



Carmichael Coal Mine and Rail Project Supplementary Environmental Impact Statement

Volume 4, Appendix C5a – Borrow 7 Quarry Applications

Containing

- IDAS Form 1 – Application details
- IDAS Form 5 – Material change of use assessable against a planning scheme
- IDAS Form 8 – Environmentally relevant activity
- IDAS Form 8 – Attachment for an application for an environmental authority
- IDAS Form 11 – Clearing native vegetation
- Borrow 7 supporting information by CDM Smith

IDAS form 1—Application details

(Sustainable Planning Act 2009 version 3.0 effective 1 July 2013)

This form must be used for **ALL** development applications.

You **MUST** complete **ALL** questions that are stated to be a mandatory requirement unless otherwise identified on this form.

For all development applications, you must:

- complete this form (*IDAS form 1—Application details*)
- complete any other forms relevant to your application
- provide any mandatory supporting information identified on the forms as being required to accompany your application.

Attach extra pages if there is insufficient space on this form.

All terms used on this form have the meaning given in the *Sustainable Planning Act 2009* (SPA) or the Sustainable Planning Regulation 2009.

This form and any other IDAS form relevant to your application must be used for development applications relating to strategic port land and Brisbane core port land under the *Transport Infrastructure Act 1994* and airport land under the *Airport Assets (Restructuring and Disposal) Act 2008*. Whenever a planning scheme is mentioned, take it to mean land use plan for the strategic port land, Brisbane core port land or airport land.

PLEASE NOTE: This form is not required to accompany requests for compliance assessment.

This form can also be completed online using MyDAS at www.dsdip.qld.gov.au/MyDAS

Mandatory requirements

Applicant details (Note: the applicant is the person responsible for making the application and need not be the owner of the land. The applicant is responsible for ensuring the information provided on all IDAS application forms is correct. Any development permit or preliminary approval that may be issued as a consequence of this application will be issued to the applicant.)

Name/s (individual or company name in full)	Adani Mining Pty Ltd			
For companies, contact name	Hamish Manzi - General Manager Environment and Sustainability			
Postal address	GPO Box 2569			
	Suburb	Brisbane		
	State	Queensland	Postcode	4000
	Country	Australia		
Contact phone number	07 3223 4800			
Mobile number (non-mandatory requirement)				
Fax number (non-mandatory requirement)	07 3223 4850			

Email address (non-mandatory requirement)

Reception.Australia

@adani.com

Applicant's reference number (non-mandatory requirement)

1. What is the nature of the development proposed and what type of approval is being sought?

Table A—Aspect 1 of the application (If there are additional aspects to the application please list in Table B—Aspect 2.)

a) What is the nature of the development? (Please only tick one box.)

☒ Material change of use ☐ Reconfiguring a lot ☐ Building work ☐ Operational work

b) What is the approval type? (Please only tick one box.)

☐ Preliminary approval under s241 of SPA ☐ Preliminary approval under s241 and s242 of SPA ☒ Development permit

c) Provide a brief description of the proposal, including use definition and number of buildings or structures where applicable (e.g. six unit apartment building defined as a *multi-unit dwelling*, 30 lot residential subdivision etc.)

Material Change of Use Development Application for Extractive Industry Involving Screening and Crushing Activities.

d) What is the level of assessment? (Please only tick one box.)

☒ Impact assessment ☐ Code assessment

Table B—Aspect 2 of the application (If there are additional aspects to the application please list in Table C—Additional aspects of the application.)

a) What is the nature of development? (Please only tick one box.)

☐ Material change of use ☐ Reconfiguring a lot ☐ Building work ☒ Operational work

b) What is the approval type? (Please only tick one box.)

☐ Preliminary approval under s241 of SPA ☐ Preliminary approval under s241 and s242 of SPA ☒ Development permit

c) Provide a brief description of the proposal, including use definition and number of buildings or structures where applicable (e.g. six unit apartment building defined as a *multi-unit dwelling*, 30 lot residential subdivision etc.)

Operational Works Development Application for Clearing of Native Vegetation

d) What is the level of assessment?

☐ Impact assessment ☒ Code assessment

Table C—Additional aspects of the application (If there are additional aspects to the application please list in a separate table on an extra page and attach to this form.)

☐ Refer attached schedule ☒ Not required

2. Location of the premises (Complete Table D and/or Table E as applicable. Identify each lot in a separate row.)

Table D—Street address and lot on plan for the premises or street address and lot on plan for the land adjoining or adjacent to the premises (Note: this table is to be used for applications involving taking or interfering with water). (Attach a separate schedule if there is insufficient space in this table.)

☒ Street address **and** lot on plan (All lots must be listed.)

☐ Street address **and** lot on plan for the land adjoining or adjacent to the premises (Appropriate for development in water but adjoining or adjacent to land, e.g. jetty, pontoon. All lots must be listed.)

Street address					Lot on plan description		Local government area (e.g. Logan, Cairns)
Lot	Unit no.	Street no.	Street name and official suburb/ locality name	Post-code	Lot no.	Plan type and plan no.	
i)		472	Twin Hills Rd, Clermont	4721	3235	PH752	Isaac Regional Council
ii)							
iii)							

Planning scheme details (If the premises involves multiple zones, clearly identify the relevant zone/s for each lot in a separate row in the below table. Non-mandatory)

Lot	Applicable zone / precinct	Applicable local plan / precinct	Applicable overlay/s
i)	Rural	Belyando Shire Planning Scheme 200	N/A
ii)			
iii)			

Table E—Premises coordinates (Appropriate for development in remote areas, over part of a lot or in water not adjoining or adjacent to land e.g. channel dredging in Moreton Bay.) (Attach a separate schedule if there is insufficient space in this table.)

Coordinates (Note: place each set of coordinates in a separate row)				Zone reference	Datum	Local government area (if applicable)
Easting	Northing	Latitude	Longitude			
					☐ GDA94 ☐ WGS84 ☐ other	Refer to maps in Supporting Document

3. Total area of the premises on which the development is proposed (indicate square metres)

36.17 hectares (Approximately 361,700m²)

4. Current use/s of the premises (e.g. vacant land, house, apartment building, cane farm etc.)

Rural activities - cattle breeding and fattening

5. Are there any current approvals (e.g. a preliminary approval) associated with this application? (Non-mandatory requirement)

☒ No ☐ Yes—provide details below

List of approval reference/s	Date approved (dd/mm/yy)	Date approval lapses (dd/mm/yy)

6. Is owner's consent required for this application? (Refer to notes at the end of this form for more information.)

☐ No
☒ Yes—complete either Table F, Table G or Table H as applicable

Table F

Name of owner/s of the land	
I/We, the above-mentioned owner/s of the land, consent to the making of this application.	
Signature of owner/s of the land	
Date	

Table G

Name of owner/s of the land	State of Queensland (Owner), F & PR DENNIS EDWIN (Leaseholder)
☒ The owner's written consent is attached or will be provided separately to the assessment manager.	

Table H

Name of owner/s of the land	
☐ By making this application, I, the applicant, declare that the owner has given written consent to the making of the application.	

7. Identify if any of the following apply to the premises (Tick applicable box/es.)

- ☒ Adjacent to a water body, watercourse or aquifer (e.g. creek, river, lake, canal)—complete Table I
- ☐ On strategic port land under the *Transport Infrastructure Act 1994*—complete Table J
- ☐ In a tidal water area—complete Table K
- ☐ On Brisbane core port land under the *Transport Infrastructure Act 1994* (No table requires completion.)
- ☐ On airport land under the *Airport Assets (Restructuring and Disposal) Act 2008* (no table requires completion)

Table I

Name of water body, watercourse or aquifer

Table J

Lot on plan description for strategic port land	Port authority for the lot

Table K	
Name of local government for the tidal area (if applicable)	Port authority for the tidal area (if applicable)

8. Are there any existing easements on the premises? (e.g. for vehicular access, electricity, overland flow, water etc)

☒ No ☐ Yes—ensure the type, location and dimension of each easement is included in the plans submitted

9. Does the proposal include new building work or operational work on the premises? (Including any services)

☐ No ☒ Yes—ensure the nature, location and dimension of proposed works are included in plans submitted

10. Is the payment of a portable long service leave levy applicable to this application? (Refer to notes at the end of this form for more information.)

☐ No—go to question 12 ☒ Yes

11. Has the portable long service leave levy been paid? (Refer to notes at the end of this form for more information.)

☒ No

☐ Yes—complete Table L and submit with this application the yellow local government/private certifier's copy of the receipted QLeave form

Table L		
Amount paid	Date paid (dd/mm/yy)	QLeave project number (6 digit number starting with A, B, E, L or P)

12. Has the local government agreed to apply a superseded planning scheme to this application under section 96 of the *Sustainable Planning Act 2009*?

☒ No

☐ Yes—please provide details below

Name of local government	Date of written notice given by local government (dd/mm/yy)	Reference number of written notice given by local government (if applicable)

13. List below all of the forms and supporting information that accompany this application (Include all IDAS forms, checklists, mandatory supporting information etc. that will be submitted as part of this application. Note: this question does not apply for applications made online using MyDAS)

Description of attachment or title of attachment	Method of lodgement to assessment manager
IDAS Forms 1, 5 8 and 11	Supplementary EIS
Development Application Supporting Documentation	Supplementary EIS
Traffic and Transport Report (Attachment to Supporting Documentation)	Supplementary EIS
Air and Noise Impact Assessment Reports (Attachment to Supporting Documentation)	Supplementary EIS
Vegetation Clearing and PMAV Reports (Attachment to Supporting Documentation)	Supplementary EIS

14. Applicant's declaration

☒ By making this application, I declare that all information in this application is true and correct (Note: it is unlawful to provide false or misleading information)

Notes for completing this form

- Section 261 of the *Sustainable Planning Act 2009* prescribes when an application is a properly-made application. Note, the assessment manager has discretion to accept an application as properly made despite any non-compliance with the requirement to provide mandatory supporting information under section 260(1)(c) of the *Sustainable Planning Act 2009*

Applicant details

- Where the applicant is not a natural person, ensure the applicant entity is a real legal entity.

Question 1

- Schedule 3 of the Sustainable Planning Regulation 2009 identifies assessable development and the type of assessment. Where schedule 3 identifies assessable development as "various aspects of development" the applicant must identify each aspect of the development on Tables A, B and C respectively and as required.

Question 6

- Section 263 of the *Sustainable Planning Act 2009* sets out when the consent of the owner of the land is required for an application. Section 260(1)(e) of the *Sustainable Planning Act 2009* provides that if the owner's consent is required under section 263, then an application must contain, or be accompanied by, the written consent of the owner, or include a declaration by the applicant that the owner has given written consent to the making of the application. If a development application relates to a state resource, the application is not required to be supported by evidence of an allocation or entitlement to a state resource. However, where the state is the owner of the subject land, the written consent of the state, as landowner, may be required. Allocation or entitlement to the state resource is a separate process and will need to be obtained before development commences.

Question 11

- The *Building and Construction Industry (Portable Long Service Leave) Act 1991* prescribes when the portable long service leave levy is payable.
- The portable long service leave levy amount and other prescribed percentages and rates for calculating the levy are prescribed in the Building and Construction Industry (Portable Long Service Leave) Regulation 2002.

Question 12

- The portable long service leave levy need not be paid when the application is made, but the *Building and Construction Industry (Portable Long Service Leave) Act 1991* requires the levy to be paid before a development permit is issued.
- Building and construction industry notification and payment forms are available from any Queensland post office or agency, on request from QLeave, or can be completed on the QLeave website at www.qleave.qld.gov.au. For further information contact QLeave on 1800 803 481 or visit www.qleave.qld.gov.au.

Privacy—The information collected in this form will be used by the Department of State Development, Infrastructure and Planning (DSDIP), assessment manager, referral agency and/or building certifier in accordance with the processing and assessment of your application. Your personal details should not be disclosed for a purpose outside of the IDAS process or the provisions about public access to planning and development information in the *Sustainable Planning Act 2009*, except where required by legislation (including the *Right to Information Act 2009*) or as required by Parliament. This information may be stored in relevant databases. The information collected will be retained as required by the *Public Records Act 2002*.

OFFICE USE ONLY

Date received

Reference numbers

NOTIFICATION OF ENGAGEMENT OF A PRIVATE CERTIFIER

To

Council. I have been engaged as the private certifier for the building work referred to in this application

Date of engagement	Name	BSA Certification license number	Building classification/s

QLEAVE NOTIFICATION AND PAYMENT (For completion by assessment manager or private certifier if applicable.)

Description of the work	QLeave project number	Amount paid (\$)	Date paid	Date receipted form sighted by assessment manager	Name of officer who sighted the form

The *Sustainable Planning Act 2009* is administered by the Department of State Development, Infrastructure and Planning. This form and all other required application materials should be sent to your assessment manager and any referral agency.

IDAS form 5—Material change of use assessable against a planning scheme

(Sustainable Planning Act 2009 version 3.0 effective 1 July 2013)

This form must be used for development applications for a material change of use assessable against a planning scheme.

You **MUST** complete **ALL** questions that are stated to be a mandatory requirement unless otherwise identified on this form.

For all development applications, you must:

- complete *IDAS form 1—Application details*
- complete any other forms relevant to your application
- provide any mandatory supporting information identified on the forms as being required to accompany your application.

Attach extra pages if there is insufficient space on this form.

All terms used on this form have the meaning given in the Sustainable Planning Act 2009 (SPA) or the Sustainable Planning Regulation 2009.

This form must also be used for material change of use on strategic port land and Brisbane core port land under the *Transport Infrastructure Act 1994* and airport land under the *Airport Assets (Restructuring and Disposal) Act 2008* that requires assessment against the land use plan for that land. Whenever a planning scheme is mentioned, take it to mean land use plan for the strategic port land, Brisbane core port land or airport land.

This form can also be completed online using MyDAS at www.dsdip.qld.gov.au/MyDAS

Mandatory requirements

- 1. Describe the proposed use.** (Note: this is to provide additional detail to the information provided in question 1 of *IDAS form 1—Application details*. Attach a separate schedule if there is insufficient space in this table.)

General explanation of the proposed use	Planning scheme definition (include each definition in a new row) (non-mandatory)	No. of dwelling units (if applicable) or gross floor area (if applicable)	Days and hours of operation (if applicable)	No. of employees (if applicable)
Quarrying	Extractive Industry	N/A	24hrs a day, 7	33-35 personnel

- 2. Are there any current approvals associated with the proposed material change of use?** (e.g. a preliminary approval.)

☐ No ☒ Yes—provide details below

List of approval reference/s	Date approved (dd/mm/yy)	Date approval lapses (dd/mm/yy)

3. Does the proposed use involve the following? (Tick all applicable boxes.)

The reuse of existing buildings on the premises	☐ No	☐ Yes
New building work on the premises	☐ No	☐ Yes
The reuse of existing operational work on the premises	☒ No	☐ Yes
New operational work on the premises	☐ No	☒ Yes

Mandatory supporting information

4. Confirm that the following mandatory supporting information accompanies this application

Mandatory supporting information	Confirmation of lodgement	Method of lodgement
All applications		
A site plan drawn to an appropriate scale (1:100, 1:200 or 1:500 are recommended scales) which shows the following: - the location and site area of the land to which the application relates (<i>relevant land</i>) - the north point - the boundaries of the relevant land - any road frontages of the relevant land, including the name of the road - the location and use of any existing or proposed buildings or structures on the relevant land (note: where extensive demolition or new buildings are proposed, two separate plans [an existing site plan and proposed site plan] may be appropriate) - any existing or proposed easements on the relevant land and their function - the location and use of buildings on land adjoining the relevant land - all vehicle access points and any existing or proposed car parking areas on the relevant land. Car parking spaces for persons with disabilities and any service vehicle access and parking should be clearly marked - for any new building on the relevant land, the location of refuse storage - the location of any proposed retaining walls on the relevant land and their height - the location of any proposed landscaping on the relevant land - the location of any stormwater detention on the relevant land.	☒ Confirmed	Supplementary EIS for the Carmichael Coal Mine and Rail Project.
A statement about how the proposed development addresses the local government's planning scheme and any other planning instruments or documents relevant to the application.	☒ Confirmed	Supplementary EIS for the Carmichael Coal
A statement about the intensity and scale of the proposed use (e.g. number of visitors, number of seats, capacity of storage area etc.).	☒ Confirmed	Supplementary EIS
Information that states: - the existing or proposed floor area, site cover, maximum number of storeys and maximum height above natural ground level for existing or new buildings (e.g. information regarding existing buildings but not being reused) - the existing or proposed number of on-site car parking bays, type of vehicle cross-over (for non-residential uses) and vehicular servicing arrangement (for non-residential uses).	☒ Confirmed ☐ Not applicable	Supplementary EIS for the Carmichael Coal Mine and Rail Project.

A statement addressing the relevant part(s) of the State Development Assessment Provisions (SDAP).	☒ Confirmed ☐ Not applicable	Supplementary EIS
When the application involves the reuse of existing buildings		
Plans showing the size, location, existing floor area, existing site cover, existing maximum number of storeys and existing maximum height above natural ground level of the buildings to be reused.	☐ Confirmed ☒ Not applicable	
When the application involves new building work (including extensions)		
Floor plans drawn to an appropriate scale (1:50, 1:100 or 1:200 are recommended scales) which show the following: - the north point - the intended use of each area on the floor plan (for commercial, industrial or mixed use developments only) - the room layout (for residential development only) with all rooms clearly labelled - the existing and the proposed built form (for extensions only) - the gross floor area of each proposed floor area.	☐ Confirmed	N/A
Elevations drawn to an appropriate scale (1:100, 1:200 or 1:500 are recommended scales) which show plans of all building elevations and facades, clearly labelled to identify orientation (e.g. north elevation)	☐ Confirmed	N/A
Plans showing the size, location, proposed site cover, proposed maximum number of storeys, and proposed maximum height above natural ground level of the proposed new building work.	☐ Confirmed ☒ Not applicable	
When the application involves reuse of other existing work		
Plans showing the nature, location, number of on-site car parking bays, existing area of landscaping, existing type of vehicular cross-over (non-residential uses), and existing type of vehicular servicing arrangement (non-residential uses) of the work to be reused.	☐ Confirmed ☒ Not applicable	
When the application involves new operational work		
Plans showing the nature, location, number of new on-site car parking bays, proposed area of new landscaping, proposed type of new vehicle cross-over (non-residential uses), proposed maximum new vehicular servicing arrangement (non-residential uses) of the proposed new operational work.	☒ Confirmed ☐ Not applicable	Supplementary EIS for the Carmichael Coal Mine and Rail

Privacy—Please refer to your assessment manager, referral agency and/or building certifier for further details on the use of information recorded in this form.

OFFICE USE ONLY

Date received

Reference numbers

The *Sustainable Planning Act 2009* is administered by the Department of State Development, Infrastructure and Planning. This form and all other required application materials should be sent to your assessment manager and any referral agency.

Department of State Development, Infrastructure and Planning

PO Box 15009 City East Qld 4002

tel 13 QGOV (13 74 68)

info@dsdip.qld.gov.au

www.dsdip.qld.gov.au

IDAS form 5—Material change of use assessable
against a planning scheme
Version 3.0—1 July 2013

IDAS form 8—Environmentally relevant activity

(Sustainable Planning Act 2009 version 3.0 effective 1 July 2013)

This form must be used for development applications for an environmentally relevant activity.

You **MUST** complete **ALL** questions that are stated to be a mandatory requirement unless otherwise identified on this form.

For all development applications, you must:

- complete *IDAS form 1—Application details*
- complete any other forms relevant to your application
- provide any mandatory supporting information identified on the forms as being required to accompany your application.

Attach extra pages if there is insufficient space on this form.

All terms used on this form have the meaning given in either the *Sustainable Planning Act 2009* (SPA), the Sustainable Planning Regulation 2009, the *Environmental Protection Act 1994* or the Environmental Protection Regulation 2008.

This form can also be completed online using MyDAS at www.dsdip.qld.gov.au/MyDAS

Mandatory requirements

1. **What is the nature of the proposed environmentally relevant activity (ERA)?** (complete a new Table A for each proposed ERA—including ERAs that are not concurrence ERAs)

Table A

ERA number and name	ERA 16 - Extractive and Screening Activities
ERA threshold	Extracting more than 1,000,000 tonnes of material
Applicable fees	\$ 551
Proposed scale/capacity	Up to 19.93 million tonnes
Type of approval sought	☒ Development permit and environmental authority (see notes) ☐ Preliminary approval
Is the proposed ERA a concurrence ERA?	☐ No ☐ Yes

2. **Are there any existing ERAs on or associated with the premises?**

- ☒ No
☐ Yes—complete a new Table B for each existing ERA

Table B

ERA number and name	
ERA threshold	
Existing scale/capacity	
Is the ERA proposed to continue on site?	☐ No ☐ Yes

3. Does the proposed activity involve any of the following? (Tick all applicable boxes.)

- ☐ Release of water or waste to a wetland for treatment
- ☐ Release of waste directly to groundwater

Mandatory supporting information

4. Confirm that the following mandatory supporting information accompanies this application

About the subject land	Confirmation of lodgement	Method of lodgement
Description of the site, including site maps showing vegetation, topography and any areas of cultural or heritage significance.	☒ Confirmed	Supplementary EIS for the Carmichael Coal
Details of any known acid sulphate soils within or adjoining the premises.	☐ Confirmed ☐ Not applicable	Supplementary EIS for the Carmichael Coal
Details about how the choice of the site, at which the activity is to be carried out, minimises serious environmental harm on areas of high conservation value and special significance and sensitive land uses at adjacent places.	☒ Confirmed	Supplementary EIS for the Carmichael Coal
Details about how the location for the activity on a site protects all environmental values relevant to adjacent sensitive uses.	☐ Confirmed	Supplementary EIS for the Carmichael Coal
Details about how the design of the facility permits the operation of the site, at which the activity is to be carried out, in accordance with best practice environmental management.	☒ Confirmed	Supplementary EIS for the Carmichael Coal
About the proposed ERA		
Attachment to IDAS form 8—application for an environmental authority (EM941) completed and required information provided.	☐ Confirmed	Supplementary EIS for the Carmichael Coal
A statement addressing the relevant part(s) of the State Development Assessment Provisions (SDAP).	☒ Confirmed ☐ Not applicable	Supplementary EIS for the Carmichael Coal

Notes for completing this form:

- An environmental authority is required to operate an ERA.
- A development approval is only required if at least one of the ERAs to be operated is a concurrence ERA.
- Schedule 2 of the *Environmental Protection Regulation 2008* states the aggregate environmental scores, the thresholds that apply to ERAs, and which ERAs are concurrence ERAs (denoted by a 'C' in schedule 2, column 3).
- This development application is taken to be an application for an environmental authority. This application is not properly made unless it includes the [Attachment to IDAS form 8—application for an environmental authority \(EM941\)](#).
- There are annual fees associated with the operation of an ERA. These fees are initially payable 20 business days after the environmental authority takes effect. After this initial payment, annual fees will be payable on the anniversary of the take effect day. Chapter 8 and Schedule 10 of the *Environmental Protection Regulation 2008* contain all information about the applicable fees and how they are calculated.

Privacy—Please refer to your assessment manager, referral agency and/or building certifier for further details on the use of information recorded in this form.

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Date received

Reference numbers

The *Sustainable Planning Act 2009* is administered by the Department of State Development, Infrastructure and Planning. This form and all other required application materials should be sent to your assessment manager and any referral agencies.

Attachment

Environmental Protection Act 1994

IDAS form 8—attachment for an application for an environmental authority

This form is to be attached to the IDAS form 8 when making a development application for prescribed environmentally relevant activities (ERAs). Under section 115 of the Environmental Protection Act 1994 (EP Act) the development approval application is taken to be an application for an environmental authority for the prescribed ERAs.

It is recommended that applicants read the technical information requirement on what to provide with an ERA application, prior to making an application. This information is located on the business and industry website **www.business.qld.gov.au**.

All applicants must be a registered suitable operator before carrying out an ERA. If you are not already registered as, or have applied for registration as, a suitable operator, fill in the application form in Attachment 2 of this form and submit it with this form and the IDAS application.

If you would like to have a pre-lodgement meeting please fill out and lodge the form Application for a Pre-Design/Pre-Lodgement Meeting (EM1125¹), prior to lodging this application form.

Definitions of terms used in this form

Where there is inconsistency between the definition of terms here and the terms used in the EP Act, the terms in the EP Act apply.

Environmentally relevant activity (ERA)	A resource activity or a prescribed ERA
Prescribed ERA	An environmentally relevant activity that is not a resource activity and is prescribed under section 19 of the EP Act.
Registered suitable operator	A person who, or a corporation which, under section 318I of the EP Act has been assessed as being suitable to carry out an ERA and has been listed on the suitable operator register.
Resource activity	An activity that is any of the following: (a) a geothermal activity (b) a greenhouse gas (GHG) storage activity (c) a mining activity (d) a petroleum activity.

¹ This is the publication number. The publication number can be used as a search term to find the latest version of a publication at **www.qld.gov.au**.

IDAS form 8—attachment for an application for an environmental authority

GUIDE

Take particular care in filling out the applicant details as these are legally required for the issuing of any environmental authority. Applicant details, including the name and the address should reflect the details of the person or registered legal entity.

If more space is required for any responses, please attach additional information as a separate page.

A sole applicant is an applicant where there is only 1 person or business applying to obtain an environmental authority.

A principal applicant is the individual or business nominated to act on behalf of joint applicants.

It is particularly important to enter the correct Australian business number (ABN); Australian company number (ACN) of the incorporated company; association number (AN) of the incorporated association; or the title and section of the legislation that gives the statutory corporation its legal status.

If there is an agent acting on behalf of the sole or principal applicant, provide details in this section. An agent could be a consultant or a contact for the environmental authority holder.

As statutory documents need to be sent to all applicants, this section can also be used when there are multiple environmental authority holders to nominate an address for statutory documentation to be sent 'care of' to.

Application details

1. Applicant details

SOLE OR PRINCIPAL APPLICANT DETAILS	
INDIVIDUAL OR BUSINESS NAME (INCLUDE TRADING NAME IF RELEVANT) ADANI MINING PTY LTD	
ABN/ACN/AN (IF RELEVANT) 27 145 455 205	
RESIDENTIAL ADDRESS OR REGISTERED BUSINESS ADDRESS (NOT A POST OFFICE BOX ADDRESS) LEVEL 25, 10 EAGLE STREET, BRISBANE, QLD 40	
POSTAL ADDRESS (IF DIFFERENT FROM ABOVE) GPO BOX 2569, BRISBANE, QLD 4001	
CONTACT PERSON HAMISH MANZI	
PHONE 07 3223 4800	FACSIMILE 07 3223 4850
EMAIL HAMISH.MANZI@ADANI.COM	

When there is more than 1 applicant complete Attachment 1—Appointment of principal applicant by all joint applicants.

Agent for principal applicant / address for service

The address supplied here will also be used as a service address for sending statutory documents. If blank, statutory documents will be sent to the sole or principal applicant.

INDIVIDUAL OR BUSINESS NAME (INCLUDE TRADING NAME IF RELEVANT)	
RESIDENTIAL ADDRESS OR REGISTERED BUSINESS ADDRESS (NOT A POST OFFICE BOX ADDRESS)	
POSTAL ADDRESS (IF DIFFERENT FROM ABOVE)	
CONTACT PERSON	
PHONE	FACSIMILE

IDAS form 8—attachment for an application for an environmental authority

EMAIL	

All applicants, including joint applicants must include their details in this section.

Once a person or corporation has been registered as a suitable operator for the carrying out of an ERA, no further suitable operator applications need to be made as long as the applicant for the environmental authority matches the name (including ABN/ACN etc, if applicable) recorded on the suitable operator register.

A person who holds a valid registration certificate given under the former section 73F of the EP Act or a valid environmental authority given under the former chapter 5 or 5A of the EP Act is taken to be a registered suitable operator under section 705 of the EP Act.

If you have previously been approved as a registered suitable operator, you can find the suitable operator registration number on the decision notice advising you of your approved application or, if you have a valid existing registration certificate, the approval number listed on the registration certificate.

2. Registered suitable operator

Have all applicants been registered as a suitable operator? Tick the box that applies and provide any further requested detail.

APPLICANT NAME	SUITABLE OPERATOR REGISTRATION STATUS	SUITABLE OPERATOR REGISTRATION NUMBER
	☒ I am a registered suitable operator. You must provide your suitable operator registration number in the adjacent column. ☐ I have lodged an application to be registered suitable operator and am waiting for it to be decided ☐ I am not an existing registered suitable operator and I have not yet lodged an application to become a registered suitable operator. You must complete the application form in Attachment 2 and submit it with the development application. Attachment 2 must be completed in full. The application form in Attachment 2 is taken to be lodged when it is received by Permit and Licence Management within the Department of Environment and Heritage Protection.	649121

IDAS form 8—attachment for an application for an environmental authority

There are currently 8 matters of national environmental significance (MNES) which have been defined in the *Environmental Protection and Biodiversity Conservation Act 1999*. These are:

- world heritage properties
- national heritage places
- wetlands of international importance (listed under the Ramsar Convention)
- listed threatened species and ecological communities
- migratory species protected under international agreements
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mines)

To determine whether the proposed ERA will have a significant impact on MNES and for referral requirements, please refer to the guidance provided by the Federal Department of Sustainability, Environment, Water, Population and Communities on www.australia.gov.au

3. Matters of national environmental significance

Is the proposed ERA/ERA project likely to have a significant impact on a matter of national environmental significance?

- ☒ Yes → please select 1 of the following:
- ☒ the proposed amendment has been referred to the Federal Government Environment Minister or delegate
 - ☐ the proposed amendment has not yet been referred to the Federal Government Environment Minister or delegate.
- ☐ No

4. Details of the prescribed ERAs

Do any of the ERAs in Table A of IDAS form 8 have eligibility criteria developed that you can comply with?

- ☐ Yes → attach details of these ERAs and identify the standard conditions that you can comply with
- ☒ No

5. Will the ERAs be carried out as a single integrated operation?

Will more than one ERA be operated at the location?

- ☐ Yes → complete the rest of this question
- ☒ No → go to question 6

Will the ERAs be operated as a single integrated operation?

- ☐ Yes → provide supporting information in the following table
- ☐ No → go to question 6

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SUPPORTING INFORMATION

A single integrated operation must meet all the following criteria:

- (a) the activities are carried out under the day-to-day management of a single responsible individual, for example, a site or operations manager
- (b) the activities are operationally interrelated
- (c) the activities are, or will be, carried out at 1 or more places
- (d) the places where the activities are carried out are separated by distances short enough to make feasible the integrated day-to-day management of the activities.

6. Take effect date

Do you want the environmental authority to take effect on a nominated date or event?

☐ Yes → nominate the date or event below and then go to question 7

NOMINATED TAKE EFFECT DATE OR EVENT

☒ No → go to question 7

You may choose to nominate a date or event for when the environmental authority will take effect. An event can include a phase of your project you know will occur before you commence operation (for example commissioning of equipment). This take effect date or event will be the date or event from which your annual fees will commence to be charged (your anniversary date).

Where you have nominated a take effect date, you must not commence any activities approved under the environmental authority until the take effect date stated on the environmental authority occurs. If you nominated an event, you will need to give written notice to the administering authority that the stated event has occurred before you commence your operation.

A biodiversity offset is required where an applicant has demonstrated they have made all practical and reasonable efforts to avoid and minimise impacts on state significant biodiversity values, but there is a residual development impact on 1 or more of these values

The Queensland Biodiversity Offsets Policy can be accessed at www.ehp.qld.gov.au.

7. Biodiversity offsets

Are the ERAs administered by a local government?

☐ Yes → go to question 8

☒ No → complete the rest of this question

Do the activities involve a negative impact to a state significant biodiversity value?

☐ Yes → attach supporting information that:

☐ demonstrates that all practical and reasonable efforts to avoid and minimise impacts on state significant

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For further information on technical information to provide with your application, please refer to the business and industry website
www.business.qld.gov.au

For further information on technical information to provide with your application, please refer to the business and industry website
www.business.qld.gov.au

Where there is more than 1 applicant, this declaration is to be signed by all applicants, unless a principal applicant has been nominated in Attachment 1, in which case the principal applicant can sign on behalf of all the joint applicants.

biodiversity values has been undertaken.

☐ describes how the requirements of the Queensland Biodiversity Offsets Policy will be met.

☒ No

☐ Don't know/uncertain

8. Assessment of the environmental impact and provision of specific supporting information

You must provide an assessment of the likely impact of each ERA on environmental values, including:

- a description of the environmental values likely to be affected by each relevant activity
- details of any emissions or releases likely to be generated by each relevant activity
- a description of the risk and likely magnitude of impacts on the environmental values
- details of the management practices proposed to be implemented to prevent or minimise adverse impacts
- details of how the land the subject of the application will be rehabilitated after each relevant activity ceases.

☒ Tick to indicate that an assessment of the environmental impact and provision of specific supporting information has been attached.

9. Details of waste management

A description of the proposed measures for minimising and managing waste generated by the ERAs must be attached.

☒ Tick to indicate attachment

10. Details of contaminated land

Is there a site management plan in effect for contaminated land that relates to the land that is the subject of this application.

☐ Yes → attach details of the site management plan

☒ No

11. Declaration

Note: If you have not told the truth in this application you may be prosecuted.

I declare that:

- I am the applicant or an authorised signatory for the applicant.

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Where the sole or principal applicant is a company, this form is to be signed by an authorised person for that company.

Privacy statement

Where ERAs are administered by the Queensland Government:

The Department of Environment and Heritage Protection and Department of Agriculture, Fisheries and Forestry are collecting the information on this form to process your application for an environmental authority. This collection is authorised under sections 115 and 125 of the *Environmental Protection Act 1994*. Your personal information will only be accessed by authorised employees within these departments and will not be disclosed to any other parties unless authorised or required by law. For queries about privacy matters please email privacy@ehp.qld.gov.au or telephone: (07) 3330 5436.

Where ERAs are administered by a local government:

Contact the local government for their privacy information.

- I have identified in question 4, any ERAs that can comply with the eligibility criteria and standard conditions.
- The information provided is true and correct to the best of my knowledge. I understand that it is an offence under section 480 of the *Environmental Protection Act 1994* to give to the administering authority or an authorised person a document containing information that I know is false, misleading or incomplete in a material particular
- I understand that failure to provide sufficient information may result in the application being refused
- I understand that all information supplied on or with this application form may be disclosed publicly in accordance with the *Right to Information Act 2009* and the *Evidence Act 1977*.
- I understand that I am responsible for managing the environmental impacts of these activities, and that approval of this application is not an endorsement by the administering authority of the effectiveness of management practices proposed or implemented.

APPLICANT'S NAME HAMISH MANZI - ADANI MINING PTY LTD	
SIGNATURE 	
POSITION OF SIGNATORY GENERAL MANAGER- ENVIRONMENT AND SUSTAINABILITY	DATE 16 JULY 2013
JOINT APPLICANT'S NAME (IF APPLICABLE)	JOINT APPLICANT'S SIGNATURE (IF APPLICABLE)
JOINT APPLICANT'S NAME (IF APPLICABLE)	JOINT APPLICANT'S SIGNATURE (IF APPLICABLE)

Applicant checklist

- ☒ Application form has been signed and completed.
- ☐ Attachment 1: Appointment of principal applicant by all joint applicants has been signed and completed (if applicable).
- ☐ Attachment 2: Application to be registered as a suitable operator signed and completed (if applicable).
- ☐ Question 4: Identification of the prescribed ERAs where eligibility criteria and

IDAS form 8—attachment for an application for an environmental authority

standard conditions can be met, have been attached (if applicable).

- ☒ Question 7: Supporting information for biodiversity offsets (if applicable).
- ☒ Question 8: Information for assessment of environmental impacts attached (if applicable).
- ☒ Question 9: Details of waste management attached (if applicable).
- ☐ Question 10: Details of contaminated land attached (if applicable).

All requested information must be provided with this application, otherwise it will not be considered properly made.

Please include a word searchable electronic PDF copy of the application documents when you lodge your application.

Further information

The latest version of this publication and other publications referenced in this document can be found at www.qld.gov.au using the publication number (EM941 for this document) as a search term.

Please submit this attachment, together with any additional information, with all relevant IDAS forms to the assessment manager for the development application.

IDAS form 11—Clearing native vegetation

(Sustainable Planning Act 2009 version 3.0 effective 1 July 2013)

This form must be used for development applications that involve the clearing of native vegetation.

You **MUST** complete **ALL** questions that are stated to be a mandatory requirement unless otherwise identified on this form.

For all development applications, you must:

- complete *IDAS form 1—Application details*
- complete any other forms relevant to your application
- provide any mandatory supporting information identified on the forms as being required to accompany your application
- include the relevant application fee, noting that referral agency fees (where applicable) are to be paid to the referral agency

Attach extra pages if there is insufficient space on this form.

All terms used on this form have the meaning given in the *Sustainable Planning Act 2009* (SPA) or the Sustainable Planning Regulation 2009.

This form can also be completed online using MyDAS at www.dsdip.qld.gov.au/MyDAS

Mandatory requirements

1. What type of development is proposed?

- ☒ Operational work for clearing vegetation made assessable under Schedule 3 of the Sustainable Planning Regulation 2009
- ☒ Material change of use of the premises
- ☐ Reconfiguring a lot

2. What type of approval is being sought?

- ☒ Development permit
- ☐ Preliminary approval
- ☐ Both—provide details below

Mandatory supporting information

3. Confirm that the following mandatory supporting information accompanies this application

For ALL applications	Confirmation of lodgement	Method of lodgement
A property vegetation management plan including as defined under the Vegetation Management Act 1999 schedule. Note: A property vegetation management plan must show the matters prescribed in s.11 of the Vegetation Management Regulation 2012.	☒ Confirmed	Supplementary EIS for the Carmichael Coal Mine and Rail
A statement addressing the relevant part(s) of the State Development Assessment Provisions (SDAP).	☐ Confirmed ☐ Not applicable	Supplementary EIS for the

For ALL applications	Confirmation of lodgement	Method of lodgement
For an operational work application for which the assessment manager is the local government		
Written confirmation that the chief executive of the Department of Natural Resources and Mines is satisfied the proposed clearing is for a relevant purpose under the <i>Vegetation Management Act 1999</i> , section 22A.	☒ Confirmed ☐ Not applicable	Supplementary EIS for the
For an operational work application where the assessment manager is the Department of Natural Resources and Mines		
Either of the following: - written confirmation that the chief executive of the Department of Natural Resources and Mines is satisfied the proposed clearing is for a relevant purpose under the <i>Vegetation Management Act 1999</i>, section 22A; or - information identifying the relevant purpose under the <i>Vegetation Management Act 1999</i>, section 22A and demonstrating how the proposed clearing is for that purpose.	☐ Confirmed ☒ Not applicable	Supplementary
For applications for a material change of use or reconfiguring a lot		
The following additional detail to be included in the property vegetation management plan: - details of the location and extent of: - infrastructure, including buildings, fences, roads and electrical, telecommunication or sewerage services; and - firebreaks and fire management lines; and - details of the way the proposed clearing complies with the applicable concurrence agency policy under the <i>Vegetation Management Act 1999</i>.	☒ Confirmed ☒ Not applicable	

Notes for completing this form

- The Department of Natural Resource and Mines (DNRM) website contains a comprehensive range of information about the *Vegetation Management Act 1999*, including assessment codes and policies, as well as the *Landholder's guide to vegetation clearing applications*.
- Question 3 for operational work applications —Under the *Vegetation Management Act 1999*, the proposed vegetation clearing is only for a relevant purpose if the applicant satisfies the chief executive of the Department of Natural Resources and Mines (DNRM) that the development applied for is one of the purposes listed in section 22A of that Act. If the assessment manager is the local government, the applicant must obtain confirmation from the chief executive of DNRM that the proposed clearing is for a relevant purpose and provide this with the application. However, if DNRM is the assessment manager, the applicant has the choice of either obtaining this confirmation before making the application, or providing adequate information for DNRM to make the decision on whether the proposed clearing is for a relevant purpose at the time the application is received.

