in Figure 12.

A sump will be formed in the base of the pit and used as a water source. As the pit enlarges the volume of water collected will increase.

The quality of the surface water is discussed in 5.4.3 Monitoring.

Groundwater Protection

Hard rock is tight and has some fractures. The elevation of the proposed pit is well above creek elevation so the water table will not be intersected. There may be some minor perched or trapped water occurring in fractures of the hard rock.

Quarrying is a clean industry, well known for minimal risk to aquifers. For example sand excavation is able to be conducted within Priority Groundwater Areas when a separation of 3 metres to the water table is maintained.

In hard rock quarries, excavation can be below perched water tables as occurs in many mines, because the rock is tight enough to minimise groundwater inflow and contain all water within the pit. In those cases the hard rock acts as an aquitard and restricts water movement.

Neither the walls or floor of the existing gravel pit show any signs of groundwater seepage.

Dewatering

No dewatering of the pit is proposed.

Acid Sulfate Risk

Acid sulfate is considered under 3.2 Soils.

There is no evidence of acid sulfate conditions and none is anticipated because the proposed pit is elevated and well above the natural water courses.

An examination of the granitic hard rock does not reveal any significant sulfides that would form acidic conditions on oxidation. In fact the presence of sulfide is detrimental to the use of hard rock in a number of cases and such rock is therefore not selected for extraction.

Therefore there is no risk of acid sulfate conditions.

Waste Rock and Tailings Management

Waste and Tailings management is considered in;

- *Department of Mines and Petroleum, 1999, Mining Environmental Management Guidelines, Safe Design and Operating Standards for Tailings Storage.*

As all the rock is used in one type of product or another there is no waste rock or tailings. Overburden is used to provide a physical and landscape banks barrier around the site, along the west and now extending to the north.

Partially weathered or subgrade hard rock is in this case going to be utilised and used in blended construction and road making products.

Subgrade materials will be incorporated into the bunding or used by inclusion into one of the quarry products. Quarry fines will be used in products.

5.4.2 Waste Materials

Unauthorised Access and Illegal Dumping

The potential for rubbish to be dumped relates mainly to unauthorised access and is low as the site is set well back from Coalfields Road. There has been no issue with illegal dumping from the gravel operations and none is anticipated.

Fencing is combined with locked gates at all times when the site is unmanned and equipment is retained on site.

Illegally dumped materials are to be removed promptly to an approved landfill or other suitable site, depending on the nature of the material if any are dumped in the future.

Solid Domestic and Light Industrial Wastes

All solid domestic and light industrial wastes from existing operations are stored in commercial waste storage containers or appropriate facility and periodically removed to an approved landfill facility. The same methods will be used for the hard rock quarry.

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

There is no waste disposal onsite.

Waste storage containers are sealed so that rainfall cannot enter, therefore preventing the formation of leachates.

Regular inspections (at least weekly) are conducted to ensure no wastes, litter and the like are present in or around the excavation and processing area.

Domestic Wastewater Disposal

An approved waste water system will either be a septic system or a service dportable system. For a permanent facility a septic system will be utilised.

Refueling and Maintenance

Hydrocarbon is managed in accordance with the procedures specific to fuel and maintenance in the DOW – DMP Water Quality Protection Guidelines for Mining and Mineral Processing.

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

Catalano has in place safety and pollution management procedures for all their operations and on site.

Fuel Storage

Mobile plant only will be used at this stage. It will be refueled from mobile tankers located in a situation where hydrocarbons can be contained in the event of a spill or leakage.

It is possible that a fixed crushing plant will be installed at some point in the future if the demand for hard rock reaches sufficient volume.

Refueling for the gravel operation complies with DER, DMP and DOW standards, such as *Water Quality Protection Guidelines for Mining and Mineral Processing*, *Above-ground fuel and chemical storage*, and the same methodology will be used for the hard rock operation.

All refueling is conducted on the quarry, processing or storage areas.

A fuel tank located in a bunded lined facility or a double skinned approved facility is anticipated to be located on site for the crushing plant.

Dangerous Goods and Hazardous Substances

There is no transport, storage or handling of hazardous materials involved in hard rock extraction apart from fuel and explosives.

Explosives are not stored on site but are brought to the site when required by contractors.

Transport of materials such as blasting requirements, is conducted in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code) and Department of Mines and Petroleum requirements.

Servicing and Maintenance

All major servicing is conducted at the Brunswick workshop.

The following activities and management are currently used on site and will be continued.

- Regular inspections and maintenance of fuel, oil and hydraulic fluids in storages and lines are carried out for wear or faults.
- Servicing plant and equipment is maintained in accordance with a maintenance schedule. Note this is only minor lubrication or repairs conducted on site using mobile facilities.
- Major servicing is undertaken at the dedicated workshop facility at Brunswick which is installed with a concrete floor and silt and hydrocarbon trapping sumps which are cleaned regularly.
- Any waste chemicals derived during routine maintenance activities are stored in appropriate sealed containers within a designated storage area or taken from site and disposed of at an approved facility.
- Grease canisters, fuel filters, oil filters and top-up oils are stored in appropriate containers in a shed or brought to the site as required.
- Waste oil and other fluids derived from the routine maintenance of mobile machinery, are transported off site and recycled by an independent contractor. Materials that cannot be recycled are disposed off at an approved landfill site.
- There is not normally any wash down of mechanical equipment.
- There is no requirement for drum or other storage on site. These items are located at the Brunswick workshops.
- An accidental spill containment and cleanup protocol is in place.
- The site is maintained in a tidy manner.
- All surface water runoff from the pit is to be collected in the sump in the base of the pit and the water used for dust suppression.
- Water from the processing and stockpile area will be directed to a detention basin prior to release to a drain to travel to the existing dam and from there as overflow to the natural watercourses.

Fuel Spill Management Plan

The following activities and management are currently used on site and will be continued.

- Fuel and maintenance equipment is stored in accordance with the DOW – DMP Water Quality Protection Guidelines for Mining and Mineral Processing, *Mechanical servicing and workshop facilities* and *Above-ground fuel and chemical storage*.
- Diesel fuel will be stored in either a bunded lined approved tank or a double lined tank.

- Soils and roadbase 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.
- Refuelling and lubricating activities only occur in designated areas. Equipment for the containment and cleanup of spills is to be provided in these areas.
- Any spills will be contained by the excavation or processing area. A fluid spill emergency response kit is in place. For larger spills soil and resource will quickly be placed around the spill to contain it in as small an area as possible. When contained, the contaminated aggregate/loam soils will be scooped up and removed to an approved landfill or other approved site.
- 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).
- All significant adverse incidents (such as a fuel spill of >5 litres) in one dump, are recorded, investigated and remediated. A record is to be kept of incidents and the Local Authority and Department of Environment Regulation notified within 24 hours. No such incidences have been recorded at the quarry.
- The only other risk is from a tank rupture, but tanks are designed to manage this eventuality. A commitment is made to notify Department of Environment Regulation/Department of Water and Shire of Harvey of any spill greater than 5 litres in one dump. This is much less than the DOW requirement trigger of 100 litres. Soil contaminated by large spills will be removed from the site to an approved disposal area.
- No significant non compliances have been recorded.

Fuel spill emergencies are included within on site training and inductions.

5.4.3 Water Monitoring

Water Sampling

A water monitoring program is proposed. Generally the water will only be sampled in winter to early spring when there is water leaving the site. No sampling will be required when there is no water flows to the natural watercourses.

The location of the sampling points are shown on Figure 4.

Water will be sampled for pH, salinity, total dissolved solids and total suspended solids. Sampling will be conducted upstream and downstream of the proposed quarrying as is normally used for hard rock quarries.

Water Management - Applicable Legislation / Policies

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

- *Overview*
- *Minesite water quality monitoring*
- *Minesite stormwater*
- *WQPN 28 Mechanical servicing and workshop (2006)*
- *Mine dewatering*
- *WQPN Landuse Compatibility in Public Drinking Water Source Areas (2004)*
- *WQPN 15 Extractive Industries near sensitive water resources. (Not strictly relevant to the site but the methodology is useful).*
- *DER Licence L4593/1983/13*
- *Health Act 1911*

Commitments to Water Management

- B and J Catalano has in place a site code outlining requirements for operators and drivers.
- B and J Catalano will continue to conduct training programs on pollution minimisation practices.
- B and J Catalano will conduct the proposed water sampling and maintain the water quality protection measures listed above.

6.0 BIODIVERSITY ENVIRONMENTAL MANAGEMENT

6.1 Flora

The site of the proposed pit is cleared.

There are, behind the pit, some minor *Darwinia citriodora*, three *Xanthorrhoea preissii*, and one *Grevillea wilsonii*. Clumps of Marri tree (*Corymbia - Eucalyptus citriodora*) also occur on site.

The proposed processing and stockpile area will be located on pasture.

The drainage lines are being colonised by *Taxandria linearifolia* regrowth and will be retained.

The only vegetation that will be required to be removed are some scattered Marri *Corymbia (Eucalyptus) calophylla*. A clearing Permit will be applied for to cover clearing of the trees. In compensation additional trees will be planted as buffers and screening vegetation. The planting will be local native trees.

6.2 Fauna

The reduced vegetation with a predominance of pasture will result in a reduction in the number of fauna. The shrubs will be providing some habitat.

No fauna study has been conducted, native fauna will be living in the *Taxandria linearifolia* thickets outside the proposed facilities and associated with the Marri Trees.

The amount of fauna is anticipated to be limited because of the continuous grazing on site.

Frogs and other wetland species will be present associated with the drainage lines. As noted above additional trees will be planted.

6.3 Wetlands

Hill et al, 1996, *Wetlands of the Swan Coastal Plain*, Volume 2b, Water and Rivers Commission and Department of Environmental Protection, record parts of three Paluslope wetlands well to the north of the proposed pit and processing area.

These are related to *Taxandria linearifolia* regrowth. When the land was covered by forest not all these areas are likely to have been present because of the greater evapotranspiration. With land clearing and reduced evapotranspiration, wetter soils developed in valleys, and these areas were rapidly colonised by *Juncus* and *Taxandria*.

This can be seen west of the proposed pit where *Taxandria linearifolia* is colonising pasture in areas where it did not naturally occur.

Much of these identified wet areas are therefore probably not original. Interestingly the drainage lines to the east and west of the pit have much greater amounts of *Taxandria* and yet are not listed by Hill et al 1996. These areas are related to drainage lines and therefore also wetlands.

No Hill et al 1996 wetlands lie near the site, being some 500 metres away. Figure 4.

Biodiversity - Applicable Legislation / Policies <ul style="list-style-type: none">• Nil
Commitments to Biodiversity Management <ul style="list-style-type: none">• The excavation areas are cleared.• Catalano will not impact on the adjoining remnant vegetation by the proposed excavation.

6.4 Dieback Management Plan

Dieback of vegetation is often attributed to *Phytophthora cinnamomi* even though there are other *Phytophthora* species and other diseases such as *Armillaria* that can cause dieback like symptoms.

In most cases dieback is caused by a pathogen, which infects 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.

Jarrah Dieback (*Phytophthora cinnamomi*) is widespread throughout this part of the State, but in many cases such as this site the vegetation is not interpretable because of the levels of disturbance.

It is not really a matter of preventing dieback from spreading because infection most likely already occurs there, but rather adopting policies and practices that minimise the spread or introduction of dieback *Phytophthora* spp or other diseases from quarrying or transport activities into State Forest to the east.

There are several guides to the management of Dieback.

- Department of Environment and Conservation (DPaW) *Dieback Hygiene Manual 1992* is a practical guide to Dieback management.
- Department of Environment and Conservation (DPaW) *Best Practice Guidelines for the Management of Phytophthora cinnamomi, draft 2004*.
- Dieback Working Group 2005, *Management of Phytophthora Dieback in Extractive Industries*.
- Dieback Working Group 2009, *Managing Phytophthora Dieback in Bushland*.

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.

The general principles that Catalano uses on the gravel operations on site, and on other locations, will be used as the opportunities are presented, and are listed below

How these activities are incorporated into dieback management on this site is outlined below.

- Dieback diseases are more likely to be transported under moist soil conditions.
- All vehicles and equipment to be used during land clearing or land reinstatement are to be clean and free from soil or plant material prior to arriving at a site.
- Vehicles and earth moving equipment are cleaned prior to entering the site if they originate from a dieback affected area.
- No soil and vegetation is brought to the site apart from that to be used in rehabilitation.
- Plants to be used in rehabilitation are obtained from dieback free sources.
- Vegetated areas ahead of excavation are quarantined to onsite access tracks
- Access to vegetated areas is discouraged through a lack of tracks and external fencing
- Rehabilitated surfaces are free draining and do not contain wet or waterlogged conditions.
- Illegally dumped rubbish is removed promptly.
- No contaminated or suspect soil or plant material is to be brought onto the site.
- When clearing land or firebreaks vehicles work from dieback free areas towards dieback identified or at risk areas.
- Roads are free draining and hard surfaced

Quarry traffic is to be restricted to the designated access roads, pit and stockpile areas as they are for the gravel operations, apart from clearing land and maintaining fire breaks.

Normally transport trucks run along the bitumen roads to their destination and return once they hit Coalfields Road. This run is considered low risk for dieback and trucks will not require cleaning during the transport phase.

The site is secured from unwanted access with fencing, gates and perimeter bunding. A hygienic site is maintained by not bringing any soil or plant material onto the site except for rehabilitation purposes or from known dieback free areas. All plants, seeds, and other materials used in rehabilitation, are sourced from dieback free areas.

Illegally dumped rubbish or material has not been an issue for the gravel operation, but if waste is dumped the materials are promptly removed from site.

Significant numbers of species known to be resistant to Jarrah Dieback are included on the landscape bank plantings.

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

- B and J Catalano will not impact on the adjoining remnant vegetation by the proposed excavation.
- B and J Catalano will maintain the Dieback Management Policy to reduce the spread of Plant Pathogens.

6.5 Weed Management Plan

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

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

Generally if the actions taken for Dieback are applied they will also control weeds. Not all potential impacts will apply all the time and the main impacts affecting this site are also listed. The management of weeds on site is integrated to normal farm management and is no different to those operations. Weeds are treated now if they occur so that pasture quality is not impeded. That process will be continued.

The following general management actions are used wherever possible.

- All vehicles and equipment to be used during land clearing or land reinstatement, are clean and free from soil or plant material when arriving at a site.
- No soil and vegetation is brought to the site apart from that to be used in rehabilitation.
- Plants to be used in rehabilitation are free from weeds.
- Vegetated areas ahead of excavation are effectively quarantined to onsite access
- Unwanted access to vegetated areas is discouraged through a lack of tracks and external fencing
- Weed affected topsoils may need to be taken offsite, used in weed affected areas, buried by 500 mm soil/overburden or taken offsite
- 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 in weed affected areas, vehicles work in conjunction with dieback principles and push from dieback free/disturbed areas towards dieback areas.
- Weeds are sprayed with broad spectrum spray prior to planting or seeding in weed affected soils.
- Unfavourable grasses are sprayed with grass selective spray prior to seeding or rehabilitation
- Weed management normally works from least affected areas to most affected.
- Declared weeds are treated promptly by digging out or spraying as outlined below.
- Ongoing monitoring of weeds is undertaken at least annually in autumn, prior to winter rains.
- Normally weed management is from the least weed affected areas to the most weed affected, which therefore gives a smaller area to treat with spray or earthworks.
- Weed affected soils are not used for rehabilitation but are buried or used in pasture areas where better control is possible.

Regular inspections are conducted by Catalano staff to monitor the presence and introduction of weeds on a bi-annual or more frequent basis. On identification of significant weeds, they are either removed, buried or sprayed with a herbicide.

Weed - Applicable Legislation / Policies
<ul style="list-style-type: none">• <i>Agriculture and Related Resources Protection Act 1976.</i>
Commitments to Weed Management
<ul style="list-style-type: none">• B and J Catalano will continue to use the weed policy to try and prevent the introduction of Declared, Environmental or other weeds to the site.

7.0 CLOSURE AND REHABILITATION PROGRAM

7.1 Background

The closure of the pit is not proposed at this stage. The hard rock quarry is anticipated to provide a long term resource over many years.

However it is possible that closure could occur either temporarily or at the end of the approval time and a contingency is required for that purpose.

The land zoning is Rural and at the end of quarrying a return to Rural land use is proposed. Lot 501 is a very large lot of 405.693 hectares. The proposal is anticipated to disturb less than 10 hectares within the next 10 – 20 years.

The main closure issues relate to the reformed slopes that need to be formed to be resistant to erosion and the water collection of the farm dam combined with visual management.

There are no significant closure issues that will require management. There will be no tailings, adverse soil or other materials or features on site and none are proposed during future excavations.

There will be some dumps of subgrade rock and overburden which will be used for rehabilitation.

The pre-mine land surface of the pit generally has slopes of 1 : 4 vertical to horizontal with some areas of rocky outcrop to the south at 1 : 2. The processing and stockpile area has slopes of 1 : 7 to 1 : 12 vertical to horizontal.

The pit is to be excavated to a series of benched faces in the north that will be rehabilitated to a steeper rocky slope of about 1 : 2 which will match the rocky local areas.

The processing and stockpile area will be formed into a flat benched floor with a steeper outer slope that will be planted to native trees. The level floor area will be retained for pasture or for shed and other future farm activities.

The current and pre-excavation land use is pasture with several scattered trees.

The site is elevated and cannot be seen from Coalfields Road but can be seen from properties at a distance from the south.

Post mining land use will be a return to productive pasture with areas of local native trees and shrubs on steeper slopes.

At the end of excavation the sediment settlement dams will be formed into a farm dam. Calculations on the catchment reveal that with suitable reforming of the excavated land the dam will be large enough to retain all surface water runoff. It should however be installed with an erosion resistant spillway to permit excess water flow to the natural creekline.

The dam will be revegetated with wetland species

A most important aspect of revegetation is that the planting and seeding must be completed within the first year of placement of the topsoil, and that planting in compacted ground reduces the success greatly.

The planting of too many trees, without shrubs, can also lead to many deaths and thinning of the visual screen, as the plants grow spindly or are subject to drought stress.

A definitive time for seeding and the planting of tube stock should not be prescribed, but rather a commitment to establish the vegetation within the first autumn/winter following placement of the overburden/topsoil.

Seeding and planting is undertaken at the most suitable time and can vary greatly depending on individual site conditions and the season. For example planting tube plants early in a dry winter year can lead to their probable failure because of a lack of early rains. Seeding with heat treated seed is not normally suitable for late summer, but scarified seed can be spread in late summer. North facing banks, are planted earlier than south facing banks which are better planted in August. All seeds are now subjected to smoke pre-treatment.

The key is to provide screening vegetation with some pasture areas that matches the local viewscales.

Stakeholder Input

There will be significant stakeholder input during the application and assessment process.

The application for development approval will be advertised locally and sent to all relevant Government Departments many of whom are likely to make comments. The application will also be assessed by the various specialist staff of the Shire of Harvey.

Finally the project will be assessed by the Shire of Harvey.

7.2 Closure Objectives

Rehabilitation will utilise best practice and be directed towards achieving a sustainable cover of productive pasture and local native vegetation.

The local native vegetation is proposed to be capable of forming a species richness and diversity that will form a useful fauna habitat.

1. All plant, foreign materials, buildings and other matter associated with excavation will be removed from site.
2. Hardstand and roads on which gravel or aggregate have been added that are not required for future land use will be removed.
3. The disturbed land will be made safe and in compliance with the *Mines Safety and Inspection Act 1994* and *DMP Mine Closure Guidelines*.

4. The reformed land surface will be internally draining or draining to an on site dam.
5. All legally binding conditions and commitments relevant to mine closure and rehabilitation will be met.
6. The land surface will be resistant to wind and water erosion.
7. Rehabilitated vegetation will be a sustainable cover of pasture and local native trees and shrubs.
8. Revegetation will be free from Declared or Environmental weeds that could compromise the success of the revegetation or spread into adjoining native vegetation.
9. The rehabilitated vegetation will have similar resilience to the local native vegetation.
10. Soil properties will be appropriate to sustaining revegetated pasture and the areas of local native trees and shrubs.

7.3 Development of Completion Criteria

The end use is to be productive pasture, which is compatible with the local Rural Land Use Zoning.

Slopes will match existing landforms.

The revegetation will be progressively monitored to ensure the Completion Criteria is met.

The Completion Criteria will be adjusted as necessary during the life of the project based on stakeholder input, data collected on the existing environment and the continued success of the rehabilitation.

Completion Criteria

- Stable post-excavation landscape with slopes of similar steepness to pre excavation slopes combined with a flat area for pasture or future rural activities and pasture, and the minimisation of wind and water erosion.
- Provide a landform that is visually compatible with the surrounding land.
- Self sustaining vegetation that is providing good visual management, slope and soil stability.
- Form shrub and tree habitat that exceeds the pre-excavated native vegetation on site in terms of area, and species.
- Provide for the protection of the local surface and groundwater resource in terms of both quality and quantity.

- Provide a self sustaining cover of perennial pasture on the lesser slopes.
- The vegetation of the rehabilitation areas will be local provenance species that resemble the local communities in structure and habitat.
- Achieve weed species at levels not likely to threaten the rehabilitated native vegetation.
- Meet the Completion Criteria on all rehabilitated areas at three years following establishment of rehabilitation.
- Reform sediment settlement dams to a farm dam.

In addition to the above, the following completion criteria are indicative of what will be aimed for within the rehabilitated areas. In some locations the vegetation may have different matches of species and composition but can be regarded as successful if they match the local pre-mined communities.

Pasture Area Completion Criteria

- Perennial pasture that has a sustainable grazing capability compatible with rural land use.

Steeper Slopes Native Vegetation Completion Criteria

- 20 local provenance shrubs and trees per 100 m² (at three years after rehabilitation) ie 2000 plants per hectare.

7.4 Closure Implementation

7.4.1 Land Clearing

Vegetation clearing requires that all topsoil and any overburden is to be recovered as ground is cleared and spread directly onto an area to be rehabilitated or retained for use in rehabilitation. The topsoil is stored separately from the overburden.

7.4.2 Land Restoration

The following procedures have been used in the past to restore the disturbed ground whether at the end of excavation, as part of ongoing rehabilitation or during premature closure. In summary the methods are;

- Rehabilitation is to occur as soon as possible following the end of excavation and other activities or as soon as a part of the operation is completed or no longer required.
- Where possible any disturbed areas that are no longer required will be rehabilitated using the methods described above within 12 months of becoming available.
- Runoff will significantly reduce as a result of rehabilitation of the excavated land. The form of the concept final land surface has taken account of the runoff and has been designed to minimise runoff from storm events and therefore manage erosion risk. It also aims to maximise infiltration of smaller rainfall events.
- The steeper slopes planted to trees and shrubs will form approximately 3.5 hectares and the more gently sloping pasture 6.5 hectares.

Pit faces

- All buildings, plant and any other foreign materials will be removed from site.
- The pit will be prepared by pushing down, reducing and backfilling the active face with a loader and bulldozer. Blasting will be used as required to knock the crest down with the rock being used for backfill.
- As a result of past research and experience it has been found that the best method of backfill is to include a substantial proportion of rock and stone to assist stability and to leave the surface rough. This is particularly important where the overburden has a high clay content. Where the surface is smooth the surface will be worked, where possible, to form channels, furrows or small banks or rough areas to encourage the penetration of precipitation and reduce surface runoff.
- The quarry benches will be left in place. Benches will be back filled with overburden with the brow remaining as a rocky outcrop. This will give the overall appearance of a steep slope broken by rocky outcrops. In some locations the brow of the benches will be broken by blasting to give the appearance of hill slopes. This final landform will provide similar habitat to the local landform.
- No natural soil or weathered regolith slope or batter will be greater than 1 : 3 to 1 : 4 vertical to horizontal. Pit slopes in hard rock will be retained at safe vertical faces or slopes at 1 : 1 to 1 : 2 vertical to horizontal in compliance with the *Mines Safety and Inspection Act 1994* and *DMP Mine Closure Guidelines*.

- The floor will be formed to be internally draining, and will retain rainfall or drain to a detention basin.
- Areas of the pit floor to be vegetated will be deep ripped where possible.
- Overburden followed by topsoil will be spread directly from an area being cleared or from overburden stockpiles and placed over the land surface being restored. Any vegetation fragments will be either spread on top of the topsoil or spread with the topsoil.
- The backfilled materials will be track rolled by bulldozer where possible and covered by 600 mm of overburden to ensure that all inert and non – natural materials are covered. Some parts of faces and boulders will be retained to provide fauna habitat.

Hardstand, roads and other such areas of the processing area

- All buildings, plant and any other foreign materials will be removed from site.
- Roadbase, hardstand and any other inert materials left over from the site operations will be scraped and picked up and will be used to backfill the pit faces.
- Steep or vertical slopes will be pushed down, although the batter slopes that form the level areas will be retained for future use.
- Where backfill is not required, used hardstand will be scraped up and placed in the pit with the inert materials
- The ex-hard stand, processing, access roads, stockpile areas and other compacted ground will be deep ripped by bulldozer at intervals of 1 – 2 metres, which will rip up the subsoils that remain in those locations.
- Ripping is preferred after the spreading of overburden/topsoil, provided ripping of the base floor material can achieve the required 1 metre.
- A minimum of 300 mm of overburden will be spread over the surface where available to provide a substrate for revegetation.
- The floor and slopes will be left with a rough surface along contour as this reduces run off and encourages plant growth.
- The steeper slopes will be installed with contour banks or structures to slow the flow of surface water.
- Any materials which may have been displaced during storm events will be picked up and used for fill.
- Where possible, overburden, followed by topsoil and recovered vegetation, will be spread directly from an area being cleared to an area being rehabilitated to minimise the potential for seed loss.

- Overburden from areas of thin soil, which contains topsoil and included seed load, will be spread across the surface.
- Where separate topsoil is available it will be spread across the overburden.
- Topsoil will be spread evenly across the rehabilitated areas in summer or early autumn prior to the winter rains. Stored topsoil rapidly loses seed viability and could be expected to be less than 50% effective if stored through one winter.

Pasture Areas

Pasture areas will be deep ripped but then scarified to smooth the surface for seeding to perennial pasture.

Farm Dam

- The dimension of the farm dam will be determined by engineering calculations of the runoff from the rehabilitated land, taking into account the flatter pasture area and the steeper slopes planted with trees and shrubs and the contour banking.
- An erosion resistant spillway will be provide for storm overflows as a contingency with any excess water flowing to the natural drainage.

7.4.3 Revegetation

All areas

- Topsoil will be transferred directly from an area being cleared and spread across the surface to provide seed sources and habitats wherever possible.
- Weed and Plant Disease Management Plans are in place and are attached.
- Any weeds likely to significantly impact on the rehabilitation will be sprayed with Roundup or similar herbicide or grubbed out, depending on the species involved. Weed affected topsoil and overburden will be buried.
- The Weed Management Plan will form the basis of weed treatment. Depending on the nature of the planting substrate, a broad spectrum spraying program may be used. In areas where grass only is a potential problem grass specific sprays will be used. In some areas where topsoil from cleared native vegetation is available no spraying may be required.

Pasture

- The preferred method of revegetation is to use the seed from existing topsoil to provide pasture. However this may be deficient and seeding is conducted to Department of Agriculture and Food or a consultant's guidelines. Fertiliser is applied at standard rates for the pasture sown.
- Any weeds likely to significantly impact on the rehabilitation are sprayed with Roundup or similar herbicide or grubbed out, depending on the species involved.
- Rehabilitation is to be carried out progressively during the first available winter months following the restoration earth works. Leaving the completed earth works for one season reduces the success of rehabilitation by at least 50%, due to compaction effects.
- Seeds of pasture species are spread during autumn if there is insufficient in the existing topsoil.
- If sufficient seed is not available or does not germinate then additional seed will be added. The establishment of pasture, including the selection of the pasture species is appended to this Management Plan. The documentation is produced by the Department of Agriculture and Food.
- For pasture land in this situation it is essential that the species are matched to the soil types and rainfall. The location falls into the "High Rainfall Coastal" planting regime with loam to clay soils. Suitable perennial legumes include Birdsfoot trefoil, Lucerne, Strawberry Clover, and Sulla. Perennial pasture includes Perennial Ryegrass, Phalaris, Cocksfoot, and Summer Active Tall Fescue, Kikuyu and Rhodes Grass. Annual pasture species include Italian Ryegrass, Serradella, subterranean clover.
- The actual species used will be determined by the individual season, nature of the rainfall in the preceding months and stocking/hay production proposed by the landholder which may change from time to time.
- Seeding rates are 2 – 5 kg/ha depending on the species used; for example Ryegrass is seeded at 3 kg/ha whereas Rhodes Grass is seeded at 4 kg/ha.
- The amount of fertiliser applied will depend on the species used; for example when planting legumes nitrogen fertiliser is reduced or not used as it inhibits nitrifying bacteria. Also the amount of sulphur, phosphate and trace elements used depends on the species and residual amounts retained in the soil. As a guide 50 kg/ha of slow release superphosphate is likely to be used to assist legume and grass based pasture.

Native Vegetation

- Pre-seeding weed control is only likely to be required where topsoils are used that contain weed species.

- If required this is normally only 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 native and some pasture species but may be required if the weed load is to be reduced.
- Rehabilitation is carried out during the first available winter months following the restoration earth works. Leaving the completed earth works for one season reduces the success of rehabilitation by at least 50%, due to compaction effects.
- Trees are to be planted as tube plants in winter, (June to August) installed with 10 g fertiliser tree tablet next to each plant. Prior to planting, the ground is deep ripped and the competition from pasture species removed through spraying or mechanical removal.
- Tube plants are established in low undulations and not on the high points of furrowed soil. The planting rate is 2000 stems per hectare.
- The vegetation will be fenced to exclude stock, or stock will not be introduced until the vegetation is sufficiently established.
- A local native plant species list is provided below.

W	Suitable for wet sites
T	Tree
L	Legume or nitrogen fixing
S	Best species for providing rapid screening cover
#	Suitable for seeding and normally introduced from seed

Local species to be used in rehabilitation

<i>Acacia extensa</i>	L#	
<i>Acacia saligna</i>	LS#	can be affected by insects
<i>Acacia urophylla</i>	L#	
<i>Allocasuarina fraseriana</i>	L#	
<i>Callistachys lanceolata</i>	S	
<i>Callistemon phoeniceus</i>	S	
<i>Calothamnus quadrifidus</i>	S#W	
<i>Calothamnus rupestris</i>	S	
<i>Calothamnus sanguineus</i>	S	
<i>Clematis pubescens</i>	#	
<i>Eucalyptus calophylla</i>	TS	
<i>Eucalyptus megacarpa</i>	TS	
<i>Eucalyptus patens</i>	TS	
<i>Eucalyptus rudis</i>	TSW	affected by insects
<i>Hakea lissocarpha</i>		
<i>Hakea petiolaris</i>		
<i>Hakea trifurcata</i>		
<i>Hardenbergia comptoniana</i>	L#	
<i>Kennedia coccinea</i>	L#	
<i>Kennedia prostrata</i>	L#	
<i>Kunzea recurva</i>	S	

<i>Leptospermum erubescens</i>	
<i>Melaleuca preissiana</i>	S
<i>Paraserianthes lophantha</i>	LS#
<i>Sollya heterophylla</i>	
<i>Taxandria linearifolia</i>	S
<i>Trymalium ledifolium</i>	
<i>Viminaria juncea</i>	S

Irrigation

- Rehabilitation of local quarries and revegetated areas has shown that when completed well there is no need for irrigation of the rehabilitation when the revegetation is completed at the appropriate time of the year.

Erosion Control

- Soil erosion occurs when soil is exposed and disturbed by wind or water. For this site the loam/clay soils will be resistant to wind erosion.
- Water erosion on the steeper slopes will be reduced by leaving the surface soft, rough and undulating, with the undulations running along contour. The final machinery run should be along contour and not down slope. In most cases any backfill will be pushed perpendicular to the face rather than pushed along contour.
- For rehabilitation areas, revegetation will take place as soon as possible following landform and soil reconstruction.
- The gently sloping pasture areas will assist in reducing runoff as will the planting of trees and shrubs on the steeper slopes.

7.5 Temporary Closure

The nature of the temporary closure will depend on the circumstances and the time frame when activity is proposed to recommence.

Completion Criteria	Seasonal or Campaign Closure	Care and Maintenance	Care and Maintenance
Length of Closure	Few months	One year	More than one year
Inspections	Occasionally	Several times per year	Once to twice per year.
Plant, foreign materials, buildings and other matters associated with excavation.	Secure the site and any plant to be left. Remove all hydrocarbons and other fluids.	Secure the site and any plant to be left. Remove all hydrocarbons and other fluids.	Secure the site and any plant to be left. Remove all hydrocarbons and other fluids. Remove any plant susceptible to combustion stealing or movement.
Provide for the protection of the local	Remove all potential pollutants as described	Remove all potential pollutants as described	Remove all potential pollutants as described

groundwater resource in terms of both quality and quantity.	above. Ensure that all watercourses are free flowing and non eroding. Retain all water that may collect “non natural materials” within the pit or detention basins. Ensure that spillways are in place and protected against erosion.	above. Ensure that all watercourses are free flowing and non eroding. Retain all water that may collect “non natural materials” within the pit or detention basins. Check for compliance during nominated site inspections. Ensure that spillways are in place and protected against erosion.	above. Ensure that all watercourses are free flowing and non eroding. Retain all water that may collect “non natural materials” within the pit or detention basins. Check for compliance during nominated site inspections. Ensure that spillways are in place and protected against erosion.
The disturbed land will be made safe and in compliance with the <i>Mines Safety and Inspection Act 1994</i> and <i>DMP Mine Closure Guidelines</i> .	Complete activities to make the site safe.	Complete activities to make the site safe.	Complete activities to make the site safe.
All legally binding conditions and commitments relevant to mine closure and rehabilitation will be met.	Ensure all legal conditions and commitments are complied with.	Ensure all legal conditions and commitments are complied with.	Ensure all legal conditions and commitments are complied with.
Provide a stable land surface which is resistant to wind and water erosion.	Inspect all areas and ensure the land surfaces are stable to erosion from wind and water.	Inspect all areas and ensure the land surfaces are stable to erosion from wind and water.	Inspect all areas and ensure the land surfaces are stable to erosion from wind and water.
Rehabilitation is to occur as soon as possible following the end of excavation and other activities.	Rehabilitate any areas that have been completed within 12 months.	Check rehabilitation during site audits and correct as necessary.	Ensure rehabilitation is conducted at a suitable time to achieve success. If timing is not suitable undertake remediation earthworks such as re-ripping and reseed.
Revegetation will be free from declared or Environmental weeds that could compromise the success of the revegetation.	Inspect the site for environmental and declared weeds. If found, inspect adjoining native vegetation for edge effects. Inspect rehabilitation and the edges of access roads.	Annually	Remove or spray environmental or declared weeds. Provide annual follow up inspections and treatment at the appropriate time of the year.
The rehabilitated vegetation will have similar resilience to the local vegetation	Inspect the revegetation to determine its long term survival from environmental and fire impacts.	Annually Continue monitoring for 3 years until signed off.	Provide additional topsoil or seed and add tube plants to increase the number and diversity of plants.

8.0 MONITORING AND REPORTING

Monitoring

All activities will be regularly monitored.

In late December or early January an annual audit of all the operating conditions will be made by an independent consultant. The results of this audit will be reported on in the annual reporting. See below.

Dust is to be assessed continuously by all staff on site. Adverse situations are reported as soon as they are noticed to the Quarry Manager who responds by taking action to mitigate any problem. This could take the form of applying additional water, ceasing or modifying a particular activity or providing for long term changes to the way in which a particular activity is conducted, including modification or upgrade to plant and process.

Noise levels are to be measured regularly in quarries for occupational health and safety. The Department of Mines and Petroleum requires regular measurements and undertakes site inspections. Personal protection equipment is used. In noisy situations investigations are undertaken and modifications to plant or process made where possible to reduce noise impacts.

Blasts are to be monitored for air blast and ground vibration. The results will be retained and used for the planning of future blasting.

Water on site is to be sampled monthly upstream and downstream of the quarrying when water is flowing from the processing or pit areas.

Measurements are to be taken for hydrocarbons, pH, total dissolved substances and total suspended sediments.

Water sample data will be retained.

Visual assessments are to be regularly made, particularly from the south, and actioned with the appropriate responses, such as planting additional trees, bunding, painting, relocation of offending items etc.

Revegetation is to be monitored in autumn with respect to survival rates and weeds. Actions are to be taken as appropriate such as the most efficient weed control and additional planting.

- During autumn an assessment of the success of the rehabilitation will be made to determine the rehabilitation requirements for the following months.

- Monitoring includes visual assessments and, where necessary, counts to determine the success of the soil stabilisation including vegetation cover and soil stability.
- As necessary steps will be taken to correct any deficiencies in the vegetation.
- Rehabilitation of each stage will be monitored for a period of three years to ensure that the revegetation meets the completion criteria of providing self sustaining vegetation cover.
- 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
 - additional tube planting.

Rehabilitation - Applicable Legislation / Policies
<ul style="list-style-type: none">• <i>EPA, Guidance 6, Rehabilitation of Terrestrial Ecosystems</i>
Commitments to Rehabilitation
<ul style="list-style-type: none">• B and J Catalano will ensure the completed land surface is formed to the standards in the <i>Mines Safety and Inspection Act 1994 and Regulations 1995</i>.• B and J Catalano will rehabilitate the surface as outlined above and monitor the revegetation and parkland pasture.

REFERENCES – INFORMATION

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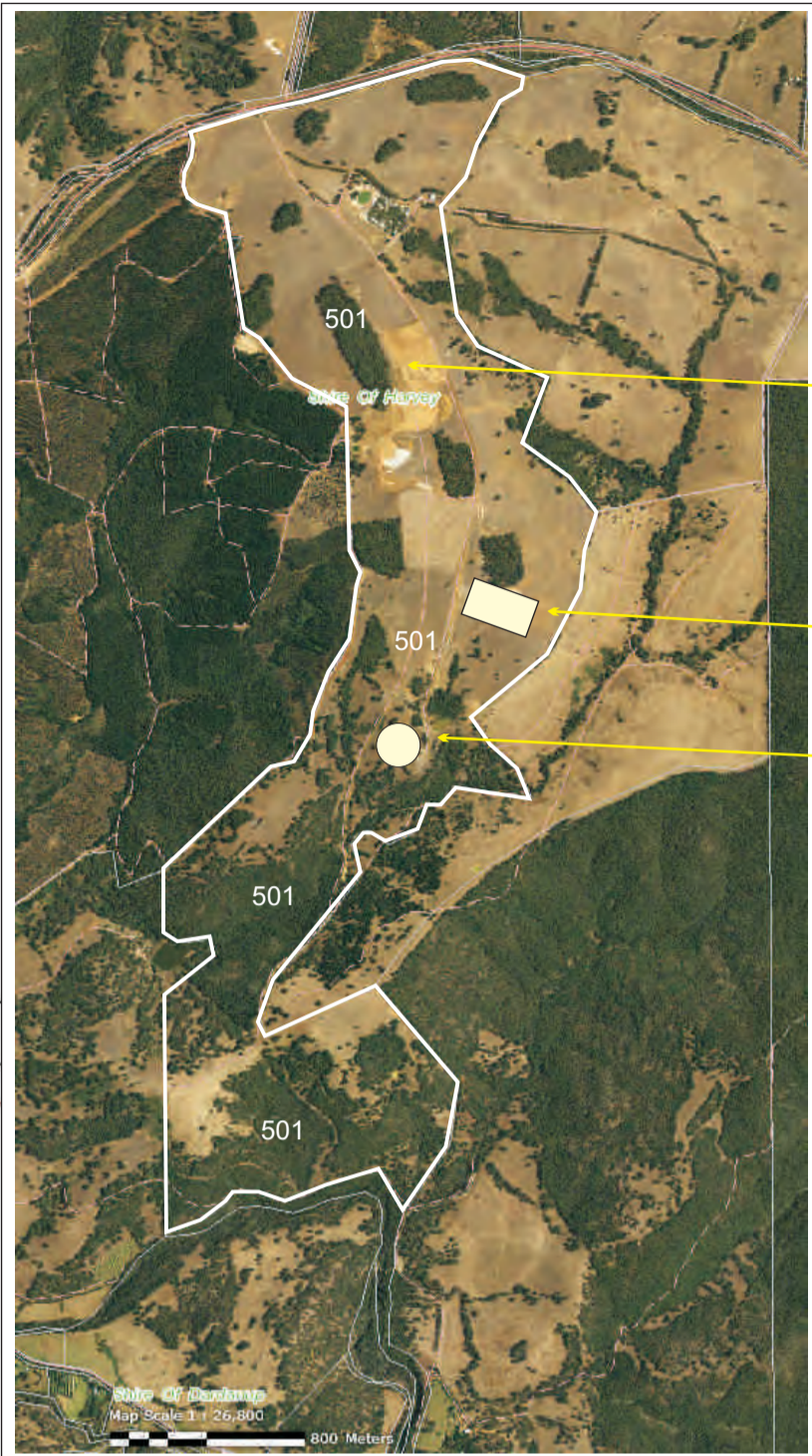
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Approved gravel operations