Privacy—Please refer to your assessment manager, referral agency and/or building certifier for further details on the use of information recorded in this form.

OFFICE USE ONLY

Date received

Reference numbers

The *Sustainable Planning Act 2009* is administered by the Department of State Development, Infrastructure and Planning. This form and all other required application materials should be sent to your assessment manager and any referral agency.

Adani Mining Pty Ltd

Borrow 7

Material Change of Use for Extractive Industry,
Environmentally Relevant Activity 16 and
Operational Works for Vegetation Clearing





Adani Mining Pty Ltd

Borrow 7

12 July 2013

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Appendix G – Conservation Significant Species
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Appendix K – Air Quality Impact Assessment
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Document History and Status

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Executive Summary

CDM Smith Australia (CDM Smith) has been engaged by Adani Mining Pty Ltd (Adani) to obtain a number of approvals to support quarry development. Adani is seeking to develop the Carmichael Coal Mine and Rail Project in the Galilee Basin, approximately 160 kilometres (km) north-west of the town of Clermont, Central Queensland. As part of the development, Adani will require significant quantities of quarry material for the construction of infrastructure associated with the mine and rail including, but not limited to, roads, camps, pads, dams and mine civil works. To supply the necessary quarry material, Adani propose to develop five new quarries.

This application is for Borrow 7, a new hard rock quarry proposed to be located on Lot 3235 PH752. The site is approximately 5 km west of the Gregory Development Road, and approximately 120 km north-west of Clermont in the Isaac Regional Council (IRC) area. The lot is zoned Rural under the *Belyando Shire Planning Scheme 2009* and is primarily used for agricultural activities.

This application seeks a Development Permit for:

- Material Change of Use for Extractive Industry;
- A concurrent Environmental Authority for an Environmentally Relevant Activity 16 (ERA) for Extractive and Screening Activities triggered for extracting more than 1,000,000 tonnes (t) of material per year; and
- Operational Works for Vegetation Clearing.

This report provides the information necessary for the Assessment Manager and Referral Agencies to efficiently assess the proposed development against relevant statutory planning and environmental instruments. The land use and planning assessment (Section 5) has established that the quarry is generally consistent with the requirements of the *Belyando Shire Planning Scheme 2009* and State Planning instruments.

Summary of Extraction and Quarry Operations

The initial site development will consist of implementing environmental controls, access and haul roads. The creation of a hardstand areas and infrastructure areas will be undertaken, with site infrastructure being brought in and set up, including crib and office buildings, ablution facilities and fuel storage.

There will be a single extraction area covering a total of 36.17 hectares (ha) with a potential yield of 19.93 million tonnes (MT). The quarry will be fully operational during the Carmichael Coal Mine and Rail construction period. Ongoing production rates post 2016 will be approximately 100,000 t per annum for maintenance works. Over the life of the quarry (post Carmichael Coal Mine and Rail Project construction) it is anticipated the entire 19.93 million tonnes (MT) of quarry resource will be utilised.

Summary of Environmental Aspects

Environmental issues and constraints were considered in the planning and design of the quarry development. The location, layout and staging of the proposed development has to a large extent, been influenced by environmental constraints. Particular considerations were the flora and fauna, minimisation of the impact on visual amenity and noise and dust emissions given to by locating the quarry between ridgelines as well as impacts from transport of the quarry material.

In particular, site surveys undertaken for fauna and flora by CDM Smith and Saunders Havill Group identified that the area is extensively disturbed and contains a significant amount of exotic species. The site is overlaid by Department of Environment and Heritage Protection (EHP) Regional Ecosystem and Remnant Mapping (Version 6.1) with two composite remnant vegetation polygons. There are three areas mapped as endangered ecosystems under the current State vegetation mapping, however this was found to be inconsistent with the on-ground extent with only non-remnant vegetation observed. A Property Map of Assessable Vegetation (PMAV) application is included, see **Appendix B**.

During the first fauna survey potential signs of Koala (Vulnerable – EPBC Act) activity, in the form of tree scratches were recorded at the proposed Disney Quarry, north of Borrow 7. Nevertheless, no scats were found to indicate recent activity and no individuals were sighted during the field surveys. The majority of the site is exposed basalt however some trees were recorded scattered along the outer edge of Borrow 7. The vegetation along the outer edge is dominated by *Corymbia dallachiana* (Ghost Gum), *Acacia harpophylla* (Brigalow), *Grevillea striata* (Beefwood), and *Acacia excelsa* (Ironwood). The density of this vegetation is sparse and not considered suitable for Koala habitat.

An Ornamental Snake (Vulnerable – EPBC Act) was recorded along a partially vegetated drainage line south of Borrow 7. The quarry is proposed approximately 2.2 km north of the sighting and will maintain Erosion and Sediment Controls (ESC) to prevent impacts on the surrounding ephemeral waterways.

A comprehensive noise and air quality reports have been prepared by VIPAC Engineers and Scientists. Modelling of acoustic emissions was undertaken based on the highest production month and demonstrates that quarry operations can comply with the indoor noise criteria of 30dB $L_{Aeq,adj,1hr}$ during the night during peak production. In addition, dust modelling illustrates that the project can achieve compliance with the *Environmental Protection (Air) Policy 2008*. Extensive management measures will be implemented to ensure impacts from noise and dust remain minimal.

TTM Traffic Engineering Group undertook a detailed assessment of the traffic impacts in accordance with the Department of Transport and Main Roads Guidelines for Assessment of Road Impacts of Development (GARID). This established that Borrow 7 and associated quarries will not have a significant or assessable pavement impact on the state controlled road network. Access into the site will predominantly be via a private access road to the south which leads onto the Carmichael Rail haul road.

No significant impact upon groundwater is expected from Borrow 7 operations. The quarry is also situated in a position of elevated hydraulic gradient and the lowest level of the quarry will remain above 230 metres (m) Australian Height Datum (AHD). There may be some localised impacts to surrounding bores and/or possible recharge, however, monitoring bores will be installed to provide early detection of any potential impact.

Active weed monitoring and control will be undertaken to ensure clean weed free fill is provided from the site to prevent and spread of weed species through the removal and transport of fill.

Erosion and sediment controls will be designed, implemented and maintained in accordance with International Erosion Control Association (IECA) Guidelines 2008. Site stormwater will be collected and reused on site for dust suppression and quarry operations. The quarry is also staged with progressive rehabilitation to ensure only a limited and manageable area to minimise exposure to erosion and sediment loss. Clean stormwater will be diverted away from the quarry workings.

Diesel and hydrocarbons will be stored on site in hard stand areas which will be bunded pursuant to *Australian Standard 1940 Storage and Handling of Flammable and Combustible Liquids*.

A cultural heritage clearance survey was undertaken by the Jangga People for the initial geotechnical investigations. Two surveys were undertaken (January and April 2013) which assessed 47 locations within the overall Borrow 7 investigation area. The survey identified a number of artefacts and one site was declared a cultural heritage sensitive area, where construction works are not to proceed. The site will have a cultural heritage clearance survey undertaken by the Jangga People as Native Title Claimants of the area under the agreed Cultural Heritage Management Plan (CHMP) prior to works being undertaken.

Adani have provided ongoing environmental management and mitigation commitments which have been comprehensively identified within this report (Section 4). These environmental management commitments address construction and operational requirements under the *Environmental Protection Act 1994* (EP Act), *Environmental Protection Regulation 2009* and subordinate legislation. The impact assessment has determined that the environmental management measures will adequately address (avoid, reduce or manage) the potential environmental impacts identified in Section 4.

Extraction will start by development of a series of linear rip faces with the dozer ripping and pushing material to a stockpile which will then be loaded via loader/excavator either straight into a truck or through a screening plant dependent upon the material quality. The quarry development will be undertaken using a number of 70 m long by 30 m wide cells which will be ripped to 5 m deep. The extraction will begin with stripping topsoils and stockpiling of the residual soil profile for latter rehabilitation over the first few cells of the area to be developed. Clearing and overburden stripping will only be undertaken for one or two cells ahead of the current active cell. Following the complete extraction of the cell, progressive rehabilitation will commence.

The objectives of this quarry development are to:

- Provide short term quarry operation to provide necessary construction material for the Carmichael Coal Mine and Rail Project construction;
- Minimise any potential environmental impact associated with the operation;
- Preserve identified remnant vegetation onsite by operating with a buffer from the Brigalow area;
- Minimise impacts to local and state roads by using internal accesses and haul roads where possible; and
- Rehabilitate the land post quarry production.

Borrow 7 development provides essential construction material for the Carmichael Coal Mine and Rail Project and is located strategically close to the rail corridor to minimise haulage requirements. Consideration of environmental and conservation issues has largely determined the location, extent and design of this quarry.

Section 1 Introduction

1.1 Purpose and Scope

This report has been prepared to provide the necessary supporting information for a development application to the Isaac Regional Council (IRC). The purpose of this report is to address all requirements for the proposed development under Queensland and local government environmental and planning legislation.

The application provides sufficient information for the Assessment Manager, Referral Agencies and other interested parties to adequately assess the potential impacts and controls regarding the development. The scope of the assessment considers the construction, operation and rehabilitation of Borrow 7 and all works associated with the quarry. It also addresses direct and indirect impacts on the environment, community and local transport network.

1.2 The Proponent

The proponent for this quarry development is Adani Mining Pty Ltd, who is also the proponent of the Carmichael Coal Mine and Rail Project. Adani is an Australian subsidiary of Adani Enterprises Limited, a company based in Ahmedabad, India. Adani Enterprises Limited has diverse interests in global trading, development and operation of ports, inland container terminals, establishment of special economic zones, oil refining, logistics, gas distribution, power generation, transmission and trading.

Adani established in Australia in mid-2010 with the intent of engaging in exploration and mining coal resources. Adani initially purchased the right to seek a Mining Lease Application (MLA 70441) over Exploration Permit for Coal (EPC) 1690 and then secured similar rights to the eastern and northern parts of EPC 1080 in December 2011. This initiated the development of the Carmichael Coal Mine and Rail Project. Adani Abbot Point Terminal Pty Ltd (AAPT), also an Australian subsidiary of Adani Enterprises Limited, has purchased the lease of Abbot Point Coal Terminal 1 and is seeking to develop Abbot Point Coal Terminal 0 as part of their overall programme for coal exportation.

Adani has not been subject to any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources. Since establishing in Australia, Adani has sought to deliver community benefit from its business involvement. Adani's Environment and Sustainability Policy is included in **Appendix A**.

1.3 Project Overview

Adani is developing the Carmichael Coal Mine and Rail Project in the Galilee Basin, approximately 160 km north-west of the town of Clermont, Central Queensland (Figure 1-1). Whilst providing material to support the construction of the overall Carmichael Coal Mine and Rail development, the Adani quarries will also provide material to upgrade local infrastructure and roads as agreed with IRC and possibly provide material fill to other Adani projects in the area.

To supply the necessary quarry material, Adani proposes to develop Borrow 7. Borrow 7 will be a new hard rock quarry to be located on Lot 3235 PH752 with access gained via an existing internal property track that connects to Twin Hills Road and the Gregory Development Road. In addition, a new dedicated haul route that connects directly to the Carmichael Coal Mine and Rail corridor will

be constructed to the north of Borrow 7. The site is approximately 5 kilometres (km) west of the Gregory Development Road, and approximately 120 km north-west of Clermont in the IRC area. The lot is zoned Rural under the *Belyando Shire Planning Scheme 2009* and is primarily used for agricultural activities.

Total quarry coal material requirements are approximately 34 million tonnes (MT) for construction of the Carmichael Coal Mine and Rail Project and the associated local council road upgrades. Borrow 7 has an inferred resource quantity of 7,521,400 cubic metres (m³) [19,931,710 tonnes (t)], a proposed operational footprint of 36.17 hectares (ha) and a depth of 15 metres below ground level (mbgl). It is anticipated that the material extracted from Borrow 7 would be used for rail ballast, scour protection and as a concrete aggregate.

At Borrow 7, rock will be quarried, crushed and screened to a range of specifications and transported to the required location. There will likely be two access roads from Borrow 7, one via Twins Hills Road onto the Gregory Development Road to provide for all weather access and one from the north by a dedicated haul road to the rail corridor. As previously identified, the material from Borrow 7 will be used for rail ballast, scour protection and as a concrete aggregate.

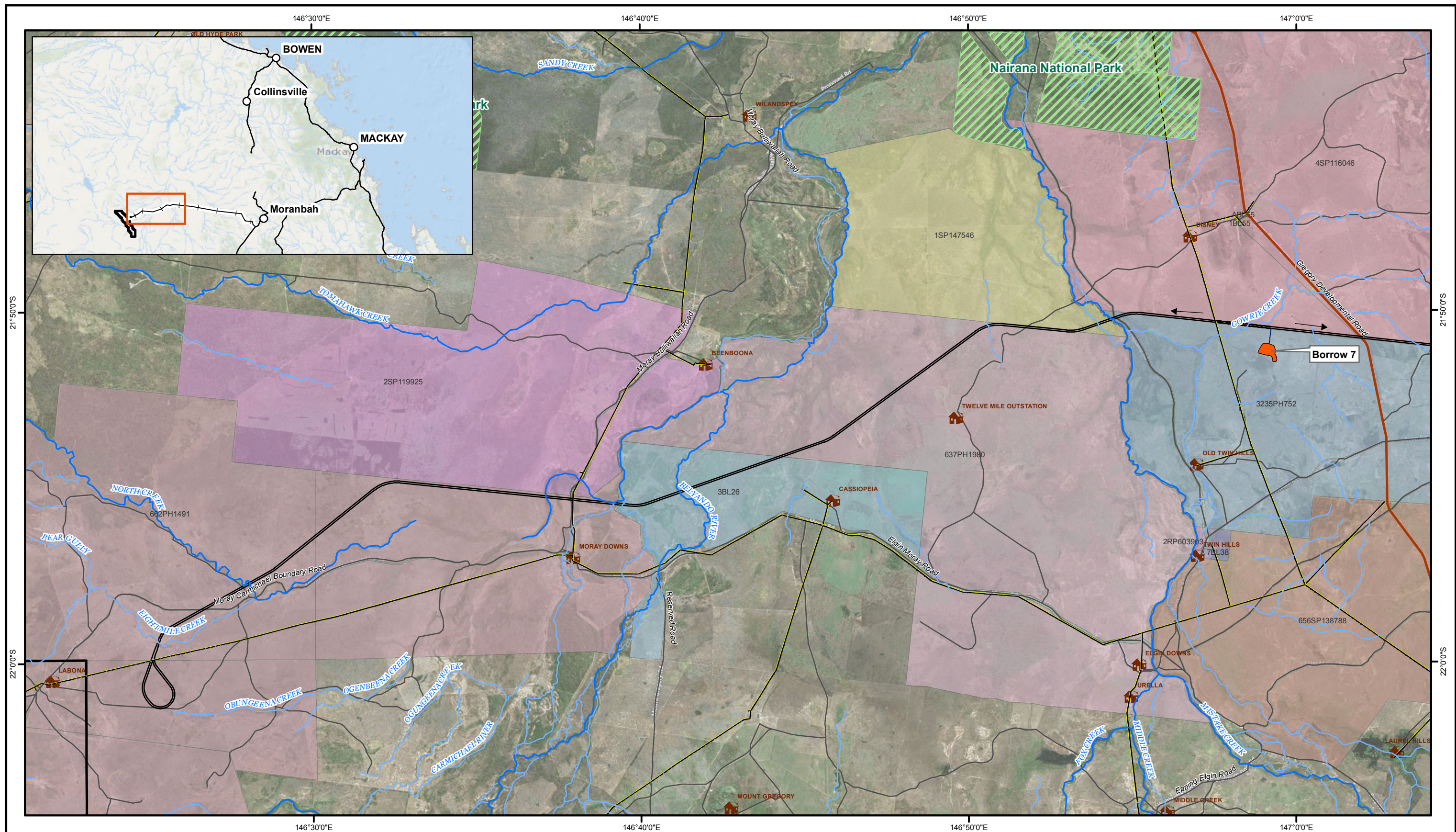
Material from Borrow 7 will be taken from one single extraction area from a low rise which is approximately 15 metres (m) higher than the surrounding plains (Figure 1-1). The extraction area is a currently disturbed area, which has been the subject of agricultural activities (Plate 1-1 and Plate 1-2).



Plate 1-1: View towards the main ridge extraction area



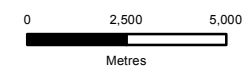
Plate 1-2: View south from the top of the main ridge



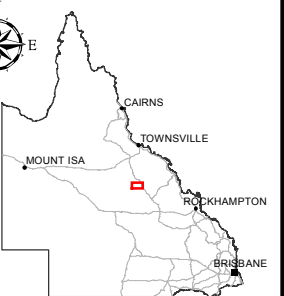
Adani Quarry Permits and Approvals
Figure 1-1 Quarry project area

Legend

- | | | |
|------------------------------|--------------------------------|-----------------------------|
| ○ Town | — Proposed Adani Rail Corridor | — Ergon Electricity Network |
| 🏠 Homestead | — Minor Road | — Major watercourse |
| ⛛ Carmichael Mine - ML 70441 | — Major Road | — Minor watercourse |
| 🌿 National Park | — Railway | ➡ Haulage Route |
| 🟠 Borrow 7 Extraction Area | — Quarry Access Road | |



DISCLAIMER
CDM Smith has endeavoured to ensure accuracy and completeness of the data.
CDM Smith assumes no legal liability or responsibility for any decisions or actions
resulting from the information contained within this map.
Data source:
Adani, 2012;
DERM, 2010;
Base Layer by Bingmaps, 2011.



1.4 Development Approval Process

Approvals under State and local legislation are required to be obtained before the development can proceed to the construction phase. Borrow 7 is required for activities and development of resource operations relating to actions occurring under the *Mineral Resources Act 1989* (MR Act) and the *State Development and Public Works Organisation Act 1971* (SDPWO Act). This application has been submitted with the Supplementary EIS for the Carmichael Coal Mine and Rail Project. Accordingly, under s37 of the SDPWO Act the decision period for this application will commence on the date of issue of the Queensland Coordinator General's Report. The information and referral stages do not apply to the application as they will be undertaken as part of the SEIS process.

Queensland's *Sustainable Planning Act 2009* (SP Act) and *Sustainable Planning Regulation 2009* (SP Regulation) seek to achieve sustainable planning outcomes through managing the process in which development takes place, managing the effects of development on the environment, and continuing the coordination and integration of local, regional and state planning.

Under the SP Act (Sch 8, Section 10(1)), a Material Change of Use (MCU) of premises generally means:

- (i) *The start of a new use of the premises; or*
- (ii) *The re-establishment on the premises of a use that has been abandoned; or*
- (iii) *A material increase in the intensity or scale of the use of the premises.*

Although historic quarrying operations at Borrow 7 may proceed under 'existing use right' a significant increase in the intensity and scale of the operations is necessary and therefore an MCU application under the SP Act is required. In accordance with the SP Regulation [Sch 3, Table 3, (1)],

The following approvals are being sought with this application:

Table 1-1 Development Approvals subject to this application

Approval	Trigger	Assessment
MCU Development Permit for Extractive Industry	Sch 8, Section 10(1) - <i>Sustainable Planning Regulations 2009</i> 4.4.1 - <i>Belyando Shire Planning Scheme 2009</i> Impact Assessable where an industrial use is a 'total use area is over 150m2 in a rural zone.	Impact Assessable
Environmental Authority for Environmentally Relevant Activity 16 – Extractive and Screening Activities. Threshold 1 (c).	Sch 3, Table 2, Item 1 - <i>Sustainable Planning Regulations 2009</i> <i>Environmental Protection Regulations 2008</i>	Impact Assessable
Operational Works Development Permit for Vegetation Clearing	Sch 3, Table 4, (1)(c) <i>Sustainable Planning Regulations 2009</i> <i>Vegetation Management Act 1999</i>	Code Assessable under the Brigalow Belt and New England Tablelands Bioregion RVMC – Version 2

1.5 Application Requirements Cross Reference

The content required for development applications is specified within the following legislation and planning provisions.

- *Belyando Shire Planning Scheme 2009* – Planning Scheme Policy 1 (Information Council May Request);
- *Sustainable Planning Act 2009* (SP Act) – Section 314 (Impact assessment-generally); and
- *Environmental Protection Act 1994* (EP Act) – Schedule 4 Dictionary (standard criteria).

A cross-reference table for the requirements of the above listed legislation has been provided below:

Table 1-2 Belyando Shire Planning Scheme 2009 requirements cross-reference

No.	Criteria to be Addressed	Section of this Document
2.1 Plans		
1 (a)	Plans should contain - a site analysis plan identifying and describing all existing site features, such as the cadastral boundaries of the site, “buildings”, structures”, Roads, vehicle and pedestrian access, car parking, servicing areas, vegetation, topographic, hydraulic and geological features	Figure 1-1
1 (b)	Plans should contain - a proposal plan identifying and describing the extent of modification of site features, such as, the cadastral boundaries of the site, “buildings”, “structures”, roads, vehicle and pedestrian access, car parking, servicing areas, vegetation, topographic, hydraulic and geological features.	Figure 3-1
1 (c)	Plans should contain - a landscaping plan detailing the location, extent, densities and species of proposed plantings and other external treatments.	Not provided, refer to Alternative Solution – PC 11 in Table 5-3
2	Plans should be drawn to scale and observe recognised drafting conventions.	Refer to Figure 1-1, Figure 3-1 and Figure 3-5
2.2 Existing “Use” and Site Details		
1 (a)	Details provided should include - existing and previous “use” of the site.	Section 3.1
1 (b)	Details provided should include - existing and previous “use” of adjoining or adjacent sites.	Section 3.1
1 (c)	Details provided should include - floor areas of “buildings” and other external activity areas, including car parking, storage areas and the like.	Not relevant for existing use as not existing buildings are being used
1 (d)	Details provided should include - site characteristics eg. levels and contours	Figure 1-1 and Figure 3-1
1 (e)	Details provided should include - descriptions of surrounding land uses, including the height and appearance of “buildings”.	Section 3.1
1 (f)	Details provided should include - the nature and location of all services and infrastructure, including easement details.	Section 3.1 and Figure 3-1
2.3 Proposed “Use” and Site Details		
1 (a)	Details provided should include - details of the proposed “use”, including floor area of “buildings”, external materials, treatments and colours of “buildings” and “structures”.	Section 3
1 (b)	Details provided should include - details of external activity areas, including car parking, storage areas and the like.	Section 3
2.4 Amenity		
1 (a)	Hours of operation.	Section 3.4.11
1 (b)	Deliver times of goods.	Table 5-3
1 (c)	Heights of “buildings” and structures.	Stockpile - 3.4.7.1 Lighting - 3.4.13 Demountables - 3.4.8
1 (d)	Setbacks and boundary clearances of all “buildings” and structures”.	Figure 3-1
1 (e)	External lighting arrangements.	Section 3.4.13

No.	Criteria to be Addressed	Section of this Document
2.5 Infrastructure		
1 (a)	Known or determined flood levels.	Section 4.2.2 , Figure 4-3
1 (b)	Proposed water supply.	Section 3.4.12.1
1 (c)	Proposed effluent disposal.	Section 3.4.12.2
1 (d)	Proposed stormwater disposal.	Section 3.4.3
1 (e)	Proposed method of liquid and solid waste disposal.	Section 3.4.14
1 (f)	Proposed electricity supply.	Section 3.4.12.1
1 (g)	Proposed telecommunication.	Section 3.4.12.1
2.6 Traffic and Servicing		
1 (a)	Traffic likely to be generated by the proposal.	Appendix C
1 (b)	The number, type and frequency of vehicles likely to service the proposal.	Appendix C
1 (c)	The times and arrangements for servicing of the “premises”.	Appendix C
1 (d)	Anticipated carparking requirements.	Appendix C
1 (e)	The extent of car parking, vehicle manoeuvring areas, crossover/access details, loading/unloading areas, service areas.	Appendix C
2.7 Emissions		
1 (a)	The nature of any anticipated emissions (including odour, noise, dust, run-off and the like).	Section 4.7
1 (b)	Measures proposed for the control of emissions.	Section 4.7.4 and Section 4.8.4
1 (c)	The location and methods of containment and control of waste disposal and waste storage areas.	Section 3.4.14
1 (d)	Types, quantities, storage methods, and protection measures relating to storage and use of chemicals.	Section 3.4.10
1 (e)	Emergency equipment and procedures to be utilised.	Section 3.4.16
2.8 Environmental		
1 (a)	Location of ridgelines and escarpments.	Section 4.3
1 (b)	Location of “watercourses” and “lakes” and the extent of associated riparian buffers.	Section 4.2
1 (c)	Location of effluent disposal areas.	Section 3.4.12
1 (d)	Location and extent of existing vegetation.	Section 4.1.1
1 (e)	Location and extent of vegetation to be retained.	Appendix D
1 (f)	Location of any known sites of indigenous, cultural or natural heritage.	Section 4.10
2.9 Constraint Areas		
1	Sufficient detail should be provided to enable “Council” to accurately determine the likely impact of the proposal on constraint areas, as identified in the Planning Scheme.	Section 3.3

Note: Section 2.10 - Reconfiguring a Lot has not been addressed in this cross-reference table as this is not part of the development.

Table 1-3 Sustainable Planning Act 2009 requirements cross-reference

No.	Criteria to be Addressed (as per Section 314)	Section of this Document
(2) The assessment manager must assess the part of the application against each of the following matters or things to the extent the matter or thing is relevant to the development—		
(a)	The State planning regulatory provisions.	Section 5.1.2
(b)	The regional plan for a designated region, to the extent it is not identified in the planning scheme as being appropriately reflected in the planning scheme.	Section 5.1.2
(c)	If the assessment manager is not a local government—the laws that are administered by, and the policies that are reasonably identifiable as policies applied by, the assessment manager and that are relevant to the application.	Assessment manager is Isaac Regional Council
(d)	State planning policies.	Section 5.1.1
(e)	Temporary local planning instruments.	N/A
(f)	Preliminary approval to which section 242 applies.	N/A – No Preliminary Approvals relevant to the Project.
(g)	The planning scheme.	Section 5.2.1

No.	Criteria to be Addressed (as per Section 314)	Section of this Document
(h)	For development not in a planning scheme area—any planning scheme or temporary local planning instrument for a planning scheme area that may be materially affected by the development.	N/A
(i)	If the assessment manager is an infrastructure provider—an adopted infrastructure charges resolution or the priority infrastructure plan.	N/A
(3) In addition to the matters or things against which the assessment manager must assess the application under subsection (2), the assessment manager must assess the part of the application having regard to the following		
(a)	The common material.	N/A
(b)	Any development approval for, and any lawful use of, premises the subject of the application or adjacent premises.	No known existing approvals
(c)	Any referral agency's response for the application.	Referral agencies have been listed

Table 1-4 Environment Protection Act 1994 requirements cross-reference

No.	Criteria to be Addressed (as per "standard criteria" definition)	Section of this Document
(a)	The principles of ecologically sustainable development as set out in the 'National Strategy for Ecologically Sustainable Development'.	Conclusion
(b)	Any applicable environmental protection policy.	Appendix J and Appendix K
(c)	Any applicable Commonwealth, State or local government plans, standards, agreements or requirements.	Section 5
(d)	Any applicable environmental impact study, assessment or report.	This document
(e)	The character, resilience and values of the receiving environment.	Section 4.1
(f)	All submissions made by the applicant and submitters.	N/A
(g)	The best practice environmental management for activities under any relevant instrument, or proposed instrument, as follows: (i) an environmental authority; (ii) a transitional environmental program; (iii) an environmental protection order; (iv) a disposal permit; and (v) a development approval.	No environmental authorities or development approvals have been granted for the proposed development.
(h)	The financial implications of the requirements under an instrument, or proposed instrument, mentioned in paragraph (g) as they would relate to the type of activity or industry carried out, or proposed to be carried out, under the instrument.	As above, not applicable.
(i)	The public interest.	Section 2
(j)	Any applicable site management plan.	An operational management plan will be developed prior to proceeding with the development.
(k)	Any relevant integrated environmental management system or proposed integrated environmental management system.	Adani are currently developing an environmental management system (EMS) in accordance with standards, for their entire operations. The EMS will apply to Borrow 7.
(l)	Any other matter prescribed under a regulation.	As set out in Table 1-2 and Table 1-3

Section 2 Development Justification

2.1 Need for Quarry Material

Quarry material is used in the building and construction industry as an essential base component for a range of infrastructure. The quarry industry is largely tied to infrastructure development, therefore, with major growth in the resource sector the necessity for quarry material has greatly increased over the past few decades. Quarries throughout Queensland help facilitate the development of the States resource sector and are vital to the construction of local public infrastructure such as roads.

Adani is proposing to develop a 60 million tonne per annum (Mtpa) thermal coal mine in the north Galilee Basin. All coal will be railed via a privately owned rail line connecting to the existing Aurizon rail infrastructure near Moranbah, and shipped through coal terminal facilities at the Port of Abbot Point and/or the Port of Hay Point (Dudgeon Point expansion). The Carmichael Coal Mine and Rail Project will have an operational life until 2071 with rehabilitation of the Carmichael Coal Mine scheduled to cease in 2074.

The Carmichael Coal Mine and Rail Project is comprised of two major components:

- The Project (Mine): a greenfield coal mine over EPC1690 and the eastern part of EPC1080, which includes both open cut and underground mining, on mine infrastructure and associated mine processing facilities and offsite infrastructure; and
- The Project (Rail): a greenfield rail line connecting the Mine to the existing Goonyella rail system to provide for export of coal via the Port of Abbot Point and/or the Port of Hay Point (Dudgeon Point expansion).

Adani Enterprises Limited sees supply from Queensland coal resources as key to meeting its target of generating 20,000 Megawatts (MW) of power from its power plants by 2020. If the Carmichael Coal Mine and Rail Project does not proceed it would likely lead to Adani's demand for coal being met outside of Australia and the benefits of significant economic investment would not be realised.

A key component of the Carmichael Coal Mine and Rail Project is the supply of suitable local quarry material. The Carmichael Coal Mine and Rail Project will require a significant amount of quarry material for upgrade and maintenance works on existing infrastructure and the construction of new infrastructure. Provisional amounts of fill expected to be needed total approximately 34 MT.

Region-wide investigations have identified an acute shortage of appropriate quarry material for construction of a development the size of the Carmichael Coal Mine and Rail Project. Existing quarries in the area are primarily historic, small and do not contain appropriate infrastructure to immediately utilise. Although existing quarries will be used, they contain limited supplies of material and are not capable of supplying the different types or volumes of materials required. Therefore, the development of new greenfield quarries is required and Borrow 7 will be a major source of the necessary rail ballast, for scour protection and concrete aggregate.

The development of Borrow 7 will provide royalties to the State for the sale of the quarry material, provide local jobs through direct employment and support services, and provide necessary material for the construction and upgrading of local infrastructure. Therefore, it is considered that the quarries are an essential development for the local area, regional and the State as a whole.

2.1.1 Quarried Products Uses and Specification

The construction of the rail and roads require certain quarry materials with characteristics that ensure the infrastructure meets the engineered design life. Quarry material needs to be of a particular sound, strength, durability, resistance and have particular behaviours to be useful for construction requirements.

The construction of the rail component will require:

- Embankment fill;
- Structural fill;
- Ballast; and
- MRD types of material.

2.1.2 Transport Costs

Quarry materials are high bulk, low cost materials. Transport costs can be a significant proportion of the total cost of the material. The majority of quarried products are carted in tip truck, dog and truck configurations. Cartage rates per tonne effectively reflect the hourly rate and the cost of transporting road base which is about 30 – 40% of the cost of the material to the user.

It would be economically unfeasible for quarry material to be transported from significant distances for the construction of the Carmichael Coal Mine and Rail Project. In addition, there would be increased impact to the environment (fuel consumption, emissions and dust), state and local roads and the community if material is required to have long cartage distance.

There is currently no operational or approved quarry within short cartage distance along this portion of the rail corridor to source quarry material, therefore, a new quarry development is required. Borrow 7 is an ideal quarry option as it is in close proximity to the rail corridor (900 m) and contains an abundant source of ballast material for construction of the railway, as well as for use in scour protection and as concrete aggregate.

2.2 Alternatives to the Project

The development of the quarries will significantly support the construction of the Carmichael Coal Mine and Rail Project and must be located in close proximity. Transportation of material from surrounding regions is not considered to be a viable alternative.

2.2.1 Alternatives Considered for Mine and Rail Project

In accordance with the Commonwealth EPBC Act [Schedule 4, Section 2.01(g)], alternatives to the Mine and Rail Project were reviewed and discussed as part of the Carmichael Coal Mine and Rail Project EIS. The Carmichael Coal Mine and Rail Project EIS noted that Adani had access to EPC 1690 and part of EPC 1080 however, has no other access to coal mining within Australia (GHD, November 2012). Therefore, there are currently no other commercially available alternatives for Adani to proceed with a major open cut and underground coal mine.

The Galilee Basin is not currently serviced by any rail infrastructure which would enable export of coal product from the Project, or other resource activities. Adani has also identified opportunities to link the rail to current and proposed rail infrastructure, to minimise the potential environment

and social impacts of linear infrastructure within the rural environs while facilitating the export of resources from the Galilee Basin region. Transport of coal by rail is the only economically feasible option for transport to the ports for export.

A no action option, that is, that Adani does not develop the Project, would likely lead to Adani's demand for coal being met from outside of Australia. The no action option for the Project would see significant capital investment totalling approximately \$21.5 billion foregone. Estimates have indicated that \$5.9 billion will be spent in the years preceding 2022. The remaining \$15.6 billion will be spent over the remaining years of operation (GHD, November 2012).

2.2.2 Alternatives Considered for Quarry Project

The location of suitable resources is limited due to the constraints imposed by geology, access, land and environmental values. Ideally, quarries should be conveniently located to limit heavy truck transport and so reduce end user costs and environmental and infrastructure impacts associated with haulage.

As part of the Project development 37 quarry locations were identified for investigation. Geotechnical investigations undertaken in late 2012 determined the nature of potential resources at each location and in combination with environmental constraints analyses eight sites were chosen to proceed for further investigations and five sites chose to proceed with development.

In addition to environmental constraints, investigations have identified an acute shortage of appropriate quarry material for construction of a Project the size of the Carmichael Coal Mine and Rail development. Existing quarries in the area are primarily historic, small and do not contain appropriate infrastructure to immediately utilise.

Investigations have also considered hauling material from larger existing quarries in the surrounding areas of Clermont, Moranbah, Charters Towers, Townsville and Emerald. However, due to the distance it was determined that haulage costs and the potential impact on the road network would be excessive and this was rejected as an alternative option.

2.2.3 Alternative Methods of Operation

A number of locations and layout plans were also considered in the development of the proposed plan. The adopted layout is considered optimum for containing potential environmental impacts without compromising economic efficiency.

Section 3 Project Details

3.1 Site Details

Borrow 7 is proposed to be located on Lot 3235 PH752 with access gained via an existing internal property track that connects to Twin Hills Road and the Gregory Development Road. The site is approximately 5 km west of the Gregory Development Road, and approximately 120 km north-west of Clermont in the IRC area. Table 3-1 details the lot on which the development is proposed and identifies the use of the lot, and the planning scheme zone under the *Belyando Shire Planning Scheme 2009*. No further lots are part of this application and nothing related to this development will hinder access to, or operation of, activities on surrounding lots.

Table 3-1 Site Details

Lot and Plan	Address	Area	Zoning	Current Use(s)	Proposed Use(s)
Lot 3235 PH752 (Leasehold)	472 Twin Hills Road, Clermont	20,700 ha	Rural	Cattle breeding and fattening	Borrow 7 over part of lot

The site lies within the Northern Brigalow Belt bioregion, however extant vegetative conditions vary considerably. The site is within an area primarily used for cattle grazing, however this is a large and topographically complex site that remains sparsely vegetated over much of its extent. Borrow 7 will be located immediately north of a low depression which is likely to collect surrounding surface water runoff (Plate 3-1). The closest dwelling houses are the Disney Homestead (6.7 km to the north-west) and Old Twin Hills Homestead (6.7 km to the south-west).



Plate 3-1: View from proposed site of Borrow 7 south

3.2 Development Description

The applicant proposes to initiate formal quarry operations on Lot 3235 PH752, as per Figure 3-1 to Figure 3-6. The development proposal includes the construction of all ancillary facilities specifically:

- Crushing and screening plant;
- Stockpile areas;
- Demountable site buildings;
- Fuel storage and treatment facilities;
- Water storage and treatment facilities; and
- Internal and external access roads.

Equipment used in the abovementioned areas will generally consist of bulldozers, excavators, loaders, articulated trucks, a rock breaker, mobile crushing and screening circuit, drilling rig and water cart. Additionally, minor ancillary equipment including service trucks will be on site when required. Temporary facilities may be erected on site which could include a demountable office, crib room, ablution facilities, and a small car park (refer to **Appendix C**). A small lay down area hardstand, and suitably bunded fuel storage area, will be located near the site infrastructure at the main point of egress from the site. All refuelling and major servicing will be completed on a hard stand area where possible. Waste materials will be disposed of off site at a licensed facility.

The extraction area for Borrow 7 has been defined as 36.17 ha. Hard rock material will be extracted from the quarry and transported, via the rail haul route which has a crossing over the Gregory Development Road. The construction of the rail corridor and activities associated with it, are addressed within the Carmichael Coal Mine and Rail EIS. This application will address the impacts of quarry material haulage to the Rail Corridor and to the Mine site for the purposes of constructing the Mine and Rail Project.

3.3 Project Planning and Design

A range of environmental, social, geological, construction and cultural constraints were considered during the design and location of the quarries. Initially desktop constraints maps were generated to identify the following constraints:

- Rivers, waterways, water bodies, dams and wetlands [particularly those triggered under State Planning Policy (SPP) 4/11 – Protecting Wetlands of High Ecological Significance in the Great Barrier Reef Catchments];
- Topography and landforms;
- Available resources (identified through exploratory drilling at each of the potential quarries and borrow pits);
- Regional Ecosystems (REs), in particular endangered and of concern REs, high value regrowth vegetation and Essential Habitat;
- Indigenous cultural heritage and Native Title claims;
- Environmental features such as restricted areas, nature refuges and reserves;
- The degree of existing disturbance (e.g. currently cleared areas and sites already utilised for quarrying activities);
- The presence of other infrastructure (including homesteads and settlements), mining and exploration lease and permit boundaries, coal resource areas, roads, power lines and pipelines; and
- Strategic Cropping Land (SCL).

Following the desktop constraints assessment, two site inspections including a vegetation assessment was undertaken to ground truth the site features. The findings of these site inspections were fed into the location and design of the quarry plan to ensure minimal impact to the environment.

Consideration was given to safety, noise, visual amenity, water quality, rock quality, engineering constraints, capital and operating costs and distance of the site from the required construction areas.

Borrow 7 was determined to be a preferred location due to proximity to rail corridor and the quality and quantity of material available. The design and staging within the quarry development plans further took into account site features including protection of the identified Ornamental Snake habitat to the south of Borrow 7 and minimising footprint through progressive rehabilitation.