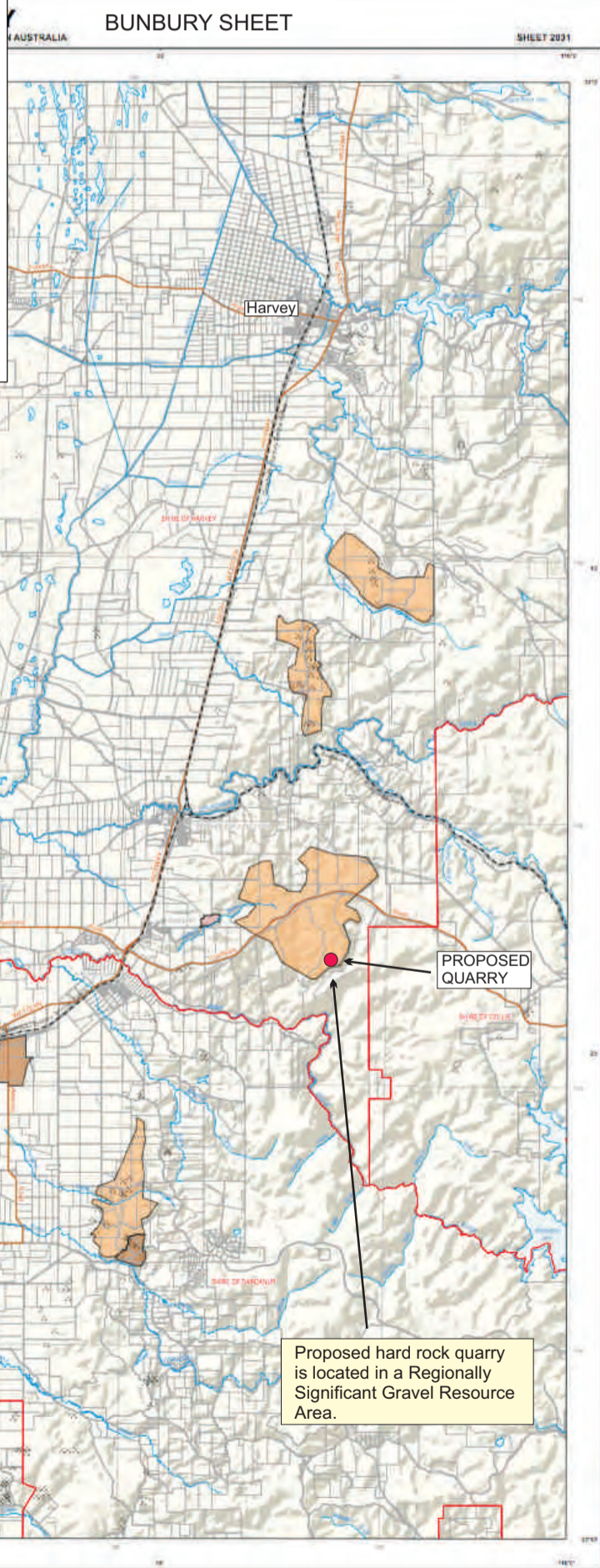
Processing area

Proposed quarry

LOT 501 - (407.71 hectares)

Figure 1

B and J CATALANO	
LOT 501, COALFIELDS ROAD, WELLINGTON	
LOCATION	
Landform Research	June 2013
Basemap LANDGATE	Scale See Plan



LEGEND

- City
- Gravel
- Limestone / sandstone high grade
- Rock aggregate
- Sand
- Quarry covering or abandoned
- Land title boundary, unshaded
- Highway / main road
- Rail
- Airport
- Local government boundary
- Drainage

NOTE: Regionally significant basic raw materials have been compiled from previous geological mapping using various techniques to identify those areas that have the potential to provide a long term supply of these materials. These areas are generally those with the largest potential extraction conditions being 20% to 40% of the total area. Areas of practical high level planning and mining concerns were noted, but these do not take into account any constraints imposed by State and Commonwealth environmental or heritage legislation. This mapping was compiled to assist government and community decision-making, but cannot be taken as a government endorsement of approval or priority in mining of these areas.

SHEET INDEX
Regionally significant basic raw materials mapping shown in green

DATA PROVISION

Theme	Date/Version	Description
City	2011/01	City
Gravel	2011/01	Gravel
Limestone / sandstone high grade	2011/01	Limestone / sandstone high grade
Rock aggregate	2011/01	Rock aggregate
Sand	2011/01	Sand
Quarry covering or abandoned	2011/01	Quarry covering or abandoned
Land title boundary, unshaded	2011/01	Land title boundary, unshaded
Highway / main road	2011/01	Highway / main road
Rail	2011/01	Rail
Airport	2011/01	Airport
Local government boundary	2011/01	Local government boundary
Drainage	2011/01	Drainage

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Geological Survey of Western Australia
Department of Mines and Petroleum

Geological Survey of Western Australia
100 St James Street, Perth WA 6000
Phone (08) 9437 3000
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Website <http://www.gswa.gov.au>
Email info@gswa.gov.au

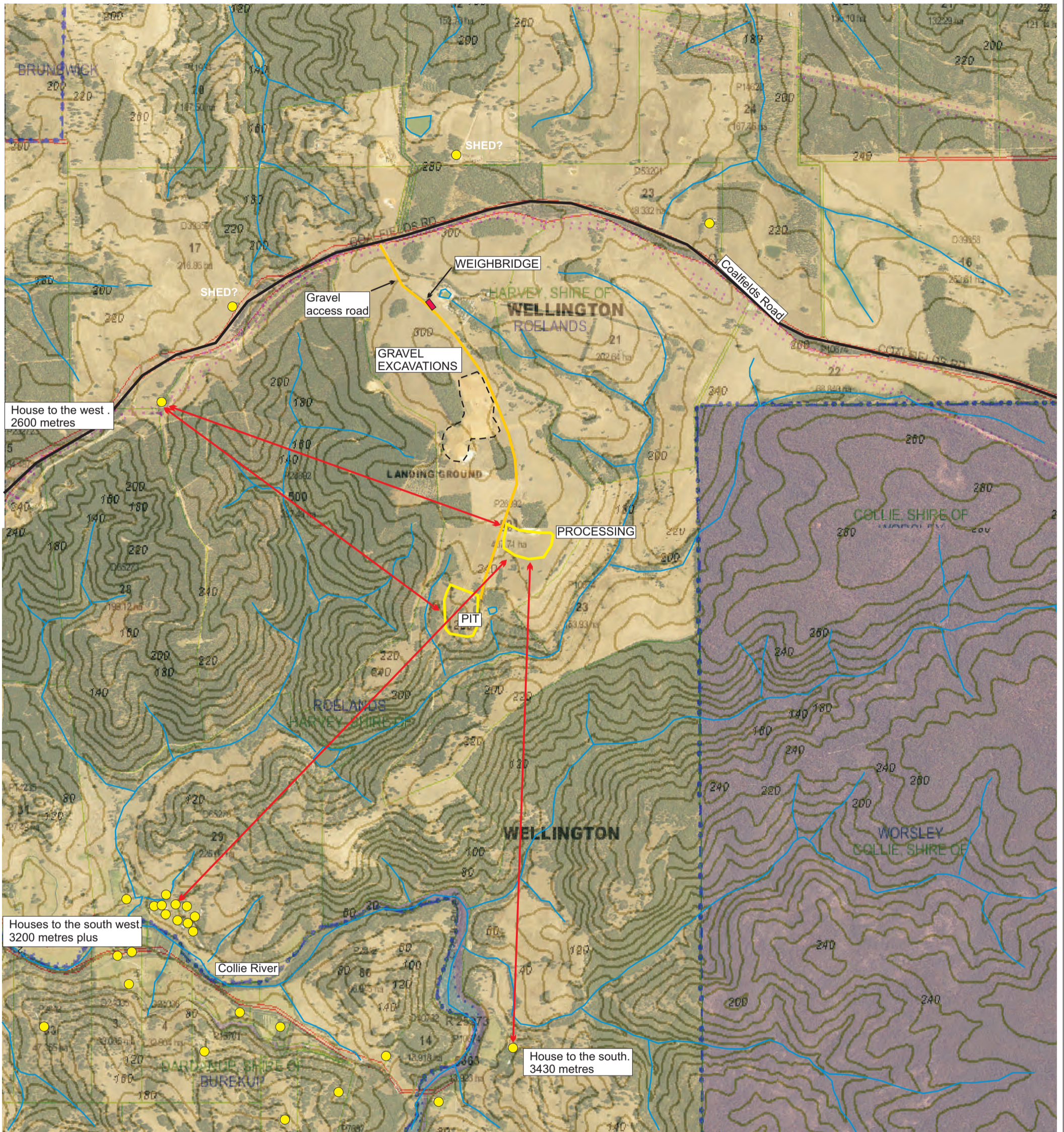


Geological Survey of Western Australia
Department of Mines and Petroleum

RESOURCE POTENTIAL FOR LAND USE PLANNING
REGIONALLY SIGNIFICANT BASIC RAW MATERIALS
BUNBURY

SHEET 2331 8881 EDITION 2012
Scale 1:100,000

Proposed hard rock quarry is located in a Regionally Significant Gravel Resource Area.



● Dwelling identified from aerial photograph












Figure 2

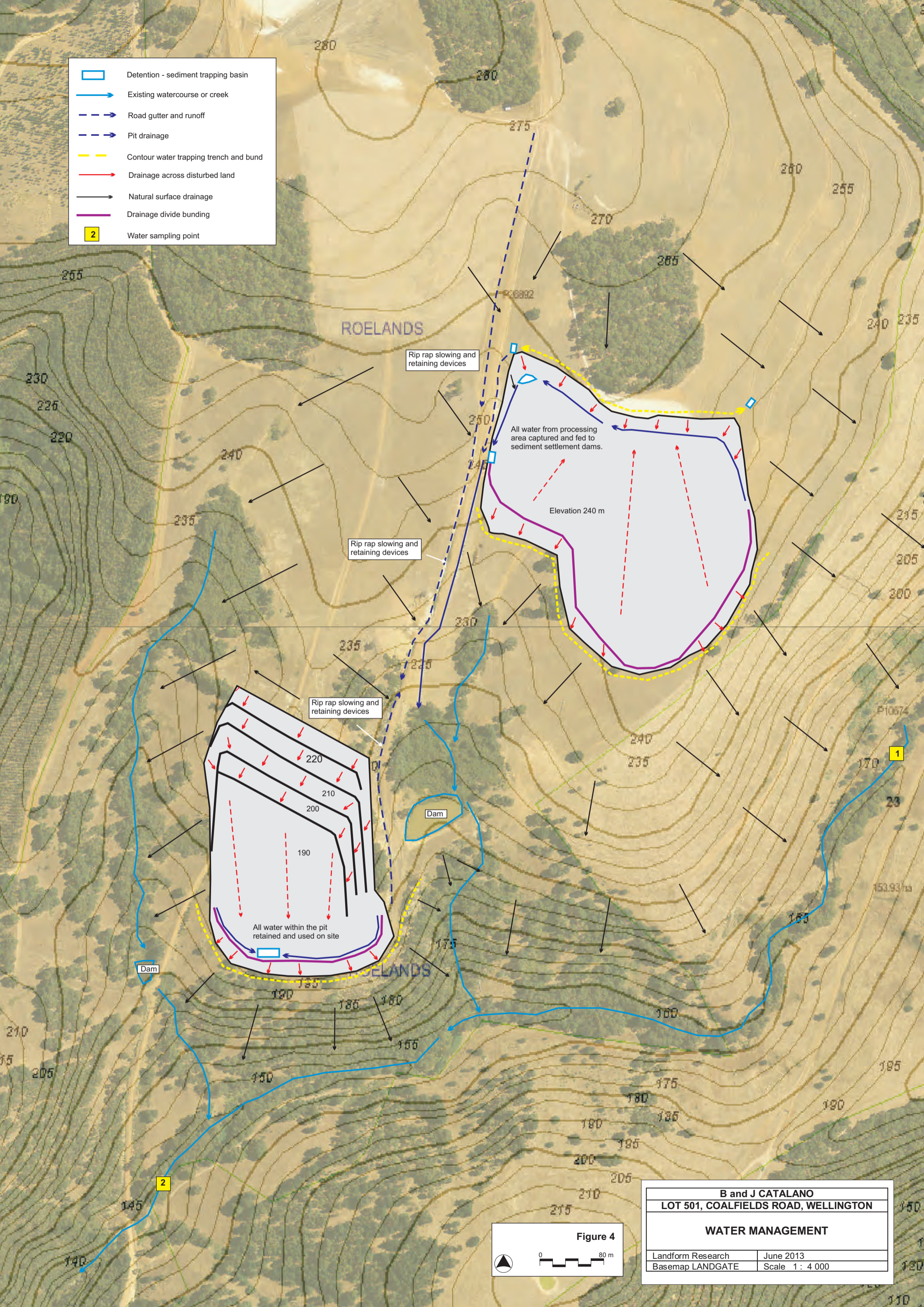
B and J CATALANO	
LOT 501, COALFIELDS ROAD, WELLINGTON	
SURROUNDING LAND	
Landform Research	June 2013
Basemap LANDGATE	Scale 1 : 22 500



Figure 3

B and J CATALANO	
LOT 501, COALFIELDS ROAD, WELLINGTON	
AERIAL PHOTOGRAPH	
Landform Research	June 2013
Basemap LANDGATE	Scale 1 : 4 000

-  Detention - sediment trapping basin
-  Existing watercourse or creek
-  Road gutter and runoff
-  Pit drainage
-  Contour water trapping trench and bund
-  Drainage across disturbed land
-  Natural surface drainage
-  Drainage divide bunding
-  2 Water sampling point



Rip rap slowing and retaining devices

All water from processing area captured and fed to sediment settlement dams.

Elevation 240 m

Rip rap slowing and retaining devices

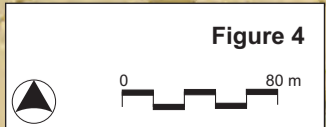
Rip rap slowing and retaining devices

Dam

All water within the pit retained and used on site

Dam

B and J CATALANO	
LOT 501, COALFIELDS ROAD, WELLINGTON	
WATER MANAGEMENT	
Landform Research	June 2013
Basemap LANDGATE	Scale 1: 4 000



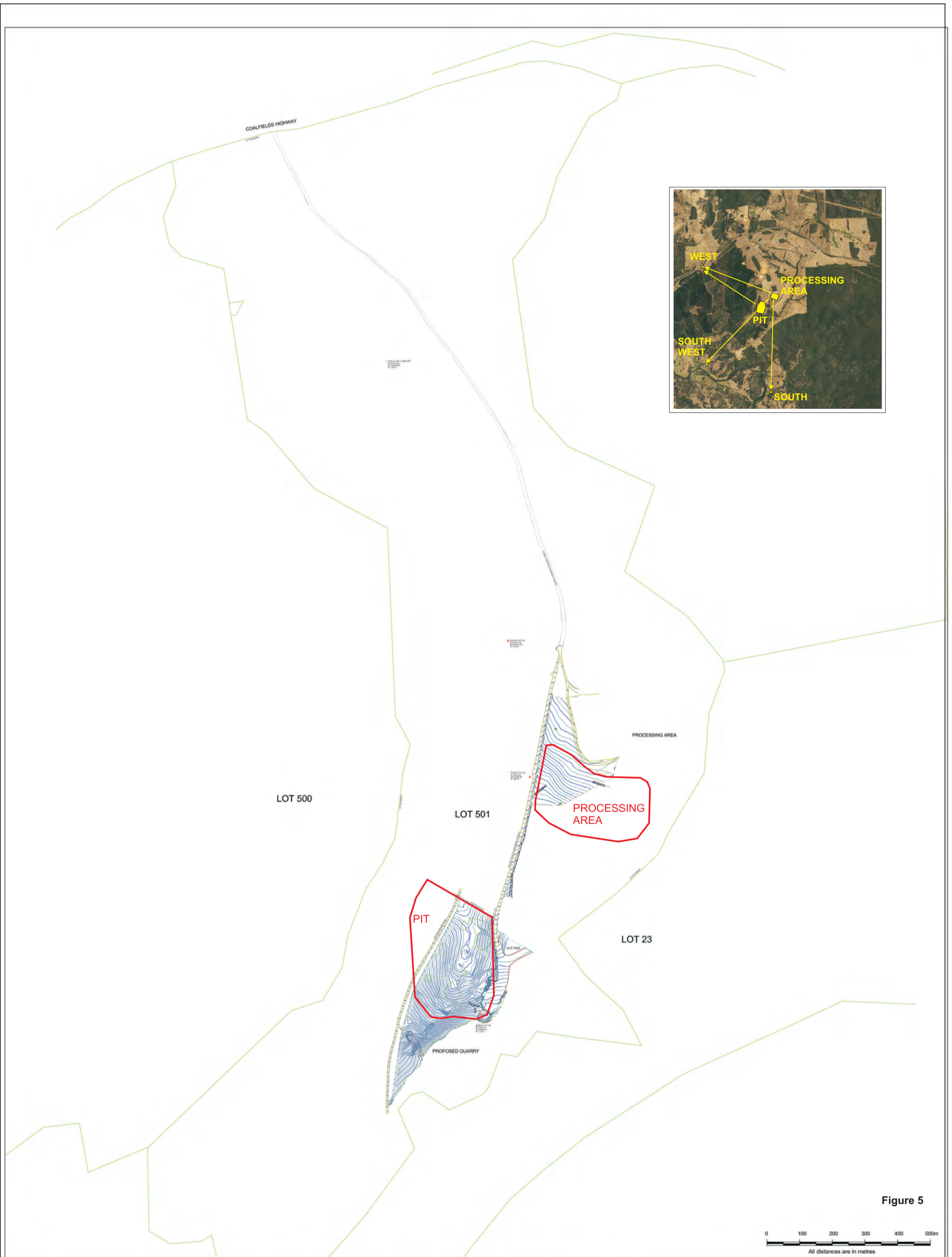



Figure 5

CLIENT: B & J CATALANO				SURVEYOR: R BICHO		DATE: 11/01/2013		 BCE SURVEYING LICENSED & ENGINEERING SURVEYING CONSULTANTS		JOB No. E3612			
				COORDINATES		NORTH POINT				PLAN No. E3612-01 B			
				HORIZONTAL : MGA 94		VERTICAL : AHD71		BUNBURY 31 ROSE STREET BUNBURY WA 6230 Ph (08) 9791 7111 Fax (08) 97916010 admin@bcesurveying.com.au		PERTH 29 AUGUSTA STREET WILLETTON WA 6155 Ph (08) 9354 2222 Fax (08) 9354 4999 admin@bcesurveying.com.au		ALBANY 7 YOUNG STREET ALBANY WA 6330 Ph (08) 9847 4700 Fax (08) 9847 4000 admin@bcesurveying.com.au	
				DISCLAIMER This plan has been prepared for extractive application only. The plan shows visible features only. Boundary information from Landgate digital data. Survey completed by GPS RTK method.		BUNBURY 31 ROSE STREET BUNBURY WA 6230 Ph (08) 9791 7111 Fax (08) 97916010 admin@bcesurveying.com.au							
B	11/04/2013	CONTOURS & ACCESS RD LINWORK MODIFIED	D. FORREST	D. FORREST					SCALE: 1 : 10 000 @ A3				
A	15/01/2013	INITIAL ISSUE	D. FORREST	D. FORREST					SHEET: 1 of 1				
REV	DATE	DESCRIPTION	DRAWN	APPROVED									

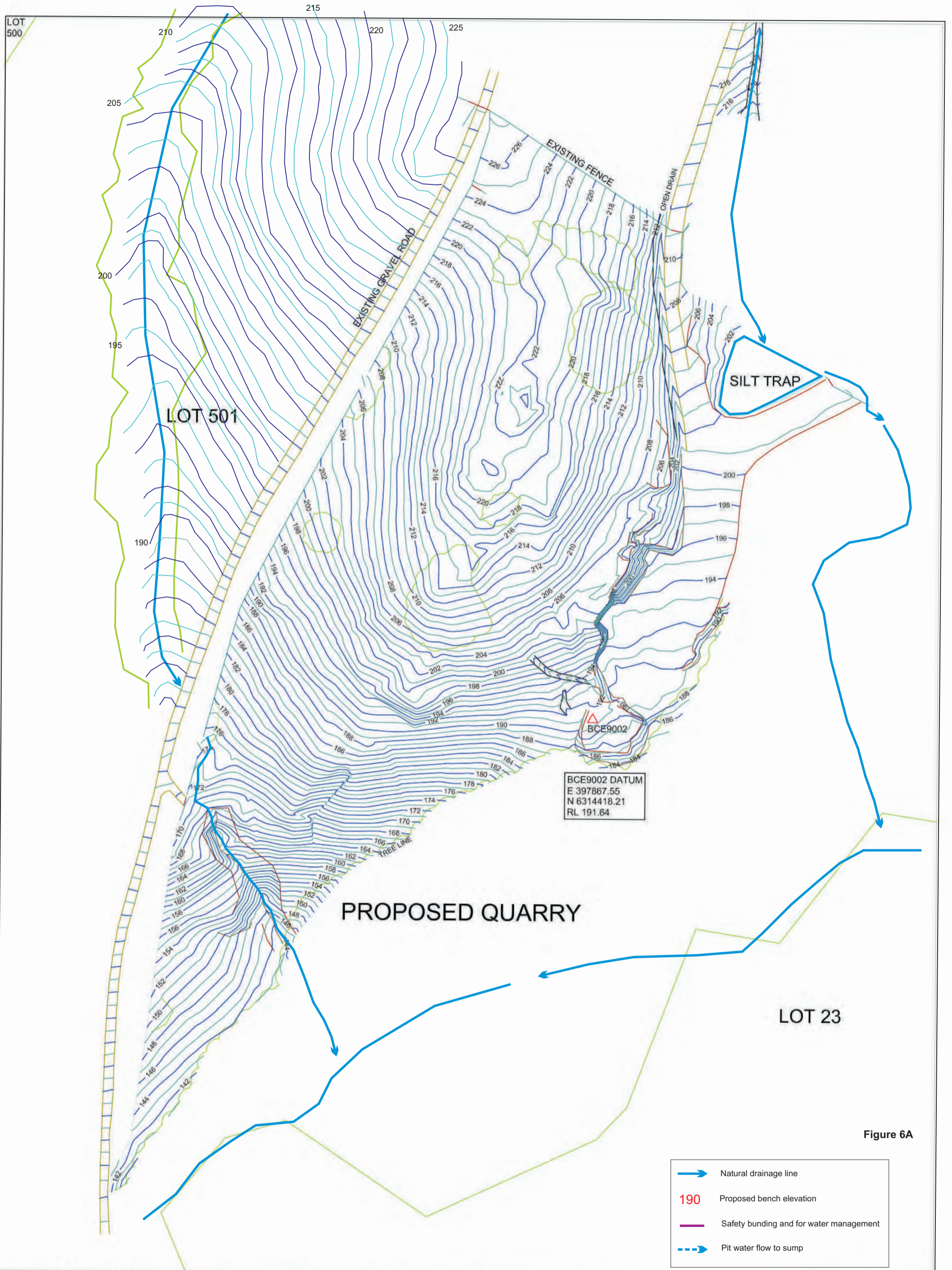
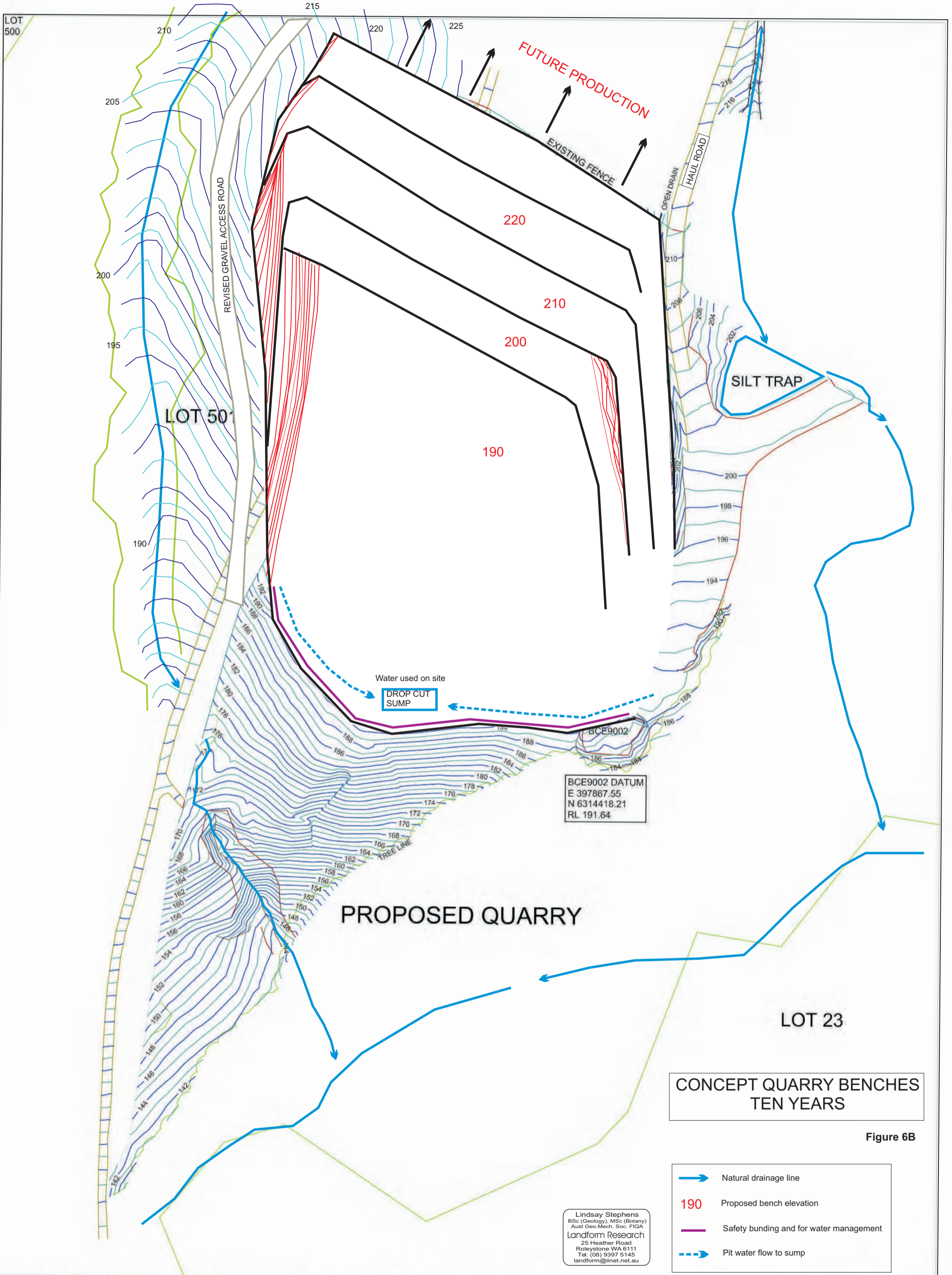


Figure 6A

CLIENT: B & J CATALANO			COORDINATE DATUM HORIZONTAL: MGAB4 VERTICAL: AHD Contour Interval: 1m		NORTH POINT		CONTOUR & SITE SURVEY OF PROPOSED QUARRY LOT 501 COALFIELDS HIGHWAY ROELANDS			JOB No E3612		
SCALE: 1 : 2000 @ A3			Civilcad Model: E3612									PLAN No. E3612-03
REV	DATE	DESCRIPTION	DRAWN	SURVEYOR	APPROVED	DISCLAIMER This plan has been prepared for extractive application only. The plan shows visible features only. Boundary information from Landgate digital data. Survey completed by GPS RTK method.			B C E SURVEYING LICENSED & ENGINEERING SURVEYING CONSULTANTS		SCALE 1 : 2000	
A	11/04/2013	Initial Issue	D. FORREST	R. BICHO	D. MORAN	DUNBURY 24 KELLY STREET DUNBURY WA 6202 Ph (08) 9471 7411 Fax (08) 9471 8185 www.bcesurveying.com.au			PERTH 26 AUGUSTA STREET WILLETTON WA 6155 Ph (08) 9484 2222 Fax (08) 9484 4099 www.bcesurveying.com.au		ALBANY 4 YOUNG STREET ALBANY WA 6330 Ph (08) 9467 4300 Fax (08) 9467 4800 www.bcesurveying.com.au	
									REVISION: A			



**CONCEPT QUARRY BENCHES
TEN YEARS**

Figure 6B

- Natural drainage line
- 190 Proposed bench elevation
- Safety bunding and for water management
- - - → Pit water flow to sump

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CLIENT: B & J CATALANO			COORDINATE DATUM HORIZONTAL : MGAB4 VERTICAL : AHD Contour Interval : 1m		NORTH POINT 		CONTOUR & SITE SURVEY OF PROPOSED QUARRY LOT 501 COALFIELDS HIGHWAY ROELANDS			JOB No E3612	
SCALE: 1 : 2000 @ A3 			Civilcad Model : E3612							BCE SURVEYING LICENSED & ENGINEERING SURVEYING CONSULTANTS	
REV	DATE	DESCRIPTION	DRAWN	SURVEYOR	APPROVED	DISCLAIMER This plan has been prepared for extractive application only. Boundary information from Landgate digital data. Survey completed by GPS RTK method.			SCALE 1 : 2000		
A	11/04/2013	Initial Issue	D. FORREST	R. BICHO	D. MORAN				REVISION: A		

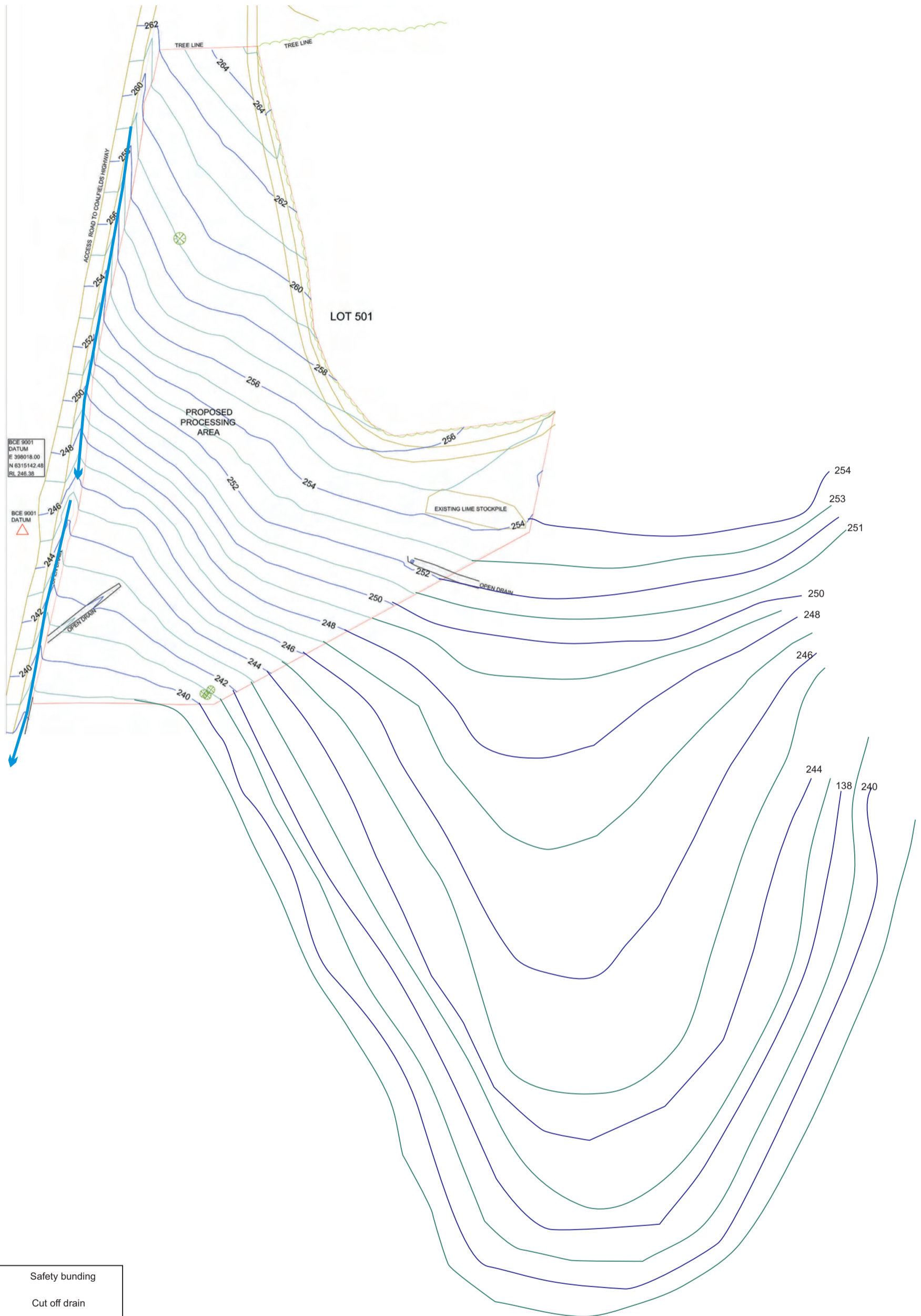









Figure 7A

-  Safety bunding
-  Cut off drain
-  Existing drain
-  Detention basin

EXISTING CONTOURS

CONCEPT PROCESSING AREA

CLIENT: B & J CATALANO			COORDINATE DATUM HORIZONTAL: MGDA94 VERTICAL: AHD Contour Interval: 1m		  	CONTOUR & SITE SURVEY OF PROPOSED PROCESSING AREA LOT 501 COALFIELDS HIGHWAY ROELANDS			JOB No E3612
SCALE: 1 : 1000 @ A3			Civilcad Model : E3612						PLAN No. E3612-02
REV	DATE	DESCRIPTION	DRAWN	SURVEYOR	APPROVED	B C E SURVEYING LICENSED & ENGINEERING SURVEYING CONSULTANTS			SCALE 1 : 1000
A	11/04/2013	Initial Issue	D. FORREST	R. BICHO	D. MORAN				SUNDURRY 24 MOLLOY STREET BUNBURY WA 6220 Ph: (08) 9781 7411 Fax: (08) 9781 8135 www.bcesurveying.com.au

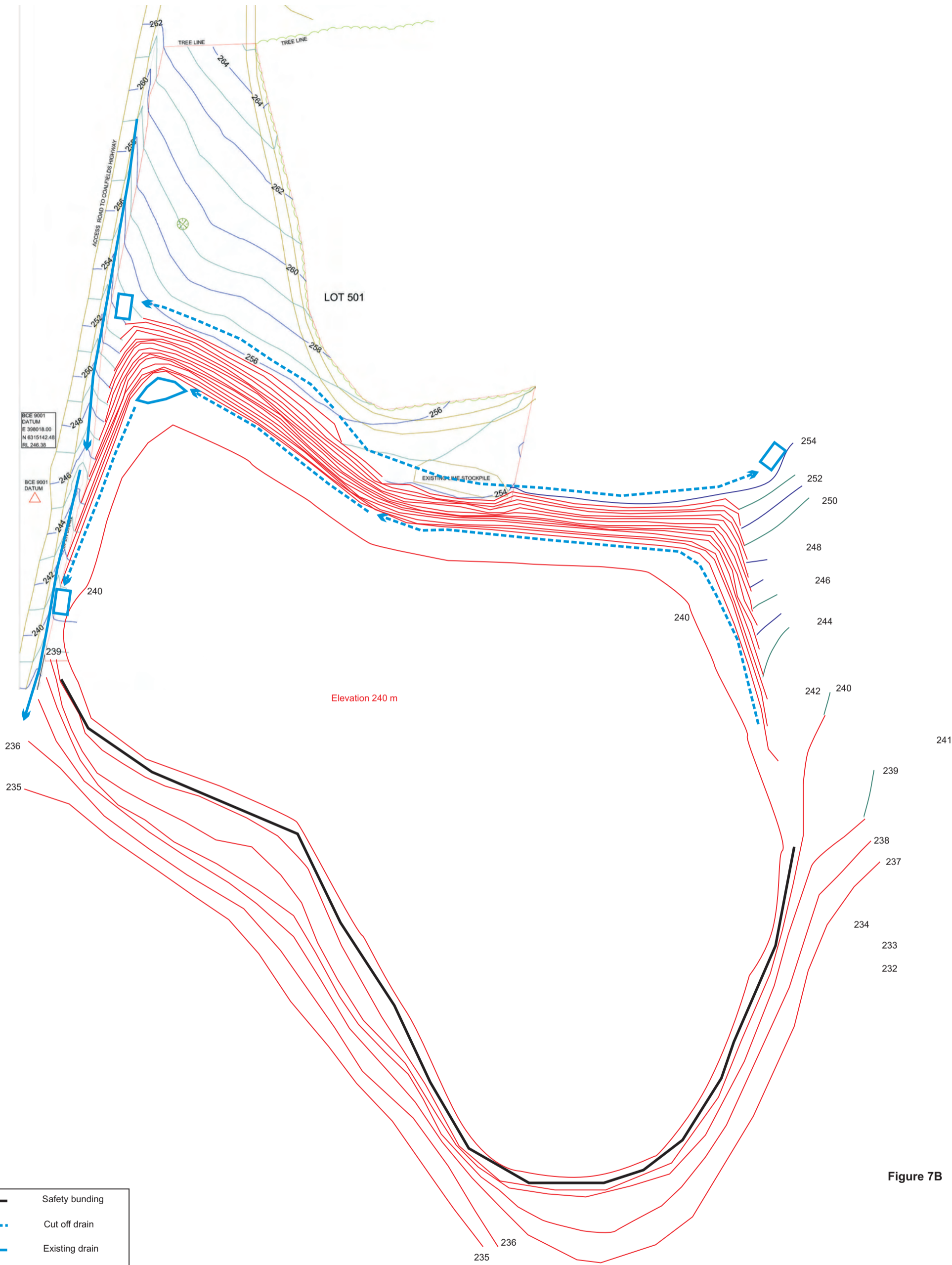


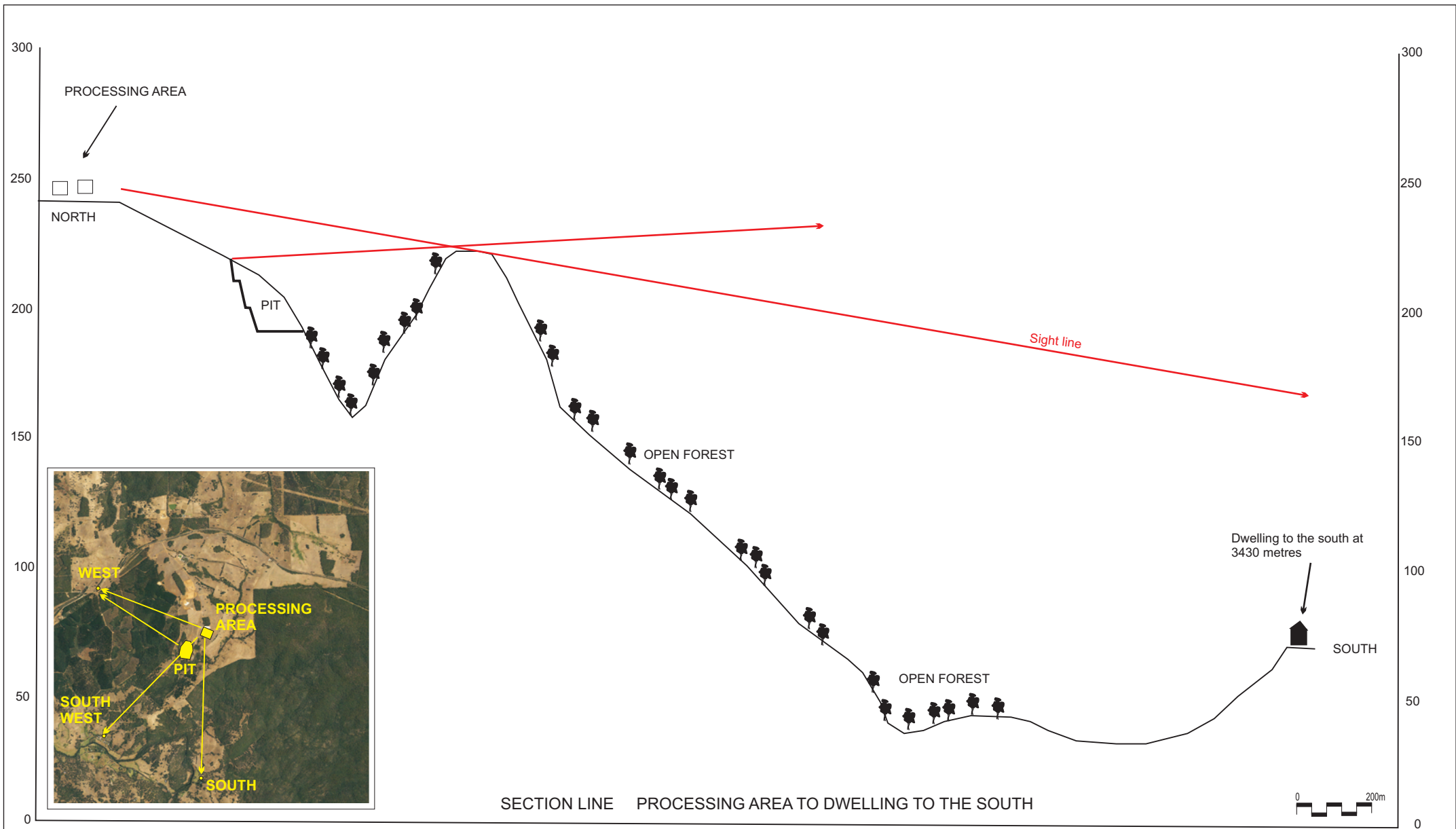
Figure 7B

CONCEPT CONSTRUCTION CONTOURS

CONCEPT PROCESSING AREA

Annotated by LANDFORM RESEARCH

CLIENT: B & J CATALANO SCALE: 1:2000 @ A3			COORDINATE DATUM HORIZONTAL: MG94 VERTICAL: AHD Contour Interval: 1m		NORTH POINT 	 JAS-ANZ 	CONTOUR & SITE SURVEY OF PROPOSED PROCESSING AREA LOT 501 COALFIELDS HIGHWAY ROELANDS			JOB No E3612
REV A	DATE 11/04/2013	DESCRIPTION Initial Issue	DRAWN D. FORREST	SURVEYOR R. BICHO	APPROVED D. MORAN					Civilcad Model: E3612 DISCLAIMER This plan has been prepared for extractive application only. The plan shows visible features only. Boundary information from Landgate digital data. Survey completed by GPS RTK method.