3.4 Quarry Development Proposal

3.4.1 Initial Construction and Commissioning Phase

This stage of development will involve:

- Demarcating the extent of the approved quarry area with durable permanent markers;
- Vegetation clearing and topsoil removal from first stage of quarry development;
- Stabilisation and revegetation of any final infrastructure batters and embankments;
- Construction of temporary internal haul road;
- Establishing initial stormwater runoff and erosion controls;
- Access road upgrades and road drainage works;
- Creation of hard stand areas;
- Installation of ancillary services (fuel storage, site office etc); and
- Installation of mobile crushing and screening plant.

Site preparation is likely to commence in early 2014.

3.4.2 Site Access and Internal Roads

Borrow 7 will maintain one all weather site access from Twin Hills Road in the south and a dedicated haul route to the north. The northern access will be the primary haul route and will connect Borrow 7 to the Carmichael Coal Mine and Rail corridor (900 m north). This will generally be an all weather access and will not cross main surface water runoff channels. A haul route will be constructed along the rail corridor and will provide an access along this route to the Gregory Development Road.

Site access roads will be constructed with a gravel pavement with a minimum of 9 m width.

The traffic and transport arrangements for Borrow 7 are further discussed in **Appendix D – Traffic and Transport Impact Assessment**.

3.4.3 Water Storages, Stormwater and Erosion Control

The site erosion and sediment controls will be designed in accordance with International Erosion Control Association (IECA) Guidelines 2008 recommended drainage design standards for temporary drainage structures in QLD with an anticipated design life >24 months.

Where possible, stormwater will be harvested for use on site and ultimately the site is designed to be self sufficient for water required for all on site operations other than potable water requirements.

All quarry workings will be free draining and the following will be undertaken:

- Stormwater will be captured in water storages and re-used on site for dust suppression and progressive rehabilitation;
- Clean water will be diverted away from the quarry workings into undisturbed catchment and drainage lines; and
- Erosion and sediment controls will be designed, implemented and maintained in accordance with IECA 2008.

Each stage of the quarry development plan requires establishing a number of physical controls prior to commencement of topsoil stripping and vegetation clearing. This includes installing culverts along the haul road, construction of diversion channels to divert clean water from entering areas of disturbance and establishing a sediment pond/capacity sump to collect site water runoff for reuse on site.

Site runoff collected in the sediment ponds will be reused on-site where possible. The water usage requirements for Borrow 7 are outlined in Table 3-2 below.

Table 3-2 Water Usage

Quantity	Dust Suppression Truck	Dust Suppression Plant	Plant Pugmill	General Usage
Litres Per Day (l/day)	180,000	62,400	280,000	15,000
Total Kiloliters Per Month (kl/month) - 16,122				

A water storage dam will be constructed to collect rain and stormwater and allow for a 1 in 1 year storm event for water supply for on site water use. Under the *Water Resources (Burdekin Basin) Plan 2007* a permit for taking overland flow is not required for storages under 250 ML. Adani will consider a number of alternative options of water supply should additional water be deemed necessary for the Project. This may include bore water supply, large water storages and sourcing from an existing water supply. Any alternative water supply options will be permitted separately and are not discussed herein.

3.4.4 Vegetation Clearing and Topsoil Management

The site clearing includes removal of vegetation and debris. There is minor sparse vegetation on site and clearing will not be significant. In order to avoid large areas of the quarry being unnecessarily exposed to the erosive effects of wind and rain, areas will be opened/cleared immediately in advance of extraction fronts in accordance with the staged plan.

All turf, topsoil and other organic and unsuitable material shall be stripped from the site. Wherever possible, such material will be stockpiled and reused for site rehabilitation. Topsoil stockpiles will be to a maximum height of approximately 2 m and stabilised, revegetated and generally treated so that the soil will remain in a productive condition for later rehabilitation.

Fencing is required due to the high concentrations of livestock on the properties adjacent to the proposed quarry area. Fencing standards will be confirmed upon consultation with relevant landowners and in accordance with requirements to facilitate fauna movement.

An Operational Works Development Permit for Vegetation Clearing is required under the *Vegetation Management Act 1999*. Accordingly, relevant documentation for this application has been provided in **Appendix E**.

3.4.5 Development of Extraction Cells

The extraction cell preparation will begin with stripping topsoils and stockpiling of the residual soil profile for latter rehabilitation over the first few cells of the area to be developed. Clearing and overburden stripping will only be undertaken for one or two cells ahead of the current active cell.

The resource will be developed over four stages using a 15 m bench heights in an easterly direction. Similar to other hard rock quarries, processing of the material will occur at the quarry face with an excavator loading into a jaw followed by a suitable secondary and tertiary screening and crushing process. Additional crushing and screening potentially on the stockpile areas, depending on the type and quantum of material, may also be required. Stockpiling of the material will occur generally off the resource area although once the quarry has expanded significantly, stockpiling of materials will likely also occur on the quarry floor at 190 m AHD. Extraction of the quarry material will occur over four stages, which are discussed in Section 3.4.5.1 below.

3.4.5.1 Sequence of Extraction

The Borrow 7 Development Plan will guide the development of the quarry and these plans are largely self explanatory. Once the quarry workings have been established quarry development will progress in a logical and sequential fashion with clearing of the next cell in preparation of workings and progressive rehabilitation of the expired extraction areas.

Initial extraction will involve development of a 15 m high working bench between 220 and 205 m AHD. This material will be removed primarily by drill and blast. Extraction will be undertaken over four stages and the anticipated potential volume within each stage is identified below:

- Stage 1 - 833,400 m³ or approximately 2.21 MT;
- Stage 2 – 1,807,400 m³ or approximately 4.79 MT;
- Stage 3 – 2,058,000 m³ or approximately 5.45 MT; and
- Stage 4 – 2,822,600 m³ or approximately 7.48 MT.

These are the available resource quantities determined through geotechnical investigations. The actual amount of quarry material to be sought from Borrow 7 for the Carmichael Coal Mine and Rail Project is approximately 2.325 MT (refer to Section 3.4.6.1 below).

An outline of the general quarry development layout, extraction sequence and staging is presented graphically in Figure 3-1 to Figure 3-4.

3.4.5.2 Blasting and Explosives Management

Following the removal of overburden, the target resource will be drilled and blasted to allow the rock to be broken into sizes which can be readily handled and transported to the primary crusher.

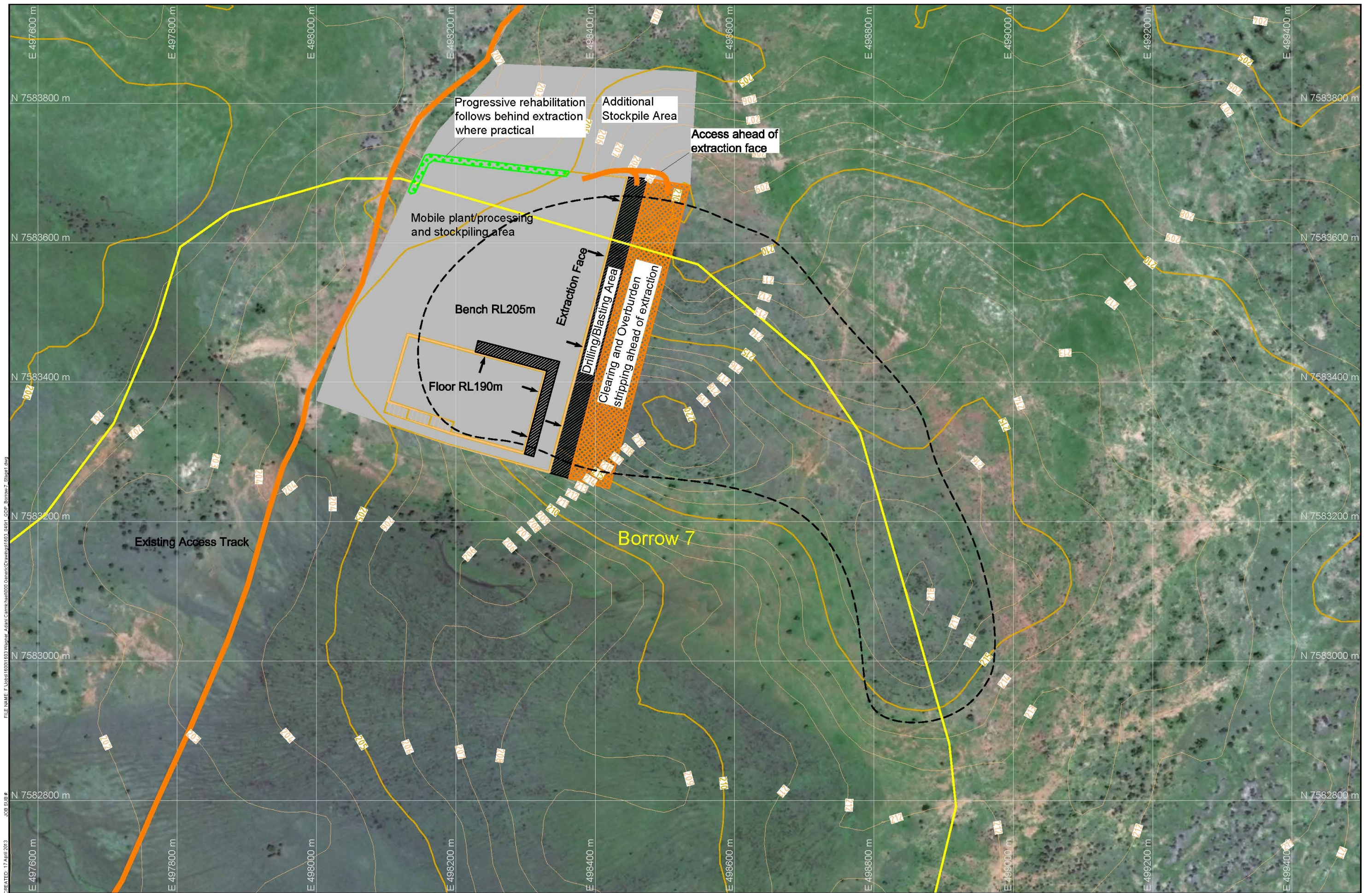
Drilling will be carried out with a modern hydraulic percussion rig fitted with effective exhaust mufflers and dust suppression equipment. It is proposed to contract out the designing, loading, initiating and monitoring of blasting activities at the quarry to a suitably qualified company. Each blast will be individually designed to maximise blast efficiency, control flyrock, ground vibration and airblast overpressure.

Should the blasting result in the formation of oversize rock fragments they will be broken up using an excavator with a rock hammer. This work will be completed in daylight hours only.

Blasting shots will occur every 60,000 to 80,000 t of material, which equates to be once a month, possibly every two months during the construction period, then one to two blasts during the main construction period and for ongoing maintenance material.

Blasting will occur at a depth of 15 m depending on the depth of the resource which will be confirmed with further drilling.

The handling, storage and use of explosives will be carried out in accordance with *Australian Standard AS2187 – Explosives – Storage, Transport and Use* and the *Mining and Quarrying Safety and Health Act 1999* (MQSH Act). Standard warning and signalling procedures will be observed as required. No explosives will be stored onsite. A Blast Management Plan which includes notification of nearby residents will be developed and implemented prior to any blasting activity.



REV	DESCRIPTION	DATE	BY
1	Add Additional Stockpile Area	17/04/13	LT

Data Sources:
Photography: Bing Maps, Date accessed: 2013-02-01
Topography: 1s SRTM 2008 DEM-S © Commonwealth of Australia (Geoscience Australia) 2012
Cadastral: Cadastre
Ecosystem: Other

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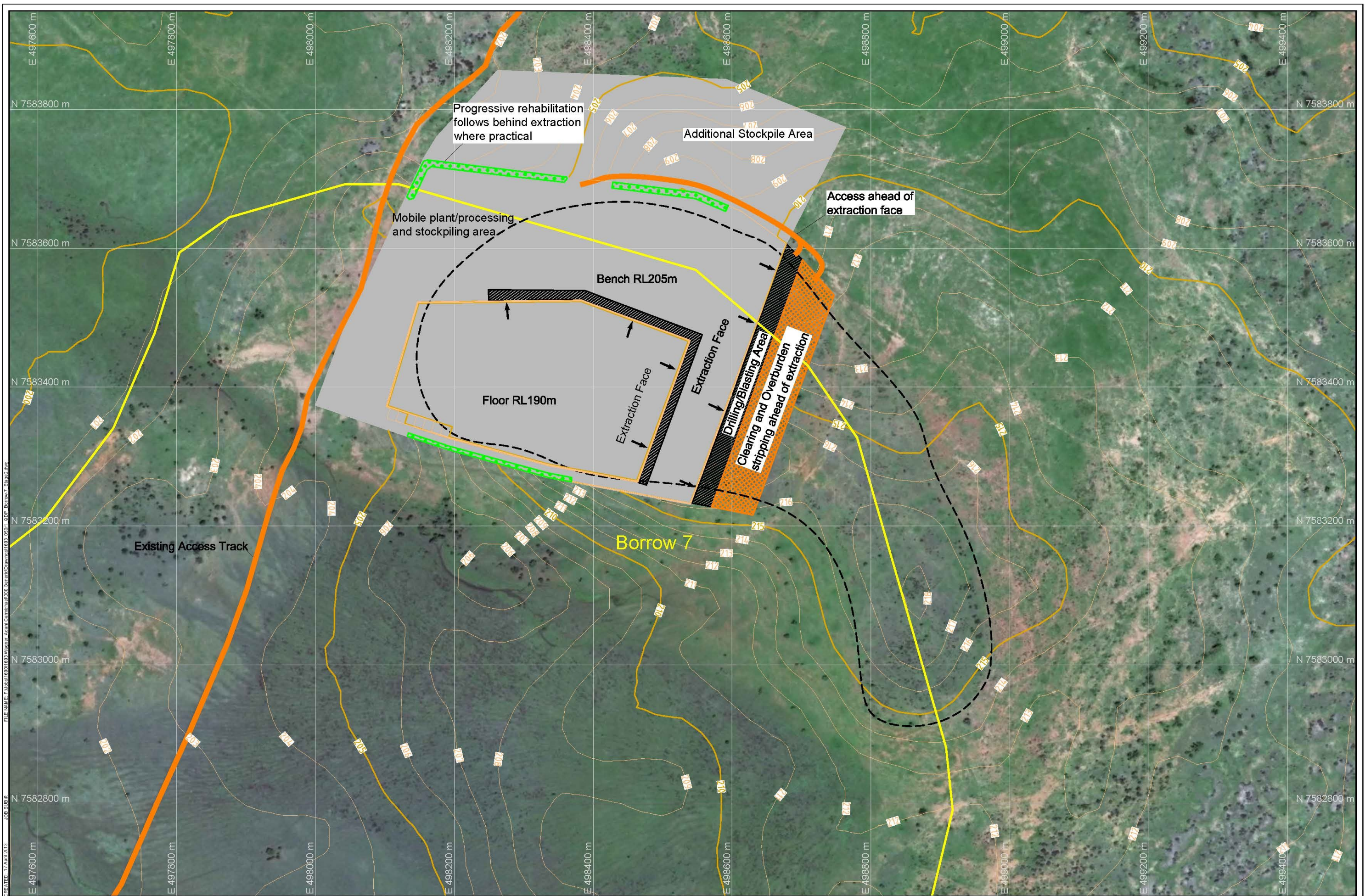
Legend:

- Site Boundary (Adani)
- Cadastral Boundary
- Edge of basalt outcrop

- Overburden Stripping
- Progressive Rehabilitation
- Drilling/Blasting Area



PROJECT:	Borrow 7	TITLE:	Figure 3-1 Extraction and schematic site layout - Stage 1
CLIENT:	Wagner Quarries Pty Ltd	SCALE:	1:5,000
		When Printed On A3	0 100 MH
		DATE:	17 April 2013
		DRAWN:	
		PRINTED:	17 April 2013
		CHECKED:	
		DATUM:	HORIZONTAL / VERTICAL / ZONE
		DRAWING NUMBER:	1603.049
		REVISION:	1
		MGA / AHD / 55	



REV	DESCRIPTION	DATE	BY
1	Add Additional Stockpile Area	17/04/13	LT

Data Sources:
Photography: Bing Maps, Date accessed: 2013-02-01
Topography: 1s SRTM 2008 DEM-S © Commonwealth of Australia (Geoscience Australia) 2012
Cadastral:
Ecosystem:
Other:

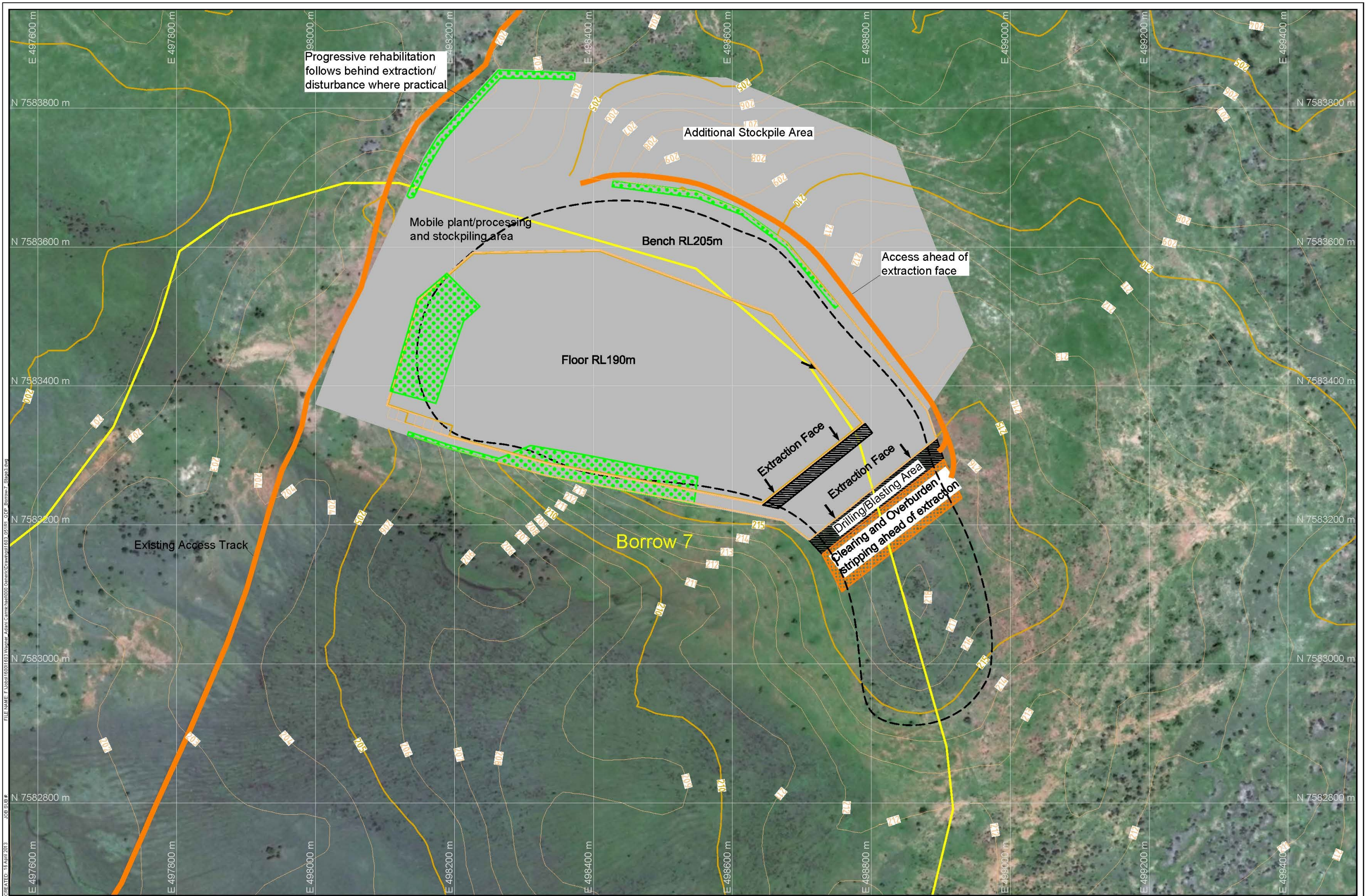
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Legend:
— Site Boundary (Adani)
— Cadastral Boundary
--- Edge of basalt outcrop

- Overburden Stripping
- Progressive Rehabilitation
- Drilling/Blasting Area



PROJECT: Borrow 7	TITLE: Figure 3-2 Extraction and schematic site layout - Stage 2
CLIENT: Wagner Quarries Pty Ltd	
GROUNDWORK plus PH: +61 7 3971 0411 WWW.GROUNDWORK.COM.AU	SCALE: 1:5,000 When Printed On A3 0 100 DRAWING NUMBER: 1603.050 REVISION: 1 DATE: 17 April 2013 PRINTED: 17 April 2013 DRAWN: MH CHECKED: DATUM: HORIZONTAL / VERTICAL / ZONE MGA / AHD / 55



REV	DESCRIPTION	DATE	BY
1	Add Additional Stockpile Area	16/04/13	MH
Data Sources:			
Photography: Bing Maps, Date accessed: 2013-02-01			
Topography: 1s SRTM 2008 DEM-S © Commonwealth of Australia (Geoscience Australia) 2012			
Cadastral: Cadastre			
Other:			
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Legend:

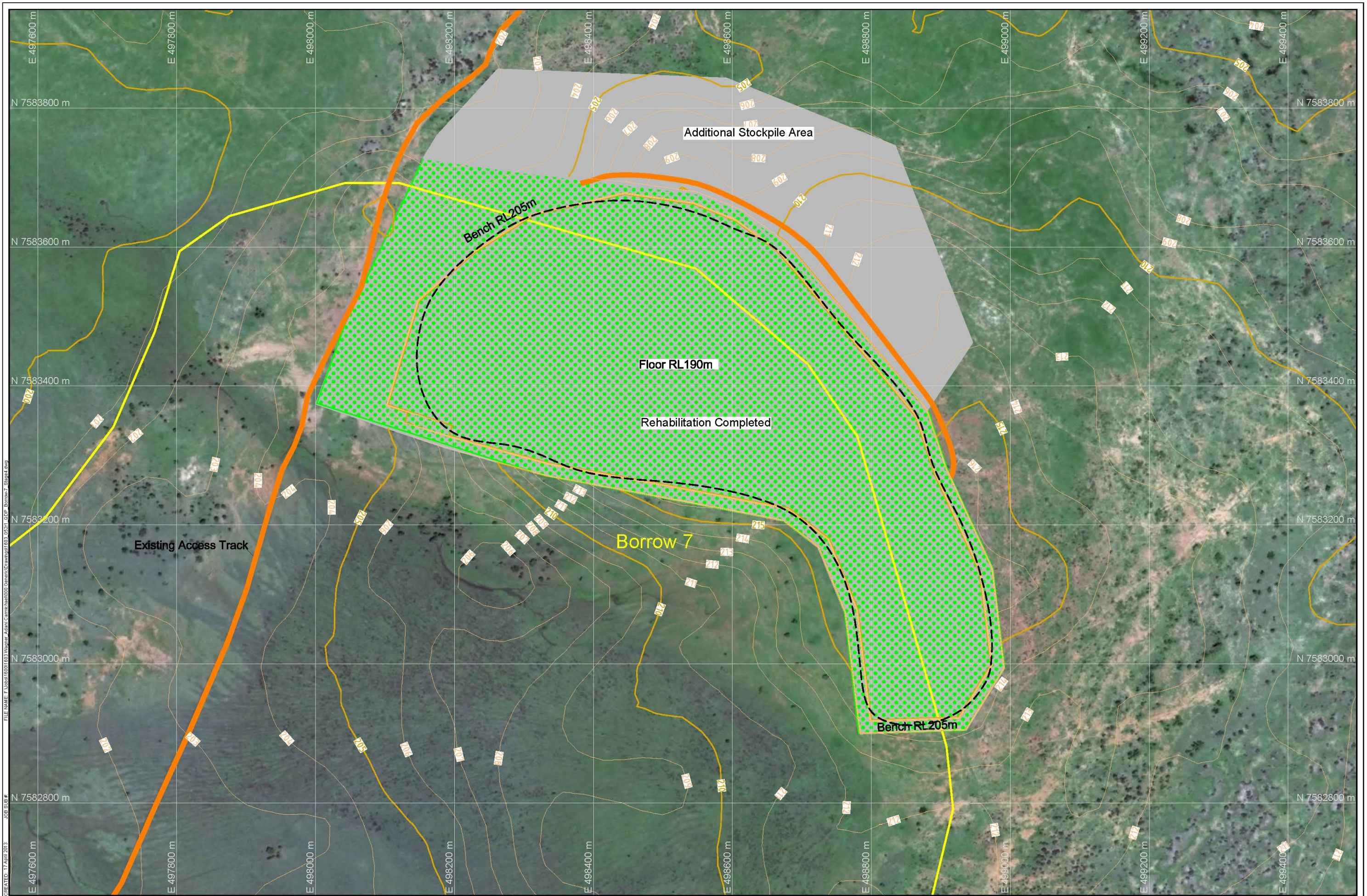
- Site Boundary (Adani)
- Cadastral Boundary
- Edge of basalt outcrop

- Overburden Stripping
- Progressive Rehabilitation
- Drilling/Blasting Area



PROJECT:	Borrow 7
CLIENT:	Wagner Quarries Pty Ltd

TITLE:		Figure 3-3 Extraction and schematic site layout - Stage 3	
GROUNDWORK plus		SCALE: 1:5,000	DRAWING NUMBER: 1603.051
PH: +61 7 3971 0411 WWW.GROUNDWORK.COM.AU		DATE: 16 April 2013 PRINTED: 16 April 2013	REVISION: 1 DRAWN: MH CHECKED: DATUM: HORIZONTAL / VERTICAL / ZONE MGA / AHD / 55



FILE NAME: F:\Jobs\1603\1603_Maynard_Adani_Carroll\1603_0524_GDP_Borrow7_Stage4.dwg
JOB SHEET #
CREATED: 17 April 2013

REV	DESCRIPTION	DATE	BY
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Data Sources:			
Photography: Bing Maps, Date accessed: 2013-02-01			
Topography: 1s SRTM 2008 DEM-S © Commonwealth of Australia (Geoscience Australia) 2012			
Cadastral: Cadastre			
Other: Other			
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Legend:
— Site Boundary (Adani)
— Cadastral Boundary
- - - Edge of basalt outcrop

- Overburden Stripping
- Progressive Rehabilitation
- Drilling/Blasting Area



PROJECT: Borrow 7
CLIENT: Wagner Quarries Pty Ltd

TITLE: Figure 3-4 Extraction and schematic site layout - Stage 4

GROUNDWORK plus	SCALE: 1:5,000 When Printed On A3	DRAWING NUMBER: 1603.052	REVISION: 1
	DATE: 17 April 2013 PRINTED: 17 April 2013	DRAWN: MH CHECKED:	DATUM: HORIZONTAL / VERTICAL / ZONE MGA / AHD / 55

3.4.6 Material Processing

Material at Borrow 7 will be processed through a screening or crushing process. It is expected that material will be ripped and stockpiled ready for dispatch to laydown areas along the rail construction corridor.

3.4.6.1 Products Produced and Production Rates

Borrow 7 will be an ongoing operation likely to commence in early 2014 and operate for the duration of the Carmichael Coal Mine and Rail Project. It is anticipated that during the Mine and Rail construction period 617,000 t of ballast material, 10,000 t of MRD Type 2.1 material and 1.698 MT of MRD Type 2.2 material will be produced from this site during the construction phase of the Carmichael Coal Mine and Rail Project. This is an average of 58,333 tonnes per month. Total production ranges from 2000 t a month to up to 200,000 t in peak construction period. The initial indications of volumes required over this time period have been illustrated in Figure 3-5 below.

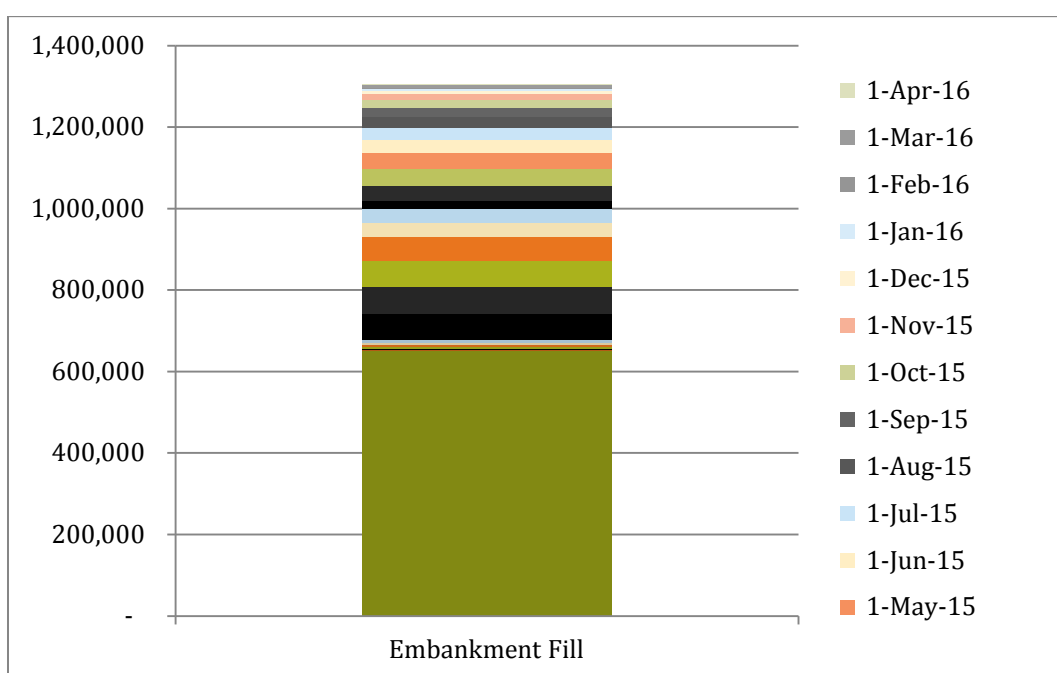


Figure 3-5 Quarry material requirements over the operation life of Borrow 7

The highest annual production rate for a year is expected to be 2015 when up to 1.6 MT of material will be produced. This volume and demand may change and is dependent upon construction schedule and construction progress of the Carmichael Coal Mine and Rail Project. Ongoing production rates, post the Carmichael Coal Mine and Rail Project construction, will be approximately 100,000 t per annum for maintenance works. Over the life of the quarry it is anticipated the entire 19.93 MT of quarry resource will be utilised.

3.4.7 Product Stockpiling and Despatch

3.4.7.1 Location of Stockpiles and Management

Stockpiling of processed products is necessary to meet construction requirements, schedules and for quality control testing. Some product stockpiles will be maintained at Borrow 7, in the area indicated on the site plan for stockpiles. The road base and fill stockpile will be approximately 3.5 m high whilst the aggregate and ballast stockpile will be approximately 3 m high. Material will

predominately be transported off site to stockpile locations along the rail corridor to await use in construction. Stockpiles will be arranged to provide ready access to different products and to provide maximum benefit for noise attenuation from fixed and mobile plant.

3.4.7.2 Dispatch and Quantity Records

The volume carried in each truck will be recorded. All records on a per trip/per day basis will be maintained with logged records of tonnes per load and destination kept.

Quarry material is planned to be used predominantly for rail ballast, scour protection and concrete aggregate. Material will be hauled with road registered triples, capable of holding 75 t. It is anticipated that quarry operations will generate maximum daily traffic movements of approximately 310 vehicles (in/out) (**Appendix D**).

All loads accessing public roads will be covered. No trucks will be permitted to leave the site unless the load is legal and secure. A driver's code will apply to all truck drivers and its requirement will apply to driver behaviour and attitudes both on and off the site. The internal site access road, between the site access point, will be hard packed with a gravel pavement.

Road signs and internal quarry road speed limits will be restricted to 40 km per hour and access road speed limits of 80 km per hour enforced on site to minimise dust and ensure safe operation of the site.

3.4.8 Ancillary Facilities

The following facilities will be erected on the proposed quarry site to service the quarry workings:

- One crib and ablution block (height of approximately 2.7 m);
- One spares container 20 ft;
- Security gates and cameras; and
- Water tanks (25,000 L) and pumps.

Plans for the crib and ablution blocks are provided in **Appendix C**.

3.4.9 Machinery and Equipment

The following is an indicative list of equipment that will be used onsite

- Two primary jaw crushers (LT 120/LT3054);
- Four secondary and tertiary cone crushers (Metso HPS 300);
- Three screens (1x ST4.8, 2x 2400 Series Warrior Screens);
- Six excavators (CAT 349DL);
- Four loaders (CAT980H);
- One water truck (Mack 8x4 Wheeler);
- Six light vehicles (Ford Ranger);
- One 100 kVA genset;
- One 70,000L fuel pod (Transtank T69);
- Seven Light plants (COMBILITE);

- Six dump trucks (CAT 740B);
- One grader (CAT- 14M);
- One service trucks (Hino);
- One cranes (20T Franna);
- One elevated work platform (GENIE);
- One bobcat (CAT242B3);
- One 4 tonne site truck (Tilt Tray);
- One tele handler (TH414);
- One fuel /oil service truck (MACK 8x4);
- One hammer (SANDVIK); and
- One precoat plant and radial stacker (Thomas Manufacturing).

Major machinery and equipment to be deployed permanently on site will include the loaders, excavators, haul trucks and water trucks. Other equipment to be deployed on an 'as needed' basis will potentially include bull dozers, screening and or crushing plant. Equipment will be maintained in accordance with manufacturer's recommendations and inspected daily with a regular maintenance program in place.

Minor servicing of mobile plant will be undertaken on site. Major servicing will be generally undertaken by specialist service providers, however Borrow 7 will also be set up for major servicing of equipment of all quarries if required. Refuelling of mobile plant will be undertaken at the bunded above ground fuel tank.

3.4.10 Storage of Fuels, Lubricants and Chemicals

Fuel storage on site will be in a self-bunded fuel tank (Transtank T69) and will store up to 75,000 L maximum of diesel at any one time. Fuel will be on a hard stand area with spill kits located beside the refill area. Any spill will be cleaned up immediately. The fuel cell will be refilled once per week to maintain operations on site.

Minor amounts of oils, hydraulic fluids, greases, coolants and other maintenance items will be stored on site in the 20 ft storage container within a bunded area. In addition, minor amounts of cleaning solvents, paints and thinners will also be stored.

Weed control chemicals and sprays may be stored onsite for maintenance weed control. In addition, fertilisers and pesticides in small quantities, required for progressive rehabilitation, works will be stored onsite.

All minor chemical and other substances will be safely stored with required separation distances, bunding and within a lockable storage.

3.4.11 Hours of Operation

The quarry will operate 24 hours a day with the following restrictions on certain activities:

- Extraction, stockpiling and dispatching – 24 hours (Monday to Sunday);
- Blasting will occur between 9 am and 3 pm Monday to Friday (9 am to 1 pm on Saturdays);
- Plant and equipment maintenance - 24 hours (Monday to Sunday); and

- Rock hammer operation will occur between 7am and 6pm (Monday to Sunday).

3.4.12 Public Utility and Services

3.4.12.1 Electricity, telecommunications and potable water

The following will be the utilities and services at the site:

- Electricity supply will be by a 10 KVA generator as no connection to main powers is available at the site;
- Telecommunications will be by a satellite phone in the office building, as no mobile reception is available at the site; and
- Potable water supplies will be trucked in and stored in a 25,000 L water tank for drinking and ablutions operation. Water for construction and dust suppression will be captured on site from stormwater in retention dams and reused on site.

3.4.12.2 Sewage and Waste Water Management

Waste water will be treated in portable treatment plants comprising modular units with capacity to treat up to 21 Equivalent Persons (EP). Wastewater from the system will be disposed off through sub-surface irrigation to a fixed landscape. It is expected that a 10 EP work force will produce a maximum of 500 L per day (L/day). The sub surface irrigation will be physically separated from any work area in a suitable location.

The onsite system is not required to have licensing under the *Environmental Protection Act 1994* as the facility is not deemed to be a "sewage treatment plant" as it has a peak design capacity of less than 21 EP. However, the installations will comply with the *Sewerage and Water Supply Act 1949* which require approvals to install, change or take away on-site sewage facilities and with NRM and Department of Health's licence conditions that are made pursuant to this Act

Sewage systems will be managed in accordance with the Australian Standard (AS1547.200) - On Site Domestic Wastewater Management, as this standard applies to systems dealing with up to 10 persons.

The functional requirements of on site sewage treatment systems are that they be designed, operated and maintained to:

- Ensure that wastewater effluent reuse practices do not create a mode of transmission for disease;
- Encourage the application of wastewater effluent to the landscape in the most efficient and sustainable method;
- Bring about simple, safe and cost-effective operation and routine service requirements;
- Ensure soil condition is not degraded;
- Ensure that by-products are disposed in an hygienic manner which is not detrimental to the environment or public health; and
- Ensure that the wastewater effluent is maintained within the boundary of the property from which it is produced, so that off-site impacts are minimised or prevented (e.g. contamination

of surface water and groundwater by nitrogen and phosphorus from the effluent or environmental nuisance).

3.4.13 Lighting

It is proposed that the quarry will operate 24 hours a day, as such lighting for night operations is required. Lighting will be provided at the extraction face, the site office and the access roads to allow for night operations.

Illumination of Borrow 7 will be provided by seven industry recognised COMBILITE. The COMBILITE features four 1500 watt (W) metal halide lights with automatic start-up and shut down and an integrated control panel. The light output will be a strong and clear pure-white illumination with a 350 degree mast rotation function whilst fully extended and operational.

When compacted for transport, the unit itself stands at 2.35 m; when the mast is fully extended the unit can reach a nominal maximum height of 9.0 m. Width of the actual unit is 1.65 m whilst the draw bar has an ability to extend to 3.14 m. The unit runs off a 1.1 L, 3 cylinder Perkins 403D-11 engine, meeting all current and proposed Australian emissions legislation. The unit is also fitted with a fluid containment tray to prevent any environmental spills.

The lights will be located at the entry and exit of the site, the quarry working face and processing areas. The lights will be moved and positioned according to the stage of quarry development. Consideration will be given to reducing light spill from the boundary of the site.

3.4.14 Waste Management

Quarry developments do not generate a significant amount of waste. Types of waste likely to be generated on site include:

- Paper and general wastes from the officers, workshop and amenities facilities;
- Scrap metals;
- Oils, greases and waste fuels; and
- Contaminated soils from any clean up of fuel, oil or grease spill.

Wastes will be sorted and recycled where possible. Paper and general wastes from the offices, workshops and amenities will be stored in appropriate containers prior to delivery to designated landfill, refuse transfer or recycling depots. The nearest landfill is located Turrama Road, Clermont QLD 4721. General waste will be transported to this facility. Scrap metals will be collected by contractor for recycling. Oils, greases and waste fuels from machinery servicing will be collected and securely stored on site in a bunded area prior to disposal off site to licensed refuse site or recycling agency.

3.4.15 Workforce

There will be approximately 33 to 35 full time employees' onsite during the quarry operations. Employees will be accommodated in the local rail construction camp. Employees will use the rail haul road where possible to access Borrow 7.

Employees will be transported to the quarry site on a mini bus and returned to the temporary camp accommodation at the end of the shift. Local contractors, businesses and utilities will benefit from activities during the quarry operation.

In addition, to the site personnel, part time and casual truck drivers, maintenance fitters, drill and blast personnel and other subcontractors may be employed either directly or as sub contractors.

3.4.16 Health and Safety and Emergency Response

3.4.16.1 Public Safety

The need to ensure the safety of the public from quarrying and quarry related activities is recognised by the proponent. Statutory requirements will be enforced and other company initiatives will be implemented to avoid injury to the public. These would include fencing, erection of signage, machinery marking and alarms, blasting controls and warnings and safety procedures.