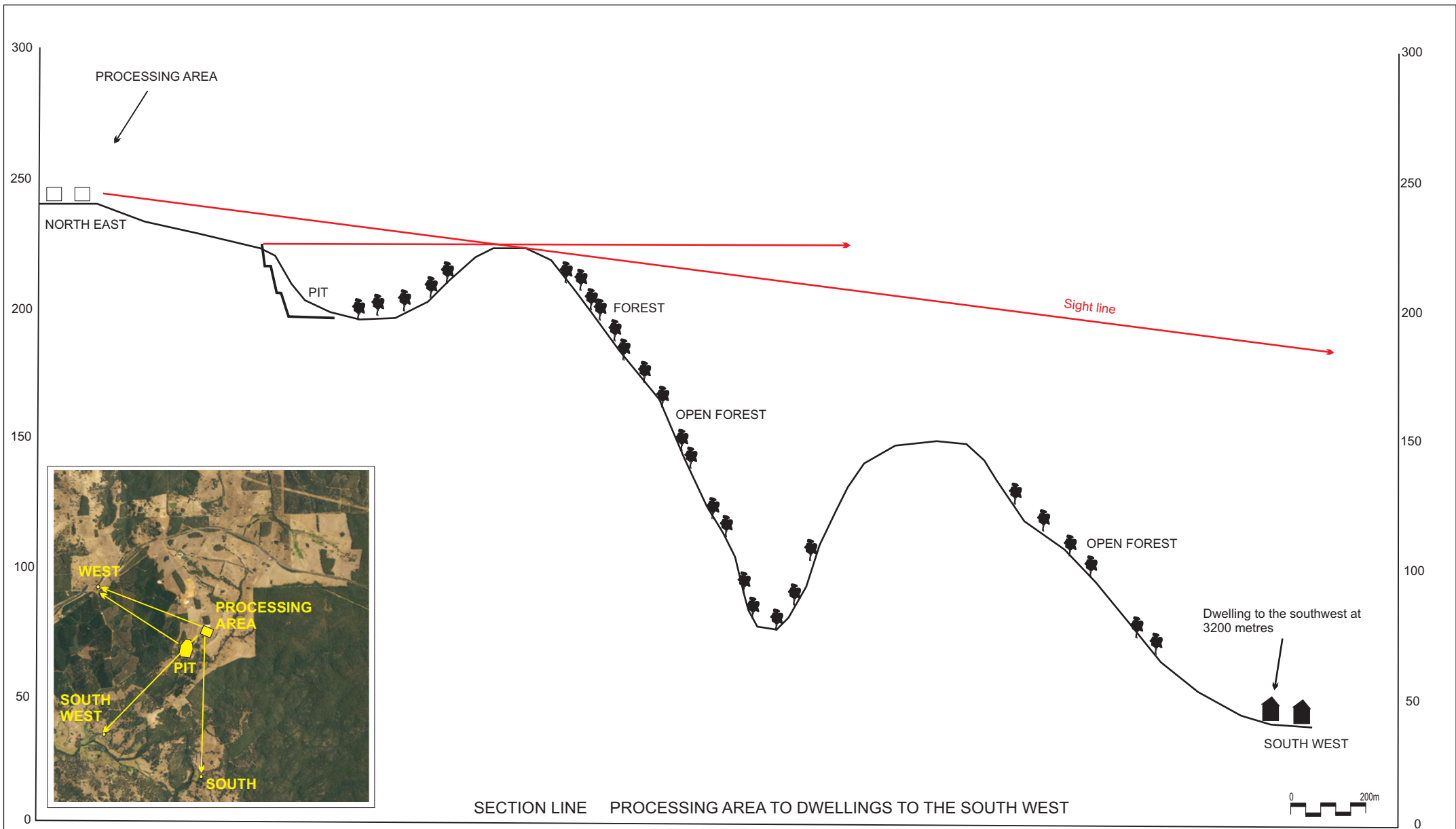
NOTE

The sightline and section is from one location only.
From other locations the landform will vary.

B and J CATALANO SHENTON RIDGE PROPOSED HARD ROCK QUARRY

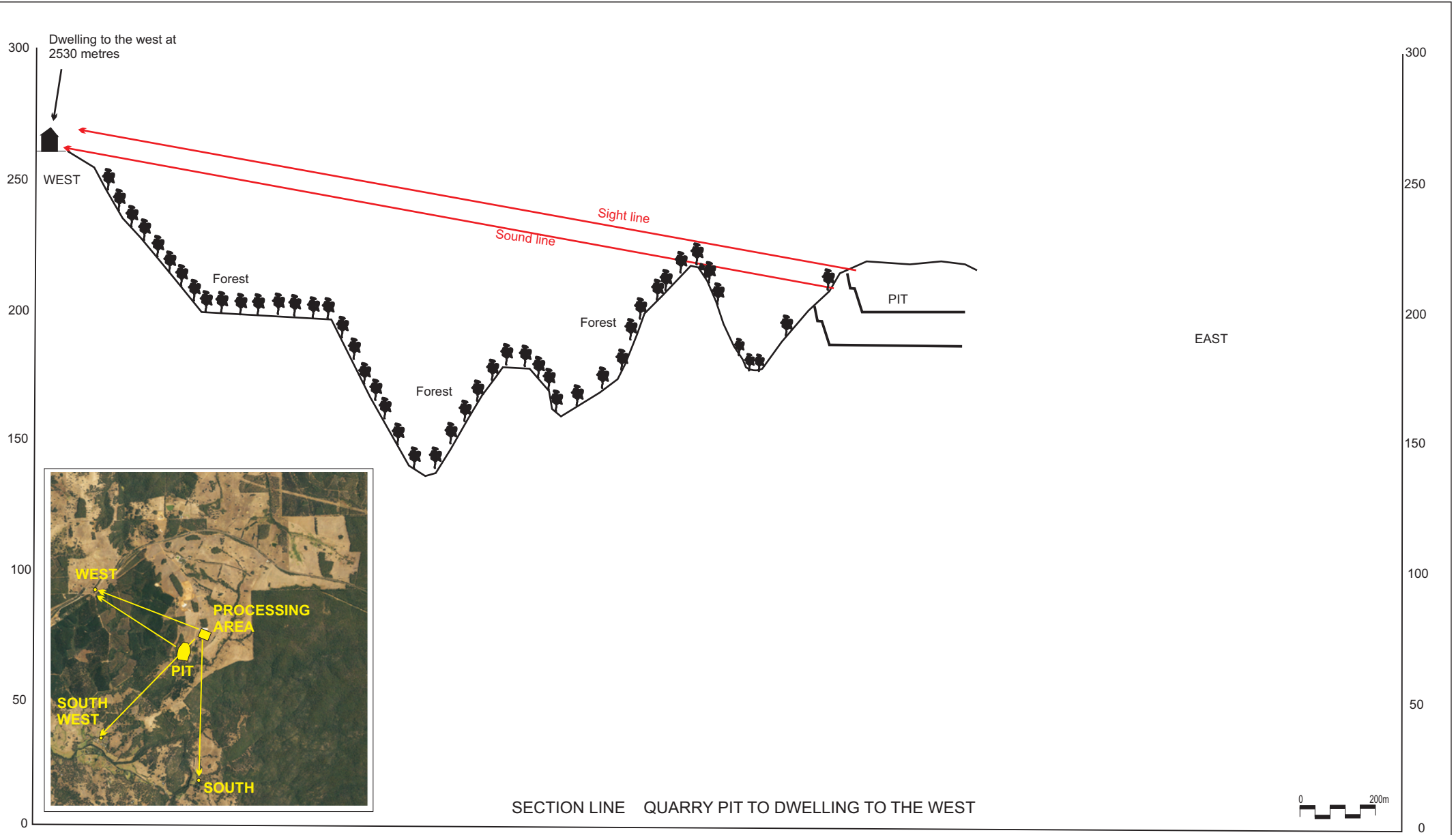
Figure 8A





NOTE

The sightline and section is from one location only.
From other locations the landform will vary.

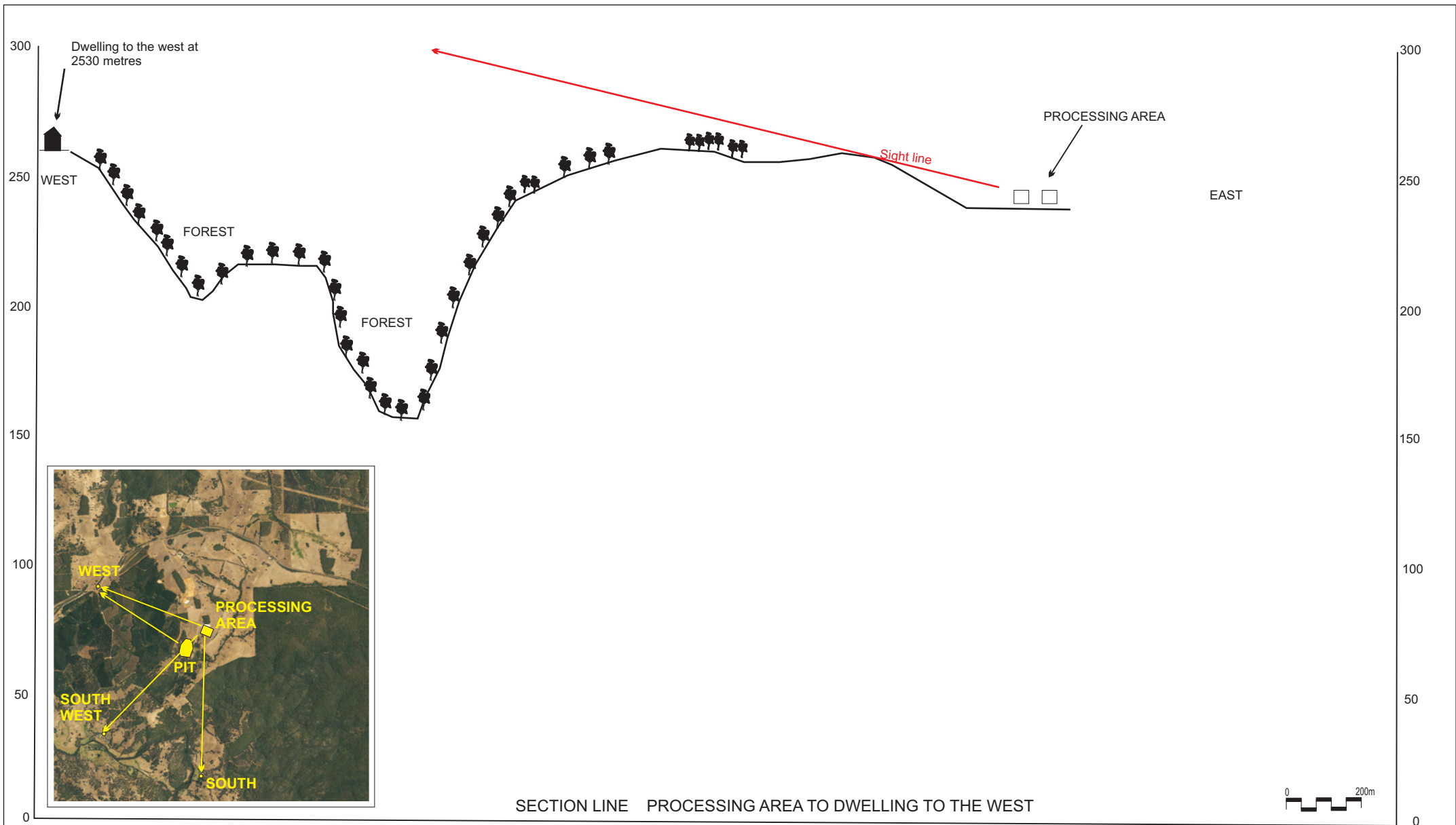


NOTE

The sightline and section is from one location only.
From other locations the landform will vary.

Figure 8C





NOTE

The sightline and section is from one location only.
From other locations the landform will vary.

B and J CATALANO SHENTON RIDGE PROPOSED HARD ROCK QUARRY

Figure 8D





Existing faces of old quarry to be re-opened.



Western flank of the pit, view north



Eastern flank of the pit, view north



Western flank of the pit, view south



The top of the hard rock resource



Access road along bench

Sump in the base of the pit to retain all water on site. Sump is used as the water supply for dust suppression.

Benches of quarry drilled and prepared for blasting

Drill holes in a pattern

Water tank
The crusher is operating.
Note the lack of dust

Mobile crushing plant located on the floor of the pit, using the existing faces to provide visual, dust and noise screening

Aggregate stockpiles

When producing armour and core stone the correct sized rock will be collected, sorted and taken offsite without crushing.

Loader picking up rock for feeding to the crusher

Rock freed by the last blast

Walls of the quarry provide visual noise and dust screening

Shows a quarry operation similar to the proposed operation. Note the processing plant will be outside the quarry because the floor will be too small.

Figure 10A



Drilling blast holes



Excavation loading a small haul truck



Loader loading a small haul truck



Water truck wetting resource ready for loading and crushing

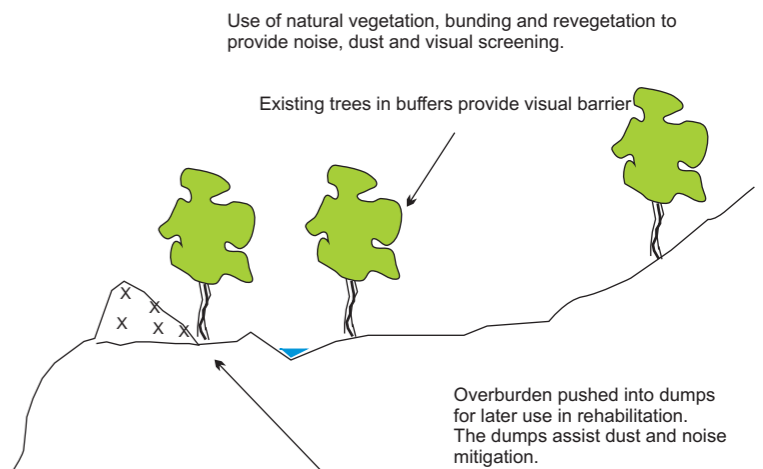
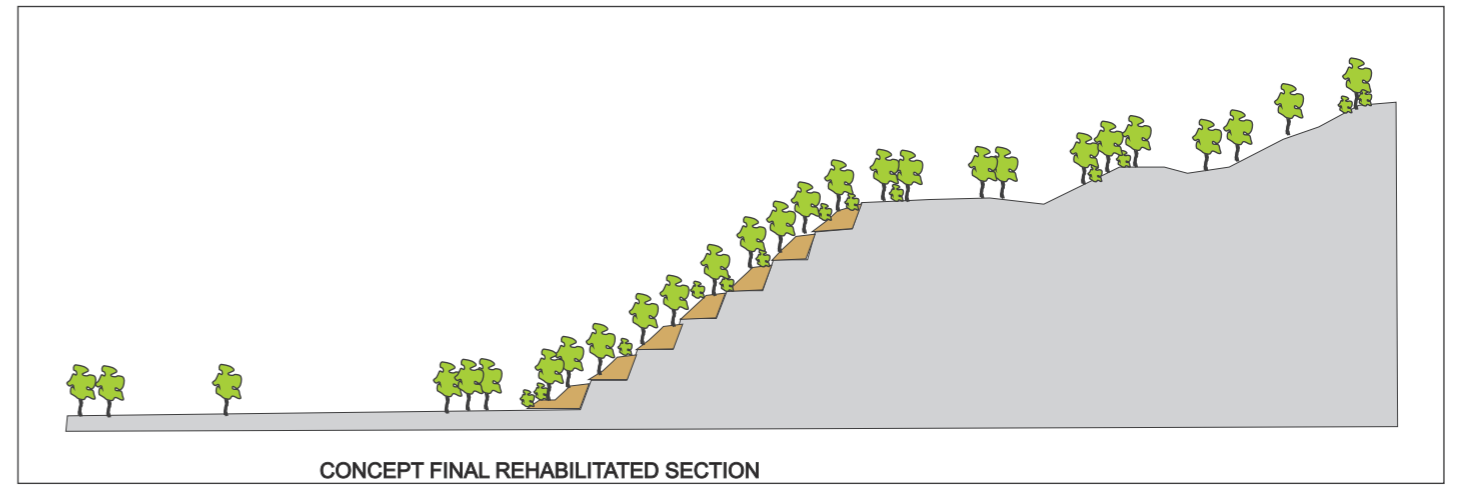
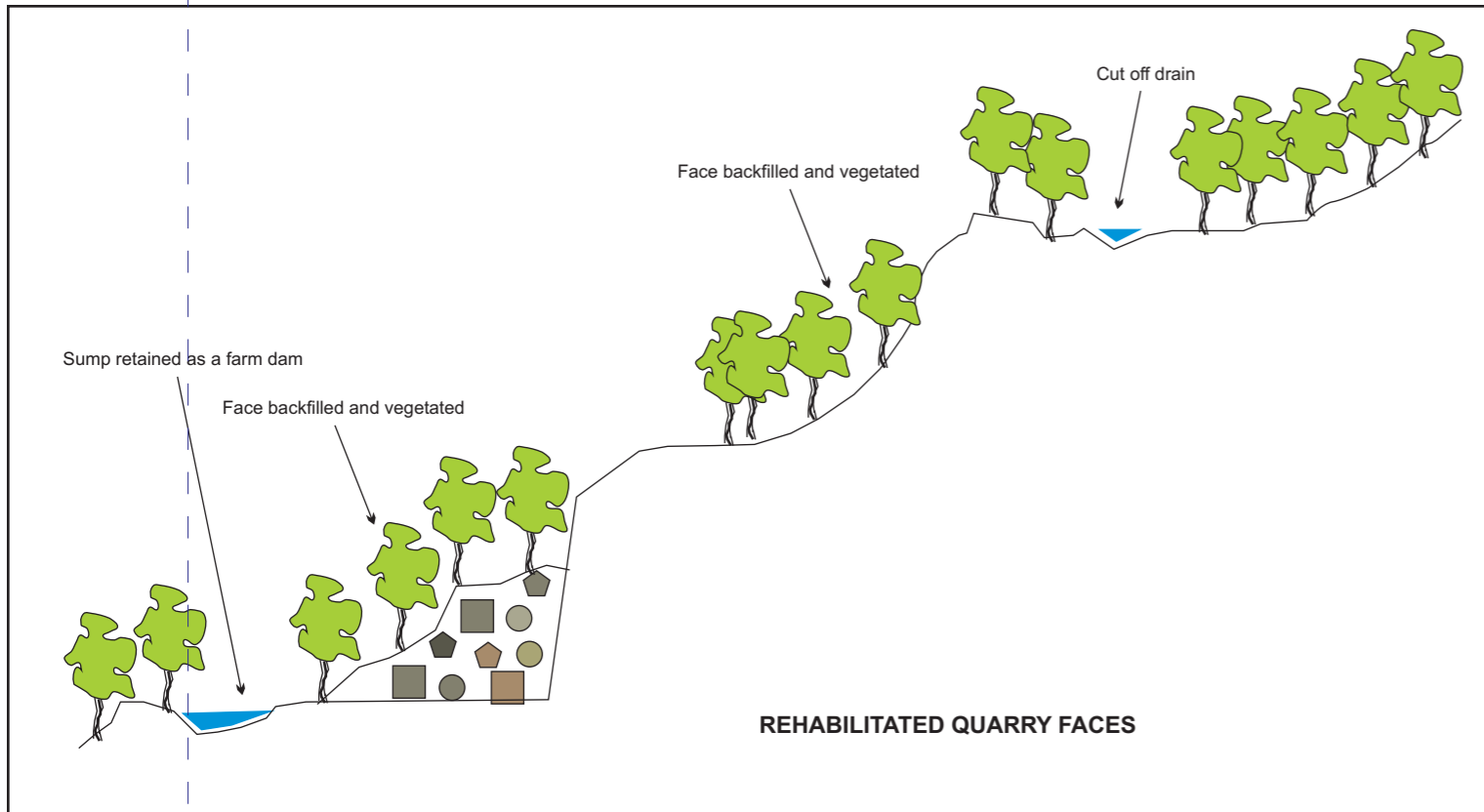


Catalano bulldozer opening new ground

TYPICAL OPERATIONS

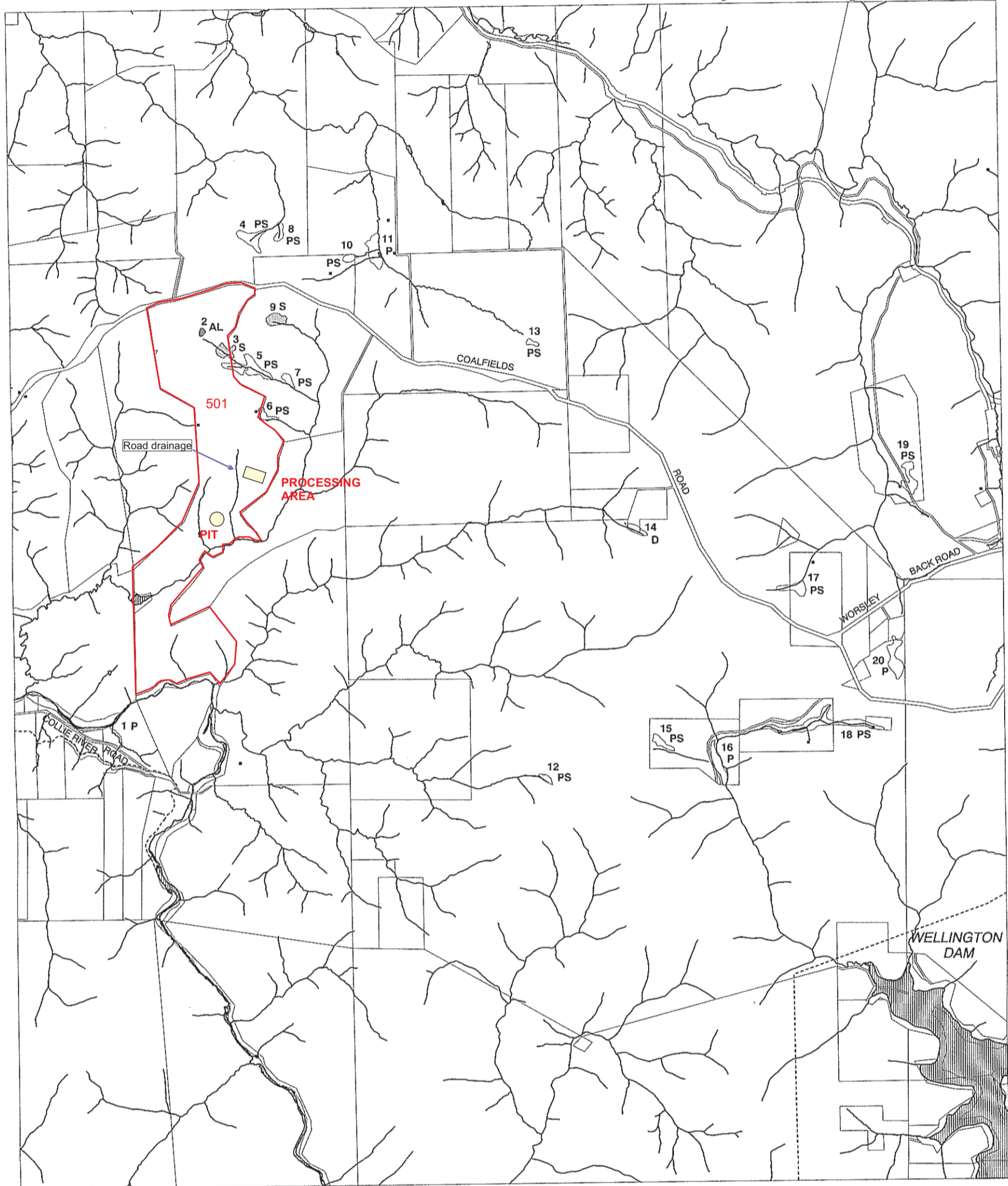


Mobile crushing plant used by Catalano to crush gravel. The proposed plant will be of a similar scale



NOTE
 The methods illustrated are general. Excavation is not the same in all pits and may change from one part of an excavation to another, or from one stage of excavation to the next stage.

WETLANDS OF MAP SHEET 2031 II NE (Burekup NE)



BASIN AND FLAT WETLANDS

- lake (permanently inundated), estuary (permanently inundated)
- sumpland, floodplain (seasonally inundated), estuary (peripheral)
- dampland, palusplain (seasonally waterlogged)
- other basin wetlands

CHANNEL WETLANDS

- River (permanently inundated)
- Creek (seasonally inundated)
- Artificial channel
- Gravity or Pressure Drainage Pipes (metro area)

WETLAND TYPE

- L Lake
- CR Creek
- S Sumpland
- D Dampland
- AL Artificial Lake
- F Floodplain
- P Palusplain
- R River
- EW Estuary (Waterbody)
- E Estuary (Peripheral)
- PS Paluslope

ZONES OF INFLUENCE

- Zone of Critical Influence 50 metre boundary
- Zone of Secondary Influence 200 metre boundary

- Road Boundary
- Property Boundary

WETLAND MAP IDENTIFICATION NOS. EG. 12, 320, 678

Map Identification Numbers have been assigned to each wetland according to their type and method of classification. Map Identification Numbers less than 300 represent wetlands mapped by the V & C Semeniuk Research Group for the Water Authority.

Map Identification Numbers ranging from 301 to 600 have been assigned to basin wetlands (mostly rock pools and dams) and numbers 601 and greater to channel wetlands (rivers, creeks, and artificial channels). Wetlands numbered 301 and greater have been described from complimentary DOLA digital hydrographic mapping.



NOTE
The annotated drainage line is road drainage. See Figure 4.

Appendix 1

SHENTON RIDGE PROPOSED QUARRY SITE.
GEOLOGICAL RECONNAISSANCE

by
C.F. Swindells
September 1982

INTRODUCTION:

Following a request from R J Griffin, District Inspector, State Mining Engineers Branch, geological reconnaissance of a potential quarry site at Shenton Ridge (4km from the Coalfields Highway) was carried out on 4/8/82. Prior to the visit a trial production blast had been performed at the site, exposing freshly broken bedrock.

GEOLOGICAL CONDITIONS

The area lies within the Collie 1:250 000 sheet. The underlying rock throughout the Collie area is largely obscured by superficial deposits of laterite, colluvium and alluvium. The plateau areas are generally laterite capped and locally deeply weathered.

Suitable rock for quarrying is mainly restricted to steeper slopes, with felsic and mafic rocks being suitable. The felsic rocks include granite and granitic gneiss where as the mafic comprise meta-dolerite granofels and amphibolite. Operating quarries at Roelands and Fernbrook work both microcline rich granite gneiss (Fernbrook) and microcline gneiss, augen gneiss and amphibolite (Roelands). The geology of these sites, notably Roelands is structurally complex.

Geological structures that can affect rock condition and quality include joints, shear zones and also in the case of the granitic rocks of the Collie area, the gneissic foliation. Joints are generally more widely spaced in the felsic rocks than in the mafic rocks, however local zones of higher joint intensity can be present. The gneissic foliation does not always form planes of

breakage when quarried, particularly in fresh rock. However, thicker mica rich layers may control fracturing in the quarried rock, particularly if the zones are weathered.

SITE GEOLOGY

The geological plan (Fig. 1), based on the 1:250 000 Collie geological map, shows the regional geology in the area of the proposed quarry. The local geology shows outcrops of mica rich granitic gneiss, overlain by gravelly laterite. In general the outcrops are of fresh granitic gneiss, locally with stained joints. However areas of completely weathered in situ granitic gneiss are present to the east and north-west of the proposed quarry site. The depth of any weathering in the gneiss is not known, further investigation was beyond the scope of the brief field inspection. The geology of the quarry site is given in Figure 2.

Many of the outcrops have curved surfaces suggestive of large scale sheet joints - such joint surfaces extend, with gentle dips of $15-25^{\circ}$, over several m^2 . These joint surfaces are often cut by steeply dipping joints both sub-parallel (dip $60-80^{\circ}$ N, strike 095°) and broadly normal (dip $55-80^{\circ}$ E and W, strike $350-025^{\circ}$) to the foliation in the granitic gneiss. The regional foliation in the granite dips $75-80^{\circ}$ W and strikes approximately 070° . Joint spacing is variable between 0.1 and > 1.5 metres.

The trial blast has exposed good quality, unweathered granitic gneiss (Fig. 3). The gneiss contains a local foliation defined by micaceous rich layers. These often coarse grained mica layers (individual micas to 15 mm) form layers up to 20 cms thick. The stock pile of blasted material comprises a range of flakey to blocky fragments of rock (Fig. 4) up to $15 m^3$. Whilst a range in fragment sizes and shapes has been produced in general, the larger and more cuboidal blocks are a product of the granitic gneiss and contain sparse or poorly defined micaceous foliation. Locally both the micaceous layering and jointing have controlled rock breakage, however, in the more massive parts of the granitic gneiss breakage is independent of the micaceous foliation.

The strength of the blasted rock was measured using a Schmidt hammer, which determines the rebound hardness of a test material. The rebound number correlates with uniaxial compressive strength in both concrete and rock, when the dry density is taken into

account. Strength values for the various rock types at the Shenton Ridge Quarry Site are given in Table 1.

TABLE 1. Uniaxial Compressive strengths, derived from Schmidt Rebound values, Shenton Ridge Quarry site.

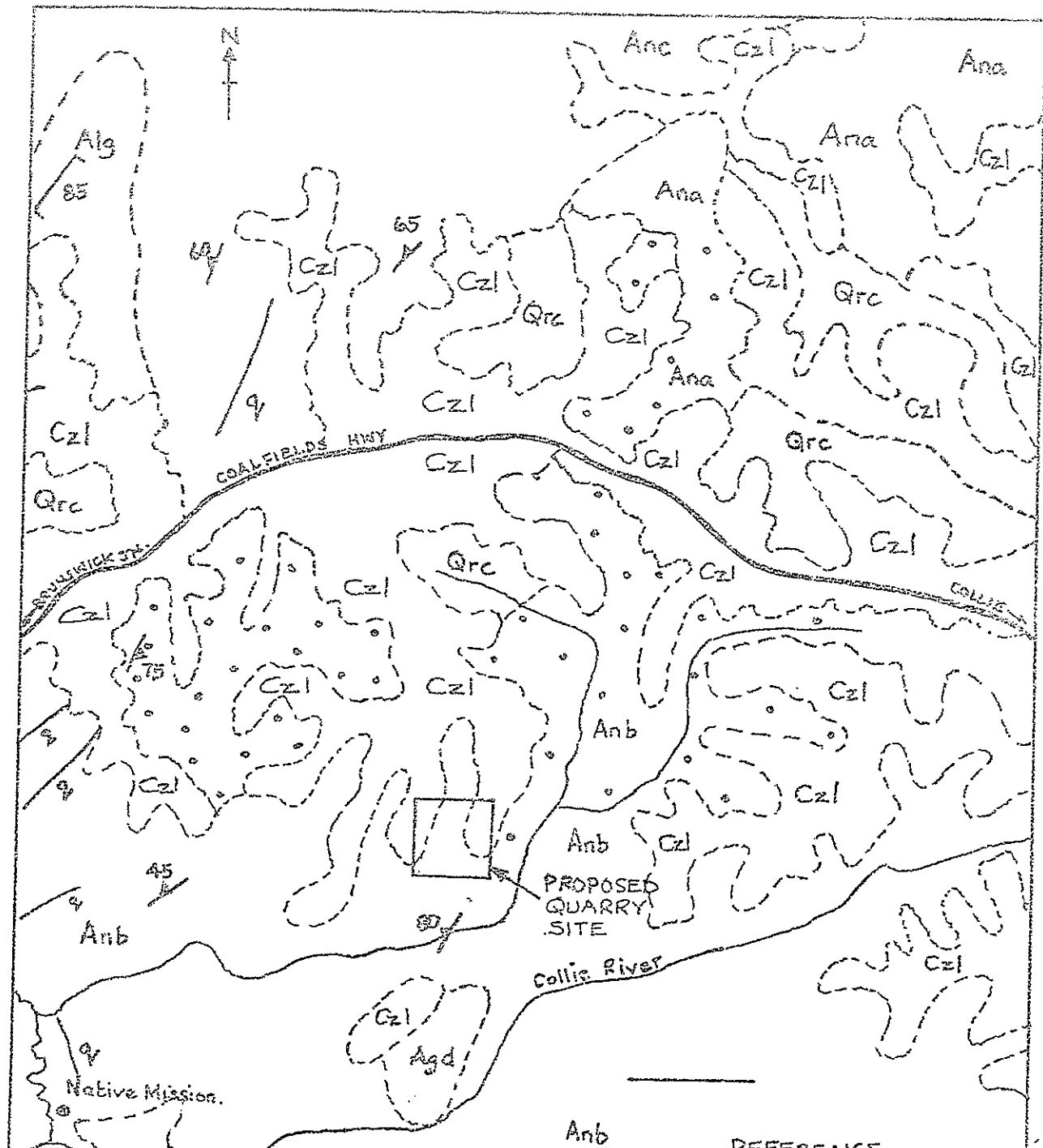
<u>Rock Type</u>	<u>Mean Uniaxial Compressive Strength</u>	<u>Range in St. values</u>
Granite gneiss outcrop	100± 40 Mn/m ²	52-200 Mn/m ²
Quartz rich gneiss (blasted rock)	95± 40 Mn/m ²	48-155 Mn/m ²
Micaceous banding (blasted rock)	35± 20 Mn/m ²	17.5-145 Mn/m ²

* derived assuming a rock density of 2.7 kN/m³

The strength values for the gneiss outcrop and quartz rich blasted rock are typical of rock classified in the range as very high strength to extremely high strength. The micaceous foliation yields values in the range low to medium strength.

CONCLUSIONS

- (1) Good quality, unweathered granitic gneiss has been exposed by the trial blast. The gneiss contains variable proportions of micaceous foliation.
- (2) Jointing is sub-parallel and broadly normal to the foliation, with spacings of 0.1 m to > 1.5 m. Such jointing may well control the size of the blasted material.
- (3) Locally the micaceous foliation has also controlled the breakage pattern of the rock, producing predominantly flakey fragment shapes. Such micaceous rich material will be less strong and more susceptible to weathering than the less micaceous granitic gneiss.
- (4) The effects of jointing and/or the micaceous foliation may well reduce the quantities of blocky material produced, dependent on local variations within the rock mass.



45 ↘ Foliation
 ↗ 45 Schistosity
 / q Quartz vein

REFERENCE	
Qrc	Colluvium, valley fill variable lateritised
Czl	Laterite - massive and overlying pisolitic gravel
Agd	Dioritic rocks
Ana	Granitic gneisses
Anb	Augen gneiss
Anc	Calc-silicate gneiss
⊙	Bedrock obscured by residual/colluvial deposits.

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

Initial	Date
Comp CFS	20/8/82
Drawn CFS	20/8/82
Chkd	
Appd	

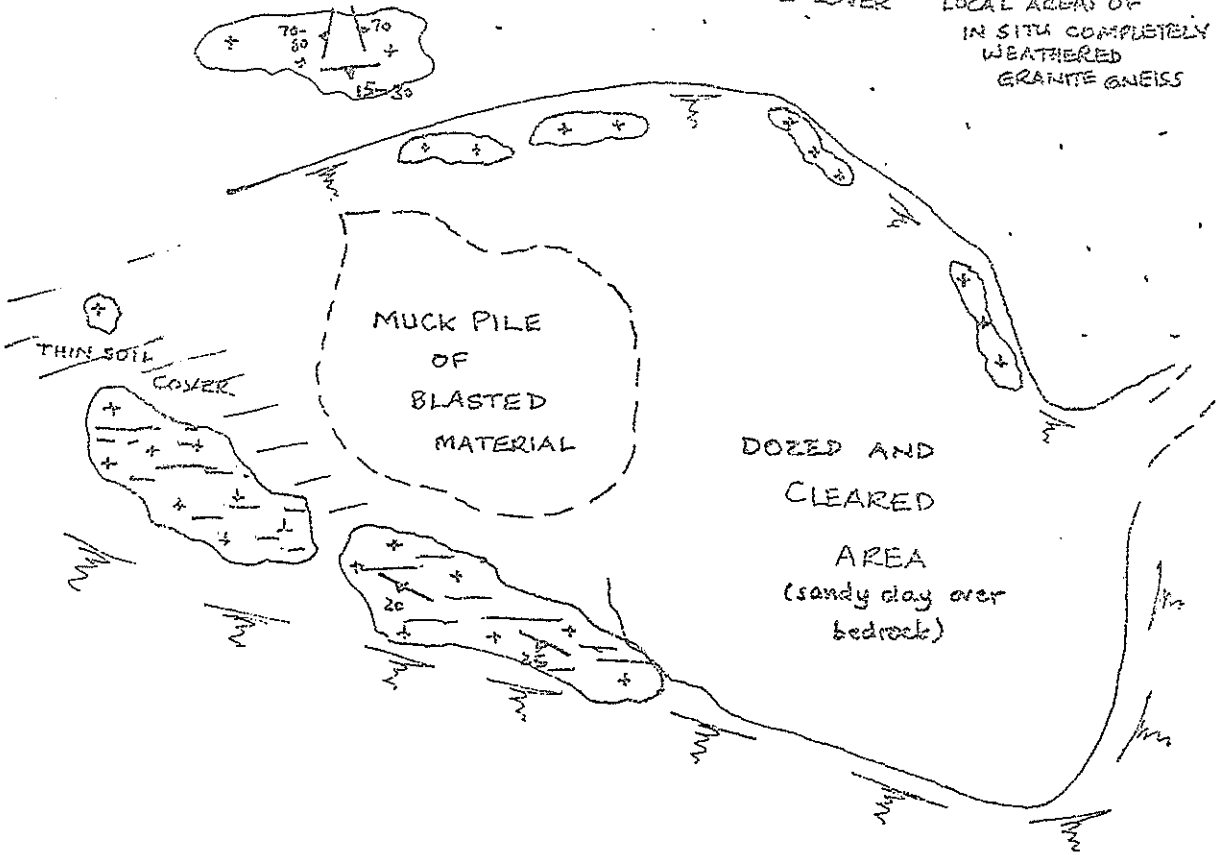
FIGURE 1:
 GEOLOGY OF THE SHEPTON RIDGE AREA
 To accompany GEOLOGICAL REPORT

Map Index
SI 50-6(203) III
GSA WA 20158



THINLY TO MODERATELY
FORESTED SLOPES
WITH GRAVELLY
LATERITE COVER

LOCAL AREAS OF
IN SITU COMPLETELY
WEATHERED
GRANITE GNEISS



REFERENCE

- GRANITE GNEISS OUTCROPS
- JOINT
- FOLIATION.

NOT DRAWN TO SCALE

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

Initial	Date	<p>FIGURE 2 SHENTON RIDGE QUARRY SITE GEOLOGICAL PLAN</p> <p>To accompany GEOLOGICAL REPORT</p>	<p>Map Index</p> <p>SI 50-6 (2031 III)</p> <p>GSWA 20159</p>
Comp. CFS	20/8/82		
Drawn CFS	20/8/82		
Chkd			
Apvd			

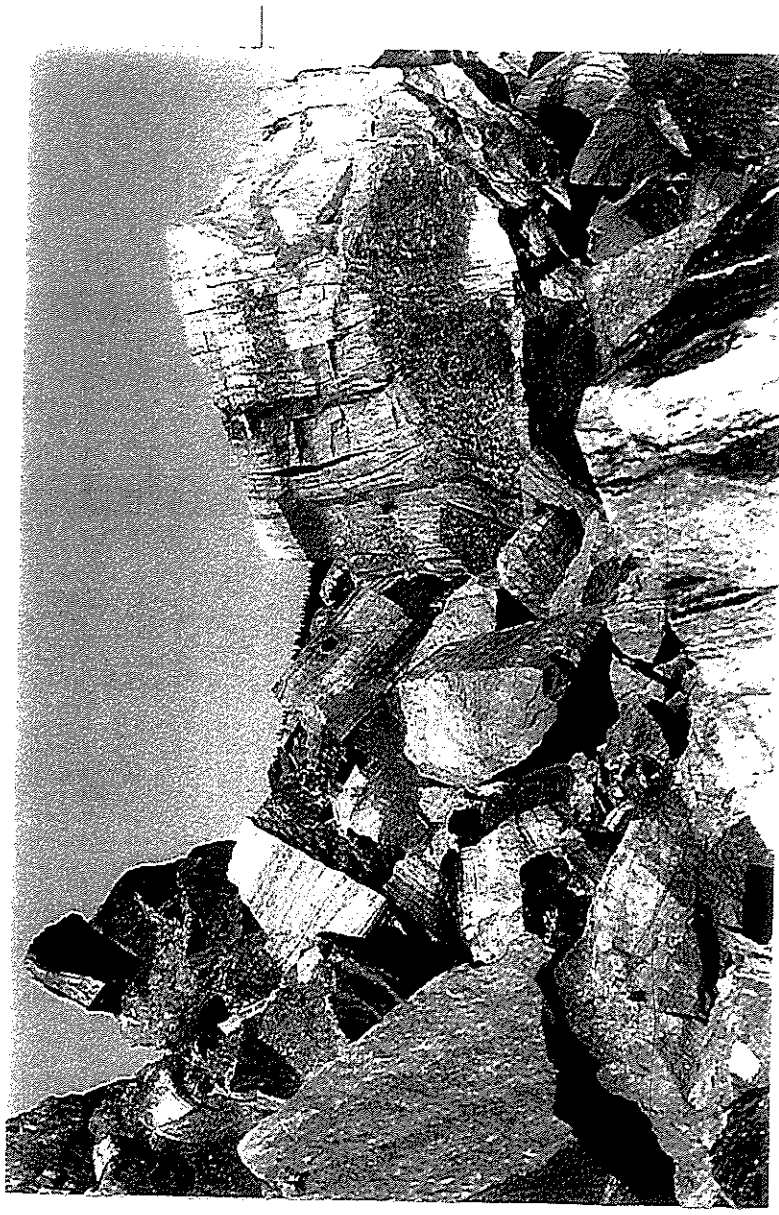


FIG. 3: Part of the blasted rock pile showing unweathered granitic gneiss

Appendix 2

Blast Management Plan,
Lot 501, Coalfields Road,
Wellington

(Shenton Ridge)

March 2014

B and J CATALANO



Prepared by Landform Research

BLAST MANAGEMENT

1.0 Need for Blasting

There is a proposal to extract hard rock from Lot 501 Coalfields Road Wellington, in conjunction with an approved gravel extraction operation.