Site safety procedures will be implemented and reviewed as necessary. The quarry will be operated in accordance with the *Mining and Quarrying Safety and Health Act 1999* (MQSH Act) and associated regulations.

3.4.16.2 Occupational Health and Safety

A site safety plan will be prepared and updated as necessary. The plan will include induction procedures, comment structures, standard work procedures, risk assessment procedures, employee training and all occupational health and safety requirements to ensure statutory compliance, audit and monitoring requirements.

3.4.16.3 Emergency Response

In accordance with the Guidance Note QGN 15: (Emergency Preparedness for small mines and quarries document), an individual Emergency Response Plan (ERP) will be developed prior to construction which considers, as a minimum:

- The type of operation;
- Site hazards;
- The range of personnel;
- Training of personnel;
- Geography of the surrounding area and remoteness; and
- Available equipment.

Adani will identify and record who should receive copies of the ERP. If information changes there will be a system developed that ensures changes are made to the site ERP and any controlled copies. The ERP will be written in plain English with critical information well indexed and easily referenced. The ERP will consist of a number of elements that contain relevant information relating to the site including the following generic topics:

- Mine Information;
- Plans and Drawings;
- Risk Management;
- Emergency equipment/facilities;
- First aid requirements;
- Personnel training;
- Incident control;

- Communication;
- Contact lists;
- Securing the site;
- Procedures for controlling site specific hazards; and
- Records.

3.4.17 Rehabilitation and Landscaping

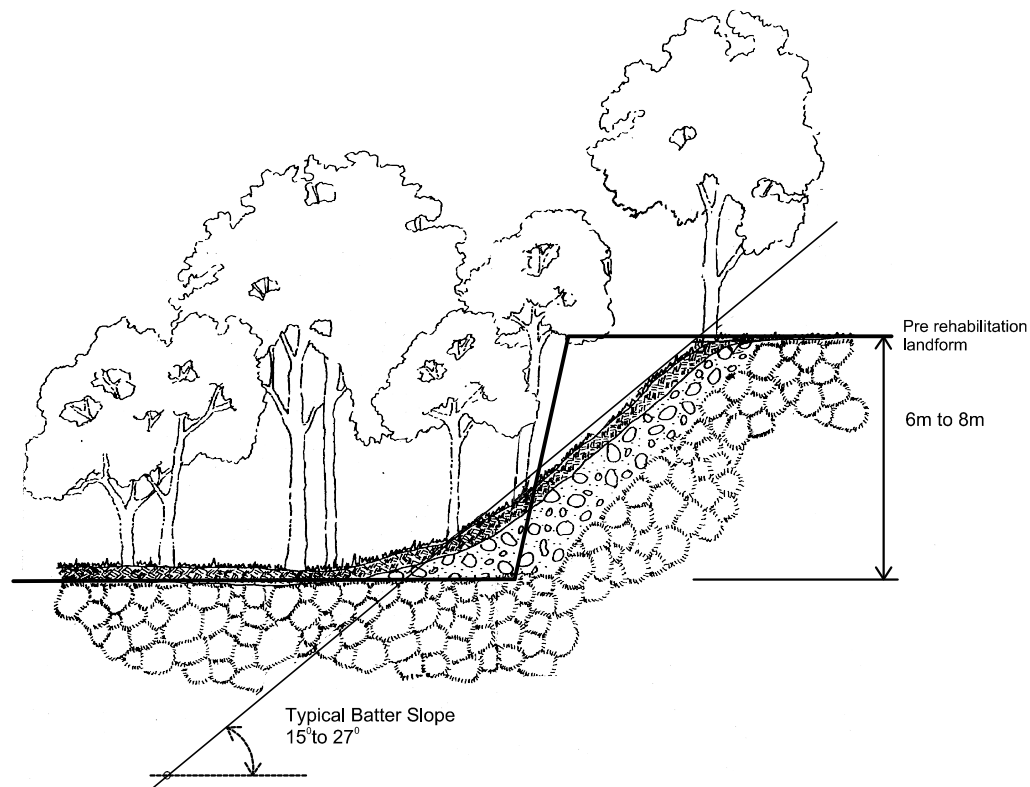
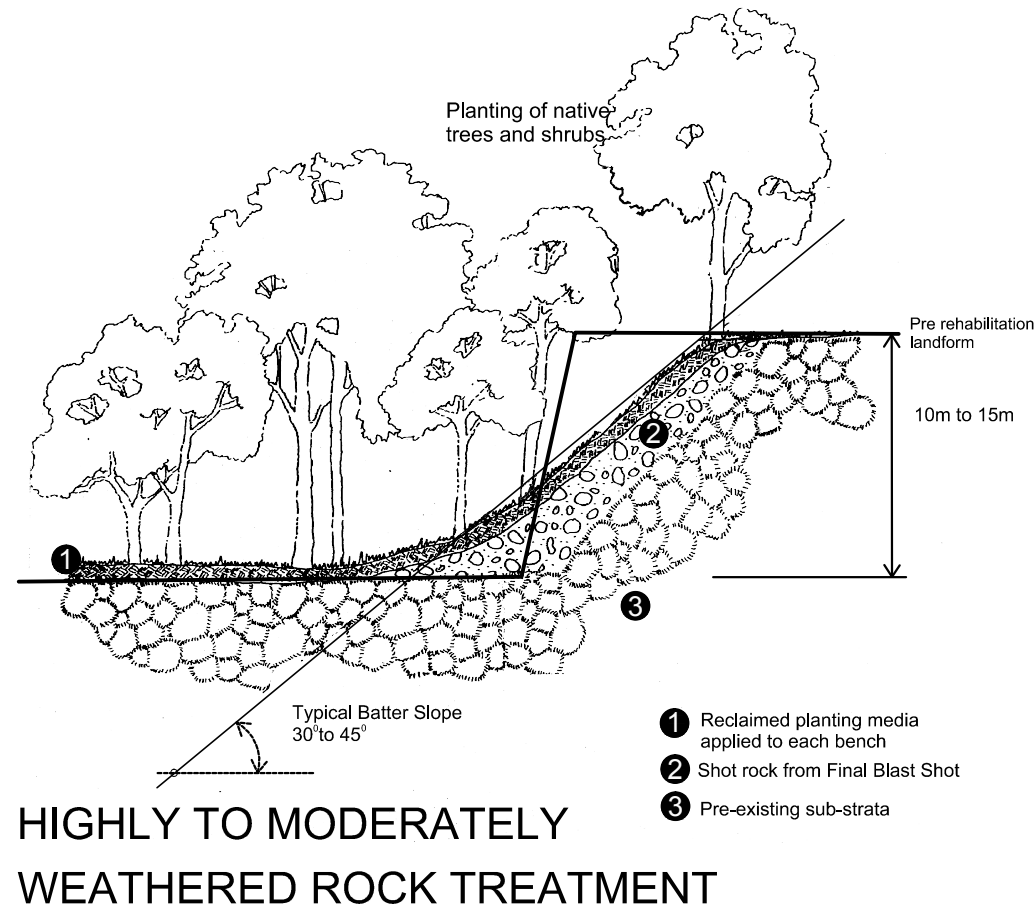
Landscaping of the site is not considered, given the rural nature of the location. Visual amenity impacts to the public are likely to be minimal and there is significant visual screening from vegetation and topography from the Gregory Development Road and the Disney Homestead.

Rehabilitation is an essential component of quarry planning and development. A staged and progressive rehabilitation program has been included in the Quarry Development Plan see Figure 3-1 and Figure 3-4 to ensure the minimum disturbed area is open at any time.

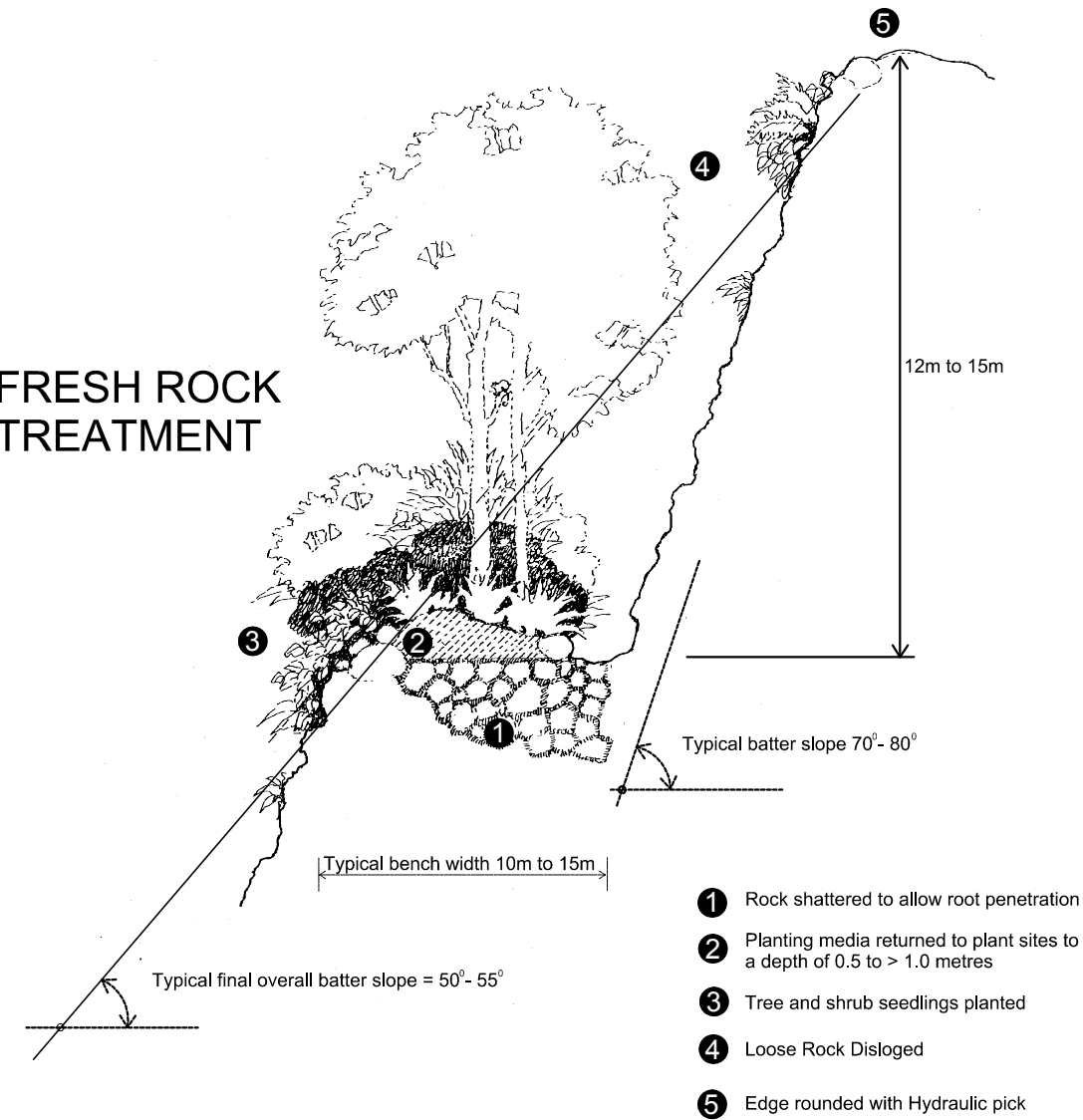
Any remaining open extraction areas will be rehabilitated and better treatments applied to all benches in accordance with Figure 3-6 and Figure 3-7. The following rehabilitation methods will be applied:

- All temporary infrastructure and facilities will be removed;
- Disturbed land will be reinstated to a stable form to enable land to reach pre-existing condition similar to the surrounding contour of the land;
- There will be no void left as land will be reprofiled to the gully contour;
- Permanent erosion and sediment controls will be designed to provide long-term stability to the disturbed area;
- Reinstatement of the topsoil over the contoured profile;
- Seed of native grasses or sterile crops during initial reinstatement works to assist in stabilising the area and reducing the potential for weed outbreaks;
- Allow natural regeneration of vegetation where viable, if not successful assisted regeneration using local species and sourced stock will be used;
- Fertilisers and soil supplements will be used only as necessary and with the agreement of landholders and authorities;
- Temporary access roads will be closed and rehabilitated to a condition compatible with the surrounding land use; and
- Weed control and ongoing monitoring will be implemented to ensure successful regeneration.

Revegetation will be carried out in consultation with the leaseholder and with the relevant government department or agency to ensure the measures proposed are acceptable and have a high likelihood of success.



FRESH ROCK TREATMENT



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CREATED: 25 June 2013

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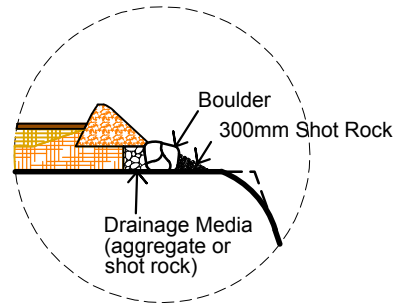
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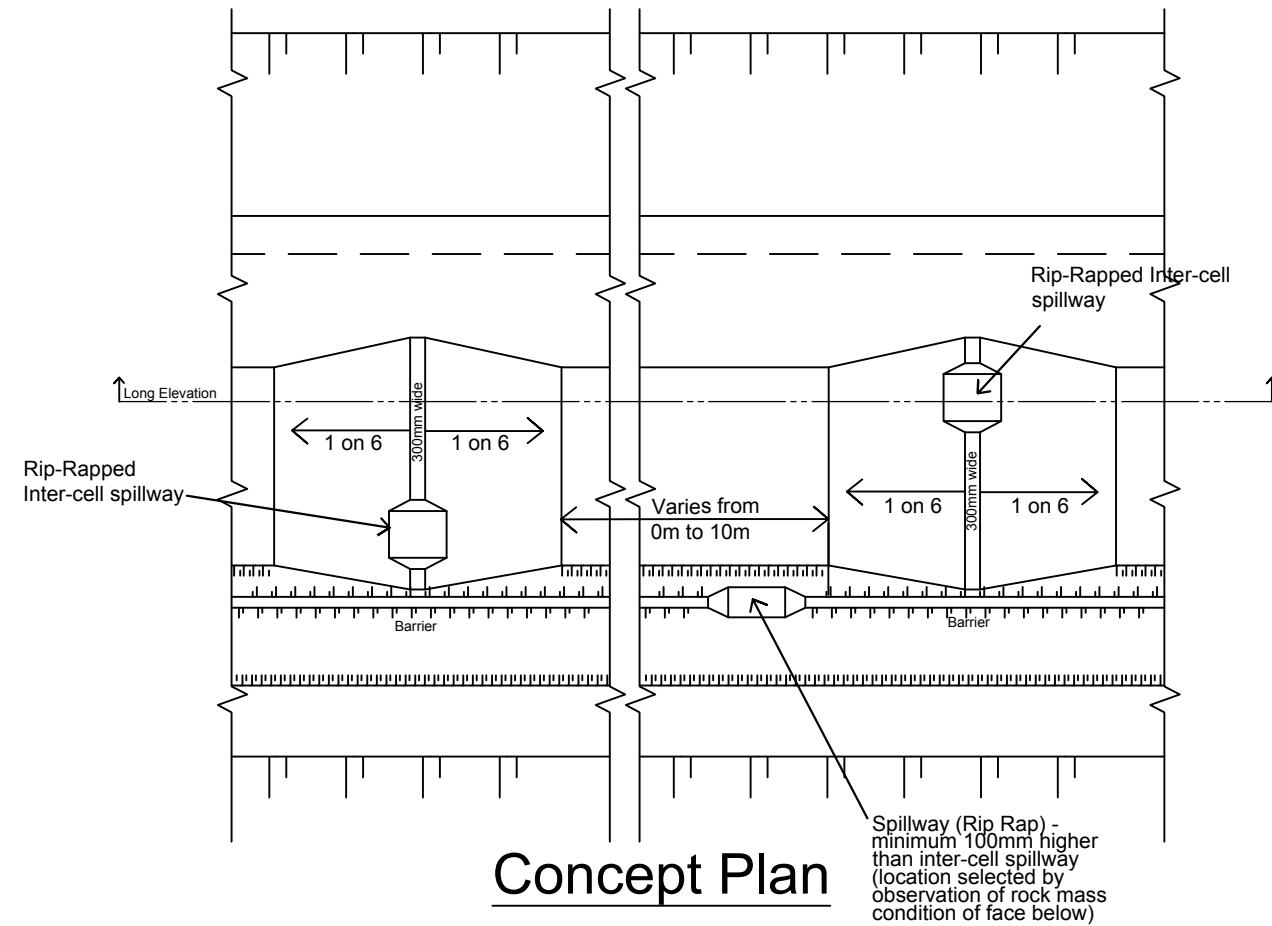
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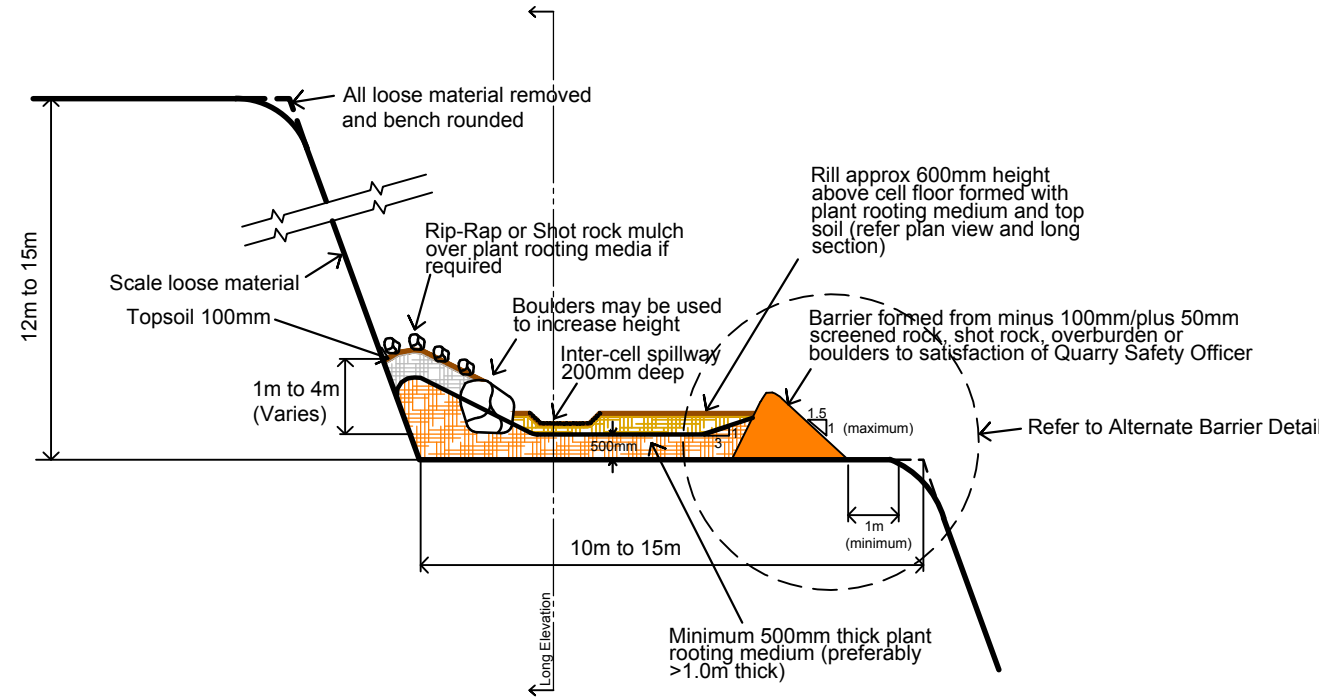
PROJECT:	Borrow 7	TITLE:	Figure 3-6 Batter treatments
CLIENT:	Wagner Quarries Pty Ltd	GROUNDWORK plus	DRAWING NUMBER: 1603.099
PH: +61 7 3871 0411	DATE: 25 June 2013	DRAWN:	REVISION:
WWW.GROUNDWORK.COM.AU	PRINTED: 25 June 2013	CHECKED:	DATE: 25 June 2013



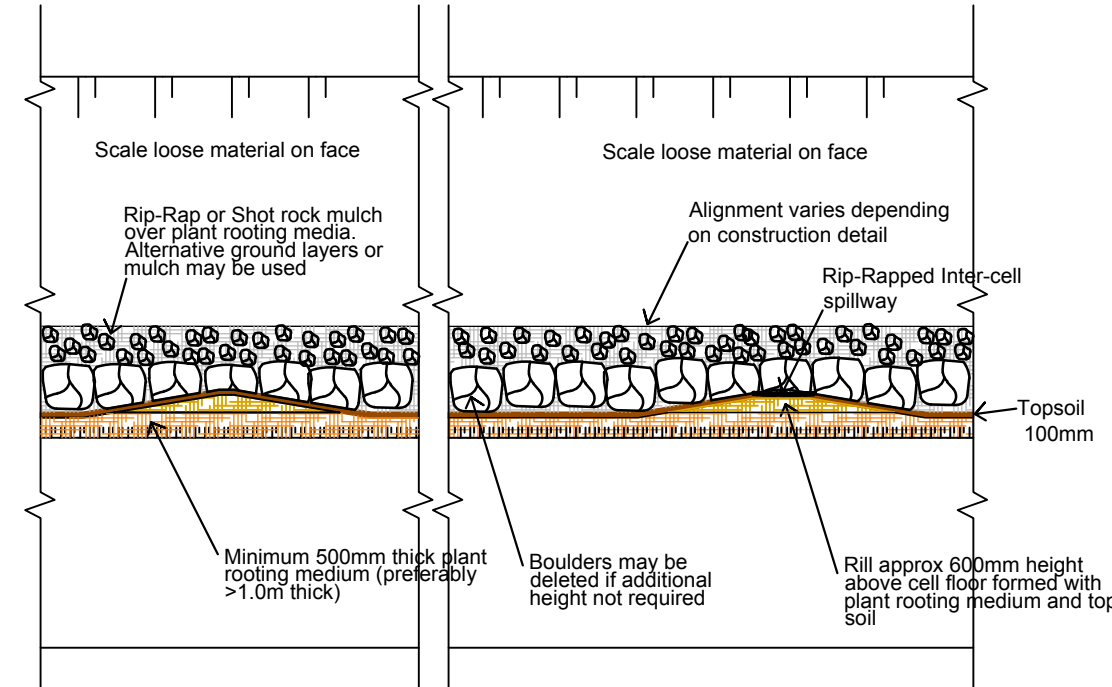
Alternate Barrier Detail



Concept Plan



Concept Cross Elevation



Concept Long Elevation

FILE NAME: F:\Jobs\1603.100\1603.100 - Schematic Bench Rehab.dwg
JOB SHEET #
CREATED: 25 June 2013

REV	DESCRIPTION	DATE	BY

Data Sources:
Photography:
Topography:
Cadastral:
Ecosystem:
Other:

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Legend:

PROJECT: Borrow 7	TITLE: Figure 3-7 Schematic of quarry bench rehabilitation
CLIENT: Wagner Quarries Pty Ltd	GROUNDWORK plus PH: +61 7 3871 0411 WWW.GROUNDWORK.COM.AU SCALE: 1:150 When Printed On A3 DATE: 25 June 2013 PRINTED: 25 June 2013 DRAWN: CHECKED: DRAWING NUMBER: 1603.100 REVISION: DATUM: HORIZONTAL / VERTICAL / ZONE / /

Section 4 Environment and Management

4.1 Terrestrial Ecology

The Borrow 7 site occurs in an agricultural area primarily used for grazing. As a result of historic and current grazing activities, the extent, connectivity and ecological integrity of vegetation communities and the fauna habitat they provide, have been substantially altered. The Borrow 7 area comprises sparse regrowth vegetation, with no major watercourses or drainage lines bisecting the proposed quarry area boundary.

4.1.1 Vegetation Communities and Fauna Habitats

The proposed site is within the Brigalow Belt North bioregion a region of high diversity of regional ecosystems (RE) (Sattler and Williams 1999). Biodiversity loss is widespread and affects most areas of the region to varying degrees (Dight, 2009).

Much of the Borrow 7 site is currently mapped by EHP as containing Brigalow associated woodland but very little extant woody vegetation now remains on the site. Scattered eucalypts occur on the rocky higher areas (Plate 4-1). Scattered Brigalow and other *Acacia* species occur over a dense, grassy ground layer (mainly the introduced Buffel Grass (*Cenchrus ciliaris*)) occur in the low-lying areas, largely concentrated around drainage lines. The majority of observed trees were scattered along the outside edge of the proposed quarry footprint as the base of the hill.

In general, the site provides little value for conservation significant fauna. Two REs are mapped over the majority of the proposed quarry. The descriptions of these REs are provided below in Table 4-1 and illustrated in Figure 4-1.

Table 4-1 Mapped REs within and surrounding the proposed indicative Borrow 7 site

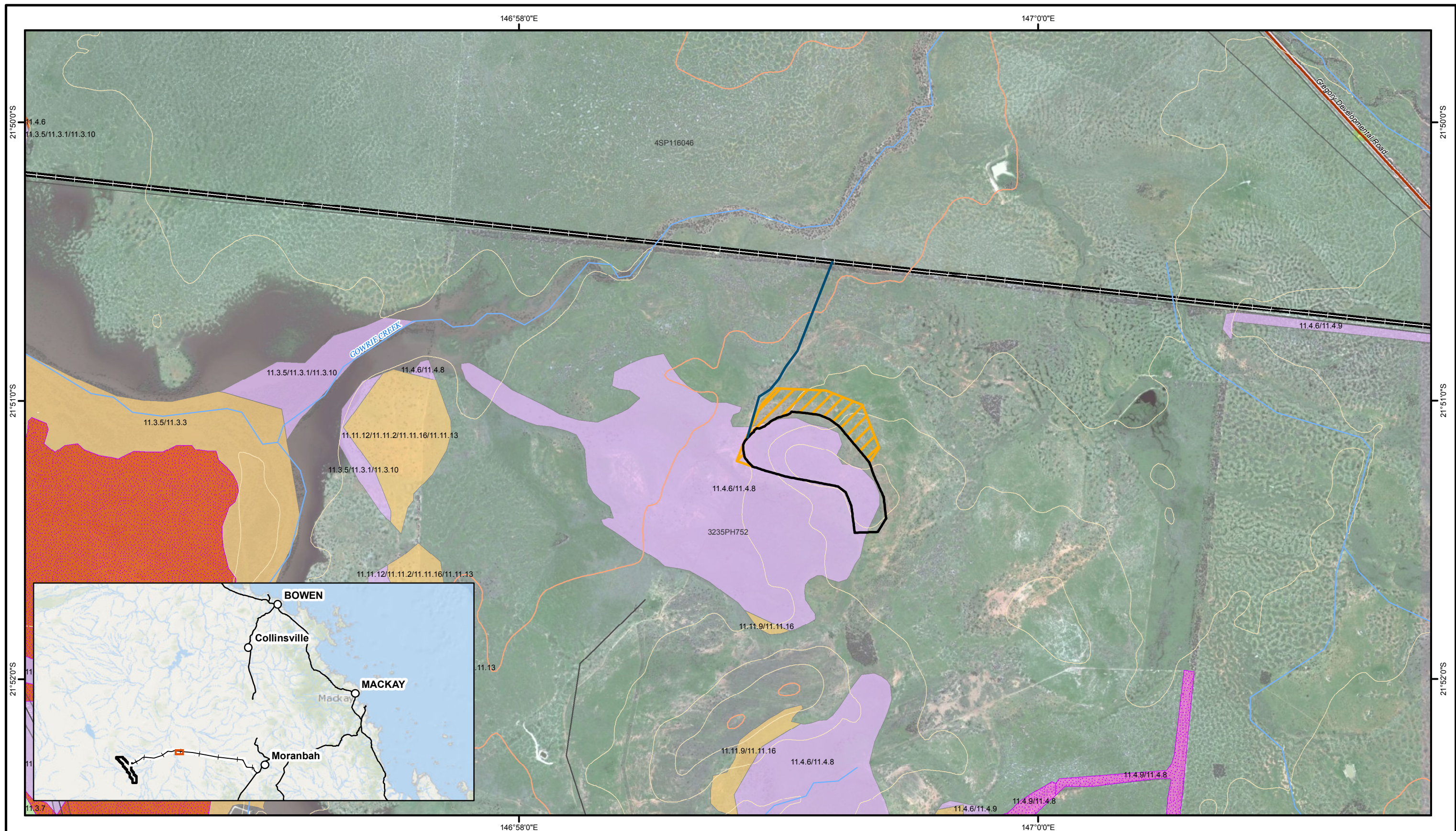
RE	Vegetation Management Act 1999 class	Biodiversity status	Short description
REs within the site			
11.4.6	Of concern	Endangered	<i>Acacia cambagei</i> woodland on Cainozoic clay plains
11.4.8	Endangered	Endangered	<i>Eucalyptus cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>A. Argyrodermon</i> on Cainozoic clay plains.
REs within close proximity to the site			
11.3.1	Endangered	Endangered	Open-forest dominated by <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> with scattered emergent eucalypts. Associated with Cainozoic alluvial plains.
11.3.5	Least concern	Of concern	<i>Acacia cambagei</i> +/- <i>Acacia harpophylla</i> low woodland or open-forest on Cainozoic alluvial plains.
11.3.10	Least concern	No concern at present	<i>Eucalyptus brownii</i> woodland on alluvial plains
11.11.2	Least concern	No concern at present	<i>Acacia shirleyi</i> or <i>A. Catenulate</i> low open-forest on hills and ranges.
11.11.9	Least concern	No concern at present	<i>Eucalyptus populnea</i> or <i>E. Brownii</i> woodland to open-woodland on undulating rises and lower slopes of hills.
11.11.12	Least concern	No concern at present	<i>Eucalyptus persistens</i> low woodland on deformed and metamorphosed sediments and interbedded volcanics.
11.11.13	Of concern	Of concern	<i>Acacia harpophylla</i> shrubby open-forest on moderately to strongly deformed and metamorphosed sediments and interbedded volcanic soils.
11.11.16	Of concern	Endangered	<i>Dicanthium sericeum</i> grassland with scattered eucalypts or low open-woodland on rises.

The proposed quarry footprint is approximately 36.17 ha, encompassing approximately 29.44 ha of area currently mapped as Endangered Remnant vegetation and 6.73 ha of area mapped as non-remnant vegetation. Four vegetation transects to determine canopy structure were completed throughout the proposed quarry footprint. Each transect revealed that canopy cover was less than that required for the vegetation to be categorised as remnant.

In accordance with the site survey, a Property Map of Assessable Vegetation (PMAV) has been submitted with the SEIS to amend the current vegetation mapping. Under these changes, the Endangered polygon that covers the site will be amended to no regional ecosystem status. Therefore, the quarry development will not impact Least Concern or Endangered REs. The full PMAV is provided in **Appendix B** and vegetation clearing report is provided within **Appendix E**.



Plate 4-1: Borrow 7 – typical sparse regrowth vegetation on the main ridge



Adani Quarry Permits and Approvals
Figure 4-1 Ecological values within and surrounding the site

Legend

- Carmichael Mine - ML 70441
- Threatened Ecological Community (EPBC)
- Stockpile Processing Area
- Borrow 7 Extraction Area
- Property Boundary

- Quarry Access Road
- Proposed Adani Rail Corridor
- Minor Road
- Major Road
- Minor watercourse

Regional Ecosystems v6.1

- Endangered Dominant
- Endangered Subdominant
- Of Concern Dominant
- Of Concern Subdominant
- Not of Concern

Job: B12849_041-R1_Borrow7_Ecol
Date: 2/05/2013

0 500 1,000
Metres

DISCLAIMER
CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.
Data source:
Adani, 2012;
DERM, 2010;
Base Layer by Bingmaps, 2011.

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4.1.1.1 Flora Species

The EPBC Protected Matters search results indicated that there is a potential for a Threatened Ecological Community (TEC) listed as Endangered (under the EPBC Act) to occur within the area: Brigalow (*Acacia harpophylla* dominant and co-dominant). Field observations indicated there is no Brigalow on the site. Additionally, the Protected Matters search results indicated *Acacia ramiflora* (listed as Vulnerable) is likely to occur within the area. This species occurs in woodland on sandstone hills (DSEWPac 2013). Sandstone does not occur on the site and there is no suitable habitat for this species.

The Queensland Government EHP Wildlife Online search (**Appendix F**) lists 159 least concern plant species as potentially occurring at the site. All of these species are listed as least concern under the *Nature Conservation Act 1992* (NC Act), except for *Acacia ramiflora* (Brigalow). The field survey confirmed the presence of the following listed species in low numbers: *Acacia cambagei* (Stinking wattle), *Acacia excels* (Ironwood), *Acacia harpophylla* (Brigalow), *Apophyllum anomalum* (Warrior Bush), *Archidendropsis basaltica* (Dead Finish), *Aristida latifolia* (Feathertop Wire Grass), *Atalaya hemiglauc* (Whitewood), *Capparis lasiantha* (Wait-a-While), *Carissa ovate* (Currant Bush), *Corymbia clarksoniana* (Clarkson's Bloodwood), *Corymbia dallachiana* (Ghost Gum), *Eremophila mitchellii* (False Sandalwood), *Eucalyptus brownie* (Reid River Box), *Grevillea striata* (Beefwood), *Heteropogon contortus* (Black Spear Grass), *Lysiphyllum carronii* (Red Bauhinia), *Owenia acidula* (Emu Apple) and *Themeda triandra* (Kangaroo Grass).

4.1.1.2 Weed Species

According to the EPBC Protected Matters search tool, the following four weeds of national significance have the potential to occur in the Project area:

- Rubber Vine (*Cryptostegia grandiflora*);
- Olive Hymenachne (*Hymenachne amplexicaulis*);
- Parkinsonia (*Parkinsonia aculeata*); and
- Parthenium (*Parthenium hysterophorus*).

All four of these species are also listed as Class 2 pests under the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act). A total of five introduced weed species were identified within the Borrow 7 survey area including Harrisia Cactus (*Eriocereus martinii*) (Table 4-2) (listed as a Class 2 pest under the LP Act). The occurrence of this weed species is consistent with the distribution shown in the latest Biosecurity Queensland Annual Pest Distribution Survey data. Harrisia Cactus is reported as being common and widespread in the area.

Table 4-2 Weed species identified within Borrow 7 survey area

Species Name	Common Name	LPA Class	WoNS
<i>Eriocereus martinii</i>	Harrisia Cactus	2	Declared
<i>Melinis repens</i>	Red Natal Grass	-	-
<i>Pennisetum ciliare</i>	Buffel Grass	-	-
<i>Salsola kali</i>	Soft Roly Poly	-	-
<i>Sida cordifolia</i>	Flannel Weed	-	-

4.1.1.3 Fauna Species

The desktop assessment of database records indicated the previous occurrence in the wider area of 13 fauna species listed as Endangered, Vulnerable or Near Threatened (EVNT) under the NC Act and EPBC Act. It also recorded eight species listed as Migratory under the EPBC Act. The EPBC Protected Matters database search tool predicted the presence of a further three species listed as Endangered or Vulnerable (EPBC Act) and three species listed as Migratory potentially occurring at the site. The results from the EPBC Protected Matters search results are provided in Table 4-3, with their respective field observations. A full list of predicted conservation significant fauna species and their potential to occur on the site are provided in **Appendix G**.

Table 4-3 Protected Matters Search Results for with respective field observations

Species	EPBC Status	Preferred Habitat	Field observation
Birds			
<i>Erythrorhynchus radiatus</i> (Red Goshawk)	Vulnerable	Prefers areas close to the coast featuring extensive open forest and woodland with a mosaic of vegetation types. Nests in tall emergent trees close to water.	Unlikely to occur. Landscape heavily cleared and unsuitable
<i>Geophaps scripta scripta</i> (Squatter Pigeon)	Vulnerable	Occurs in dry woodland. Generally on sandy soils close to water.	Unlikely. Observed on two occasions in general area. Habitat unsuitable in quarry area.
<i>Neochmia ruficauda ruficauda</i> (Star Finch – southern/eastern)	Endangered	Occurs in grassy flats/woodlands near water.	Unlikely to occur. Habitat unsuitable. Out of species present range
<i>Peophila cincta cincta</i> (Black-throated Finch - southern)	Endangered	Occurs in grassy open woodlands near water. Prefers areas of intact woodlands.	Unlikely to occur. No suitable habitat.
<i>Rostratula australis</i> (Australian Painted Snipe)	Vulnerable, Migratory	Prefers temporary shallow wetlands. Nests in freshly flooded wetlands with low vegetation.	Unlikely to occur. No suitable habitat.
Mammal			
<i>Phascolarctos cinereus</i> (Koala)	Vulnerable	Occurs in a variety of eucalypt woodlands and open forest.	Unlikely to occur. Habitat cleared.
Reptiles			
<i>Denisonia maculata</i> (Ornamental Snake)	Vulnerable	Prefers seasonally inundated areas on deep cracking clay soils and adjacent habitat. Feeds exclusively on frogs. Rare to absent where Cane Toads are abundant.	Unlikely to occur on quarry site. Substrate unsuitable (rocky). Species detected nearby in suitable habitat.
<i>Egernia rugosa</i> (Yakka Skink)	Vulnerable	Occurs in a variety of dry sclerophyll woodlands largely in the Brigalow Belt. Constructs burrows in a variety of soil types.	Unlikely to occur. Habitat unsuitable
<i>Furina dunmalli</i> (Dunmall's Snake)	Vulnerable	Rarely encountered. Forests to woodlands, associated with Brigalow scrub.	Unlikely to occur. No database records and on edge of known distribution
Migratory Marine Birds			
<i>Apus pacificus</i> (Fork-tailed Swift)	Migratory	Aerial foraging species that occur over a variety of landscapes including highly modified environments.	Potential to occur in area
<i>Ardea alba</i> (Great Egret)	Migratory	Great Egret occurs on a variety of wetlands and intertidal habitats.	Unlikely to occur. Observed in general area.
<i>Ardea ibis</i> (Cattle Egret)	Migratory	Cattle Egret prefers damp grassy areas for feeding, particularly pasture.	Potential to occur in area however quarry site is unsuitable

Species	EPBC Status	Preferred Habitat	Field observation
<i>Gallinago hardwickii</i> (Latham's Snipe)	Migratory	Occurs in generally low numbers in a variety of permanent or ephemeral wetlands across eastern Australia.	Potential to occur in area however quarry site is unsuitable
Migratory Terrestrial Species			
<i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)	Migratory	Occurs in coastal areas including beaches, estuaries and lagoons, but may range well inland on larger rivers. Predominantly feeds on fish.	Unlikely to occur. Habitat unsuitable
<i>Merops ornatus</i> (Rainbow Bee-eater)	Migratory	Widespread species that may occur in a variety of habitats. Nests in burrows in sandy banks.	Observed in general area however quarry site is generally unsuitable. Little vegetation.

The Queensland Government EHP Wildlife Online search (**Appendix F**) lists 113 Least Concern, 2 Near Threatened and 1 Vulnerable (Squatter Pigeon) fauna species as potentially occurring at the site. An overview of conservation significant fauna observed in the area is provided in Section 4.1.1.4 below.

4.1.1.4 Conservation Significant Fauna Observed

Three terrestrial fauna species listed as EVNT under the EPBC Act and/or NC Act were recorded within the quarry areas or surrounds during the site inspections (29 January 2013 – 2 February 2013):

- Cotton Pygmy-goose (*Nettapus coromandelianus*) (NC Act – Near Threatened; EPBC – Migratory) – minimum of 30 individuals observed on large farm dam approximately 6.5 km roughly south-east of the proposed Borrow 7;
- Squatter Pigeon (EPBC Act and NC Act – Vulnerable) – two individuals observed approximately 8.6 km south of the proposed Borrow 7; and
- Ornamental Snake (EPBC Act – Vulnerable; NC Act – Vulnerable) – recorded along an ephemeral drainage line approximately 2.6 km south of the proposed Borrow 7.