The whole site is underlain by the Granitoid rocks of the Boddington Terrane of Archaean age (Wilde 2001). The Boddington Terrane consists of granitic migmatites which have granitic composition but have lineations and some gneissosity, generally trending north.

A geological investigation of the resource was prepared by C F Swindells in 1992 who examined the quality and fracturing of the rock and its suitability for hard rock aggregates and construction products. A copy of that report is attached to the main report as Appendix 1. The rock was also reviewed by Lindsay Stephens of Landform Research.

The area selected for the pit is an existing small hard rock quarry, located low in the landscape, to provide visual and noise protection. The pit has been selected to be extended to the north if the demand justifies it, at a later stage.

2.0 Geology

The granitic rocks are described by Swindells 1982 which is appended to this report.

The resource is a light coloured fresh mica rich granitic gneiss that is highly suitable for aggregates, as discussed by Swindells.

The Mean uniaxial compressive strength is 95 – 100 Mn/m². Some minor micaceous bands have lower strength and will be selected and sorted during excavation.

The rock has curved surfaces suggestive of large scale sheet joints that are often steeply dipping and broadly normal to the foliation and gneissosity.

3.0 Discussion of Blasting Techniques

Blasting is used to break the rock from the face. This is achieved by drilling holes into the rock in a defined pattern. The holes are then filled with explosive and capped. An electric detonator is used to remotely detonate the charge by triggering the chemical reaction within the explosive. This produces a very large volume of gas in a very short time which places pressure on the sides of the drill hole, fracturing and breaking the adjoining rock.

Blasts are normally designed in a rectangular pattern of multiple holes that are fired with milli-second delays in a particular pattern that lifts and pushes the rock from the face in a sequence. The pattern of blasting can be designed to maximise the production of a certain sized rock fragment which can assist in reducing the amount of crushing or secondary breaking that is required.

Blast impacts consist of air blast overpressure and ground vibration. Ground vibration tends to push back into the face whereas airblast is an air pressure wave that emanates forwards out into the quarry, usually in the opposite direction to ground vibration. Both ground vibration and air blast spread out in a spherical manner and, with the same impact spreading out in an increasingly large volume or area, both dissipate quickly with distance.

For ground vibration there is also normally a distinct drop off of impact with distance, although occasionally the geology can reduce this drop off impact under certain conditions or may even lead to an enhancement of ground vibration. There are certain situations such as a particular geological structure or land surface that may lead to an impact travelling further in one direction than another.

On this site, with the quarry located on a south facing spur and the rocks striking north, there may be a possibility that ground vibration will travel further north than east or west. As blasting will be conducted on a northern face, southern travel of ground vibration is less likely.

Generally there is a distinct drop off of blast effects with distance. This is most pronounced with airblast. However there can be times when airblast carries further, such as the direction of the blast, or under conditions when the airblast is restrained such as under a temperature inversion.

The nature of the blast in terms of the degree of fracturing of the rock to be moved, the orientation of the face, the size of the blast and the weather conditions can all influence the potential impact of a blast. Therefore it is not uncommon for each blast to appear different in character.

Therefore potential blast impacts consist of air blast overpressure and ground vibration.

Changes to the blast levels of air blast overpressure and ground vibration, received at a particular sensor, depend on which face is being excavated.

With progress of the proposed pit, and the orientation of the face, it can be expected that when the northern face is fired, airblast will have a greater tendency to travel south. Ground vibration from the northern face blast will have a greater tendency to travel north.

Sometimes it is difficult for residents to distinguish between air blast or ground vibration because both can make windows rattle under certain conditions. The Statutory Blast limits are set at levels that will not lead to structural impacts but yet may still be heard.

Therefore monitoring of blast impacts is undertaken to provide better design of the succeeding blasts and better management of potential impacts.

Trial Blast

In 1982 a trial blast was conducted. This was found by Swindells to produce good quality fresh granitic rock that was separated into blocks by micaceous layers and jointing.

The rock was tested by Swindells and found to vary in mean uniaxial strength from 100 +/- 40 Mn/m² for fresh granite to 95 +/- 40 Mn/m² for quartz rich gneiss with much lower results for the micaceous banding.

4.0 Normal Blasting Procedures used at Quarries

Blasting today is much better understood and controlled than previously, with good control of blast design, strength of the blast and potential impacts.

Nowadays consultants and good operators are able to closely predict the likely implications after several test blasts, and design the drilling and blasting pattern accordingly. This will be undertaken on this site. A trial blast was undertaken in 1982 but techniques are significantly better today and additional trial blasting will be required using modern techniques.

Blasts are designed with millisecond delays so they do not go off with one bang but are sequential and provide heave to the rock. The blast also has to be designed to provide the correct fracturing and the desired rock size for the purpose.

However normal procedure is to undertake several test blasts and monitor the blast levels. From the data, adjustments, as necessary, can be made to the drilling and blasting pattern.

Considering the distances, and the geology as known, it is unlikely that any blast will have significant impact on sensitive premises. In any event the blast design can be used to mitigate any such impacts.

Mitigation can, for example, include which face is fired, the design of the excavation, the amount of rock fired, the depth of drill holes, the spacings of the drill patterns, the number of blasts, time of firing and the time delay patterns.

Explosives will not be stored on quarry site, but will be brought to site as required. The materials commonly used are fertiliser and petroleum substances that only become explosive when mixed in a particular ratio and manner and when triggered by a detonator in an enclosed situation. Detonators will be brought to site as required for each blast.

Explosives management procedures are required. People using explosives are required to hold a Shotfirer's Licence through the Department of Mines and Petroleum.

5.0 Regulation

Blasting noise (airblast overpressure) is controlled by the Department of Environment Regulation under the *Environmental Protection (Noise) Regulations 1997*.

The *Environmental Protection (Noise Regulations 1997)* were changed on 5 December 2013, *Environmental Protection (Noise) Amendment Regulations 2013 – gazetted on 5 December 2013*, and state that no blast should exceed 120 dB for a sensitive premises and 125 dB for a non sensitive location. In addition nine in every 10 consecutive blasts are required to be below 115 dB for a sensitive premises and 120 dB for a non sensitive premises. These levels do not appear to apply when a person is not present at the receiving premises.

Prior to 5 December 2013 the levels of air blast were 5 dB higher.

AS2187 Explosives Storage Transport and Use also provides control on the transport, storage and use of explosives. Storage and Transport and use of explosives is controlled by the Department of Mines and Petroleum and there are several Guidelines and Regulations relating to them, for example *Dangerous Goods Handling and Storage Regulations 1992*.

Blasting controls are also covered by *the Mines Safety and Inspection Act 1994 and Regulations 1995*. These are now covered by compliance with *Australian Standard AS2187 Explosives Storage Transport and Use*.

DER Licence requirements normally require blasts to comply with 9 out of 10 blasts below 5mm/sec with none above 10mm/sec. Where peak particle velocity exceeds 5mm/sec, notification of the Director of the DER is normally required within 24 hours.

Even though the Statutory Blast limits are set at levels that will not lead to structural impacts they may still be heard or felt.

Ground vibration is often set in Western Australia at 5mm/s with only one in every 10 consecutive blasts being permitted above that level. The Australian Standard for dwellings is 10mm/s for which no blast is to exceed.

6.0 Proposed Blast Methodology

When blasting is required, a section of the face will be pattern drilled and then blasted with explosives. Millisecond delays are used on all blasts to reduce both the air blast over-pressure and the ground vibration.

All drilling equipment will be fitted with noise suppression features and regularly checked to ensure compliance with all safety standards.

No explosives are to be kept on site. They will be brought to site as required by the explosives contractor.

Consultants will design the blasts in conjunction with Catalano staff, and the same consultants will monitor each blast and provide written documentation to the company.

The blast holes are to be located in the patterns and spacings, combined with blast design using various combinations of airdecks, charging and stemming to produce the best outcome with the least impact. The blasts will then be fired using millisecond delay detonators to reduce noise and ground vibration.

At the time of each blast, the weather conditions are to be recorded. The main weather conditions of concern are the wind speed and direction, and the possibility of a temperature inversion in the atmosphere, which may have the potential to reflect blast noise downwards.

To minimise these features the shots will be fired, wherever possible, around midday, when temperature inversions have broken up and when the wind is most commonly from the south west, blowing away from the main settled areas to the west of the quarry.

Blasting will be conducted below the surrounding level of the hills, located low in the landscape, with the adjoining ridges adding to the shielding of adjoining properties.

It is anticipated that blasting will be in the order of four times per year.

The Shire of Harvey and the nearest residences will be rung prior to each blast as a matter of courtesy.

A consultation program will be implemented prior to blasting as outlined in the Blast Management Plan in Appendix 3.

A complaints register will be maintained and all complaints will be investigated. As far as is known no complaints have been received within the last five years relating to noise.

7.0 Potential Blast Impacts

7.1 Number of Blasts Proposed

For normal operations it is anticipated that 50 000 – 100 000 tonnes of resource will be removed from the pit annually. It is anticipated that up to 4 blasts will be used per year, at least initially. When testing and opening the pit there may be several more smaller blasts.

However when the faces have been formed the number of blasts per year may reduce to two.

The design of the pit is summarised below. The figures attached to the main report should be consulted in relation to the location and design of the pit.

The pit will be operated with a series of northern faces and three x 10 metre operational benches. The height of the benches will depend on the mobile plant used and may eventually go to two x 15 metre benches if plant, safety and efficiency dictates. See Figures 3, 4, 5, 6A, 6B, 9 and 11.

Initially a northern face of 5 – 10 metres, will be established from the existing operational area. The elevation will be approximately 210 m AHD.

A 210 metre bench will enable the pit to be cut back to the north because the top of the spur is at an elevation of 220 – 222 metres AHD. The first bench and northern face will be cut to the northern extremity of the pit.

This will take a floor east west across the spur. From there the excavation face will be work north to near the northern end of the existing operational area.

A new bench and northern face will then be formed at an elevation of 200 metres AHD, cut to the northern extremity with a bench retained for future access and stability.

The next bench will be 190 metres AHD. After the 190 m bench, which is anticipated to take more than ten years, excavation will then jump back to the north in another sequence of benches.

7.2 Compliance of Blasts - Dwellings

The existing land uses of the area surrounding the quarry have not changed within the time the gravel excavation has been operating.

The land to the east, north and south is pasture with mainly grazing activities. Forest lies to the east and plantation forest to the west. Gravel extraction has been approved on Lot 501 for the past 4 years.

The only nearby dwellings are isolated and a significant distance from the site. There is a cluster of sensitive premises to the south west.

The closest dwellings are;

Dwelling to south Lot 28	2800 metres from pit 3500 metres from crusher	Will probably be able to see the pit and the crushing area
Dwelling to north east Lot 23	3200 metres from pit 2480 metres from crusher	Located behind ridge
Dwelling to the west Lot 17	2690 metres from pit 2530 metres from crusher	Generally located behind ridge
Sensitive premises to the south west Lot 29	2800 metres from pit 3500 metres from crusher	The pit appears to be located behind the landform. The processing area is higher but also appears likely to be protected by landform
Building. Dwelling/shed Lot 5	2550 metres to the north west	Protected by landform and the intervening ridge.
Shed? Lot 17	2600 metres north from processing area	Protected by landform and the intervening ridge

Other dwellings are further away, protected by landform. See Figure 2. Section lines from the dwellings are shown in Figures 8A to 8D.

There have been some initial community concerns with respect to the gravel crushing operation. These relate to erosion and have now been addressed through contouring and pasture establishment.

7.3 Existing Quarry data

B and J Catalano is a large company which has extensive experience in extraction of basic raw materials and quarries, and in particular the removal of laterite duricrust.

They will use the assistance of consultants to plan the quarry and design the blasting and operation of the hard rock quarry.

Some background on current quarrying in Western Australia will illustrate how this site matches other hard rock quarries and the risk that may apply from blasting.

Other major hard rock quarries are located at much closer distances to dwellings than this quarry. For example, WA Bluemetal, Byford, Hanson at Byford, Boral at Orange Grove, Hanson at Red Hill and Holcim at Gosnells.

In fact the proposed quarry will have some of the largest buffers to any hard rock quarry. The examples below illustrate how well blasting is now understood and the minimal impacts that can be designed for. Lindsay Stephens of Landform Research is familiar with all the examples below and worked in some capacity on those quarries.

For example the closest dwellings to Boral quarry at Orange Grove are located 500 metres from the active face. Boral (orange Grove) is a major hard rock quarry producing perhaps ten times the amount of rock annually that this quarry is to produce and yet all blasts are well within compliance.

At Esperance the buffer available when the Port of Esperance was expanded in 2001 – 2002 was very small. The quarry produced rock for the break water construction and the contractor monitored all blasts. There were 399 blasts, all in compliance with the Regulations/ Standards, with the closest dwelling being as close as 220 metres from one edge of the quarry.

At Hanson Mt Barker Quarry the nearest dwelling is 120 metres from the closest face, there is a second dwelling at 300 metres and other dwellings at 700 metres. Blasting is within compliance.

At Bunbury the closest dwellings to the Hanson Quarry are 600 metres. The closest distance from Holcim Quarry at Gelorup is 250 metres. Again blasting is in compliance.

At Byford, the Hanson and WA Bluemetal Quarries have dwellings at 800 metres. Blast levels are also in compliance.

Compared to the distances available for this proposed quarry, in excess of 2.5 km to all dwellings the risks are considered to be minimal to nil with effective design and management of blasting.

The above quarries, like all such operations, comply with the *Environmental Protection (Noise) Regulations 1997* for air pressure and *Australian Standard AS2187 Explosives Storage Transport and Use* for ground vibration and illustrate the significant improvements that have taken place in blast technology, design and monitoring in recent years.

The main points demonstrated from the existing quarries is that blasting techniques today are very good and can be designed to minimise airblast and ground vibration at relatively small distances that would apply to the existing dwellings.

In addition the data shows that there is a large difference between isolated dwellings and a new urban or rural living development. For example the proposed quarry has only four isolated residences in the locality. This should be compared to urban land at Orange Grove, Esperance and Gelorup which are near the quarries in those locations.

For new blasting operations in hard rock the allocation of larger buffers is very prudent to prevent potential real or perceived landuse conflicts.

As discussed below a 1 000 metre buffer is recommended for this pit and is readily available.

7.4 Required Buffer

Even though some quarries have isolated dwellings and developed areas closer than 1 000 metres, this does not mean that buffers of less than 1 000 are recommended.

A study of the buffer requirements for the Gelorup Area was commissioned by the Western Australian Planning Commission; *Orica, 2001, Gelorup Basalt Quarry Buffer Study – Bunbury WA*.

Whilst the rock types are different, basalt versus hard schists with some dolerite and granite, the principles are the same. Orica concluded that it was likely that at distances of less than 1 000 compliance was likely to be able to be achieved and this has generally proven to be the case. There is a risk, that occasional blasts may exceed the recommended limits.

In 2000 the WAPC released the Greater Bunbury Region Scheme. In the Strategic Minerals and Basic Raw Materials Resource Policy of the Greater Bunbury Region Scheme, the WAPC nominated a 1 000 metre buffer referral area in Section 3.0 Application and Figure 1.

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

EPA guidance No 3, "Separation Distances between Industrial and Sensitive Land Uses", June 2005 lists the generic buffers for hard rock quarries as 1000 metres depending on the extent of processing. A generic buffer relates to the distance at which there are unlikely to be any problems without some further investigations and does not mean that smaller buffers are not acceptable.

The proposed pit exceeds the generic buffers by substantial margins.

As is normal practice, blasting consultants are to be used to design and monitor blasts, to ensure that the most efficient, safe and environmentally sensitive blasting techniques are used. This is proposed for the Shenton Ridge Pit.

There is no means of definitively modeling blast impact prior to blasting occurring, because the geology cannot be intimately known until the quarry commences and faces of rock are exposed. However current knowledge of blasting has reached a level of sophistication that quarry operators and Blast Management Consultants can be confident that blasts can be designed and fired in compliance with the regulations and standards, and that potential impacts are minimised.

Normal practice when opening a quarry is to use small blasts to check compliance. When monitored results are available, and the first faces are exposed, the design of the blasts can be adjusted and increased, to the point where greater production efficiency is achieved whilst maintaining compliance and minimising any blast impacts on local residents.

Blasts at the large hard rock quarries in the south west of Western Australia are normally in the range of 95 to 115 dB for airblast and < 2mm/sec for ground vibration, at the monitoring stations which are normally located at the closest dwellings.

The existing hard rock quarries demonstrate that blasting can be managed within the buffer distances available. In addition B and J Catalano is committed to minimising any adverse impact on the existing local residents and will work with them to ensure a satisfactory outcome is achieved.

The buffer to dwellings is listed previously and shown in Figure 2 and in the sections in Figures 8A to 8D.

8.0 Management of Blasting

B and J Catalano is committed to minimising any risk of impact on local residents or structures and will ensure that the concerns of residents are noted and incorporated into all operational and blast procedures.

A number of mechanisms are available to minimize blast impact from airblast and ground vibration. These are summarised from *Orica, 2001, Gelorup Basalt Quarry Buffer Study – Bunbury WA* and current practices.

- Use smaller diameter drill holes.
- Reduce the height of benches.
- Use blast initiation sequences that drive away from areas of concern.
- Achieve the best firing time by delaying the blast, if necessary. This can raise other issues and is not always available.
- Increase stem lengths in blast holes.
- Splitting charges in half to reduce the kg of explosives per delay.
- Manipulate the delay sequences and point of initiation.
- Use greater front row burdens.
- Generate ground vibration reduction trenches, although this may not be possible in all situations on site.
- Firing more holes less frequently, because it is found the local people generally prefer less blasts rather than more blasts even if they are smaller.
- Use of pre-splitting or line drilling to create a smooth face and reduce impacts.
- Use of air decks to manipulate the blast.

The following Blast Management is proposed.

1. No explosives or detonators will be stored on site. Blasting materials will only be brought to site by a licensed supplier. The materials will be blended on site, only at the time of charging the blast holes; the same practice used in all hard rock quarries.
2. Catalano will inform the nearby residents prior to the commencement of blasting.
3. Catalano will undertake blasting in compliance with *Australian Standard 2187* which sets out good management practices and procedures for blasting.

4. Catalano will comply with the *Environmental Protection (Noise) Regulations 1997* for air blast over pressure and *Australian Standard AS2187 Explosives Storage Transport and Use* for ground vibration. They will also comply with any Department of Environmental Regulation Licences, if they condition blasting.
5. Blasting consultants will be used to design all blasts, to ensure that the most efficient, safe and environmentally sensitive blasting techniques are used.
6. All drilling equipment will be fitted with noise suppression devices and regularly checked to ensure compliance with all standards.
7. All blasts will be designed to heave the rock with millisecond delays in firing to reduce the impacts. This produces a slightly extended rumble rather than a loud bang.
8. There is potential to have smaller more frequent blasts or larger less frequent blasts. At other quarries residents prefer larger less frequent blasts and Catalano will use this procedure.
9. For each blast an assessment of the risks from fly rock will be made to determine what management is required for each individual blast for site operations.
10. All initial blasts will be monitored by a consultant. Later blasts will be monitored either by consultants or by Catalano staff under the supervision of consultants depending on the frequency of blasts.
11. Initial blasts will be small, with blast size increasing only gradually. The blasts will be monitored and the size of subsequent blasts will only be increased when Catalano and the consultants are confident that impacts of a larger blast can be maintained within the required levels.
12. Blast monitoring stations will be established at strategic locations around the pit, on Lot 501. The monitoring equipment will be rotated around the monitoring sites.
13. On this site, with the quarry located on a south facing spur and the rocks striking north, there may be a possibility that ground vibration will travel further north than east or west. As blasting will be conducted on a northern face, southern travel of ground vibration is less likely. Therefore, at this stage, it is anticipated that the main monitoring station will be located north of the pit along the ridge.
14. Initial monitoring will be conducted at two sites, but as the characteristics of the pit become better known, and bearing in mind the distances involved, it may be possible for one monitoring station to be representative of potential impacts. On the other hand there may be occasions when more monitoring stations are used.
15. Catalano will have in place an operational Blast Management Plan that will detail, among other procedures, that only a licensed Shotfirer will be permitted to use explosives, and the procedures for on site warning of an impending blast, traffic and road management. This will be based on an appropriate guideline such as *The Institute of Quarrying Australia, Explosives Management*.
16. A record will be kept of all blast monitoring and the weather conditions at the time of blasting.

17. Blasts will normally be conducted between 11.00 am and 2.00 pm.
18. During normal operations, the Shire of Harvey and any of the four closest residences who wish to be informed will be notified 24 hours prior to a blast occurring.
19. A complaints register will be maintained and all complaints will be investigated. Records will be kept of all complaints and the results of the investigations into those complaints.

Appendix 3

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LANDFORM RESEARCH

PROPOSED HARD ROCK QUARRY LOT 501 COALFIELDS ROAD WELLINGTON

NOISE ASSESSMENT

SEPTEMBER 2013

OUR REF: 16862-1-13186



DOCUMENT CONTROL PAGE

NOISE ASSESSMENT
WELLINGTON

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FOR

LANDFORM RESEARCH

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This report has been prepared in accordance with the scope of services and on the basis of information and documents provided to Herring Storer Acoustics by the client. To the extent that this report relies on data and measurements taken at or under the times and conditions specified within the report and any findings, conclusions or recommendations only apply to those circumstances and no greater reliance should be assumed. The client acknowledges and agrees that the reports or presentations are provided by Herring Storer Acoustics to assist the client to conduct its own independent assessment.

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5.	MODELLING	3
6.	DISCUSSION	5

APPENDICIES

A	Locality Plan	
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1. INTRODUCTION

Herring Storer Acoustics was commissioned by Landform Research to carry out an acoustical assessment of noise emissions from a proposed hard rock quarry located at Lot 501 Coalfields Road, Wellington. The objectives of the study were to:

- Determine, by modelling, noise propagation from the pit.
- Assess the predicted noise levels received at the neighbouring noise sensitive premises, for compliance with the *Environmental Protection (Noise) Regulations 1997*.
- If exceedances are predicted, investigate possible noise control options that will reduce noise emissions to achieve compliance with the regulations.

For information a locality plan is attached in Appendix A.

2. SUMMARY

It is understood that the pit would only operate during the day period, therefore, noise emissions from the pit need to comply with the assigned day period noise levels at the neighbouring residences. As shown on the locality plan attached, the closest residences to the pit operations are located to the west and south.

Given the location of the neighbouring residence, it is likely that noise received at these residence would be deemed not to contain any annoying characteristics, however to be conservative, the assessment includes a +5 dB(A) adjustment for tonality.

For the proposed operating hours, noise received at the neighbouring residence would, even with the inclusion of the +5 dB(A) penalty for a tonal component, comply with the requirements of the Environmental Protection (Noise) Regulations 1997.

3. CRITERIA

The *Environmental Protection (Noise) Regulations 1997* stipulate the allowable noise levels that can be received at a premise from other premises. The allowable noise level when received at a residence is determined by the calculations of an influencing factor, which is then added to base noise levels. In this case the influencing factor for the noise sensitive premises located around the quarry would be 0 dB. Therefore, the assigned noise levels for the neighbouring noise sensitive premises are listed in Table 1.

TABLE 1 - ASSIGNED NOISE LEVEL

Time of Day	Type of Assigned Noise Level		
	L _{A10}	L _{A1}	L _{max}
0700 - 1900 hours - Monday to Saturday (Day Period)	45	55	65
0900 - 1900 hours - Sunday & Public Holidays (Evening Period)	40	50	65
1900 - 2200 hours - All Days (Evening Period)	40	50	55
2200 - 0700 hours - Monday to Saturday (Night Period)	35	45	55
2200 - 0900 hours - Sunday & Public Holidays (Night Period)	35	45	55

Note: The L_{A10} noise level is the noise that is exceeded for 10% of the time.
The L_{A1} noise level is the noise that is exceeded for 1% of the time.
The L_{Amax} noise level is the maximum noise level recorded.

The assigned noise levels are also conditional on no annoying characteristics existing such as tonal components etc. If such characteristics exist, then any measured level is adjusted accordingly. The adjustments that apply are shown in Table 2.

TABLE 2 - ADJUSTMENTS TO MEASURED LEVELS

Where tonality is present	Where modulation is present	Where impulsiveness is present
+5 dB(A)	+5 dB(A)	+10 dB(A)

Note: these adjustments are cumulative to a maximum of 15 dB.

The Influencing Factor at these neighbouring noise sensitive premises of concern has been determined to be 0.

It is noted that under the regulation 3, noise emissions from vehicles travelling on roads are exempt from the Regulations. Hence it is only the noise received at the neighbouring from the truck movement on site that needs to be assessed under the Regulations.

4. QUARRY OPERATIONS

It is understood that the quarry activity and crushing / processing would only operate during the day period, this being between 0700 and 1900 hours Monday to Saturday (excluding Public Holidays). However, transport of material would occur between 0600 and 1900 hours Monday to Saturday (excluding Public Holidays). Therefore, noise emissions from the entire site (i.e. pit, processing and transport) needs to comply with the assigned L_{A10} day period noise level of 45 dB(A) at the neighbouring residences. Additionally, noise from the loading of road trucks and road truck movements on site needs to comply with the assigned L_{A10} night period noise level of 35 dB(A).

From information supplied, we understand that the equipment of concern, used on site is as outlined below. However, not all are expected to be running at once as some will not be required and there would be some diversity of operations.

Front end loaders (2)

- Crusher feed Loading of road trucks in stockpile areas
- Load road trucks

Excavator (1)

- Loading articulated truck in quarry.

Dump Truck (1)

- Articulated dump truck in quarry.

Crushers and screens mobile (3)

- Primary, secondary and tertiary crushers
- screens

Water Cart (1)

- Water cart for dust suppression..

Drill Rig (1)

- Within quarry.

From information supplied, we understand that there would be on average 8 road truck movements per day. Given this number of truck movements, noise emissions from trucks movements on site would be for less than 10% of the time. Therefore, noise emissions from truck movements would need to comply with the assigned L_{A1} noise level at the neighbouring residence. However, as the number of trucks per day would vary, to be conservative, the road truck movements have been included in the L_{A10} assessment for the entire operation.

5. MODELLING

Modelling of the noise emission propagation was carried out using "SoundPlan". SoundPlan uses the theoretical sound power levels determined from measured sound pressure levels to calculate the noise level received at a specific location. For this study, single point calculation were undertaken to determine the noise that would be received at the neighbouring residence.

The calculations used the following input data:

- a) Ground contours.
- b) Sound power levels as listed in Table 7.
- c) Ground contours.

Weather conditions for the modelling were as stipulated within the Environmental Protection Authority's "Draft Guidance for Assessment of Environmental Factors No. 8 - Environmental Noise" for the day period were as listed in Table 6.

TABLE 6 - WEATHER CONDITIONS

Condition	Day Period
Temperature	20 °C
Relative Humidity	50%
Pasquill Stability Class	E
Wind Speed	4m/s*

* From sources, towards receivers.

TABLE 7 - SOUND POWER LEVELS dB(A)

Item	Sound Power Level dB(A)
Primary Crusher	116 (1 off)
Secondary Crusher	114 (1 off)
Tertiary Crusher	114 (1 off)
Screens	112 (3 off)
Generators	100 (3 off)
Excavator	109 (1 off)
Drill Rig	121 (1 off)
Front End Loaders	109 (2 off)
Articulated Truck	115 (1 off)
Haulage Trucks	104 (2 off)

Note : To be conservative, noise modelling was undertaken with all the equipment located at ground level, without any bunding or screening.

Noise modelling was undertaken for the following scenarios :

Day Period - All plant and equipment operating, as listed in Table 7.

Night Period - 1 Front End Loader and 2 road trucks.

The results of the modelling, are listed in Table 8 below.

TABLE 8 - CALCULATED NOISE LEVELS AT RESIDENCES

Residence	Calculated Noise Level dB(A)	
	Day Period	Night Period
South	34	23
South West	19	6
West	38	28

6. ASSESSMENT

Given the location of the residence, it is likely that noise received at the neighbouring residence would be deemed not to contain any annoying characteristics, however to be conservative, the assessment includes a +5 dB(A) adjustment for tonality.

Based on the above total calculated noise level, the following adjustments as listed in Tables 9 and 10 would be applicable.

Table 9 – Applicable Adjustments and Assessable Level of Noise Emissions – Day Period, dB(A)

Residence	Calculated Noise Level	Applicable Adjustments to Measured Noise Levels			Assessable Noise Level
		Where Noise Emission is NOT music			
		Tonality	Modulation	Impulsiveness	
South	34	+5	-	-	39
South West	19	+5	-	-	24
West	38	+5	-	-	43

Table 10 – Applicable Adjustments and Assessable Level of Noise Emissions – Night Period, dB(A)

Residence	Calculated Noise Level	Applicable Adjustments to Measured Noise Levels			Assessable Noise Level
		Where Noise Emission is NOT music			
		Tonality	Modulation	Impulsiveness	
South	23	+5	-	-	28
South West	6	+5	-	-	11
West	28	+5	-	-	33

Tables 11 and 12 summarise the applicable Assigned Noise Levels, and assessable noise level emissions for each identified noise.

Table 10 – Assessment of Day Period Operations Operations

Residence	Assessable Noise Level, dB(A)	Applicable Times of Day	Applicable L _{A10} Assigned Noise Level (dB)	Exceedance to Assigned Noise Level (dB)
South	39	0700 – 1900 hours Monday to Saturday	45	Complies
South West	24	0700 – 1900 hours Monday to Saturday	45	Complies
West	43	0700 – 1900 hours Monday to Saturday	45	Complies

Table 11 – Assessment of Night Period

Residence	Assessable Noise Level, dB(A)	Applicable Times of Day	Applicable L _{A10} Assigned Noise Level (dB)	Exceedance to Assigned Noise Level (dB)
South	28	2200 – 0700 hours Monday to Saturday	35	Complies
South West	11	2200 – 0700 hours Monday to Saturday	35	Complies
West	33	2200 – 0700 hours Monday to Saturday	35	Complies

Note : The assessment during the night period for the loading and movement of trucks before 0700 hours (ie night period), should be assessed under the L_{A1} assigned noise level of 45 dB(A), but to be conservative, this activity has been assessed under the L_{A10} assigned noise level of 45 dB(A).

7. DISCUSSION

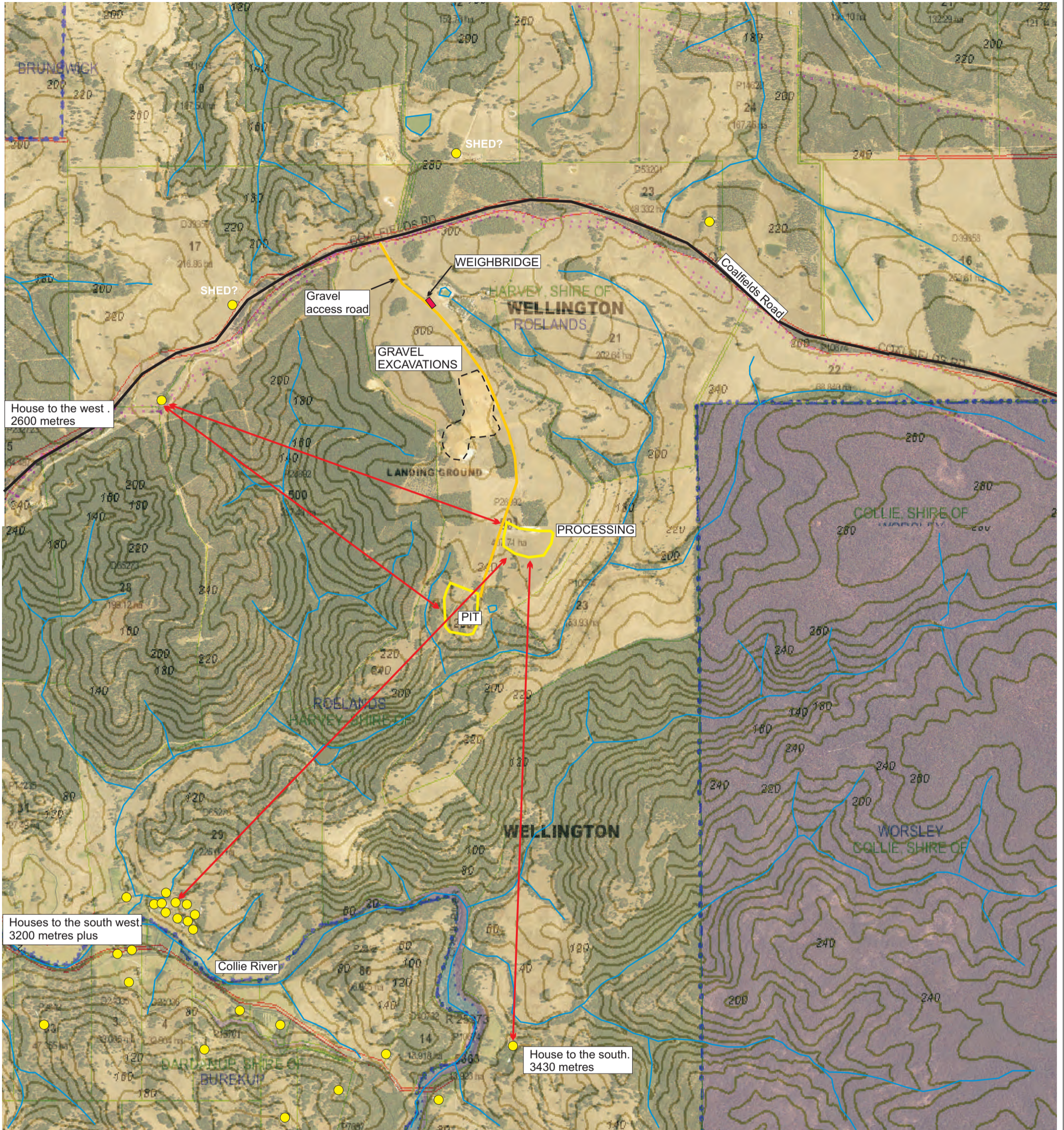
Given the location of the residence, it is likely that noise received at the neighbouring residence would be deemed not to contain any annoying characteristics, however to be conservative, the assessment includes a +5 dB(A) adjustment for tonality.

It is understood that the quarry would only operate during the day period. Therefore, noise emissions from the entire quarry operations needs to comply with the assigned L_{A10} day period noise of 45 dB(A) at the neighbouring residences. Additional to the above operations, it is also understood that the loading of road trucks could occur between 0600 and 0700 hours. From information supplied, there would be on average 4 road truck movements per day and given this number of truck movements, noise emissions from trucks movements on site would be for less than 10% of the time. Therefore, noise emissions from truck movements would need to comply with the assigned L_{A1} noise level at the neighbouring residence. However, to be conservative, the loading of trucks and the truck movements on site during the night period has been assessed against the L_{A10} night period assigned noise level of 35 dB(A).

Noise received at the neighbouring residence from the proposed operations of the hard rock quarry, would, even with the inclusion of the +5 dB(A) penalty for a tonal component, comply with the requirements of the Environmental Protection (Noise) Regulations 1997. Noise received at the neighbouring residence from trucks being loaded, entering and leaving the site during the night period (ie between 0600 and 0700 hours) would also comply with the Regulatory requirements.

APPENDIX A

LOCALITY PLAN

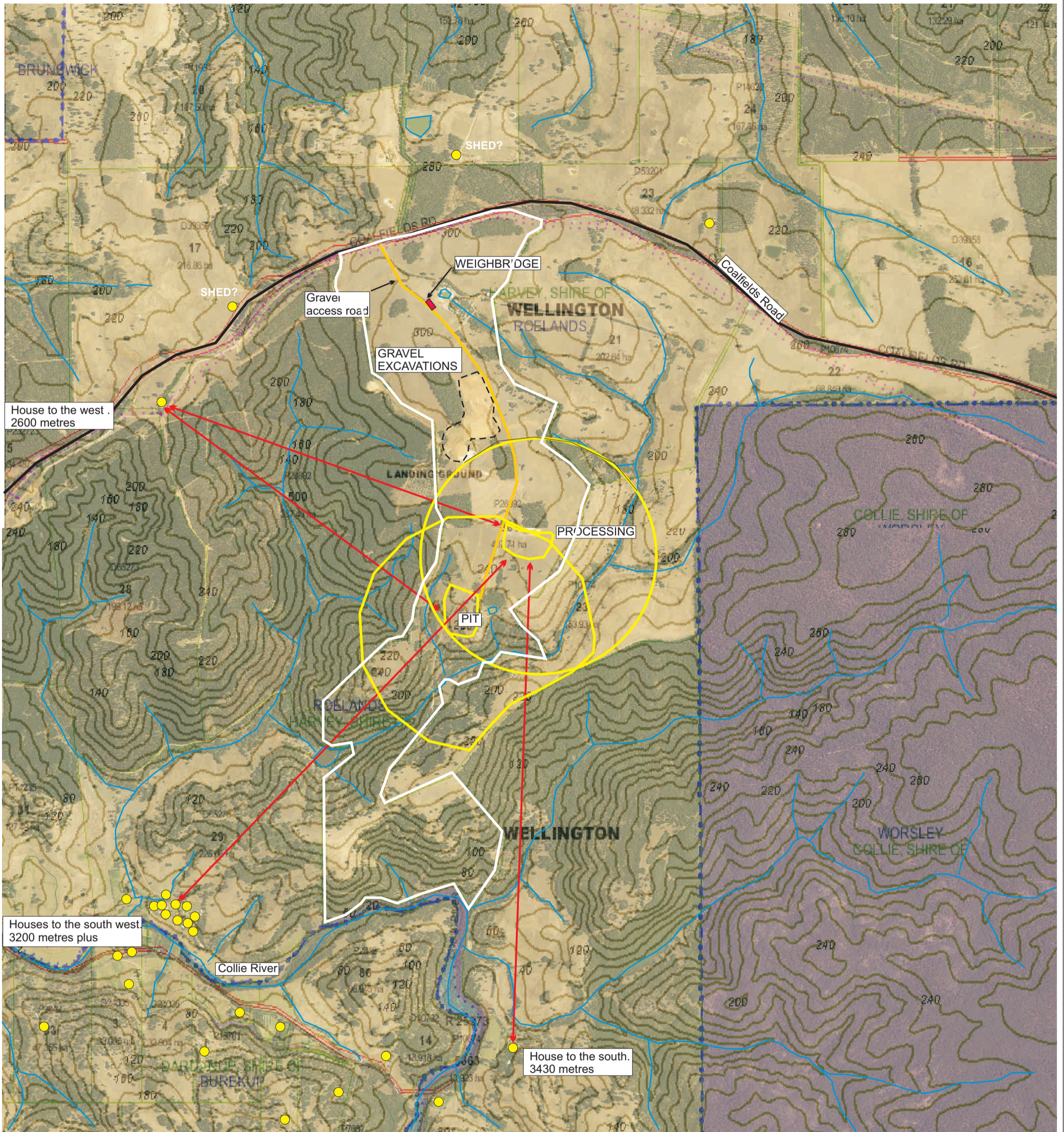


● Dwelling identified from aerial photograph

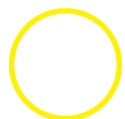


Figure 2

B and J CATALANO	
LOT 501, COALFIELDS ROAD, WELLINGTON	
SURROUNDING LAND	
Landform Research	June 2013
Basemap LANDGATE	Scale 1 : 22 500



● Dwelling identified from aerial photograph



500 generic buffer from the edge of the quarry and processing area.
Note that the buffer is cut off from the quarry by the ridge.
A 1000 metre generic buffer is not appropriate because of the landform.

BUFFER

B and J CATALANO	
LOT 501, COALFIELDS ROAD, WELLINGTON	
SURROUNDING LAND	
Landform Research	June 2013
Basemap LANDGATE	Scale 1 : 22 500