In addition, potential signs of Koala (EPBC Act – Vulnerable (QLD, NSW and ACT)) in the form of tree scratches were recorded in the wider search area.

Conservation significant species locations are depicted in Figure 4-2. An additional four species listed as Migratory under the EPBC Act were also sighted in the surrounding areas:

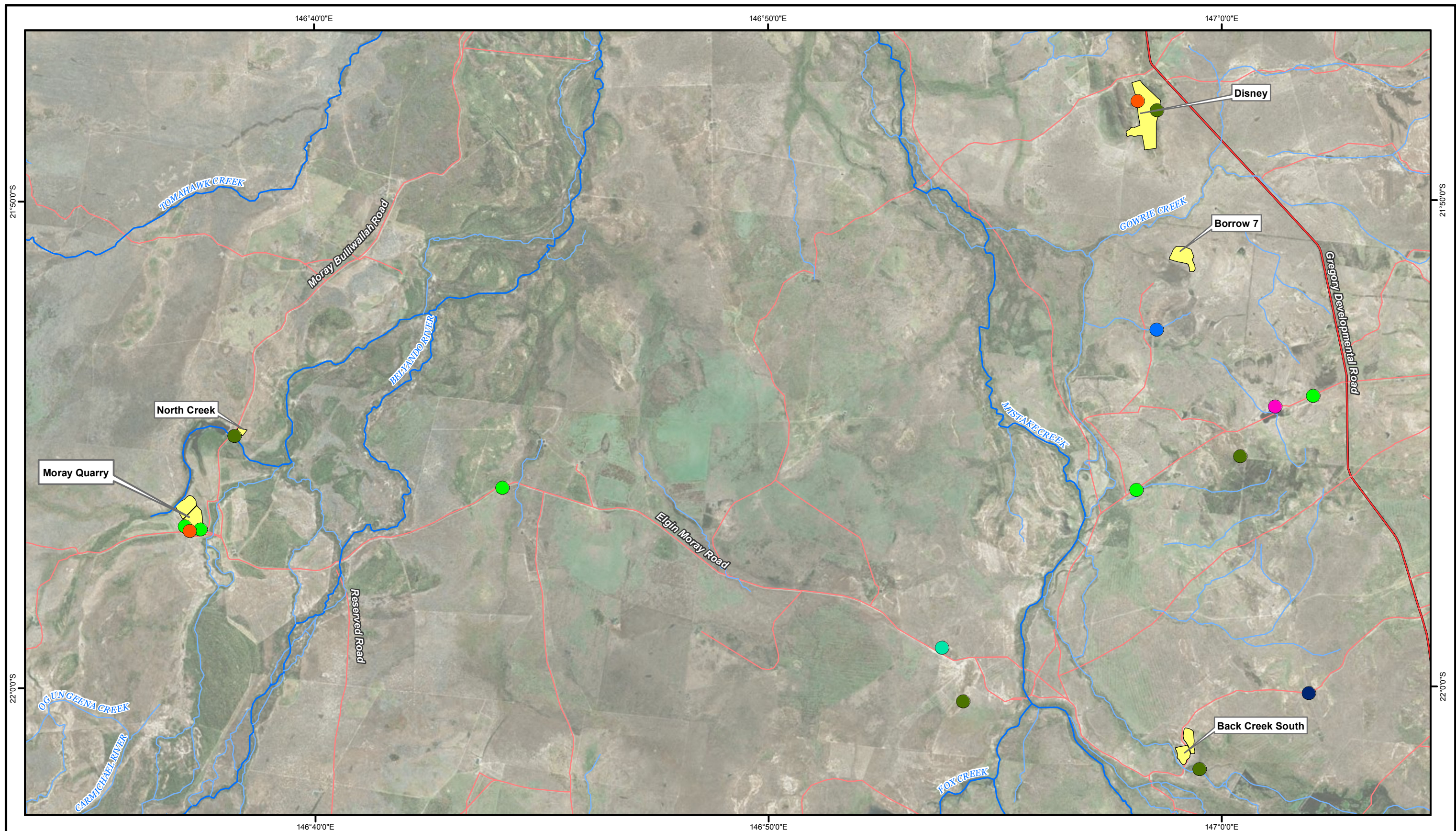
- White-throated Needletail (*Hirundapus caudacutus*);
- Eastern Great Egret;
- Glossy Ibis (*Plegadis falcinellus*); and
- Rainbow Bee-eater.

None of the species listed above were recorded at the site of the proposed Borrow 7. All were recorded in the surrounding area.

4.1.1.5 Protected Areas

Four protected areas are located in the vicinity of the proposed Borrow 7: Wilandspey Conservation Park; Nairana National Park; Mazeppa National Park; and Epping Forest National Park (Scientific). Nairana National Park lies 12 km north of the quarry area. Wilandspey Conservation Park is located approximately 42 km west of the site. Both parks protect extensive tracts of Brigalow woodlands.

Mazeppa National Park is located 50 km south-east of the site and is adjacent to the east side of the Gregory Development Road. Epping Forest National Park is located approximately 58 km south-west of the site and is accessed from Elgin Road. Epping Forest National Park is well known as the location of the last remaining wild population of the Northern Hairy-nosed Wombat (*Lasiorhinus krefftii*). All of the protected areas are a considerable distance from the proposed quarry site, will not need to be traversed for site access and will not be impacted by the developments activities.



Adani Quarry Permits and Approvals
Figure 4-2 Conservation significant species locations

- Legend**
- | | | |
|-----------------------------|--------------------------------------|------------------------------|
| — Minor Road | ● Squatter Pigeon | ● Rainbow Bee-eater |
| — Major Road | ● Potential Koala Scratches | ● Eastern Great Egret |
| — Major watercourse | ● Ornamental Snake | ● White-throated Needle-tail |
| — Minor watercourse | ● Cotton Pygmy-Goose and Glossy Ibis | |
| ■ Quarry Investigation Area | | |

0 1,250 2,500 5,000
Metres

DISCLAIMER
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 Data source:
 Survey by CDM Smith, 2013; Adani, 2013; DERM, 2010;
 Base Layer by Bingmaps, 2011.

4.1.2 Potential Impacts to Terrestrial Ecology

The development of Borrow 7 is likely to have the following direct impacts on the terrestrial ecology:

- Clearing of 36.17 ha of highly disturbed non-remnant vegetation (as per PMAV changes);
- Temporary removal of existing habitat within the quarry footprint until site is rehabilitated. Most animals will be able to move away from the area of primary impact into adjacent areas, this will be further encouraged through the progressive clearing of the cells just prior to extraction;
- Potential animal strikes from vehicle movements both from clearing operations and from material haulage; and
- Vegetation clearing would potentially disrupt avifauna breeding if undertaken during spring, a time when birds nesting and raising young (Biota 2004).

A number of potential indirect impacts will also be present due to the operation of the quarry itself through increased noise, dust emissions and traffic increases, including:

- Disturbance to fauna, distress from operational noise;
- Increase in dust residue on plant foliage decreasing the sunlight absorption and photosynthesis process; and
- Potential to increase weed distribution through spread of weed within the fill, or on vehicles carting the quarry material.

4.1.3 Management of Terrestrial Ecology

The main objectives in regards to flora and fauna are:

- Avoid (where possible) and minimise disturbance and adverse impacts on native flora and fauna;
- Ensuring no injury or death to native fauna;
- Ensuring no vegetation is disturbed outside of areas designated for clearing within the quarry area; and
- Avoid any spread or increase in weed distribution through quarry operations.

4.1.3.1 Flora and Fauna

The clearing footprint has been strategically designed to minimise the need for clearing of remnant vegetation and to avoid high-value habitat including Brigalow communities within the area. The following management measures will be implemented to minimise impacts from the development:

- Pre-clearing surveys will be completed and appropriate management measures have been identified and implemented prior to clearing. Pre-clearing surveys will be undertaken by suitably qualified persons;
- During the pre-clearance survey, large and small tree hollows that may provide daytime shelter for fauna will be identified and marked. These hollows will then be saved (recovered) and used for habitat in non-disturbed areas in the Project surrounds. Any habitat suitable for Koalas will also be surveyed prior to any construction activity to assess whether the species occurs;
- A qualified fauna spotter/catcher will be present prior to and during all clearing activities to actively search all habitat for wildlife and to ensure that clearing methods are appropriate. All fauna will be identified, captured and released to suitable habitat locations. These locations will be established prior to clearing activities in a manner suitable to the needs of species or species groups, in accordance with relevant permits;
- Clearing of vegetation will be undertaken in a manner to allow more mobile, non-flying fauna to move away, unhindered, from the disturbance area;
- Avoid clearing in spring or nesting seasons where possible;
- Use of fencing to prevent fauna from entering working quarry face and operational areas and to prevent vehicles from incursions into bushland. Fencing will be inspected regularly to ensure no fauna species are trapped;
- Ensure rehabilitation of completed areas is undertaken progressively and upon completion of the area;
- Minimise vehicle speed within site to 40 km and along access tracks to 80 km to reduce threat of vehicle strike;
- In the event any native fauna are injured as a result of quarry activities, they will be transported to a native animal hospital/refuge facility. Records of all captures and deaths will be kept by the site's Environmental Officer and notification procedures and field audits will be established. The cause of any injuries or deaths will be investigated and new management measures will be implemented to minimise the potential of it occurring again; and
- Targeted training and awareness in relation to terrestrial ecology matters and environmental responsibilities will be provided to all staff and contractors during site inductions. Ongoing training including the observance of (and compliance with) speed limits and reporting of on-site fauna observations and fauna mortality will be implemented.

The Koala-sensitive Design Guideline: ‘A guide to koala-sensitive design measures for planning and development activities’ provides guidance on minimising impacts to koala’s and potential habitats (Department of Environment and Heritage Protection, 2012). The following considerations from this guideline will be adopted to ensure risk of injury or habitat damage is minimised the quarry development:

- Locate the design of the development to avoid vegetation species favoured by koala’s;
- Construction phases that do not increase the risk of death or injury to koalas;
- Clearing of native vegetation, will be undertaken as sequential clearing and rehabilitation of the site will include koala favoured species; and
- Clearing of koala habitat trees, undertaken in the presence of a fauna spotter.

Ornamental Snake has been identified near the site (2.6 km to the south). The species is listed as Vulnerable under both the NC Act and EPBC Act. Targeted training and awareness for terrestrial ecology matters and responsibilities will be provided to all staff and contractors during site inductions. Ongoing training including the observance of (and compliance with) speed limits and reporting of on-site fauna observations and fauna mortality will be implemented.

4.1.3.2 Pest and Weeds

Pest (including feral animals) and weed management will include, as a minimum:

- Measures for a pre-construction weed audit to be undertaken;
- If noxious weeds are identified, weed control will be undertaken in the surrounding area to minimise any contamination of fill material to be transported off site;
- Routine inspections that will include observations for declared plants, listed weeds, feral cat and pig, rabbit, red fox and other identified pests within the construction area;
- A control/eradication plan for pests that may potentially occur on the quarry site;
- Identification of treatment methods and techniques, chemicals, equipment and sources of assistance for pest and weed management;
- Weed hygiene declaration forms to accompany plant and machinery being brought to site;
- Vehicle wash-down protocols and processes to ensure vehicles and their loads as per the Weed Hygiene Declaration (Part 2);
- Methods for monitoring and control of weed populations within the site;
- Control measures and processes of how to maintain weed infestations; and
- Processes to ensure weed free certifications can be provided with the fill material as per the Weed Hygiene Declaration (Part 1).

Training will be provided to all construction personnel regarding pest plant, weed and feral animal awareness. A car park for housing vehicles entering the site will be provided and regularly checked for any weed and pest animal infestations. Treatment of weeds will be undertaken in accordance with Biosecurity Queensland guidelines and fact sheets for each species as well as other appropriate sources of weed management.

4.2 Aquatic Ecology, Surface Water and Hydrology

4.2.1 Aquatic Ecology

As previously mentioned, there are no major water bodies within the site. A minor low-lying drainage area is located south of the proposed quarry area. This area is flat and will retain water after heavy rainfall. No gilgais were present. Overland flow from this area towards Gowrie and Mistake Creeks would only be likely in flood conditions after very heavy rainfall. This area is likely to support amphibians however, the quarry site itself does not contain any drainage lines and will not support aquatic flora and fauna.

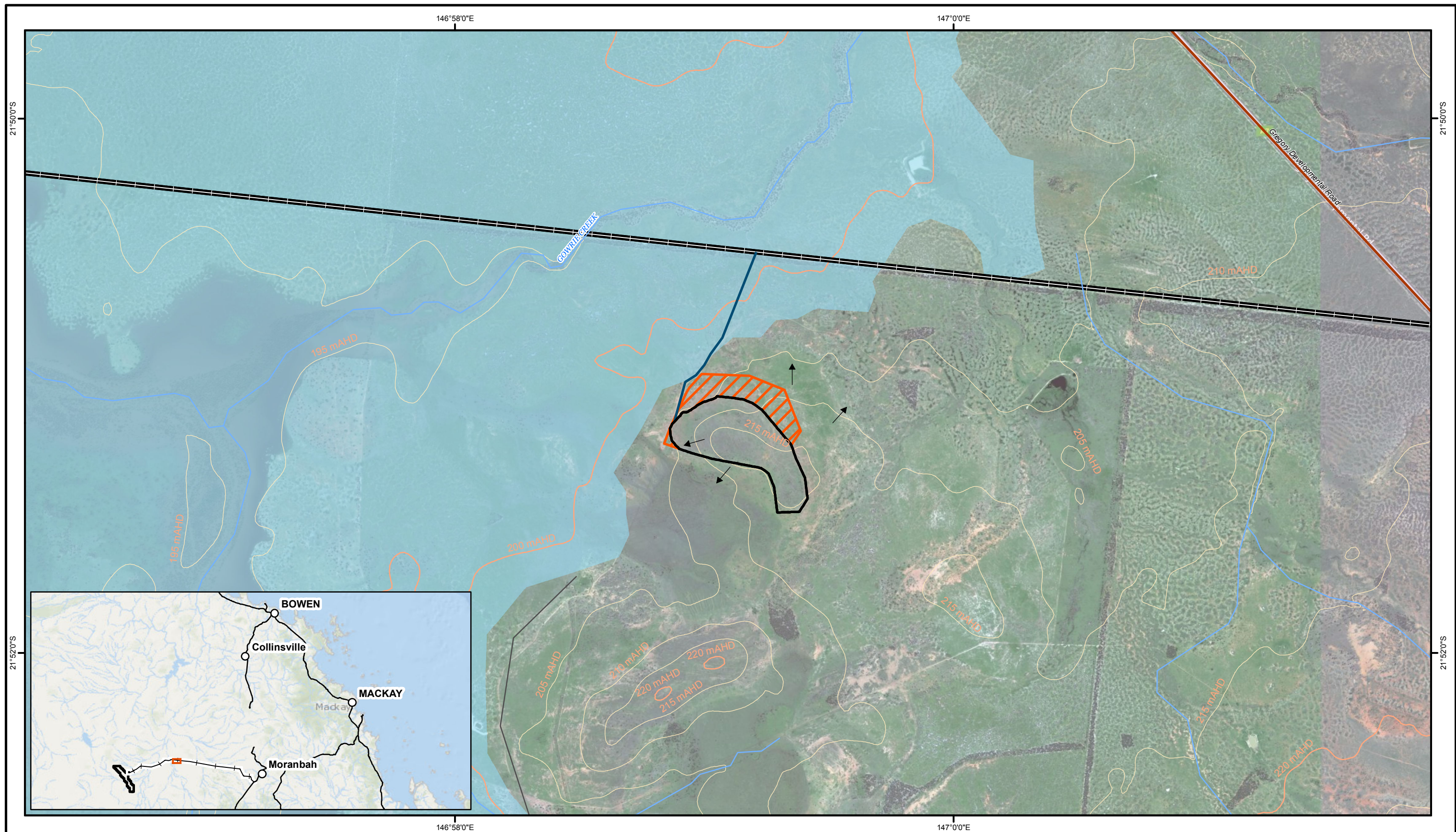
The EPBC Protected Matters Search results indicated the potential presence of four migratory wetland species. No wetland habitat was observed on the site and it is unlikely the site provides any value for these species. The EHP Wildlife Online Search (**Appendix F**) has indicated the potential presence of a range of aquatic dependant flora in the area. Previous studies undertaken for the Carmichael Coal Mine and Rail Project have identified 26 aquatic dependant flora. The majority of these are listed as least concern under the NC Act and none are identified as conservation significant under the EPBC Act (GHD, November 2012). However, the site provides no habitat suitable to the aquatic species, and the closest likely habitat is an anabranch of Mistake Creek, approximately 3.1 km to the west (Figure 4-3).

4.2.2 Surface Water and Hydrology

4.2.2.1 Existing Environment

The site is located within the Burdekin River Basin, which forms part of Australia's North East Coast Drainage Division (NLWRA, 2002). The Burdekin River is one of Australia's largest and carries a massive sediment load, and is on average the biggest single source of sediment and fresh water to the Great Barrier Reef lagoon (NRM, 2002). Specifically, the site is located within the Suttor River Sub-basin area, which drains into arid inland areas in the south and central west via the smaller Cape River (Board, 2005). The nearest mapped wetland areas to the site are two lacustrine wetlands (i.e. farm dams) located 3.1 km and 3.8 km to the south and wetlands along Mistake Creek 6.7 km to the west. Lacustrine wetlands are defined as fresh water systems that are found in a topographic depression or dammed river, have little vegetation cover (less than 30%) and are larger than 8 hectares.

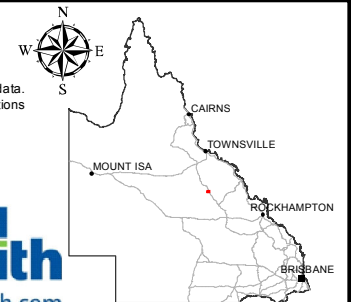
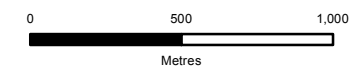
On-site studies identified the presence of a minor drainage line running east-west (with pools) 2.1 km south of the proposed quarry area (see Plate 4-2). Little standing water was observed in the drainage area south of the quarry site despite 144.8 mm of rainfall being received in the Clermont region in the month prior to undertaking fieldwork (BOM, 2013).



Adani Quarry Permits and Approvals
Figure 4-3 Surface water and hydrology

Legend

- | | | |
|------------------------------------|--------------------------------|---|
| ○ Town | — Railway | → Indicative surface water drainage direction |
| — Proposed Access Track | — Proposed Adani Rail Corridor | |
| ⬢ Carmichael Mine - ML 70441 | ⬢ Borrow 7 Extraction Area | |
| ⬢ Stockpile Processing Area | — Minor Road | |
| ▨ Wetland | — Major Road | |
| ■ Flood Prone Area (1 in 100 year) | — Major watercourse | |
| | — Minor watercourse | |



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Data source:
Adani, 2012; DERM, 2010; Flood by QLD Reconstruction Authority, 2012, Elevation created from 1sec SRT DEM, Base Layer by Bingmaps, 2011.

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Plate 4-2: Drainage line observed 2.1 km south of the proposed Borrow 7 site

4.2.3 Potential Impacts

The quarry poses no potential impacts to aquatic ecology. The quarry has potential for some localised impacts to surface water and hydrology by altering the surface water runoff flows around the quarry workings and into storage dams for reuse on site. The diversion of surface water flows may cause some erosion and sediment movement and possible scouring during large rain events. This will be managed through the installation of erosion and sediment controls outlined in the conceptual erosion and sediment control plan in **Appendix H**.

4.2.4 Management of Aquatic Ecology, Surface Water and Hydrology

As mentioned in Section 4.2.2 above, no major watercourses currently exist within the proposed quarrying area. There is a minor drainage area directly south of the main ridge and outside of the proposed works. This drainage area contained little standing water despite the region receiving over 140 mm of rain during the month prior to field work. No gilgais were present and overland flow towards any creek lines is only likely in major flood events.

It is not anticipated that the quarry will have any major impacts on surface water or aquatic ecological values directly within the area.

In order to ensure the appropriate protection of downstream surface waters, the following measures will be implemented:

- Erosion and Sediment Control Plans (ESCPs) will be implemented for each construction activity, prior to the commencement of construction;
- Disturbance areas will be minimised to reduce the volume of disturbed sediment that may potentially effect downstream water bodies;
- Native vegetation clearance will only be undertaken in accordance with relevant permits and approval conditions; and
- Vegetation clearance will consider constraints such as slope and proximity to drainage lines.

Stormwater management will include as a minimum, measures to monitor weather forecasts from the Bureau of Meteorology (BoM) to plan for potential rainfall events that may hinder construction or operational activities, and management measures to be implemented in the event that a heavy rainfall event is predicted.

4.3 Landscape and Visual Amenity

The property is leasehold with access gained from Twin Hills Road which connect to the Gregory Development Road. A range of powerlines bisect Lot 3235 PH752, however these are not located close to the development and no electrical utility companies are referral agencies to the development application. The wider landscape consists mainly of remnant sedimentary formations, although granitic intrusions in the form of isolated ranges are also common surrounding the quarry area. Easily eroded cracking clays, with highly dispersive properties due to high sodium content, are common in low-lying areas of the catchment. Previous clearing of vegetation has caused loss of habitat and fragmentation of REs, whilst overgrazing and weed infestations have caused land degradation and reduced soil health in many areas (Roth CH, 2002).

The site consists of a low rise dominated by basalt amongst low-lying clay plains that have been largely cleared. Woody vegetation is very sparse and the area is currently subject to disturbance from cattle grazing. The approach track to the proposed Borrow 7 passes through several gates used for separating cattle grazing paddocks.

4.3.1 Bushfire Risk and Management

Bushfire risk mapping has been created for the Isaac region by the Rural Fire Service of Queensland. The most recent mapping (2008) indicates that Borrow 7 site occupies a mixture of 'Low' and 'Medium' category fire-risk areas. The majority of the site and surrounding area has been cleared in the past and is now largely exotic grassland (Buffel Grass) used for cattle grazing with scattered small regrowth trees. The proponent will develop a Fire Risk Management Plan in consultation with Isaac Regional Council and local landowners to minimise any risk of fire as a result of the quarry's activities.

4.3.2 Visual Amenity Potential Impacts

During the short term operation of the quarry there is likely to be visual impacts from earth moving and construction vehicles, haulage trucks. Given the short nature of these impacts being limited to the construction period they are not considered significant.

During the night operations there will be impacts from night lighting. With 24 hour operations visual impacts are predominately more noticeable at night and will be able to be seen from much greater distances. A glow may be seen from the Gregory Development Road however, this will be a temporary impact as the traffic passes this area. In addition, it is unlikely that the Disney or Old Twin Hills Homesteads will be impacted due to the topography shielding the operations and the distance from the quarry (approximately 6.7 km)

4.3.3 Management of Landscape and Visual Amenity

The proponent commits to ensuring that the placement of plant and equipment minimises its visibility from the Gregory Development Road and the sensitive receptors approximately 6.7 km to the north-west and 6.7 km to the south-west of the proposed quarry location.

Management measures the right to be in place to mitigate impacts, include:

- Retain appropriate screening and landscape buffers between Gregory Development Road, public vantage points and surrounding homesteads;
- Minimise clearing between the site and the Gregory Development Road;
- Undertake progress rehabilitation to minimise visual impacts of the site; and
- Consultation with potentially affected sensitive receptors.

4.3.3.1 Management of lighting impacts

Only essential lighting will be included in the development. Throughout the construction phase, night lighting will be limited to specific construction activities and safety. Lighting on site will be required for the operation of the quarry over the 24 hour period, lighting will be provided at the site office and amenities area as well as on the working area of the quarry. Main access routes will be identified and illuminated appropriately. Lighting design will comply with the best available technologies (i.e. Type 6 luminaires) and include light shrouding techniques (i.e. be well shielded, full cut-off and downward directed type fixtures). Luminaires will be mounted low in the vertical plane and use the lowest intensity for the task. Surfaces of structure and ground covering will be designed to minimise reflection. To ensure lighting management measures are complied with, periodic visual inspections, audits and corrective management of light sources will be undertaken.

4.4 Soils, Geology and Topography

4.4.1 Geology

Borrow 7 is located within Late Devonian – Early Carboniferous Drummond Basin, which predominantly comprises of a thick succession of sedimentary and volcano-lithic rocks. The geological profile of the basin is generally comprised of sedimentary and volcano-lithic sediments of the Drummond Group, divided into numerous formations that range in age from Late Devonian to Early Tertiary.

Present on the western part of the Drummond Basin are sedimentary formations of the overlying Bowen Basin. Overlying these formations are predominantly colluvial and alluvial Tertiary deposits, some of which feature deep weathering profiles resulting in the formation of duricrusts and silcrete deposits. The Tertiary deposits are overlain with predominantly unconsolidated alluvial deposits of Quaternary age. In sporadic locations throughout the Drummond Basin, granitoid intrusions, as well as basal rocks of the Anakie Metamorphic Group are present as outcrops. The presence of these older rocks indicates partial to complete erosion of the overlying strata. A detailed stratigraphy of the Drummond Basin is provided in Figure 4-4.

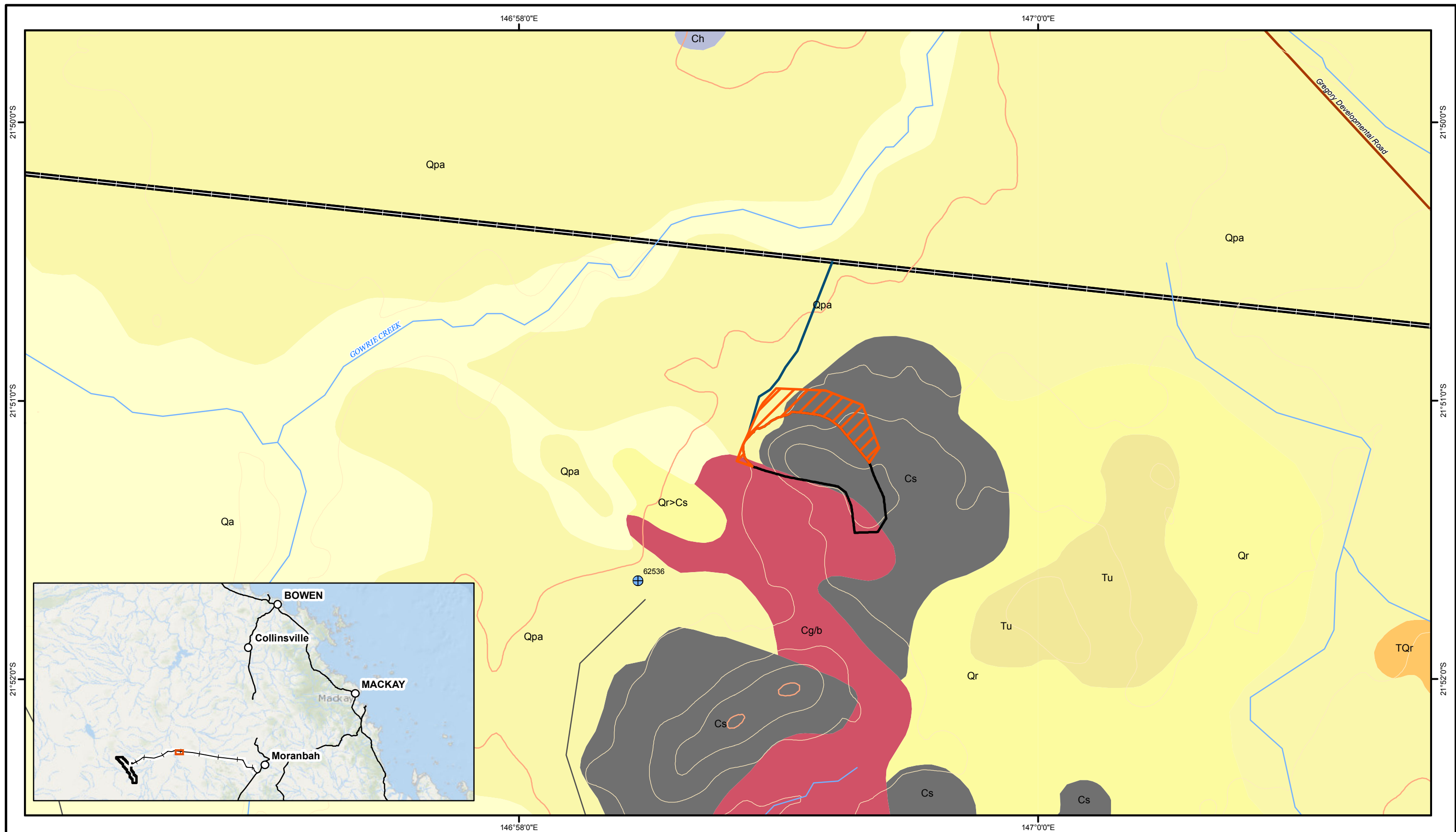
Structurally, the Drummond Basin comprises several anticline and synclines, as well as faults, most of which are responses to orogenic movements (Buchanan Geology Notes). The main folding episode in the Drummond Basin was at the end of the Lower Carboniferous age, as a result of the uplift of Anakie Inlier, which marks the basement of the basin. Other orogenic movements resulting in structural deformation include granitoid intrusions and acid volcanic extrusion (Buchanan Geology notes). In places little evidence of these structures remain, as they have been masked by Quaternary alluvial deposits. Key geology and structures regional to the Borrow 7 area is discussed below.



Plate 4-3: Indicative view of main rocky rise on Borrow 7

Figure 4-4 Detailed Stratigraphy (Olgers, 1970)

Age		Rock unit and map symbol	Thickness (feet)	Lithology	Palaeontology	Stratigraphic Relationships	Environment of deposition	
CAINOZOIC	QUATERNARY	(Qa)	0-50	Silt, sand, gravel, alluvium		Unconformable on all older rocks	Fluvial	
		(Qs)	Superficial	Sand, sandy soil, colluvium			Aeolian/fluvial	
		(Cz)	Superficial	Soil, sand, gravel			In situ weathering, aeolian and fluvial	
		(Czd)	Superficial	Silcrete, ferricrete (duricrust)		Best developed on Tertiary in NE and on Moolayember Form.	Weathering profile	
	TERTIARY	(T)	0-30	Poorly sorted argillaceous sandstone, commonly lateritized.		Unconformable on all other rocks	Mainly fluvial with piedmont deposits near the hills and ranges.	
MESOZOIC	JURASSIC TO LOWER CRETACEOUS	Ronlow Beds (J/Kr)	200-300	Sandstone, dominantly quartz sandstone. Minor mudstone and siltstone	Silicified wood, plant debris. Microspores and pollens	Disconformable on Moolayember Form. Elsewhere ?disconformable under Walumbilla Form. Probably equivalent of Hutton Sst-Hooray Sdst sequence elsewhere in Eromanga Basin.	Fluviatile deposition in rivers, on floodplains, and local lakes	
	MIDDLE TO UPPER TRIASSIC	Moolayember Formation (Rm)	1000 ±	Dominantly mudstone and siltstone, interbeds of lithic sandstone and quartz sandstone	Poorly preserved plants (White, 1965). Microspores.	Conformable on the Warang Sst. Boundary gradational	Freshwater basin.	
	LOWER TRIASSIC	Warang Sandstone (Rlw)	600	Kaolinitic quartz sandstone, minor lenticular ferruginous siltstone. Large scale trough cross-bedding	Unfossiliferous. Spores elsewhere	Disconformable on Rewan Form.; equivalent to Dunda Beds and Clematis Sst. in south. Unconformable on Betts Creek Beds and Unit C-P	Fluvial and aeolian	
		Dunda Beds (Rld)	250 ±	Lithic to quartz sandstone with subordinate thick intervals of mudstone and siltstone	Plant fossils in Galilee Sheet area (White, 1965)	Probably disconformable on Rewan Form.	Fluvial	
		Rewan Formation (Rlr)	Subsurface only. 1058 in Exoil Lake Galilee No. 1 Well 12m south of Sheet area	Subsurface only. Lithic sandstone, mudstone, shale, siltstone, minor quartz sandstone in neighbouring areas.	Spores and plant remains elsewhere.	Possibly conformable on Betts Creek Beds subsurface.	Fluvial and possibly deltaic	
PALAEOZOIC	UPPER PERMIAN	Betts Creek Beds (Pub)	200+	Interbedded feldspathic lithic sandstone; commonly carbonaceous. Coal recorded in subsurface. Minor conglomerate lenses. Sandstone thin-to thick-bedded, commonly trough cross-stratified.	Mainly poorly preserved plant fragments (White, 1965).	Unconformable on C-P	Mainly fluvial, some swamp deposits	
	UPPER CARBONIFEROUS TO LOWER PERMIAN	(C-P)	5000 ±	One small outcrop of lithic sandstone at White Cliffs. Elsewhere conglomerate, sandstone, siltstone, mudstone, coal.	Indeterminable plant material	Unconformable between Drummond Basin sequence, and Betts Creek Beds and Warang Sst.	Swamp, fluvial, glacial and fluvio-glacial.	
	LOWER CARBONIFEROUS	Drummond Group	Natal Formation (Cln)	4000 +	Alternating sequence of fine feldspathic quartz sandstone, olive siltstone and mudstone; concretions are common.	Poorly preserved plant material	Conformable on Bulliwallah Form.	Shallow freshwater.
			Bulliwallah Formation (Cib)	6000	Thin to thick bedded, fine to medium feldspathic quartz sandstone; minor olive mudstone, pebbly feldspathic quartz sandstone and algal limestone.	Poorly preserved plant fossils; algae .	Conformable on Star of Hope Form.	Shallow freshwater.
			Star of Hope Formation (CIs)	2000	Lapilli tuff, welded tuff, tuffaceous sandstone, minor acid flows; volcanic lithic sandstone; quartz pebbly sandstone and conglomerate.	Plants (White, 1967).	Conformable on Raymond Form.	Fluvial and terrestrial.
			Raymond Formation	3500	Fine to medium quartz sandstone, locally feldspathic; minor interbeds of clayey sandstone and mudstone.	Plants (White, 1967).	Conformable on Mount Hall Form.	Fluvial (mainly flood plain).
			Mount Hall Formation (CIh)	9000 ±	Cross-bedded pebbly and conglomeratic quartz sandstone, coarse quartz sandstone. Minor mudstone and lithic sandstone.	Wood fragments	Conformable on Scartwater Form.	Fluvial (mainly point bar).
	UPPER DEVONIAN TO LOWER CARBONIFEROUS		Scartwater Formation (D/Cw)	4000 +	Fine feldspathic sandstone with interbeds of calcarenite, algal limestone, olive mudstone, lithic tuff and tuff.	Plants (White, 1967).	Probably conformable on Llanarth Volcanics and unconformable on Saint Anns Form. and Ukalunda Beds	Fluvial
			Llanarth Volcanic Member (D/CI)	3200	Dominantly fine tuff. Some thin acid flows and locally at the base volcanic lithic sandstone and conglomerate.	Plants (White, 1967)	Overlapped by Scartwater Form. north of Saint Anns homestead.	Shallow water and terrestrial
			Saint Anns Formation (D/Ca)	2400	Acid and intermediate flows, crystal tuff and lapilli tuff and algal limestone at top. Arkosic, feldspathic and lithic sandstone, conglomerate minor green mudstone and phosphatic sandstone.	Plants (White, 1967); Algae and worm casts.	Unconformable on Ukalunda Beds	Shallow water, possibly partly marine; the upper volcanic part of the unit may be terrestrial.
			Silver Hills Volcanics (D/Cs)	2000 +	Rhyolite, breccia, crystal lithic tuff, fine tuff.		Probably unconformable on Anakie Metamorphics.	Probably largely terrestrial.
			MIDDLE DEVONIAN	Ukalunda Beds (Dk)		Lithic and feldspathic sandstone, siltstone, schist, slate, phyllite. Richly fossiliferous limestone in area to the east.	Rich marine fauna elsewhere (Malone et al., 1966).	Unconformable on Anakie Metamorphics.
	PRE-DEVONIAN	Anakie Metamorphics (Pza)		Schist, slate, phyllite, sandstone, shale.	Algae elsewhere (Malone et al., 1965).	Oldest unit in the area.		



Adani Quarry Permits and Approvals
Figure 4-5 Geology and topography

Legend

- Groundwater Bore
- Stockpile Processing Area
- Carmichael Mine - ML 70441
- Borrow 7 Extraction Area
- Quarry Access Road

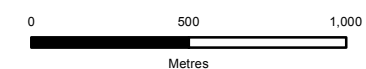
Proposed Adani Rail Corridor

- Minor Road
- Major Road
- Minor watercourse

Geology

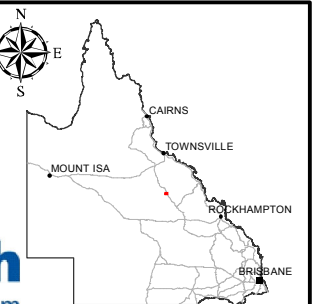
- Qa-QLD
- Qr-QLD>Star of Hope Formation
- Qr-QLD
- Qpa-QLD
- Suttor Formation

- Cg/b-DRUM
- Mount Hall Formation
- Star of Hope Formation



DISCLAIMER
CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.
Data source:
Adani, 2012; Geology from DME, 2012; Elevation created from 1s SRTM DEM; GW bore, from GHD, 2011;DERM, 2010;

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Regionally, Pleistocene-aged alluvium on high terrace deposits comprising clay, silt, sand and gravel dominate the surficial geology to the north, east and west. In these areas elevation generally ranges between 205 to 210 m AHD. In areas to the east, pockets of underlying Tertiary-aged Suttor Formation, comprising sandstones, mudstones, conglomerate and lacustrine sediments with minor interbedded basalt is present, however much of the area has been overprinted by younger Quaternary-aged colluvial and residual deposits comprising clay, silt, sand and gravel occur. In isolated pockets erosion to a limited extent has resulted in the exposure of the Suttor Formation.

Areas southeast of the proposed quarry are dominated by Quaternary-aged colluvial and residual deposits but in places exposures of older Carboniferous-aged Star of Hope Formation (lithic conglomerate, feldspathic sandstone, rhyolitic to dacitic ignimbrite and flows, tuffaceous siltstone and rare sinter) occurs where elevation is notably higher (> 215 m AHD). Areas south of the quarry area are notably higher in elevation (215-220 m AHD) resulting in exposures of Star of Hope Formation and Carboniferous-aged intrusive (fine to medium grained pyroxene gabbro and dolerite). Areas to the west are dominated by Pleistocene-aged alluvium on high terrace deposits, which has been dissected by flood plain alluvial deposits of similar lithology, as a result of Gowrie Creek. These flood plain deposits are dispersed in a fan-like manner further west of the quarry area, where local elevation decreases to 195 m AHD.

Locally, the Borrow 7 area sits at an elevation of 215 m AHD. The higher elevation has preserved underlying geology and as such outcrops of the Carboniferous-aged Star of Hope Formation are present over much of the quarry footprint. The southern tip and the western boundary of the proposed quarry footprint, however, comprise exposures of the Carboniferous-aged intrusive.

As the geology of the Borrow 7 area consists of a combination of labile volcanic and sub-labile sedimentary rocks, a wide range of engineering quality quarry material is present. The crest of the quarry area is likely to provide higher specification materials capable of producing concrete aggregates, ballast and CBR 80+ material. The area shown in Plate 4-3 above will be extracted using drilling and blasting techniques. The expected output of Borrow 7 is 2,363,705 t with the highest extraction of 209,906 t expected to occur in November 2015.

4.4.2 Soils

The Geological Survey of Queensland Interactive Resource Tenure Map broadly defines the soils regional to the Borrow 7 area to comprise red massive earths, associated with undulating lands with high gravelly ridges. These soil classifications are primarily based on desktop level interpretation of available geological, aerial and geomorphological information due to a lack of physical mapping at the local scale.

A more recent environmental impact study conducted by GHD (GHD, 2012) provided an assessment of the potential soils likely to be present within the Project (Rail) corridor. The assessment was based on existing soil and land system information provided by Australian Natural Resource Atlas (ANRA) website, which is accessible through the following source: (<http://www.anra.gov.au/topics/soils/overview/qld/html>).

The ANRA soil classification is based on two mapping forms:

- Land systems – repeating patterns of soils, vegetation, geology and geomorphology that provide broad statements of dominant soils or vegetation types, land condition and potential land capability; and

- Soils mapping – focuses on predominant soils type or soil association at a smaller scale that provide information on soil types and proportions, land qualities and land suitability (GHD, November 2012).

A similar type of mapping tool established by Department of Primary Industries (DPI) was used for establishing the soil type/s that is potentially present within the proposed quarry area.

The Central Queensland area, prior to the recent boom in mining activity has historically been primarily worked for agricultural/pastoral purposes, and consequently meaningful information on soils is available from land management studies undertaken for the area. The DPI has undertaken land management studies aimed at identifying and grouping areas with similar physico-geographical and pedological properties directed towards sustainable development. DPI groups areas at a local scale into two divisions according to land management requirements for specific land types; Land Resource Area (LRA) and Agricultural Management Unit (AMU) (Thwaites and Maher, 1993). LRA are broad landscape units that has been mapped and grouped for different soils developed from related geological units with recurring patterns of topography and vegetation. AMU further separates the LRA units into groups of soil with similar landforms, vegetation and agricultural potential that require similar management requirements. Each LRA can contain multiple AMUs.

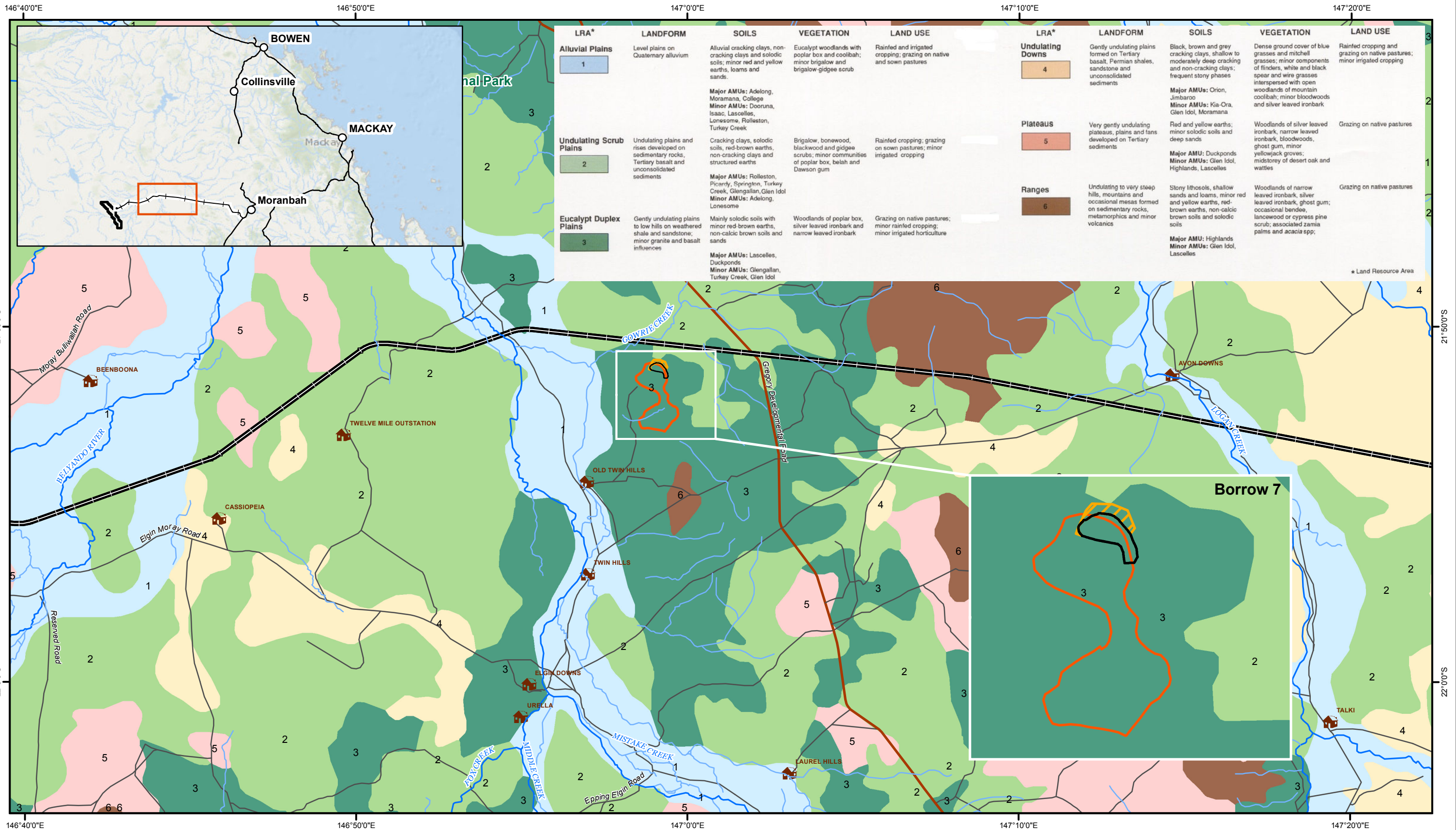
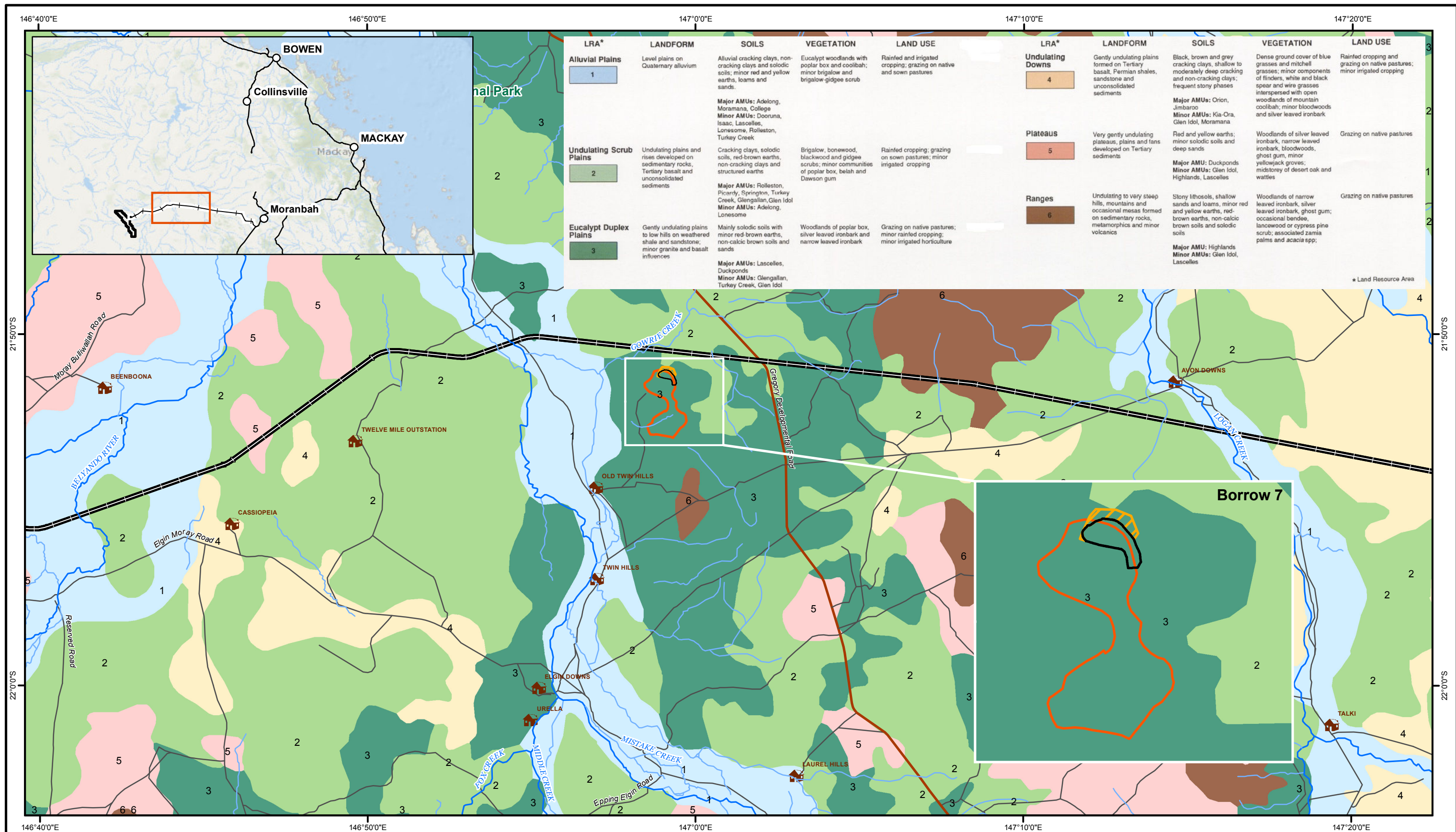
This tool was adopted by CDM Smith, as each identified soil unit/s is complemented with 1-2 page summary sheets that identify common properties including a generalised lithological profile and photo, limitations and management recommendations for each soil type, group as AMU, identified.

The Borrow 7 area falls within the Central Highlands, which at a regional scale (within 5 km) comprises four LRAs. Each LRA, in turn comprises of numerous AMUs. Given that AMUs provide a better description of the productivity potential of the land, it allows a better assessment of the potential impacts that may arise as a result of soil disturbance and further allows the development of appropriate safeguards to return the land to productivity, following disturbance.

Table 4-4 provides a summary of the common AMUs associated with each LRA for areas regional to the Moray Quarry area. Description of each AMU is provided in Table 4-5, which shows that the dominant flora type together with surface soils can be used as relatively quick field guide to identify the types of soils present in the area.

Table 4-4 Relationship of AMUs to LRAs for Borrow 7 area, Central Highlands

LRA	AMUs	
	Major Occurrence	Minor Occurrence
LRA 1: Alluvial Plains	Adelong, Moramana, College	Dooruna, Issac, Lascelles, Lonesome, Rolleston, Turkey Creek
LRA 2: Undulating Scrub Plains	Rolleston, Picardy, Springton, Turkey Creek, Glengallan, Glen Idol	Adelog, Lonesome
LRA 3: Eucalypt Duplex Soils	Lascelles, Duckponds	Glengallan, Turkey Creek, Glen Idol
LRA 6: Ranges	Highlands	Lascelles, Glen Idol



Adani Quarry Permits and Approvals
Figure 4-6 Land Resource Areas

Table 4-5 Description of Agricultural Management Units regional to the Borrow 7 area.

LRA	General Soil Type	AMU	Soil Surface/Description	Distinguishing Features
LRA 1 Alluvial Plains	Uniform Clays	Adelong	Heavy cracking clay with strong but thin (~ 2 mm) mulch; may have thin sandy crust	Dark, uniform and deep (>90 cm) heavy clays on flat to gently undulating floodplains. Dense brigalow, coolabah scrub. Shallow gilgai can also occur
		Moramana	Medium cracking clay with finer and deeper (2-5 mm) mulch than above	Deep reddish brown to grey clay under open coolabah. Well drained. Commonly river deposited material associated with basaltic or shale downs. Shallow gilgai can occur
		College	Cracking and non-cracking grey to brown clay with a sandy crust, a coarse mulch or hard setting surface.	Open woodlands of poplar box, brigalow and baubinia with associated species. May have restricted depth due to gravel layering or high salinity below 50 cm depth. Differs from ROLLESTON AMU in severity of physical restrictions of plant growth.
		Dooruna	Severe surface and/or sub-soil physical limitations indicated by prolonged water logging, regularly water stressed plants, or bare areas. Very coarse surface mulch or crust	Open grassland with isolated, severely stunted brigalow clumps. High salinity below 30 cm and acidic below 50 cm. Restricted occurrence to an area north of Kilcummin
		Rolleston	Deep clays (>90 cm), with typical vegetation of whipstick or moderately stunted brigalow and eucalyptus (mainly Dawson Gum).	Gilgai either absent or less than 40 cm deep
		Lonesome	Subsoils are normally pale coloured and mottled below 60 cm. Drainage is restricted. Surface gravel can occur	Gilgai more than 40 cm deep
	Duplex soils	Lascelles	Sandy loam, hard setting	Pale grey to brown, moderately deep (20 to 45 cm to clay) sandy loam surface overlies very hard, coarse and mottled clay subsoils. Very poorly drained, and a bleached soil layer above the clay is common. Open box, ironbark woodlands with associated brigalow, currant bush and others.
		Isaac		Deep sandy loam surface soil (>45 cm to clay)
		Turkey Creek		A thin sandy surface layer (<10 cm) overlying deep, moderately well drained grey or brown clay. Tall brigalow, belah and Dawson Gum are common. Forms uniform clay with a sandy clay surface following cultivation.
	Deep Uniform sandy soils	Isaac	Loose, coarse sandy to firm	Tall open blue gum, Moreton Bay ash forest with associated species. Deep sandy loams

LRA	General Soil Type	AMU	Soil Surface/Description	Distinguishing Features
LRA 2 Undulating Scrub Plains	Uniform clays	Adelong	Heavy cracking clay with a strong but thin (about 2mm) mulch; may have thin sandy crust	Dark, uniform and deep (more than 90 cm) heavy clays on flat to gently undulating floodplains. Dense brigalow, coolabah scrub. Shallow gilgai can occur
		Picardy	Cracking and forming a fine, 'soft' mulch	Red, brown to dark grey soils under gidgee, brigalow and softwood scrub. Deep (more than 90 cm), well structured clays often shallow gilgai less than 40 cm deep
		Rolleston	Cracking or non-cracking with sandy crust, coarse mulch or hard setting surface	Grey, brown heavy clays typically under whipstick or slightly stunted brigalow scrub with associated eucalyptus (mainly Dawson Gum) and a range of understorey species. Subsoils are pale coloured and often mottled below 60 cm depth. Drainage is restricted – GILGAI ABSENT OR LESS THAN 40 CM DEEP
		Lonesome		Grey, brown heavy clays typically under whipstick or slightly stunted brigalow scrub with associated eucalyptus (mainly Dawson Gum) and a range of understorey species. Subsoils are pale coloured and often mottled below 60 cm depth. Drainage is restricted – GILGAI MORE THAN 40 CM DEEP
		Springton		Mainly reddish brown to brown often non-cracking and gravelly clay. Distinctive coarse-structured subsoil at 30 cm depth which is indicated by surface waterlogging and reduced water storage capacity (i.e. regularly water stressed plants). Soil depth is greater than 45 cm but often less than 90 cm to rock or gravel. Vegetation commonly brigalow, Dawson Gum, bendee or gidgee scrub
	Duplex Soils	Glengallan	Sandy loam, hard	Pale grey to brown shallow sandy loam surface (<20 cm to clay) overlies very hard, coarse and mottled clay subsoils. Very poorly drained, and a bleached soil layer above the clay is common. Open box, ironbark woodlands with associated brigalow, currant bush and others
		Glenidol		Reddish brown sandy loam to clay loam overlies moderately well drained (i.e. few mottles) clay subsoils. Open ironbark, brigalow or box with associated species
		Turkey Creek		A thin sandy duplex soil under brigalow, Dawson Gum scrub. After cultivation, a sandy clay surface plough layer to 20 cm forms.

LRA	General Soil Type	AMU	Soil Surface/Description	Distinguishing Features
LRA 3 – Eucalypt Duplex Plains	Duplex Soils	----- Glengallan ----- Lascelles ----- Duckponds	Sandy loam, hard setting	Pale grey to brownish yellow sandy loam over hard and coarse mottled clay which is poorly drained. Soil immediately above the clay is often bleached and/or gravelly. Poplar box, ironbark, brigalow are dominant tree types. Key distinguish feature is based on the depth of surface horizon: ----- Shallow sandy loam (<20 cm to clay) ----- Moderate depth to sandy loam (20 to 45 cm to clay) ----- Deep sandy loam (>45 cm to clay)
	Deep, uniform, sandy	Duckponds	Loose to firm; very sandy	Deep sands or sandy loams of red, yellow to pale brown earths. Tall open bloodwoods, ironbark, cypress pine and a range of associated species.
LRA 6 – Ranges	Shallow, rocky duplex soils and earths	Highlands	Rocky, gravelly or sandy	Includes the range of shallow, rocky and infertile soils associated with dissected ranges and plateaus
	Duplex	Lascelles	Hard setting sandy loam	Pale grey to brown, moderate depth sandy loam surface soil (20-45 cm) overlies very hard, coarse and mottled clay subsoils. Very poorly drained, and a bleached soil layer above the clay is common. Open box, ironbark woodlands with associated brigalow, currant bush and others
		Glen Idol		Reddish brown sandy loam to clay loam with ironbark, brigalow or box. Usually no bleach or mottling. Often a gravelly surface. Clay subsoils are moderately well-drained, although quite hard when dry.

Locally, Borrow 7 encompasses an area classed as LRA 3 (Figure 4-4). Table 4-4 identifies that numerous AMUs, and hence soil types are present within the area. Table 4-5 indicates that pockets of different soils exist locally, which is significantly different to the desktop based tenure maps. According to Figure 4-6 Land Resource Areas dominant soil types present local to the Borrow 7 area include:

- Duplex soils – hard setting sandy loams; and
- Deep uniform sandy materials – loose to firm and predominant in sand.

Typical constraints, as a result of their physical properties for types of soils potentially present locally to the quarry area are detailed in Table 4-6. A summary of each AMU is provided in **Appendix I**, which details the physical properties of the soils and identifies typical constraints and safeguards for their disturbance.

Table 4-6 Potential constraints of soils from Borrow 7 area.

Soil Type	AMUs	Potential Constraints
Duplex soils	Glengallan, Glen Idol, Turkey Creek, Lascelles and Duckpond	Hard setting; Medium to extremely high erosion potential; Infertility; Potentially sodic sub-soil; Generally poorly drained with the exception of DUCKPOND and GLEN IDOL AMU which are well drained and exhibit high infiltration and therefore are sensitive to groundwater recharge
Deep uniform sandy materials	Isaac and Duckponds	well drained and exhibit high infiltration and therefore are sensitive to groundwater recharge

4.4.3 Potential Impacts

The potential impacts to the soils, geology and topography include:

- Increased risk of erosion and sediment movement from clearing vegetation, alterations to drainage patterns and stormwater flows, excavation and stockpiling of material and operating during high rain fall events. The impacts from erosion and sediment movement are predicted to be localised and remediated during the rehabilitation process;
- Sediments within water runoff have the potential to collect in the surface waters. However, the nearest waterway is Gowrie Creek 3.5 km to east and it is unlikely that sediment will impact Gowrie Creek;
- Localised salinity hotspots, as a result of vegetation removal;
- Loss of topsoil that may contribute to soil infertility during rehabilitation;
- Areas dominated by sandy materials are likely to exhibit high infiltration rates and therefore sensitive to groundwater recharge. Although a deep groundwater table is inferred given the location of the proposed quarry is on an anticline, localised soil impacts may result from impacts of contaminants (e.g. fuel spills and leaks); and
- Localised changes to landform as an unavoidable result of the extraction of material.

4.4.4 Management of Soils, Geology and Topography

Objectives of management of soils, geology and topography include:

- Appropriate soil conservation practices are planned and implemented;
- Creation of stable post-construction landforms; and
- Installation of erosion and sediment controls in accordance with the conceptual ESCP.

The following management measures will be implemented to minimise any impacts to soils, geology and topography.

Loss of topsoil and to a lesser extent subsoil from the construction area is important in terms of rehabilitation success. Topsoil is the most valuable resource in relation to rehabilitation and needs to be retained onsite and in a good re-usable condition (GHD, November 2012).

A conceptual erosion and sediment control plan prepared by a suitably qualified professional and incorporated into the site plan, this is provided in **Appendix H**. The staged site plans and conceptual erosion and sediment control plan includes the following controls, as a minimum:

- Site water will be directed into water storage dams for use on site, clean water will be diverted away from the site;
- Measures to limit the area of disturbance and progressively clear areas immediately before construction;
- Minimises the period soils are left exposed during construction;
- Process material stockpiles will have silt fences or established bunds installed on the downstream side, and diversion bunds on the upstream side;
- Topsoil stockpiles to be stored for long periods of time (e.g. for longer than one month), will have permanent measures put into place such as grassing; and
- Placement of sediment traps and silt fences to minimise off-site impacts.

On site implementation measures also to be implemented include:

- Processes to maintain a site monitoring program to assess erosion control measures;
- Areas of identified dispersive soils shall be closely monitored to assess the efficacy of the erosion control measures and progressive land rehabilitation works will be undertaken where land is disturbed as use of those areas ceases. Regrading will be undertaken post disturbance to produce slopes that are suitable for the proposed land use;
- Strip and stockpile topsoil for rehabilitation;
- Records will be maintained of stripped material to ensure usable soils are retained and logs of stockpiles and kept to reconcile predicted and actual soil volumes; and
- Reprofile the land to match the surroundings and reinstate pre-existing natural drainage flows and pathways.

Fossils

Although no evidence of fossils has been noted in the proposed quarry area, it is acknowledged that sedimentary settings similar to those associated with the quarry site preserve fossiliferous records. If any unique or scientifically important fossil specimens are uncovered, the quarry operator will consult with the Queensland Museum regarding the find. Work will avoid the find area until advice is received from the Queensland Museum is received.

4.5 Groundwater

4.5.1 Existing Environment

The proposed Borrow 7 site falls within the Burdekin Basin Catchment, where the *Water Resource (Burdekin Basin) Plan 2007* and *Burdekin Basin Resource Operations Plan 2010*, apply. The Water Resource Plan (WRP) for the Burdekin Basin Catchment does not have management requirements for groundwater.

4.5.1.1 Bowen Unincorporated Area Groundwater Resource Area

Groundwater management units (GMUs) have been identified for the whole of Australia as part of the Australian Water Resources Assessment 2000 (DSEWPaC, 2009). The assessment forms part of the *2000-2002 National Land and Water Resource Audit*. Borrow 7 is located within the Unincorporated Area (UA) – Bowen Basin Groundwater Management Units, referred to as the Bowen UA.

The major aquifers within the Bowen UA are Quaternary-aged alluvium, the sand and gravel horizons of the Tertiary-aged sediments and the Tertiary-aged basalts (Australian Government, 2009). The majority of groundwater can be defined as marginal quality; however, supplies of good quality groundwater are common from the alluvial and basalt aquifers. Poorer quality groundwater is typical of the coal bearing strata particularly in the Bowen Basin Stratigraphy. The achievable bore yields are generally below 5 litres per second (L/s) and consequently most groundwater development would be limited to stock and domestic supplies (GHD, 2012).

Aquifers within the Bowen UA are generally utilised for pastoral, irrigation, mining, stock and domestic, and town water. Increased irrigation, developments in the local coal industry and increased mining activity in the gem fields have resulted in recent increases to groundwater demands (Australian Government, 2009). Despite this, the groundwater resources in the Bowen UA are not heavily exploited and the Bowen UA is not considered a major priority and therefore has not been considered to require active management in the form of a resource plan (DSEWPaC, 2009).

4.5.1.2 Hydrostratigraphic Units

Based on the analysis of existing borehole logs and geological mapping the following hydrostratigraphic units are delineated beneath and within the vicinity of Borrow 7:

- Unconsolidated Sediments –comprising unconsolidated alluvium, colluvium and miscellaneous sediments of Quaternary to Tertiary age. Colluvium is mapped on the slopes and toward the base of the outcropping units and alluvial deposits dominate the low-lying areas along existing creeks and drainage lines; and

- Bedrock – dominated by Tertiary, Carboniferous and Permian sedimentary rocks and a number of outcropping igneous volcanic and metamorphic units. The bedrock is interpreted as a fractured rock aquifer.

The shallow Quaternary alluvium (Qa and Qpa in Figure 4-5) follows the major rivers, creeks and drainage lines, including Mistake Creek, Logan Creek and Diamond Creek (Figure 4-3). No borehole log data is available within the vicinity of Borrow 7 and along Mistake Creek to the west to interpret the thickness of the alluvium. An indicative thickness of the alluvium may be inferred from borehole logs further away from the quarry. For example, alluvium thicknesses of 54 and 40 m are indicated at RN 12030089, located along the Belyando River approximately 32 km west of the quarry, and at RN 90368, located a further 20 km to the west, respectively (GHD, 2012). The geological map indicates that Borrow 7 is located on a single main ridgeline formed by a basalt flow or plug.

Depths to the top of Tertiary sediments and bedrock in the broader, Carmichael Coal Mine and Rail Project area presented in GHD (2012) are based on limited borehole data from the DNRM Groundwater Database. The data indicate the depth to the top of Tertiary sediments and Carboniferous bedrock to be 36 to 60 m below ground level (bgl) and 39 to 96 m bgl respectively.

Geotechnical boreholes were drilled on site during 18 to 24 June 2013 found minimal water within 30 m depth. One bore hole had water come in approximately 23 – 24 m but only enough to make the sample damp.

4.5.1.3 Groundwater Users and Bores

A search of the Queensland NRM Groundwater Database (2012) identified eight registered bores within a 10 km buffer surrounding the quarry site. All bores are registered as active, with four unknown uses, one water resources investigation bore, one water supply bore and two mineral or coal exploration holes. There are no active water extraction bores within 10 km of the quarry site. Table 4-7 outlines all the registered bores within 10 km of the Borrow 7 site.

Table 4-7 Groundwater bore details within 10 km of Borrow 7

Registered Number (RN)	Type	Distance from Quarry	Standing Water Level (SWL)	Target Aquifer and Details
62536	Active unknown bore	0.5 km W	27.4 mbgl	Unknown details
132195	Active water supply bore	8 km SW	53 mbgl Depth of 75 to 83m	Weathered shale within the Star of Hope Formation. Yield of 0.75L/s. EC of 2000 Microsiemens per centimetre (µS/cm).
12030176	Active Sub artesian Monitoring bore	5.5 km NE	43.26 mbgl	Drilled in 2004 into Quaternary – Undefined. EC of 52700 µS/cm.
103913	Mineral or Coal exploration hole	9.5 km SW	75 mbgl	Star of Hope Formation
103912	Mineral or Coal exploration hole	9.5 km SW	N/A	Aquifer has top 85 and base of 97, with a maximum yield of 3.43 L/s.
84363	Active unknown bore	6.2 km N	N/A	Good water quality with EC of 495 µS/cm. Screen Base is 54.86 mbgl.
62587	Active unknown bore	6.2 km N	60.96 mbgl	Screen Base is 97.5 mbgl. EC indicated to be good (fresh).
22068	Active unknown bore	7 km NW	N/a	Drilled in 1956, unknown formation and water quality

It should be noted that prior to 1998 there was no requirement for registration of private bores. Additional water supply bores may exist within the quarry area and the surrounds that have not been identified in this desktop review.

4.5.1.4 Aquifer Properties and Bore Yield

No aquifer properties and bore yield data are available within the quarry area. Bore yield data within the broader Carmichael Coal Mine and Rail Project area are summarised in GHD (2012) and provide indications of the general productivity of aquifers in the region. The majority of the bore yield data are less than 5 L/s, typical of the Bowen UA, with the exception of 11 L/s yield recorded at RN30176, an abandoned water supply bore located approximately 52 km west of Borrow 7 and installed within the bedrock. RN 90368 is an existing water supply bore in the alluvium, located approximately 3 km south of RN30176, with maximum recorded yield of 3.9 L/s.

4.5.1.5 Groundwater Flow Regime

The nearest bore to Borrow 7 is RN 62536, located 0.5 km to the west (Table 4-7). The bore has a depth of 45.7 m bgl, with one depth to water reading of 27.4 m bgl in the Groundwater Database (NRM, 2012). No water quality data is available although groundwater is indicated to be brackish. No borehole log is available to infer the screened aquifer.

There are four bores (RN 12030081, 120082, 12030083 and 12030084) installed within the alluvium along and in the vicinity of Mistake Creek, located approximately 18 km to the south of the quarry. The available data from the Groundwater Database (NRM, 2012) indicate absence of groundwater in these bores at the time of gauging, suggesting that the water table may occur below the maximum bore depth of 13.6 m bgl (GHD, 2012). Further away from the quarry area, water levels of 11.3 m bgl and 15 m bgl have been recorded at RN 12030089 and RN 90368, respectively. It is likely that the alluvium is saturated to some depth particularly closer to and below the invert of the creek, where the depth to water table would be expected to be shallower.

Episodic rainfall and runoff events, especially those that cause flooding along the creeks, are likely to supply recharge to the water table along the creeks and drainage lines. Therefore, during these wet periods, the creeks function as losing streams and the groundwater system receives recharge. During longer dry periods, transpiration by vegetation and potential evaporation of shallow groundwater along creeks and drainage lines would discharge groundwater back to the atmosphere. Regionally, the water table is likely to follow the regional topography with groundwater flowing away from the quarry area towards Mistake Creek and its tributaries. Site specific data will be required to ascertain the groundwater flow direction and elevation of the water table within the quarry area.

As part of the Carmichael Coal Mine and Rail Project EIS, GHD (2012) prepared bore hydrographs for registered bores in Project (Rail) Section 2 and Project (Rail) Section 3, located to the north and north east of Borrow 7. The hydrographs indicate that the water levels in the bedrock aquifer (Anakie Metamorphics, the Mt Hall Formation and the Suttor Formation) have remained relatively static and have not responded to seasonal variations in rainfall. This is consistent with the interpretation that most of the rainfall induced recharge is likely to be occurring along the existing creeks and drainage lines via alluvium, with some recharge potentially occurring over parts of the bedrock albeit at reduced rates. Depth to water in the bedrock aquifer is variable and ranges from 27 to 75 m bgl, based on the available groundwater level data within the Carmichael Coal Mine and Rail Project area (GHD, 2012).

4.5.1.6 Groundwater dependant springs

According to the Springs of Queensland dataset (EPA, 2005) there are no reported spring complexes within the surrounding area. The nearest springs are the Doongmabulla Springs which are listed under the Directory of Important wetlands approximately 76 km from Borrow 7.

4.5.1.7 Groundwater Dependiant Ecosystems

The National Atlas of Groundwater Dependent Ecosystems (GDE) (BOM, 2013) presents the current knowledge of GDEs across Australia, and shows known GDEs as well as ecosystems that potentially use groundwater. The mapping indicates zones of low and high potential to support groundwater dependent vegetation within the quarry area, however no GDEs were identified in the Borrow 7 area through previous field investigations. Further away from the quarry, zones of high potential to support groundwater dependent vegetation have been identified along Mistake Creek and its tributaries located approximately 3.5 km to the west of Borrow 7. The Carmichael Coal Mine and Rail Project EIS indicates that flow in Mistake Creek may be groundwater fed during pro-longed dry periods, such that a series of semi-permanent waterholes are likely to be maintained along the water course (GHD, November 2012). Therefore, GHD (2012) suggests that vegetation within the riparian zone is likely to be groundwater dependent to some degree and this is consistent with the GDE Atlas.

4.5.1.8 Groundwater Quality

Groundwater at RN 62536, located 0.5 km to the west of Borrow 7 is indicated to be of brackish quality (DNRM, 2012). No other groundwater quality data within the quarry area are available. Limited groundwater quality data, primarily electrical conductivity (EC) and pH, from bores located within the Carmichael Coal Mine and Rail Project area to the north of Borrow 7 are presented in GHD (2012). The groundwater EC of bores installed in the bedrock aquifer is generally high, up to 53,100 $\mu\text{S}/\text{cm}$, with EC of up to 15,500 $\mu\text{S}/\text{cm}$ recorded at RN 12030175 located approximately 18 km west of Borrow 7. One EC measurement of 373 $\mu\text{S}/\text{cm}$ is available from the Tertiary sediments at RN 17980, located more than 58 km south-west of the quarry. No water quality data is available from the alluvium; however, it is expected to vary spatially and temporally due to the influences of recharge and evaporative concentration. The total dissolved solids (TDS) data from bores constructed in the alluvium of the Galilee Basin range from 48 to 4,380 milligrams per litre (mg/L) (RPS, 2012) and reflects fresh to brackish groundwater typically expected in alluvial aquifers.

4.5.1.9 Water supply for Quarry

Water supply options are currently being investigated. Quantities of water sufficient to satisfy the site operational requirements may be sourced on site from stormwater harvesting and groundwater seepage. The site operational water requirements are outlined in Section 3.4.3.

It is understood that Adani will consider a number of alternative options of water supply should additional water be deemed necessary for the quarry. This may include bore water supply, large water storages and pipeline from an existing water supply. Any alternative water supply options will be permitted separately and are not discussed herein.

4.5.2 Potential Groundwater Impacts

The potential groundwater impacts due to the quarry include:

- Drawdown of the water table due to quarry excavation and associated dewatering activities. The extent of the impact will largely depend on the potential for the base of the quarry to intersect the water table and hydrogeological properties of the aquifer surrounding the quarry. The potential drawdown impacts include the lowering of water table at the location of potentially groundwater dependent vegetation along Mistake Creek to the west and lowering of water levels at registered and unregistered bores. The planned elevation of the quarry base is 190 m AHD, approximately 30 m below the peak pre-construction elevation of 220 m AHD. A depth to water measurement of 27.4 m bgl at RN 62536 is within this range albeit at a lower ground elevation of approximately 202 m AHD. Therefore, the water table beneath Borrow 7 may be below the proposed quarry base;
- Drawdown of the water table due to pumping from groundwater supply bores. The likelihood of impact is considered low due to the anticipated low bore yield and supplementary water demand. The risk is conservatively assessed as moderate due to the presence of registered bores and current uncertainty about their uses. However, there are no current plans to source water from bores and any impacts will be assessed in the approvals required for a water bore;
- Alteration of the local groundwater flow regime during construction through blasting activities and associated changes in the hydrogeological properties of the surrounding formations;
- Localised recharge to the water table from quarry operations and associated salinisation and mounding of the water table is considered a low risk. This may arise if the water table is not intersected by the quarry and stormwater at the site is not properly managed. The mounding of the water table may facilitate lateral transport of dissolved salts and contaminants if present within the saturated zone. Appropriate management of water in the pit, particularly if dewatering is required, would minimise recharge induced impacts; and
- The risk of localised degradation of groundwater quality due to accidental leaks or spills of chemicals during construction and subsequent lateral migration of contaminants within the saturated zone is considered low as the risk of groundwater contamination can be minimised through appropriate management of on-site chemicals.

4.5.3 Management Measures

Based on the preliminary risk assessment, works associated with the development will not be expected to significantly impact groundwater. The main objectives with regards to groundwater include:

- Prevention of the degradation of groundwater quality in the area within and surrounding the development;
- Protection and maintenance of integrity of surrounding bores;
- Protecting the quality of existing groundwater resources; and
- Ensuring the development does not impact values associated with groundwater dependent ecosystems.

In order to minimise adverse impacts to groundwater, the following management methods will be undertaken:

- Laydown areas for vehicles and machinery and storage areas for chemicals, oils and fuels will be contained in appropriately designed facilities. Containment and correct storage will prevent spills, leaks, infiltration and surface runoff and hence prevent contaminants from entering aquifers, waterways and the general environment;
- Spill kits will be available to all personnel in the event of a spill or leak;
- Potential contaminants will be stored and handled in a controlled manner to prevent impacts to creeks, rivers, bores or groundwater dependent ecosystems;
- Visual inspections of any groundwater seepage during extraction activities. If the water table is intersected during construction, the rate of groundwater seepage is likely to be low due to the assumed low permeability of the bedrock. It is assumed that groundwater seepage could be managed by in-pit sump pumping to facilitate dry construction;
- A number of groundwater monitoring bores shall be installed and tested prior to construction to assess baseline groundwater conditions including depth to water, groundwater flow direction, indicative aquifer permeability and groundwater quality. There are three water monitoring bores drilled during geotechnical investigations and are currently capped for ongoing water monitoring use; and
- Prior to blasting a census of all groundwater bores and spring complexes within a one km radius will be undertaken. A search of the Queensland Groundwater Database (DNRM, 2012) shows one registered bore within 1 km radius of Borrow 7. Enquires with the local council and liaison with local landholders will inform the presence of any unregistered bores or unidentified springs within 1 km radius that may warrant monitoring during construction.

4.6 Contaminated Land

The site has been used for cattle breeding and fattening. A search of the Environment Management Register (EMR) and Contaminated Land Register (CLR) indicates that no known notifiable activity has been undertaken on Lot 3235 PH752. The EMR/CLR Search is attached in **Appendix J**. In addition, multiple site inspections have failed to reveal any indication of hazardous materials being stored, or hazardous activities being undertaken, in the area of the proposed development.

4.7 Air Quality

4.7.1 Existing Environment

The quarry is located within a rural regional landscape dominated by agricultural and mining activities. The air quality is generally of a good standard. VIPAC undertook background monitoring of air quality at the Disney Homestead to allow the incremental impact of the quarry to be assessed against the existing background pollutant concentrations.

The existing levels of particulate matter were monitored at Disney Homestead between the 27th March and 1st April 2013, using an environmental dust monitor, which records a particulate matter value every five minutes. The monitoring device was located 90 m north-east of the main homestead. Analysis of the data determined the background PM₁₀ concentration to be 18 micrograms per cubic metre (µg/m³), which is the 90th Percentile.

The PM₁₀ concentration has been used to derive appropriate background concentrations for PM_{2.5} and TSP. The Australian Coal Review states that an average of 40% of TSP was found to consist of particles in the size range of PM₁₀. Particles in the size range of PM_{2.5} were found to comprise only 4% of TSP or equivalently 10% of PM₁₀.

The following estimates of background levels of dust have been determined:

- Annual average concentration of TSP of 45 µg/m³;
- 24-hour average concentration of PM₁₀ of 18 µg/m³;
- 24-hour average concentration of PM_{2.5} of 1.8 µg/m³; and
- Dust deposition of 50 milligrams per square metre per day (mg/m²/day).

Full details of the background monitoring are provided within the Air Quality Assessment prepared by VIPAC in **Appendix K**.

4.7.2 Project Criteria

The *Environmental Protection (Air) Policy 2008* prescribes ambient air quality goals relevant to this quarry. Provided are criteria for PM₁₀ (particulate matter less than 10 microns in diameter), PM_{2.5} (particulate matter less than 2.5 microns in diameter). The most critical of these is the PM₁₀ criterion as the fraction of PM_{2.5} against PM₁₀ emissions from extraction operations is small (typically less than 10%).

Deposited dust is commonly used as a measure of the potential for dust nuisance, and high levels can reduce the amenity of an area. No formal criteria for dust deposition exist within Queensland, however the EHP has recommended a nuisance guideline of 120 mg/m²/day.

From all of the regulations, the strictest applicable criteria have been selected for this assessment and are presented in Table 4-8.

Table 4-8 Quarry Air Quality Goals (VIPAC)

Pollutant	Basis	Criteria	Averaging Time	Exceedances*
TSP	Human Health	90 µg/m ³	1-year	-
PM ₁₀	Human Health	50 µg/m ³	24-hour	Five days per year
PM _{2.5}	Human Health	25 µg/m ³	24-hour	-
Dust deposition	Amenity	120 mg/m ² /day	30 days	-

* Allowance intended for natural events such as dust storms or bushfires

Particulate emissions from the surrounding environment include contributors from farming activities (i.e. dust from cultivated areas) and smoke from activities associated with burning off.

4.7.3 Potential Impacts

Air quality impacts are likely to include dust emissions and vehicle and equipment emissions at the quarry operational area and along the haulage routes. The activities likely to contribute to the impacts to air quality include:

- Ripping of quarry material;
- Stockpiling;
- Operation of fuel burning equipment onsite through exhaust emissions;
- Loading of quarry material into haulage trucks; and
- Movement of haulage trucks along dirt roads and haul roads.

An Air Quality Assessment report for Borrow 7 has been prepared and is provided **Attachment K** to this report.

VIPAC undertook modelling and assessment of the potential impact of the quarry operations using the 3-dimensional dispersion wind field model, CALPUFF and The Air Pollution Model (TAPM), which is a 3-dimensional prognostic model developed and verified for air pollution studies by the CSIRO to simulate the impacts from the quarry. The modelling was based on the peak production month of November 2015 when 209,906 tonnes will be extracted. This rate was modelled for the duration of one year and as such the modelling results show the worst case scenario with minimal controls in place (dust suppression with a water truck). The actual impacts of the quarry are likely to be significantly less than the predictions and modelling of the worst case scenario.

The nearest sensitive receptors to the proposed quarry are Old Twin Hills Homestead (approximately 6.7 km south-west) and Disney Homestead (approximately 6.7 km) north-west of Borrow 7.

The TSP, PM₁₀, PM_{2.5} and dust deposition results for the Old Twin Hills and the Disney Homestead are detailed in Table 4-9 and Table 4-10 respectively.

Table 4-9 Quarry dust results at Old Twin Hills Homestead (VIPAC)

Pollutant	Background Levels	Quarry Related Activities	Total	Criteria	Compliance
Dust Deposition (mg/m ² /day)	50	7.61	57.61	120 mg/m ² /day (30 days)	Yes
TSP (µg/m ³)	30	1.27	31.27	90 µg/m ³ (1-year)	Yes
PM ₁₀ (µg/m ³)	10	8.57	18.57	50 µg/m ³ (24-hour)	Yes
PM _{2.5} (µg/m ³)	1	3.77	4.77	25 µg/m ³ (24-hour)	Yes

Table 4-10 Quarry dust results at Disney Homestead (VIPAC)

Pollutant	Background Levels	Quarry Related Activities	Total	Criteria	Compliance
Dust Deposition (mg/m ² /day)	50	7.5	57.5	120 mg/m ² /day (30 days)	Yes
TSP (µg/m ³)	30	0.8	30.08	90 µg/m ³ (1-year)	Yes
PM10 (µg/m ³)	10	11.96	21.96	50 µg/m ³ (24-hour)	Yes
PM2.5 (µg/m ³)	1	6.76	7.76	25 µg/m ³ (24-hour)	Yes

VIPAC's monitoring and modelling of air quality indicates that even in the worst case scenario peak production the operations will be compliant with required air quality standards. It was noted that highest contributor to all pollutants is from haul truck movements.

Due to the distances between Borrow 7 and the other five quarries, cumulative dust impacts will not occur at the closest receptors (Disney Homestead and Old Twin Hills).

4.7.4 Air Quality Management

Air quality and dust management measures will include the following measures:

- Watering of tracks and roads to minimise wheel-generated dust;
- Ongoing visual dust inspections;
- Water sprays should be used for excavation activities where necessary;
- Water spraying of stockpiles will be done on a frequent basis in order to keep the raw material moist to suppress fugitive dust release. The frequency of watering will depend on weather conditions;
- Progressive clearing to minimise the area of potential dust generating areas subject to wind erosion;
- Earth moving activities should be avoided or restricted during meteorological conditions that are favourable for dust dispersal;
- Restriction of the speed of on-site traffic to minimise wheel generated dust;
- Ensuring all vehicles are suitably fitted with exhaust systems that minimise gaseous and particulate emissions to meet vehicle design standards;
- Limiting vegetation and soil clearing, so as to minimise the area of exposed soil that may generate dust;
- Cattle grids placed on entrance to any sealed public road (that an Adani project enters) to assist in the removal of dust from vehicles prior to haulage on the public road;
- Compaction of construction site and stabilisation of vegetation to minimise dust lift off as a result of wind erosion;
- Place organic mulch and/or plant exposed soils to reduce dust generation and wind erosion;
- General awareness of minimising dust levels and it's benefits should be instructed to workforce personnel;
- Complaint management processes that ensure complaints are readily registered and rapidly addressed; and
- Haul vehicles will be covered when travelling on public roads or when significant dust is being produced from works on site.

4.8 Noise and Vibration

4.8.1 Existing Environment

The nearest sensitive receptors to Borrow 7 are the Old Twin Hills Homestead (approximately 6.7 km south-west) and the Disney Homestead (approximately 6.7 km to the north-west). A further sensitive receptor is the Twin Hills Homestead located approximately 10.9 km south-west of Borrow 7.

Winds occur predominantly from the north-east during spring and summer, often no greater than 5 metres per second (m/s) (18 kilometres per hour (km/h)). In autumn and winter, the dominant winds occur from the southeast with the highest wind speed of 8 m/s (28 km/h). The cooler, drier air is characteristic of the dominant southeast winds of moderate strength, usually with long calm periods in the winter (VIPAC, 2013).

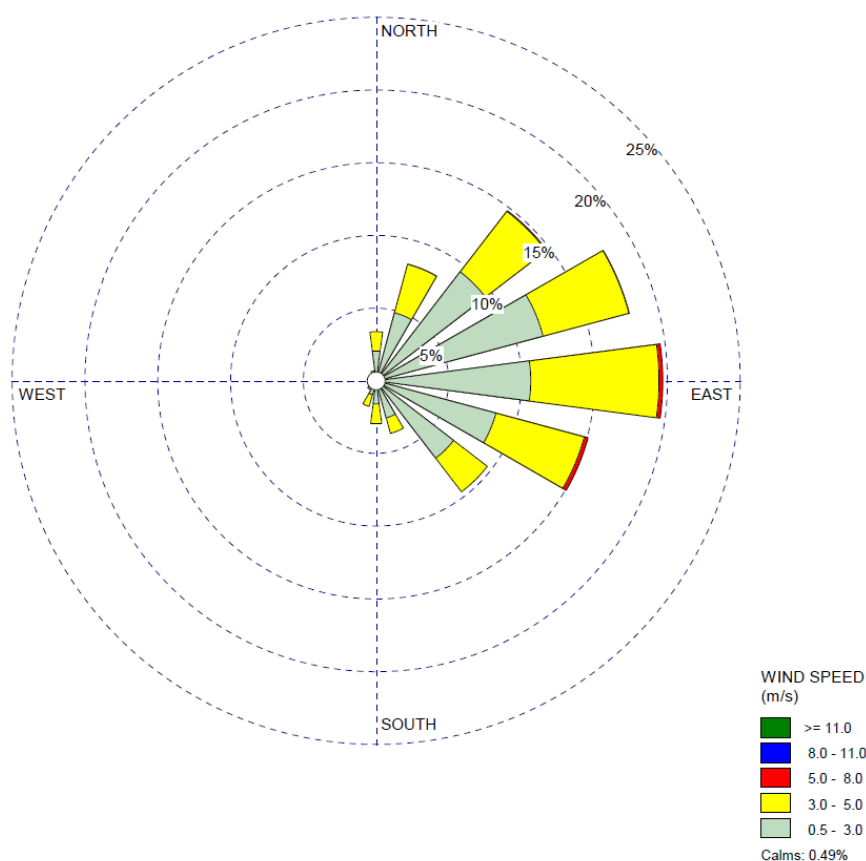


Figure 4-7 Annual Wind Rose (2006) (Vipac 2013)

Background monitoring was undertaken 110 m north-east of the Old Twin Hills Homestead and 150 m north-east of the main Disney Homestead. Table 4-11 provides the noise monitoring results for all of the days captured at each location. It should be noted that all of the noise monitoring locations are free-field positions adjacent to the receptors. The noise monitoring data for individual days is shown in tabulated and graphical form in within the full Noise Assessment provided in **Appendix L**.

Table 4-11 Summary of noise monitoring results

Noise Descriptor	Old Twin Hills			Disney		
	Day (07:00-18:00)	Evening (18:00-22:00)	Night (22:00-07:00)	Day (07:00-18:00)	Evening (18:00-22:00)	Night (22:00-07:00)
LAeq (Average)	43.5	43.8	32.5	41.5	42.3	37.3
LAeq, 1 Hour (Max)	47.4	47.1	38.4	47.0	45.2	43.2
LA90 (Average)	32.8	33.5	24.5	29.2	35.7	28.1
LAmx (24 hour)	76.3			76.3		

4.8.2 Proposed Criteria and assessment

The *Environmental Protection (Noise) Policy 2008* (EPP (Noise)) is designed to protect the acoustic environment for health and well-being. Section 8 and Schedule 1 of the EPP (Noise) outlines these acoustic quality objectives as shown in Table 4-12.

Table 4-12 EPP (Noise) acoustic quality objectives for dwellings

Sensitive Receptor	Time of Day	Acoustic Quality Objectives (measured at receptor) dB(A)			Environmental Value
		L _{Aeq,adj,1hr}	L _{A10,adj,hr}	L _{A1,adj,1hr}	
Dwelling (outdoors)	Daytime & evening	50	55	65	Health & Wellbeing
Dwelling (indoors)	Daytime & evening	35	40	45	Health & Wellbeing
	Night-time	30	35	40	Sleeping

The time periods referred to in the EPP (Noise) are defined as: Day: 7 am to 6 pm, Evening: 6 pm to 10 pm, Night: 10 pm to 7 am

The Acoustic Quality Objective applicable to this project is the Dwelling (indoors) night time criteria of 30 dB L_{Aeq,adj,1hr}. This noise level is an indoor level. In order to predict the external levels, a façade transmission loss of 7 dB has been applied. As such, the adjusted external night time criteria of 37 dB L_{Aeq,adj,1hr} is applied.

The prediction of noise has been predicted using SoundPLAN noise modelling software with the CONCAWE prediction methodology to take into consideration the weather conditions at the site. The significant construction and operational noise sources used for this assessment have been obtained from VIPAC's database of noise emissions.

Blasting has been assessed in accordance with DERM's Ecoaccess (2006) '*Noise and vibration from blasting*' requiring that 9 of 10 consecutive blasts comply with ground vibration of 5 mm/s and airblast overpressure of 115 dB.

4.8.3 Noise Impacts

Noise sources are likely to include the following:

- Operation of vehicles and equipment, primarily the dozer and excavator;
- Excavation and stockpiling of material;
- Reversing alarms on vehicles and equipment; and
- Blasting.

The majority of noise sources will remain constant throughout the life of the quarry. These sources will be around the quarry and generally be operating for 100% of the time. As such, the noise from these activities has been predicted separately to provide a worst-case scenario for the extraction activities.

The modelling shows the predicted night time noise levels for the extraction activities during the peak production rate month will be 30(dB $L_{Aeq, 1hr}$) at the Disney Homestead and 30(dB $L_{Aeq, 1hr}$) at the Old Twin Hills Homestead. This is in compliance with the proposed external noise criteria of 37 (dB $L_{Aeq, 1hr}$). Figure 4-8 shows the noise impact profile for the combined quarry activities at Borrow 7 site during night time.

The combined noise levels show that noise levels are driven by the extraction activities, primarily from the dump truck and excavator. The results have shown that compliance with the acoustic objectives for the night-time period will be achieved at all receptors during peak output in stable conditions. Noise predictions were also conducted for adverse weather. Results indicate that during adverse weather conditions the night-time $L_{Aeq,adj,1hr}$ noise criteria would not be exceeded.

This impact and modelling is based on no noise mitigation measures in place at the quarry. A number of noise mitigations will be installed to further reduce noise impacts.

Blasting activities will release around 60,000-80,000 t of material and occur approximately once or twice a month in high production months. Blasting will occur however ground vibration and airblast overpressure from blasting can be controlled to acceptable levels at the currently identified residential receptor locations using standard blasting practices.

A cumulative noise assessment indicated that when Borrow 7 and Disney Quarry are operational (with peak production occurring concurrently), the night-time $L_{Aeq,Adj,1hr}$ noise criteria may be marginally exceeded by 1 dB(A), under neutral weather conditions. While Borrow 7 does contribute, the exceedance is primarily due to extraction activities at the Disney Quarry.

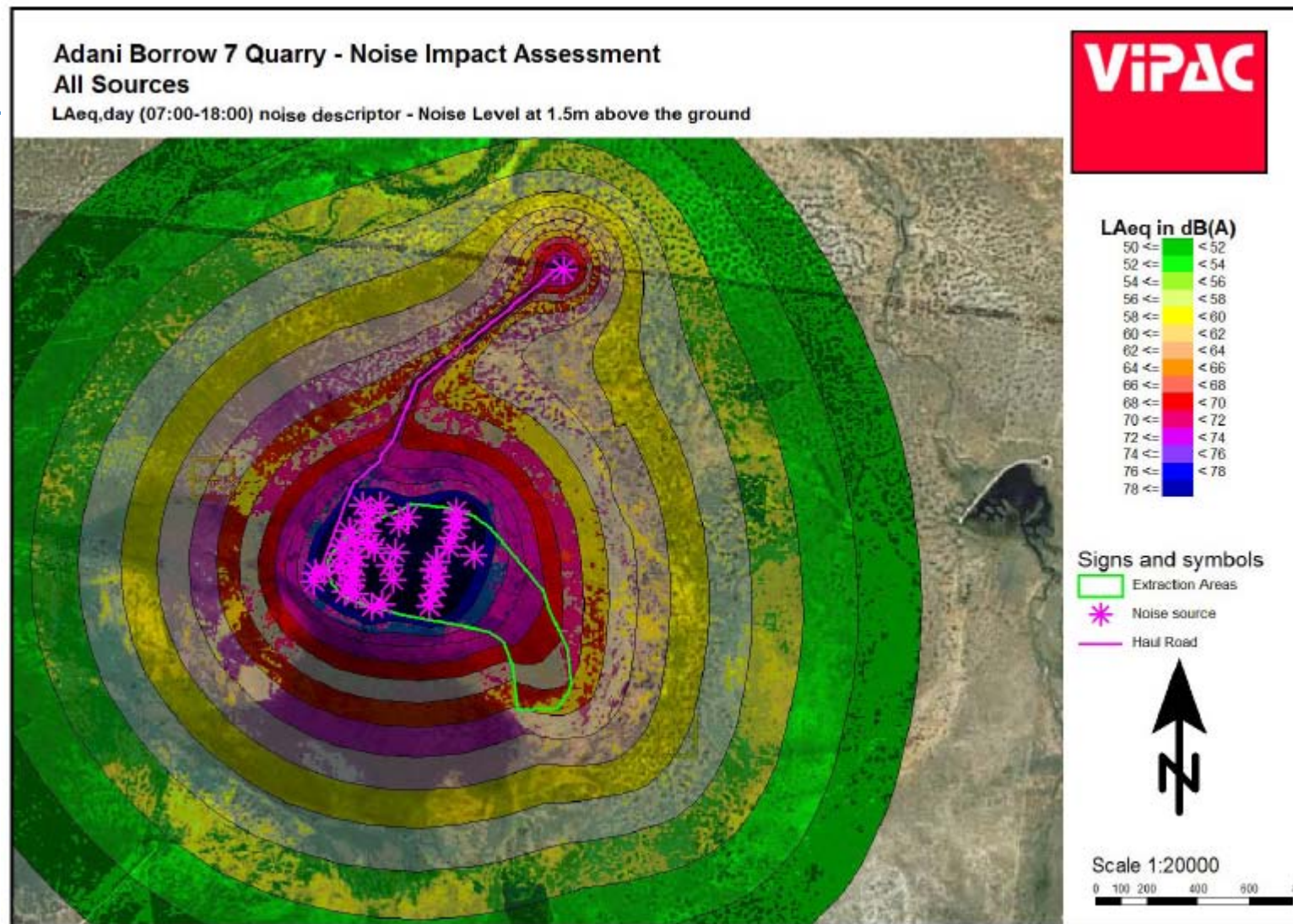


Figure 4-8 Noise impacts – Borrow 7 and haulage route

4.8.4 Noise and Vibration Management

Noise and Vibration management measures will include the following:

- Conduct trial blasts to determine the Maximum Instantaneous Charge (MIC) per delay, which would comply with the blast noise and ground vibration criteria;
- Avoiding unnecessary revving of engines and switch off equipment when not required;
- Ensure that all operators of plant and haul trucks do not drive aggressively and horn use is limited;
- Minimise the drop heights of materials;
- Start up plant and vehicles sequentially rather than all together;
- Audible reversing warning systems on mobile plant and vehicles shall be of a type which, whilst ensuring that they give proper warning, has a minimum noise impact on persons outside sites. When reversing, mobile plant and vehicles should travel in a direction away from sensitive receptors whenever possible;
- As far as reasonably practicable, sources of significant noise shall be enclosed. The extent to which this can be done depends on the nature of the machine or process to be enclosed and their ventilation requirements;
- Plant shall always be used in accordance with manufacturers' instructions. Care should be taken to site equipment away from noise sensitive areas. Where possible, loading and unloading should also be carried out away from such areas;
- Machines that might have intermittent use should be shut down between work periods or should be throttled down to a minimum. Machines should not be left running unnecessarily, as this can be noisy and wastes energy;
- Plant from which the noise generated is known to be particularly directional should, wherever practicable, be orientated so that the noise is directed away from noise-sensitive areas; and
- Acoustic covers to engines shall be kept closed when the engines are in use and idling.

Noise monitoring will only be carried out in the event of a complaint and upon formal request from, the regulatory authority to ensure mitigation measures are effective in maintaining noise below the noise limits.

4.9 Traffic, Transport and Site Access

4.9.1 Traffic and Transport requirements

Traffic generated by Borrow 7 development through construction and site set up, employees, service vehicles and the haulage of quarry material. The study area as shown in Figure 4-9 therefore incorporates the Gregory Development Road and the route to the quarry and mine site via Elgin Road and Twin Hills Road.

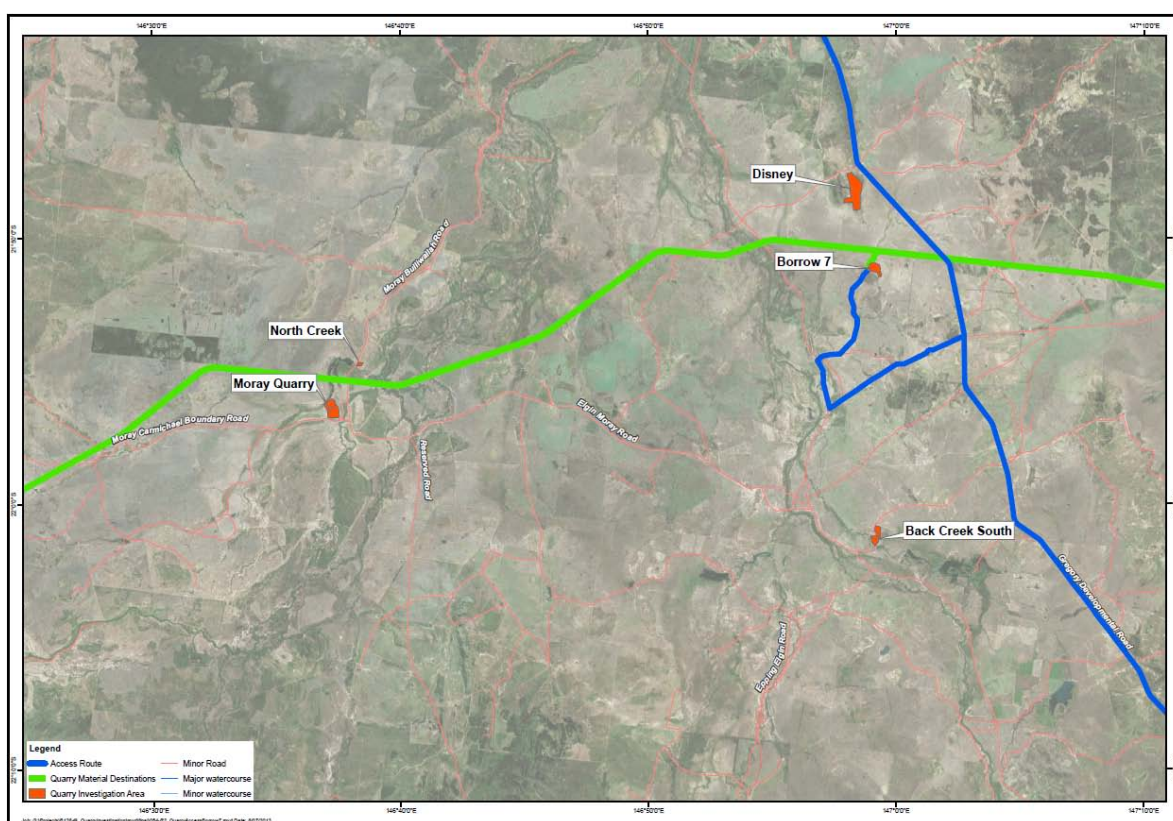


Figure 4-9 Access routes and haulage (TTM, 2013)

TTM has undertaken a detailed estimate of the likely development traffic generation and distribution, with the site predicted to generate a maximum daily traffic generation of 310 vehicles (in / out).

The Council controlled roads do not have a posted speed limit and therefore 80 km per hour has been adopted as the highest speed allowed on these gravel roads. Elgin Road is partially signed as 20 km per hour in the vicinity of a homestead immediately south of the intersection with Bulliwallah Road. Elgin Road and Bulliwallah Road vary in carriageway width from 6 m to 10 m, however are generally around 8 m wide. Twin Hills Road is generally one lane construction, however some sections allow vehicles to pass each other.

All intersections within the study area are 3 arm priority controlled intersections, with the exception of Gregory Development Road / Twin Hills Road / Avon Road intersection which is a four arm staggered intersection. The Elgin Road / Bulliwallah Road / Doongmabullah Road intersection does not appear to have a specific priority route.

All haulage of quarry material will be via the local road network and a private haul road. Haulage of quarry material will be undertaken by AB Triple vehicles with an average payload of 75 tonnes.

The highest predicted annual haulage from Borrow 7 will be 1,900,000 t. Haulage will be restricted to the local road network and a private haul road. As this quarry will provide material for the rail line on the west of the Gregory Development Road, some haulage movements will cross the state controlled road network. The operation of the Gregory Development Road / haul road intersection will be assessed by other parties.

TTM has estimated the Daily and Peak Hour Haul Vehicle generation, and this is shown in Table 4-13.

Table 4-13 Estimated daily & peak hour haul vehicle generation (TTM)

Tonnage/day	Average tonnes per load	Trucks in (load bearing)	Trucks out (non load bearing)	Total daily truck movements	Peak hour truck movements
Total Average: 2,584t	75	34 (313 ESA)	34 (57 ESA)	68 (370 ESA)	14
Total Peak Month: 6,997t	75	93 (856 ESA)	93 (155 ESA)	186 (1,011 ESA)	38
Crossing GDR Average: 2,160t	75	30 (276 ESA)	30 (50 ESA)	60 (326 ESA)	12
Crossing GDR Peak: 4,198	75	56 (515 ESA)	56 (94 ESA)	112 (609 ESA)	22

*ESA = Equivalent Standard Axles

In addition to the haulage of material there will be a number of service vehicles required to set up the site and service the operation of the site, these include:

- 180 truck movements required for set up of the site and delivery and mobilisation of equipment and plant;
- Four fuel deliveries per week from Townsville to be transported in B-double with a 50,000 L capacity, this will also service other proposed quarry sites; and
- Two water deliveries per week from the Carmichael Mine site or will be sourced onsite from a bore;

This equates to 908 truck movements during the first year of the quarry including the set up of the quarry.

Borrow 7 traffic is expected to increase traffic on the roads in the study area by no more than 200 vehicles per day (vpd) during peak operations and as such the Level of Service 'A' is expected to be retained on all roads.

The highest volume road within the study area is Gregory Development Road which carries 450 vpd. This volume is significantly less than the AADT threshold for a Level of Service 'A'.

4.9.2 Potential Impacts

TTM Consulting was engaged to undertake a Traffic and Pavement Impact Assessment for the development of Borrow 7. The scope of the transport assessment included:

- Identification of likely traffic volumes, distribution and composition from the future development;
- Identification of likely traffic impact of development on the public road network;
- Identification of likely pavement impact of development on the public road network;
- Road upgrades to be provided to mitigate the impact of the proposed development on the external road network, if any; and
- Access configuration to provide efficient and safe manoeuvring between the site and the public road network.

A summary of the impacts as assessed in the report are:

- A detailed assessment of the development traffic impacts in accordance with the GARID guidelines has established that Borrow 7 and associated quarries will not have a significant or assessable pavement impact on the state controlled road network;
- TTM consider that no school route, pedestrian or cyclist impacts associated with the development proposal. TTM are of the view that there are no traffic planning or engineering reasons why the proposed development should not proceed as planned.
- TTM considers that all intersections within the study area will operate under uninterrupted flow conditions; and
- Impacts to the local road network will be restricted to the Elgin Moray and Moray Carmichael Roads which are subject to a Road Agreement with IRC which includes upgrades by Adani of this road network.

A copy of the Traffic and Transport Impact Assessment undertaken by TTM is provided in **Appendix D**.

4.9.3 Management Measures

In order to mitigate the impacts of traffic and transport from the quarry site and within the quarry site the following general measures will be implemented:

- Haulage of quarry material will be restricted to the rail haul road and avoid transport of material on State and local roads;
- Speed limits within the site to 40 km/h and along the rail haul road to 80 km/h to reduce dust and safety impacts; and
- A Traffic Management and Maintenance Plan will be developed and implemented prior to commencement of the Carmichael Coal Mine and Rail Project.

The management measures that will be implemented for the Borrow 7 access road from Twin Hills Road:

- A posted speed limit of 80 km/h with suitable site distances to approaching vehicles;
- A 7 m wide carriageway;
- Lane flares at the access to allow haul vehicles to enter and exit simultaneously without conflict;
- Basic right (BAR) turn treatments and shoulder provisions; and
- A cattle grid at the property boundary if the access leads onto a sealed public road to remove dust and gravel from vehicle tyres.

4.10 Cultural Heritage

The desktop assessment of cultural heritage values for this report includes:

- Identification of indigenous stakeholders through registered cultural heritage bodies, Native Title tenure and Indigenous Land Use Agreements (ILUA);
- Identification of non-aboriginal cultural heritage places and values through evaluation of relevant cultural heritage databases; and
- Identification of heritage sites collected in EIS completed within the area.

4.10.1 Indigenous Cultural Heritage Assessment

The principle legislation protecting indigenous cultural heritage in Queensland is the *Aboriginal Cultural Heritage Act 2003* (ACH Act). Under the ACH Act a person who carries out an activity must take all reasonable and practicable measures to ensure the activity does not harm Aboriginal cultural heritage (the 'cultural heritage duty of care').

There is one registered Native Title claim covering the site (QUD6230/98, QC98/10), and an Indigenous Land Use Agreement (ILUA) is currently being prepared between Adani and the Jangga people (Table 4-14). The site is on leasehold land and therefore Native Title is not extinguished, as such the quarry and its associated operations will be addressed within the forthcoming ILUA with Jangga Operations Pty Ltd. No further Native Title determinations were identified from the National Native Title Register (NNTR) for the study area.

Table 4-14 Native Title Claim Details

Name	Tribunal No.	Status	Agreement Details
Jangga People Registered Native Title Claim Area (QUD 6230/98)	QC98/10	In Negotiation	Area Agreement

In addition to the current ILUA negotiations, Adani have the following agreements with the Jangga People:

- An Early Works Agreement was established in July 2011 for cultural heritage clearances undertaken from July to November 2011; and
- A Cultural Heritage Management Plan (CHMP) for the life of the Project was established and approved by the Chief Executive of EHP in November 2011. The CHMP is being amended to include Borrow 7 operations.

Indigenous cultural heritage studies undertaken with the Carmichael Coal Mine and Rail Project EIS have identified indigenous cultural heritage sites located within the region. The Carmichael Coal Mine and Rail (2012) literature suggested there is considerable evidence of the close association of discreet archaeological deposits with soaks and gilgai, which are predominate in the area of the proposed quarry.

Cultural heritage finds in the general locality have been dominated by a considerable variety of stone artefacts, with only three scarred trees and two occurrences of grinding grooves being noted. The majority of the scatters were low density; however, several scatters exhibited medium to high artefact densities, indicating that they may represent the locations of camping sites.

Adani understands its duty of care to protect and manage Aboriginal cultural heritage values under the ACH Act, and is committed to the management of cultural heritage values in and surrounding the Borrow 7 site. Adani will manage those values and mitigate quarry impacts through the CHMP as executed with the Jangga People, and through pre-clearance onsite cultural heritage surveys undertaken by qualified heritage personnel.

4.10.2 Non-Indigenous Cultural Heritage Assessment

The *Queensland Heritage Act 1992* (QH Act) is the principle legislation protecting non-indigenous cultural heritage in Queensland. The QH Act establishes the Queensland Heritage Council, which administers the Queensland and local heritage registers. Under the QH Act, penalties may apply for damage caused to places or items on the registers.

The Carmichael Coal Mine and Rail EIS (GHD, November 2012) listed the Great Barrier Reef and the Tree of Knowledge (Barcaldine) as the only Non-Indigenous cultural heritage sites applicable to the overall Project. Neither of these sites is within close proximity to the proposed Borrow 7 and therefore the development will not impact listed Non-Indigenous cultural heritage sites. Nevertheless, un-listed Non-Indigenous cultural heritage sites exist and these can include homesteads, churches, convict paving, agricultural buildings, survey trees, various sheds and huts, windmills, camps, tracks and stock routes. Various registers and data sources were consulted to identify existing sites of significant cultural heritage. Table 4-15 below lists of results from the Queensland Heritage Register search.

Table 4-15 Queensland Heritage Register search results

Title	Registration Type	Street Name	Location
Carmila Cane Lift	State Heritage	49 Hindles Road	Carmila West
Christ Church Anglican Church	State Heritage	Cannon Street	Saint Lawrence
Clermont Cemetery	State Heritage	Cemetery Road	Clermont
Irlam's Ant Bed Building	State Heritage	Clermont-Alpha Road	Oaky Creek
Meatworks and Wharf Site	State Heritage	Settlement Road	Saint Lawrence
Nebo Hotel	State Heritage	2 Reynolds Street	Nebo
Police Station and former Courthouse and Cell Block	State Heritage	Macartney Street	Saint Lawrence
Stone Farm Building	State Heritage	739 Fleurs Lane	Clermont

(GHD, November 2012)

The searches have indicated that there are no known Indigenous or non-Indigenous Cultural Heritage sites on the property or in the immediate vicinity.

4.10.3 Potential Impacts

A cultural heritage clearance survey was undertaken by the Jangga People for the initial geotechnical investigations. Two surveys were undertaken (January and April 2013) which assessed 47 locations within the overall Borrow 7 investigation area. The site will have a full cultural heritage clearance survey undertaken by the Jangga People as Native Title Claimants of the area under the agreed CHMP prior to works being undertaken.

4.10.4 Cultural Heritage Management

Cultural heritage will be managed through the CHMP. The CHMP defines and describes the objectives and practical measures for protecting or enhancing Indigenous cultural heritage environmental values, these include:

- Provisions for review and amendment;
- Commitment to implementing duty of care requirements;
- Commitment to ongoing field assessment of areas to be disturbed; and
- Commitment to adopting a hierarchical policy of avoidance through to management of impact (GHD, November 2012).

The management and mitigation processes set out in the CHMP include:

- Cultural heritage awareness training;
- Continued communication; and
- Continued cultural heritage assessment and associated reporting.

Adani will work with relevant Aboriginal parties to include cultural heritage training into its induction materials for exploration, construction and operation.

Representatives from relevant Aboriginal groups will have the opportunity to present cultural heritage awareness training face to face with key project personnel (GHD, November 2012).

No activities will be commenced until a full assessment of the site has been undertaken in line with the CHMP. Aboriginal parties and their relevant archaeologists will report on the outcomes of their surveys, including: methodology, nature and extent of Aboriginal cultural heritage observed, significance of artefacts, items or places of conservation or cultural heritage values and their values, likely impacts and recommendations for management (GHD, November 2012).

Based on the recommendations contained in the survey report and ongoing communications, management measures will be implemented and may include avoidance, further assessment, mitigation and or monitoring (GHD, November 2012).

Section 5 Land Use and Planning

The Borrow 7 development triggers assessment against multiple State and local legislative instruments and includes three referral agencies for the activities. Section 5 provides an assessment of the proposed development against the relevant legislative instruments.

5.1 State Planning Instruments

5.1.1 State Planning Policies

A State Planning Policy (SPP) is a statutory instrument developed by the State Government for matters of state interest and is prepared under the SP Act. SPPs may provide detailed codes and standards used in technical aspects of development assessment. Assessment against the 13 current SPPs is given in Table 5-1, only the temporary SPP 2/12 – Planning for Prosperity is applicable to the Borrow 7 development.

Table 5-1 State Planning Policy Assessment

State Planning Policy	Applicability
Temporary SPP 2/12 – Planning for Prosperity	The SPP applies to development on the Property and gives additional weight in the decision making process to: ▪ Agricultural uses in an area zoned for agricultural uses; and ▪ Mineral and extractive resource development which is complementary to an area's primary intended use. Part 2 of the SPP states that when making a decision on a development the assessment manager shall give weight to <i>"extractive industry development which can be shown to be complementary to an area's primary intended use"</i> (p.3). Under the <i>Belyando Shire Planning Scheme 2009</i>, Extractive Industry is listed as an 'appropriate use' within the Rural Zone. Therefore, SPP 2/12 is applicable to the development and shall be considered by IRC when assessing the development.
SPP 1/12 – Protection of Strategic Cropping Land (SCL)	The property does not contain any potential or confirmed SCL. Therefore, SPP 1/12 and the <i>Strategic Cropping Land Act 2011</i> (SCL Act) is not applicable to this development application.
SPP 4/11 – Protection Wetlands of High Ecological Significance in Great Barrier Reef Catchments	Although Lot 3235 PH752 contains a wetland protection area the SPP is not applicable as no relevant development will be occurring within the trigger area. The wetland protection area is located approximately 2.3 km to the south of the proposed quarry site.
SPP 5/10 - Air, Noise and Hazardous Materials	The SPP is not applicable as the area is not listed as a management area for the purposes of the policy.
SPP 4/10 – Healthy Waters	The SPP is relevant to stormwater and wastewater management for urban purposes. The proposed development is for Extractive Industry in a Rural zoned area and therefore the SPP is not relevant.
SPP 3/10 – Acceleration of compliance assessment	The SPP is not applicable as reconfiguration of a lot is not proposed as part of the development.
SPP 2/10 – South East Queensland Koala Conservation	The SPP is not applicable as the site is outside the South East Queensland area defined in the SPP.
SPP 2/07 – Protection of Extractive Resources and Guideline	The SPP is not applicable as no key resource areas are located within, or near, the site.
SPP 1/07 – Housing and Residential Development	The SPP is not applicable as it applies only to local governments, and the development is seeking to establish an Extractive Industry.

State Planning Policy	Applicability
SPP 1/03 – Mitigating the Adverse Impacts of Flood, Bushfire and Landslide	As per the introductory note in the Belyando Shire Planning Scheme 2009 SPP 1/03 the flooding component of SPP 1/03 is the only part applicable to development in the former shire area. This is confirmed in Annex 2 and Annex 3 of the SPP which exempts the Belyando Shire Council area from the fire and landslide provisions. In addition, no natural hazard management areas were identified as affecting the site.
SPP 2/02 – Planning and Managing the Development Involving Acid Sulfate Soils	Acid sulfate soils are not likely to occur at the site as elevations are greater than 10 m AHD (elevation is between 210 m and 220 m AHD). Therefore, an assessment against the provisions of SPP 1/02 has not been included.
SPP 1/02 - Development in the Vicinity of Certain Airports and Aviation Facilities	SPP 1/02 is not applicable as no aviation facilities are located at or near the site.
SPP 1/92 – Development and the Conservation of Agricultural Land	All three types of Good Quality Agricultural Land (GQAL) are located on Lot 3235 PH752. GQAL Class A occurs in a small section of the lot to the east of the Gregory Development Road. Class B occurs to the east of the Gregory Development Road and in the eastern portion along Gowrie and Mistake Creeks. Class C1 occurs immediately north and east of the proposed quarry site. Nevertheless, the location of the Extractive Industry development is outside the mapped GQAL area and therefore SPP 1/92 is not applicable to the development.

The Queensland Government released a new Draft SPP on the 22 April for public comment. This draft SPP is intended to replace the 13 current SPP's into one single SPP.

5.1.2 Mackay, Isaac and Whitsunday Regional Plan 2012 and State Planning Regulatory Provisions

The *Mackay, Isaac and Whitsunday Regional Plan 2012* (the Regional Plan) establishes the strategic direction for the region to 2031. As the pre-eminent plan for the region the regional plan takes precedence over all other planning instruments. The Regional Plan implements this strategy through a regional framework, Desired Regional Outcomes (DRO) and contains the Regional Plan State Planning Regulatory Provisions.

The proposed development is considered complementary to the regional framework and the DRO's of the Regional Plan for the following reasons:

- The proposed development is located on a site with no known flooding, landslide or fire hazard mapping. The proposed development will assist in developing a sustainable regional economy and due to the temporary nature of the development (24 months) it is not expected that climate change will have an impact.
- It will assist in diversifying the region's economy and provide employment opportunities;
- Quarry material from the proposed development will be used to construct *"infrastructure and services that meet the region's needs to support the economy"* (p.14) and accessibility;
- The development will be located in a currently disturbed environment and will limit impacts on the general environment;
- The development will facilitate the development of the region's natural resources, particularly the Carmichael Coal Mine and Rail Project which will provide rail access to the Galilee Basin;
- The surrounding ridgelines and points visible from public areas will be protected, therefore retaining the regional landscape; and
- The quarry will provide 33 - 35 onsite jobs and potentially more than 50 haulage personnel. This complements the vision to develop a strong regional economy.

The proposed development is in the Regional Landscape and Rural Production Area of the Regional Plan. Although urban and residential uses are considered inappropriate in this area, economic diversification is supported, including small-scale industrial development such as the proposed Borrow 7.

5.2 Local Planning Instruments

5.2.1 Belyando Shire Planning Scheme 2009

The proposed Borrow 7 is defined as 'Extractive Industry' under the *Belyando Shire Planning Scheme 2009* and is located within the Rural Zone. In accordance with Section 4.1.1 – Rural Zone Table of Assessment, an MCU for Extractive Industry is an impact assessable development to be assessed against all applicable codes.

5.2.1.1 Desired Environmental Outcomes

The *Belyando Shire Planning Scheme 2009* contains three Desired Environmental Outcomes (DEO) that set the strategic direction for the Shire. Given the scale and size of the proposal, together with the nature of the matters to be assessed, it is considered prudent to undertake an assessment against the relevant DEOs of the *Belyando Shire Planning Scheme 2009* to demonstrate that the proposal achieves the intent of the planning scheme.

Table 5-2 Assessment against Desired Environmental Outcomes

Desired Environmental Outcome	Assessment
The Natural Environment and Cultural Heritage	Under the DEO the ecological systems, natural environment and significant cultural heritage is to be protected and existing or intended landscape maintained. None of the ecologically significant sites listed in the DEO will be impacted by the development. As a result of historic and current grazing activities at the Borrow 7 site, the extent, connectivity and ecological integrity of vegetation communities and the fauna habitat they provide, have been altered. Nevertheless, the operations and extraction areas have been located to minimise impacts on the environment and management measures have been provided in Section 4. Therefore, it is considered that the proposal is consistent with this DEO.
Economic Development	The DEO states that the viability of the mining industry is to be protected and the economy of the area is to be diversified. In addition, natural resources are to be used suitably. The Borrow 7 development will be utilising a historic quarry area and is necessary for the construction of the Carmichael Coal Mine and Rail project which will open up the Galilee Basin to coal export opportunities. Therefore, it is considered that the proposal is consistent with this DEO.
Community Wellbeing	Under the DEO the towns of Moranbah and Clermont are retained as the primary employment centres for the Shire and provide the regions primary services. The towns are to maintain strong, connected and vibrant communities. The rural amenity and productive capacity of other parts of the Shire is to be maintained. The proposed development will increase demand for goods and services from the towns of Moranbah and Clermont, further establishing them as the primary service centres for the region. In addition, the quarry will be located in an unproductive area not classified as GQAL and the productive capacity of the surrounding agricultural land will be retained. Therefore, it is considered that the proposal is consistent with this DEO.

5.2.1.2 Rural Zone Code Assessment

The proposed Extractive Industry development is consistent with the outcomes for the Rural Zone Code (Section 4.1.2.2) particularly the following:

- *"The Rural 'Zone' retains its viability as an area of primary production and natural resource use, including mining."*
- *"Rural activities" and mining are appropriately located within the Rural "Zone" and are not prejudiced by inappropriate development."*
- *"Is located, designed and operated in a manner that protects and enhances the predominant rural scale, intensity, form and character"*
- *"Does not prejudice or impact adversely on other 'uses', particularly 'sensitive land uses', including those within other zones."*
- *"Has an appropriately designed access to the road network, and traffic generated by the development does not impact adversely on the local road network."*
- *"Does not adversely impact on areas and sites of conservation importance, including cultural and high landscape values."*

In accordance with the Rural Zone Code the following is an appropriate use:

- *"Extractive industries, where they are located and operated so as to ensure no unacceptable detrimental impact on surrounding uses or on the environment" [Section 4.1.2.2 (4) (b)].*

A review of development against the Performance Criteria and Acceptable Solutions for MCU in the Rural Zone has been undertaken. Where the proposed development does not comply with a Performance Criteria and Acceptable Solutions, alternative solutions have been proposed and are listed in Table 5-3.

Table 5-3 Alternative solutions

Performance Criteria	Acceptable Solutions
Amenity	
PC2 Non-"Rural Activities" - Scale Non-"rural activities" are of a scale that is consistent with the amenity and character of the locality and do not prejudice the operation and viability of other "uses" or activities in the Rural "Zone" or other "zones".	AS2 The "total use area" is less than 150m ² .
Alternative Solution – PC2	
The development is a non-rural activity and is considered consistent with the amenity and character of the locality. The total use area will be approximately 36.17 ha however due to its location (set back from public roads and residential dwellings) the development will not adversely impact the amenity of the surrounding area. Management measures to reduce light spillage, as well as prevent dust and noise impacts on surrounding sensitive receptors, Twin Hills Road and the Gregory Development Road are outlined in Section 4. The location of the activity exceeds all minimum separation distances in schedule 2.	
PC3 Non-"Rural Activities" - Operating Hours Non-"rural activities" are operated so as to ensure that the activities and the operation of equipment occur at appropriate times to protect the amenity of the locality.	AS3 Non-"rural activities" are operated only between the hours of 7:00am and 6:00pm.

Performance Criteria	Acceptable Solutions
Alternative Solution – PC3	
In order to maintain the Carmichael Coal Mine and Rail construction schedule Borrow 7 is proposed to operate on a 24 hr basis. The location for the Extractive Industry is remote and the closest sensitive receptor is located approximately 6.7 km to the north-west of the proposed quarry pit. Noise and dust emissions from the quarry are unlikely to impact these residences; nevertheless management measures will be implemented to avoid any potential adverse impacts. The activities of the quarry at night will be minimised to essential operations only and management measures will be implemented to avoid any potential noise and light impacts. The quarry may be up to 15 m deep, however the sides of the main ridge will be maintained and will provide visual shielding.	
PC4 Non-“Rural Activities” - Delivery of Goods The loading and unloading of goods in connection with non- “rural activities” occurs at appropriate times to protect the amenity of the locality.	AS4.1 Loading and unloading occurs only between the hours of: (a) 7:00am and 6:00pm, Monday to Friday; and (b) 7:00am and 12:00 (noon) on Saturdays. AS4.2 No loading and unloading occurs on Sundays and public holidays.
Alternative Solution – PC4	
In order to maintain the Carmichael Coal Mine and Rail construction schedule Borrow 7 is proposed to operate on a 24 hr basis. The location for the Extractive Industry is remote and the closest sensitive receptor is located approximately 6.7 km to the north-west of the proposed quarry pit. Noise and dust emissions from the quarry are unlikely to impact these residences; nevertheless management measures will be implemented to avoid any potential adverse impacts. The activities of the quarry at night will be minimised to essential operations only and management measures will be implemented to avoid any potential noise and light impacts. The quarry may be up to 15 m deep, however the sides of the main ridge will be maintained and will provide visual shielding.	
PC11 Landscaping and External Activity Areas Landscaping and external activity areas are provided on-site to: (a) contribute to a pleasant and functional rural built form; (b) provide positive sun and breeze control; (c) make provision for recreation areas; and (d) contribute to the positive visual qualities of the locality.	No acceptable solution is prescribed.
Alternative Solution – PC11	
The development will be for an operating quarry and may have some permanent infrastructure during the life of the quarry operations. The site will not be visible from any public areas and will not be accessible to the general public. Therefore, landscaping is not considered necessary for the development.	
PC12 Lighting The design of lighting does not prejudice the amenity of the locality through poorly directed lighting, lighting overspill or lighting glare.	AS12 Direct lighting or lighting does not exceed 8.0 lux at 1.5 metres beyond the boundary of the site.
Alternative Solution – PC12	
Lighting will be directly focused on work fronts, access and amenities areas. Lighting will be provided by industry standard mobile light towers with four 1500 W halide lights with the ability to be directed towards the specific work area to prevent light spill from the boundary. The units are fitted with a fluid containment tray to prevent any environmental spills.	

Performance Criteria	Acceptable Solutions
Infrastructure	
PC14 Water Supply All “premises” have an adequate volume and supply of water for the “use”.	AS14.2 “Premises” are connected to an approved water allocation as provided by the relevant agency. or AS14.3 “Premises” are connected to a rain water tank with a minimum capacity of: (a) 45, 000 litres where not in a reticulated water supply area; (b) 22, 000 litres where in a reticulated water supply area.
Alternative Solution – PC14	
25,000 L water tank on site to supply drinking water and ablution water. On site water for operations and dust suppression to be supplied by a water storage dam which will have approximate capacity of 45 ML to collect overland flow from the quarry site.	
PC15 Effluent Disposal All “premises” provide for the treatment and disposal of effluent and other waste water to ensure the protection of public health and environmental values.	AS15.1 “Premises” are connected to Council’s reticulated sewerage system. or AS15.2 “Premises” not in a sewered area have an on-site effluent disposal system in accordance with Schedule 1, Division 4: Standards for Sewerage Supply, Section 4.2.
Alternative Solution – PC15	
“Premises” not in a sewered area will have an on-site effluent disposal system in accordance with Schedule 1, Division 4: Standards for Sewerage Supply, Section 4.2. The onsite sewage code DNRM and the onsite sewage facilities guidelines for effluent Quality DNRM are no longer current documents. The site will comply with the AS1547.300 – Onsite Domestic –Wastewater management as this applies to systems dealing with up to 10 persons.	
PC19 Vehicle Parking and Service Vehicle Provision Vehicle parking and service vehicle provision is adequate for the “use” and ensures safe and functional operation for motorists and pedestrians.	AS19.1 All “uses” provide vehicle parking in accordance with Schedule 1, Division 2: Standards for Roads, Carparking, Manoeuvring Areas and Access, Section 2.2(1)(a). AS19.2 Car parking, service vehicle parking and manoeuvring areas are designed and constructed in accordance with Schedule 1, Division 2: Standards for Roads, Carparking, Manoeuvring Areas and Access, Section 2.2(1)(b).
Alternative Solution – PC19	
Under Schedule 1, Section 2.2 (1) (a) of the <i>Belyando Shire Planning Scheme 2009</i> , Industry uses (including Extractive Industry) must have 1 car parking space per 100m ² of total use area. The definition of ‘total use area’ would likely include all areas of the proposed development used for quarrying. To comply with the code for a 36.17 ha Extractive Industry activity would require an excessive number of car spaces. Adani will have 30 - 35 personnel on site at any one time who will be transported by bus and therefore proposes 4 car spaces for visitors which will be segregated from the work and haul areas. This quantity of spaces will accommodate the workforce and no car parks for public vehicles are required.	
PC20 Roads Adequate all-weather road access is provided between the “premises” and the existing road network.	AS20 Roads are designed and constructed in accordance with Schedule 1, Division 2: Standards for Roads, Car parking, Manoeuvring Areas and Access, Section 2.1(1).

Performance Criteria	Acceptable Solutions
Alternative Solution – PC20	
Access road from the quarry will be directly to the rail haul road and will be designed for all weather access. The access roads will be hard patched gravel with a 9 m width.	
PC30 Excavation or Filling Excavating or filling of land: (a) ensures safety and amenity for the users of the “premises” and nearby land; (b) minimises soil erosion and instability of surrounding areas; and (c) does not degrade the environmental values of receiving waters	AS30.1 Batters have a maximum slope of 25%, are terraced at every rise of 1.5 metres and each terrace has a minimum depth of 750mm. AS30.3 The extent of filling or excavation does not exceed 40% of the site area or 500m ² whichever is lesser. AS30.4 Filling and excavation is not greater than 1 metre in height or depth.
Alternative Solution – PC30	
Not relevant to an extraction area, but is relevant to the development of site access roads. The extraction and filling for the access roads will meet AS30.1 and AS30.4. The access road will be 9 m wide and approximately 900 m long, with an area of 36,000 m ² .	

Section 6 Conclusion

Borrow 7 is proposed to be developed over 36.17 ha of generally disturbed land (grazing and quarry activities), approximately 144 km north-west of Clermont in Central Queensland. Borrow 7 is a large and topographically complex site that is generally vacant of vegetation, contains a significant amount of exotic species and has no watercourses.

Monitoring and surveys were carried out to assess the existing environment, the flora and fauna present on site, the existing background noise and air quality and the current road conditions and traffic movements.

Desktop analyses by field experts were undertaken for the flora and fauna, ecology, soils and geology, hydrogeology and traffic and transport.

The impact assessment has determined that the activity will be acceptable and no major or high risk impacts are likely. The main issues required carefully management include:

- Weed control prior to development of the site to address Parthenium (and other weeds) presence;
- Careful management and noise controls of night time noise during the peak production month of May 2015 in unstable weather conditions to ensure noise limits are not exceeded; and
- Baseline monitoring of nearby groundwater bore and installation of groundwater bores to ensure there are no unexpected impacts to local groundwater.

The land use and planning assessment has established that the quarry is generally consistent with the requirements of the *Belyando Shire Planning Scheme 2009* and State Planning instruments.

In accordance with Australia's National Strategy for Ecologically Sustainable Development (1992), ecologically sustainable development is defined as *"using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased"* (ESDSC, 1992). Borrow 7 is proposed to be developed on a disturbed site and will be located to avoid Threatened Ecological Communities and areas of conservation significance. The Borrow 7 development seeks to appropriately utilise quarry resources for the construction of essential infrastructure to service the surrounding region. Comprehensive environmental management controls will be enforced during construction and operation of the quarry and the ecological processes of the surrounding area will be maintained. Borrow 7 will support the economy and employment in the local and wider region and is considered consistent with the principles of ecologically sustainable development.

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Section 8 Acronyms and Abbreviations

Acronym/Abbreviation	Description
AAPT	Adani Abbot Point Terminal
ACH Act	<i>Aboriginal Cultural Heritage Act 2003</i>
AHD	Australian Height Datum
CBR	California Bearings Ratio
CHMP	Cultural Heritage Management Plan
CLR	Contaminated Land Register
DEO	Desired Environmental Outcome
DRO	Desired Regional Outcome
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMR	Environment Management Register
EP Act	<i>Environmental Protection Act 1994</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EP Regulation	<i>Environmental Protection Regulation 2008</i>
ERA	Environmentally Relevant Activity
ESCP	Erosion and Sediment Control Plan
GQAL	Good Quality Agricultural Land
ha	Hectare
IDAS	Integrated Development Assessment System
ILUA	Indigenous Land Use Agreement
IECA	International Erosion and Sediment Control Guidelines 2008
IRC	Isaac Regional Council
km	Kilometre (s)
LT Act	<i>Land Title Act 1994</i>
m	Metre (s)
m ³	Cubic Metres
Mbgl	Metres Below Ground Level
MCU	Material Change of Use
NNTR	National Native Title Register
MQSH Act	<i>Mining and Quarry Safety and Health Act 1999</i>
Mtpa	Million Tonnes Per Annum
NC Act	<i>Nature Conservation Act 1992</i>
NRM	Department of Natural Resources and Mine (Qld)
PMAV	Property Map of Assessable Vegetation
PVMP	Property Vegetation Management Plan
QH Act	<i>Queensland Heritage Act 1992</i>
RE	Regional Ecosystem
SARA	State Assessment and Referral Agency
SCL	Strategic Cropping Land
SCR	State Controlled Road
SDPWO Act	<i>State Development and Public Works Organisation Act 1971</i>
SP Act	<i>Sustainable Planning Act 2009</i>
SP Regulation	<i>Sustainable Planning Regulation 2009</i>
SPP	State Planning Policy
SWMP	Stormwater Management Plan
t	Tonnes
TMR	Department of Transport and Main Roads (Qld)
VM Act	<i>Vegetation Management Act 1999</i>

Appendix A – Adani Environment Policy

Adani Mining Pty Ltd

Environment and Sustainability Policy

Adani Mining Pty Ltd is an environmentally responsible company that is committed to protection of the environment and to the sustainable management of its operations and activities.

We will achieve this by:

- Promoting engagement, participation and a culture of innovation;
- Encouraging the efficient use of water and energy, recycling of materials, reduction of waste and prevention of pollution;
- Improving our management of greenhouse emissions and energy efficiency;
- Implementing and maintaining an Environmental Management System in accordance with AS/NZS ISO 14001;
- Meeting or exceeding environmental legislation and other criteria to which we subscribe;
- Completing regularly reviews of our environmental performance and identify and implement opportunities for improvement;
- Motivating and influencing our suppliers and subcontractors with our approach towards responsible environmental practice;
- Promoting initiatives, systems, values and behaviours that drive environmental sustainability;
- Displaying strong leadership in environmental management internally and within the industries we operate; and
- Provide a positive environmentally friendly working environment.

We all have an accountability and responsibility to:

- Immediately report and remediate any damage, spills or loss of containment;
- Follow all environment and sustainability work practices, procedures, instructions and rules;
- Work in a manner which ensures minimal environmental impact;
- Encourage other employees to work in a responsible manner; and
- Participate in training.

A blue ink signature of Samir Vora, written in a cursive style.

Samir Vora
Chief Operating Officer

Date: 24th May 2012

Appendix B – PMAV

environmental management



Borrow 7 Quarry Complex PMAV

Old Twin Hills, Elgin Moray Road, Clermont

6550
3 May 2013
Adani Mining Pty Ltd





Document Control

Title	Borrow 7 Quarry Complex PMAV
Address	Old Twin Hills, Elgin Moray Road, Clermont
Job Number	6550
Client	Adani Mining Pty Ltd

Document Issue

Issue	Date	Prepared By	Checked By
Draft	08.04.2013	Dr Andrew Davies	Ross Marshall
Internal Review	10.04.2013	Dr Andrew Davies	Murray Saunders
Client Issue	11.04.2013	Dr Andrew Davies	Murray Saunders
Final	03.05.2013	Dr Andrew Davies	Murray Saunders

Disclaimer

This report has been prepared for **Adani Mining Pty Ltd**. **Saunders Havill Group** cannot accept responsibility for any use of or reliance upon the contents of this report by any third party.

Reports and/or Plans by Others

Reports and/or plans by others may be included within this PMAV report to support the document.



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Plans

- Plan 1: Proposed PMAV



I. Introduction

The *Environmental Management Division* of the **Saunders Havill Group** was engaged by **Adani Mining Pty Ltd** to prepare a *Complex Property Map of Assessable Vegetation* (PMAV) application for the proposed Borrow 7 Quarry on the Old Twin Hills property, Elgin Moray Road, Clermont. The purpose of the Borrow 7 Quarry is to provide hard rock material for the Carmichael Coal Mine and Rail Project, a 'significant project' under the *State Development and Public Works Organisation Act 1971*. This Complex PMAV application has been prepared as per the requirements outlined within the *Application Kit for a Property Map of Assessable Vegetation (2004)* and the *Vegetation Management Act 1999* (VMA) and is intended to rectify mapped Regional Ecosystems at the property scale.

The lot covers 20,700 ha, while the proposed Borrow 7 Quarry site encompasses an area of approximately 36.17 ha. The mapped polygons addressed in this PMAV cover an area of approximately 221.1 ha. Contextually, the assessment site is located approximately 120 kilometres North-West of Clermont (Refer to **Figures 1 & 2**). The surrounding land use is rural.

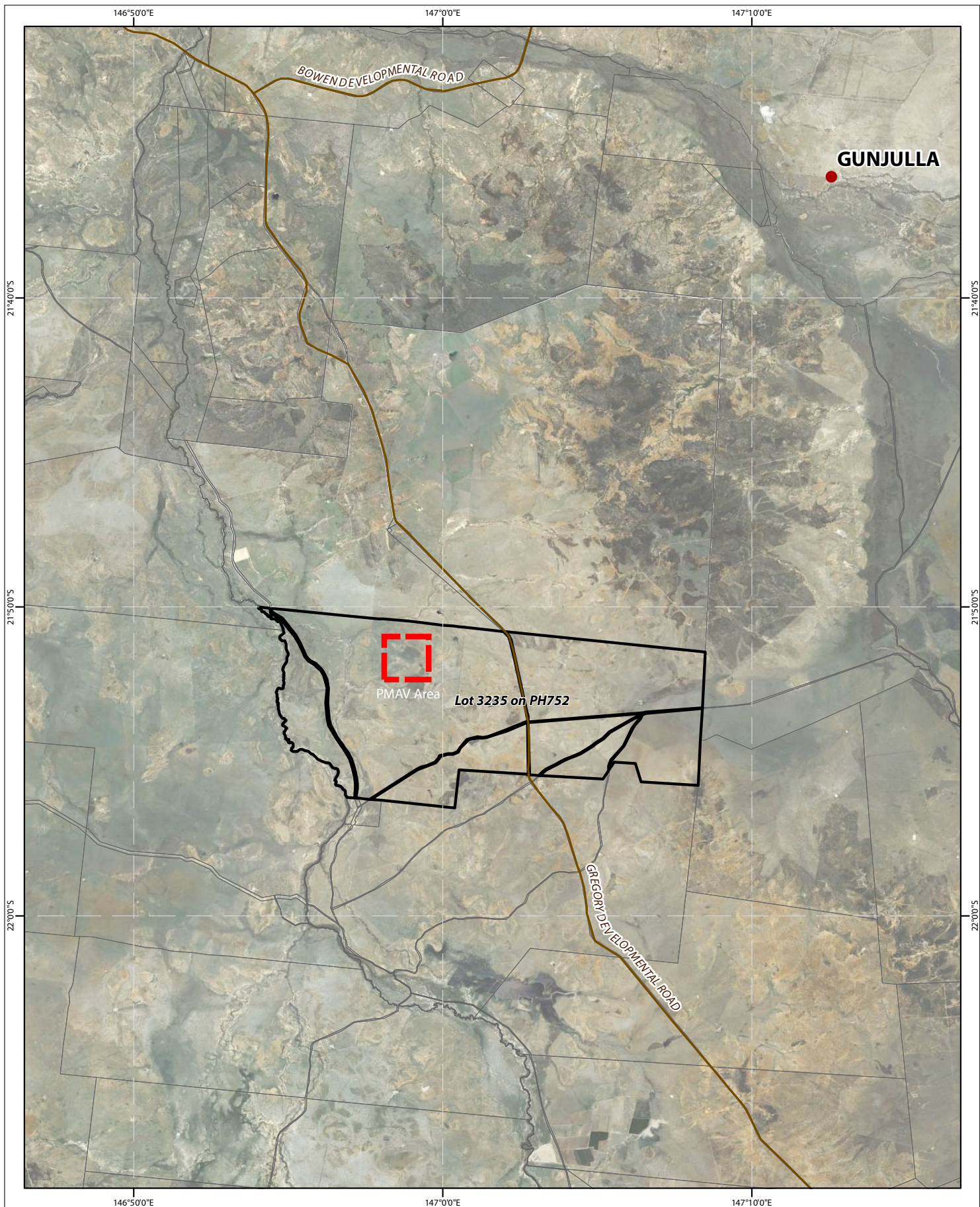
Table 1: Property Summary

Address	Old Twin Hills, Elgin Moray Road, Clermont
RPD	Lot 3235 on PH752
Area Addressed by PMAV	Approximately 221.1 ha
Local Government Area	Isaac Regional Council
Planning Scheme	<i>Belyando Shire Planning Scheme 2009</i>
Local Plan Zoning	Rural
VMA 1999	Composite Endangered • Of Concern RE 11.4.6 • Endangered RE 11.4.8 Composite Of Concern • Of Concern RE 11.11.9 • Endangered RE 11.11.16
Topography	Gentle Undulating Rise and clay plains
Existing Land Use	Rangelands
Proposed Land Use	Quarry / Extraction
Land Tenure	Leasehold
Previous PMAV Applications	NA



I.I. Report Purpose

The purpose of this report is to provide supporting evidence for the submitted PMAV. The PMAV redefines the presence of mapped remnant communities on a section of the property and accurately delineates the true boundary of each of these communities at the property scale. The information within this report provides evidence to demonstrate that all categories and/or Regional Ecosystem codes assigned to the submitted PMAV are accurate.



Legend

- Town / Place Name
- Major Roads
- Lot 3235 on PH752
- Isaac DCDB

Figure 1 Site Context

File ref. 6550 E 01 Aerial Site Context A
Date 10/04/2013
Project Carmichael Coal Rail Project

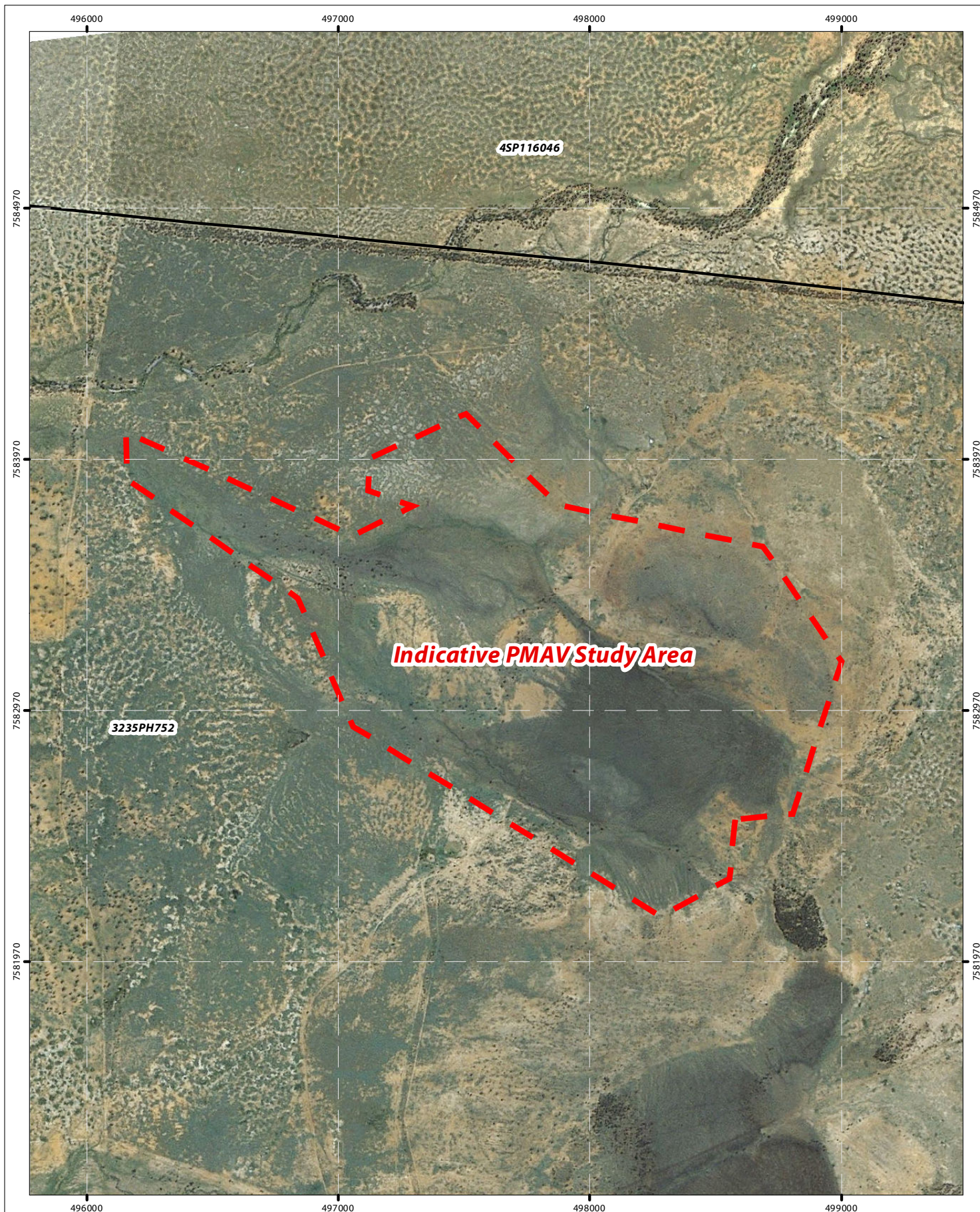
0 1 2 4 6 8 10 km
 Scale (A4): 1:300,000 [GDA 1994 MGA Z55]



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Legend

 Lot 3235 on PH752

Figure 2 Site Aerial

File ref. 6550 E 01 Site Aerial A

Date 10/04/2013

Project Carmichael Coal Rail Project

0 100 200 400 600 800 m
Scale (A4): 1:20,000 [GDA 1994 MGA Z55]



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2. Methodology

A detailed site assessment was conducted to accurately map and define vegetation into categories as defined by the **Queensland Herbarium**. The applied methodology was designed to ensure an accurate delineation of the separate polygons and ensure all supporting information responds to the requirements of a properly made PMAV submission. The following steps were undertaken:

1. Desktop Research
 - Existing environmental studies undertaken on the surrounding lots by **Saunders Havill Group**
 - Regional Ecosystem species lists
 - Soil maps
2. Review of Historical Aerial Photography
3. Vegetation Survey
4. GPS Mapping of Vegetation Communities

2.1. Desktop Research

Prior to entering the site, the following vegetation based information resources were assessed to assist in the final determination of the on-site survey methodology:

- Existing vegetation mapping released under the provisions of the *Vegetation Management Act 1999* and Regional Ecosystem descriptions.
- Review of the **Queensland Herbarium** mapping methodology and procedures outlined in Neldner, V.J., Wilson, B.A., Thompson, E.J. and Dillewaard, H.A. (*Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland*).
- Environmental Database Searches for the *Environment Protection and Biodiversity Conservation Act 1999*.
- Applicable Schedules of the *Nature Conservation (Wildlife) Regulation 1994*.
- Geology (250K), Soils and Topographical Maps.
- Specific **Queensland Herbarium** searches for records of unknown or specific vegetation species listed to occur in the region.
- Previous complex PMAV applications in the locality.

2.2. Vegetation Survey Methodology

Following the broad delineation of vegetation communities using historical aerial photography and information obtained in the desktop review (including stereoscopic analysis), a detailed vegetation survey was conducted to locate, describe and map the Regional Ecosystem polygons located on-site.

A combination of Vegetation Transects (Form D) and Quaternary Survey Sites were utilised to evaluate vegetation status in the field. All mapping data were collected using a Trimble GEO-XT with sub 1 m accuracy. (Refer to **Plan 1** for Proposed PMAV Plan).



2.3. Scale

Spot 5 Imagery and aerial photography have been used to delineate the correct remnant boundary line-work. The remnant vegetation polygon was traversed and logged using a Trimble GEO-XT sub 1 m accurate GPS unit. The PMAV has been completed at a scale of 1:5000.



3. Desktop Analysis

3.1. Geology & Soils Mapping

Geology mapping overlays elevated areas of the quarry site as 'Pebbly quartz, sandstone, quartz sandstone, conglomerate, minor mudstone and lithic sandstone - Clh' and lower areas as 'Soil, sand and gravel - Cz' and 'Silt, sand and gravel - Qa' (**Figure 3**). Cz and Qa refer to relatively recent Cainozoic Tertiary and Quaternary deposits, respectively. Clh formations are part of the *Mount Hall Formation* of quartzose to feldspathic sublabile sandstone, quartz-pebble conglomerate, mudstone and red and green siltstone formed in the Lower Carboniferous.

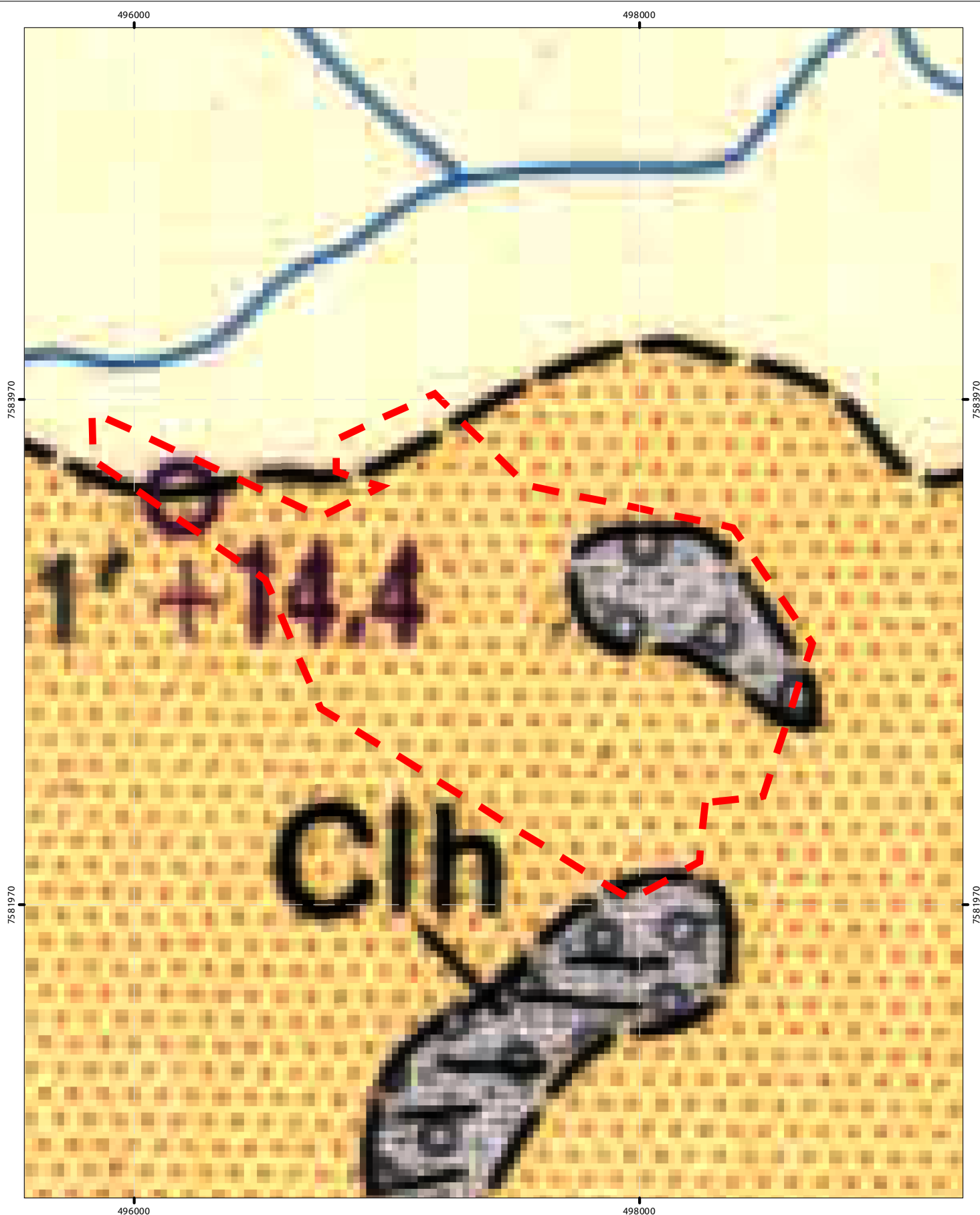
Soil mapping indicates the quarry site is predominantly made up of Kandosols to the West and Sodosols to the East (**Figure 4**). Kandosols and Sodosols are described as;

Kandosols- structure-less soils

Kandosols are mostly well-drained, permeable soils although some Yellow and most grey Kandosols have impeded subsoil drainage. They are common in all states except Victoria and Tasmania but are most widespread in the arid and semi-arid interior. Kandosols are used for extensive agriculture in the wheatbelt of southern New South Wales and southwest Western Australia. In the better watered areas they are used for a range of horticultural crops. Most Kandosols have low fertility and land use is restricted to grazing of native pastures. Grazing lands are susceptible to surface soil degradation such as hardsetting and crusting even though grazing intensity is low.

Sodosols- soils high in sodium and an abrupt increase in clay

Sodosols have an abrupt clay increase down the profile and high sodium content, which may lead to soil dispersion and instability. Seasonally perched water tables are common and subsoil horizons have a striking prismatic or columnar appearance. Sodosols are usually associated with a dry climate and are widely distributed in the eastern half of Australia and the western portion of Western Australia. Common land uses include grazing of native or improved pastures for both dryland and irrigated agriculture, and forestry. Many will hardset when dry and are prone to crust formation. Dispersive subsoil's make sodosols particularly prone to tunnel and gully erosion and arid zone sodosols may be strongly saline.



Legend

- | | |
|--|---|
|  | Soil, sand & gravel |
|  | Pebbly quartz, sandstone, quartz sandstone, conglomerate, minor mudstone and lithic sandstone |
|  | Silt, sand, gravel |

Figure 3 Geology Mapping

File ref. 6550 E 03 Geology A
Date 10/04/2013
Project Carmichael Coal Rail Project

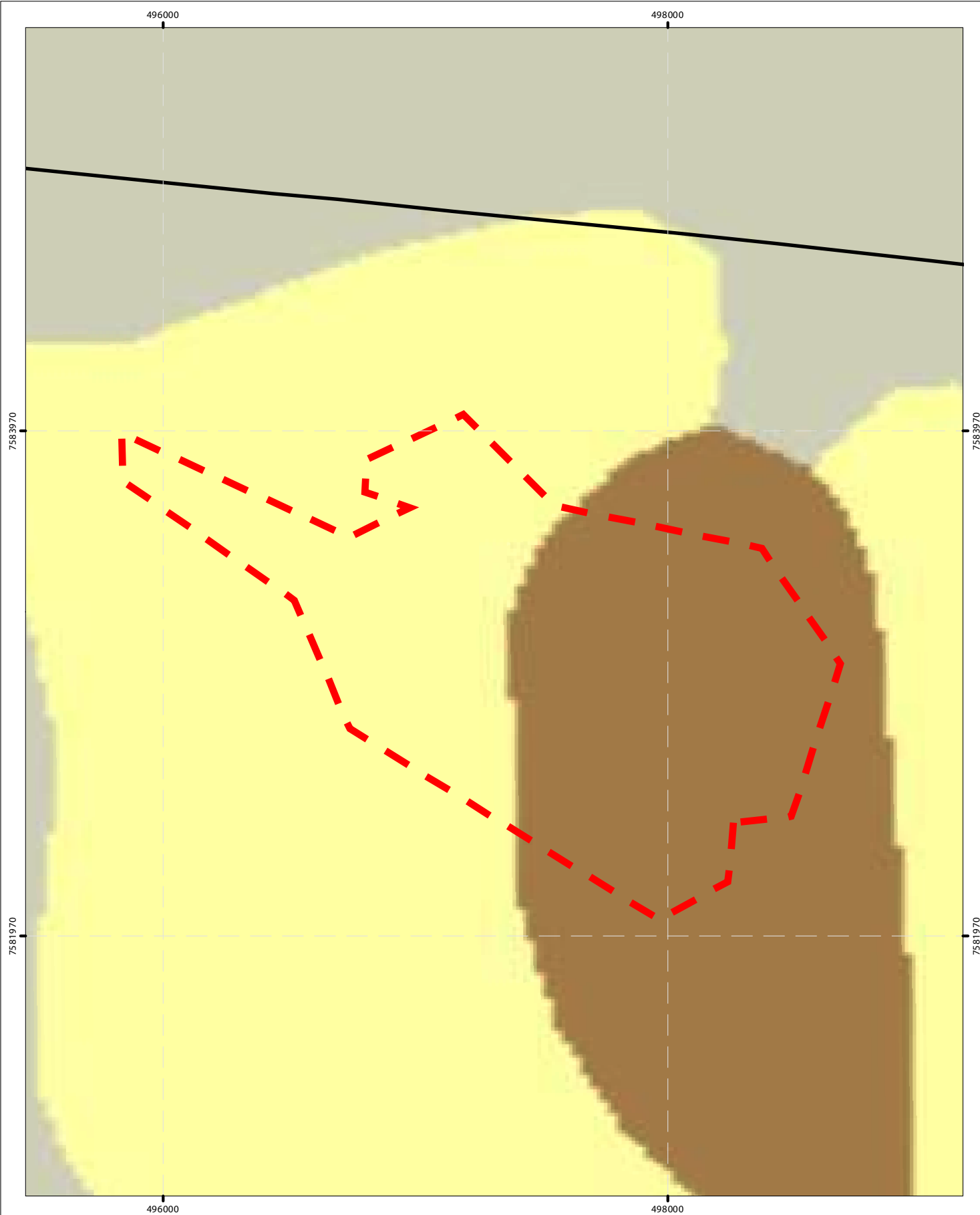
0 100 200 400 600 800 m
 Scale (A4): 1:20,000 [GDA 1994 MGA Z55]



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Legend

-  Isaac DCDB
-  Kandosols
-  Vertosols
-  Sododols

Figure 4 Soils Mapping

File ref. 6550 E 04PMAV Soils A

Date 10/04/2013

Project Carmichael Coal Rail Project

0 0.5 1 km
Scale (A4): 1:20,000 [GDA 1994 MGA Z55]



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3.2. Regional Ecosystem Mapping

The site is overlaid by *Regional Ecosystem and Remnant Mapping Version 6.1* with two composite remnant vegetation polygons. The larger of the two polygons is comprised of Of Concern Regional Ecosystem 11.4.6 (90%) and Endangered Regional Ecosystem 11.4.8 (10%) (**Figure 5**). The small Of Concern polygon to the South of the site is comprised of Least Concern Regional Ecosystem 11.11.9 (80%) and Of Concern Regional Ecosystem 11.11.16 (20%) (**Figure 5**).

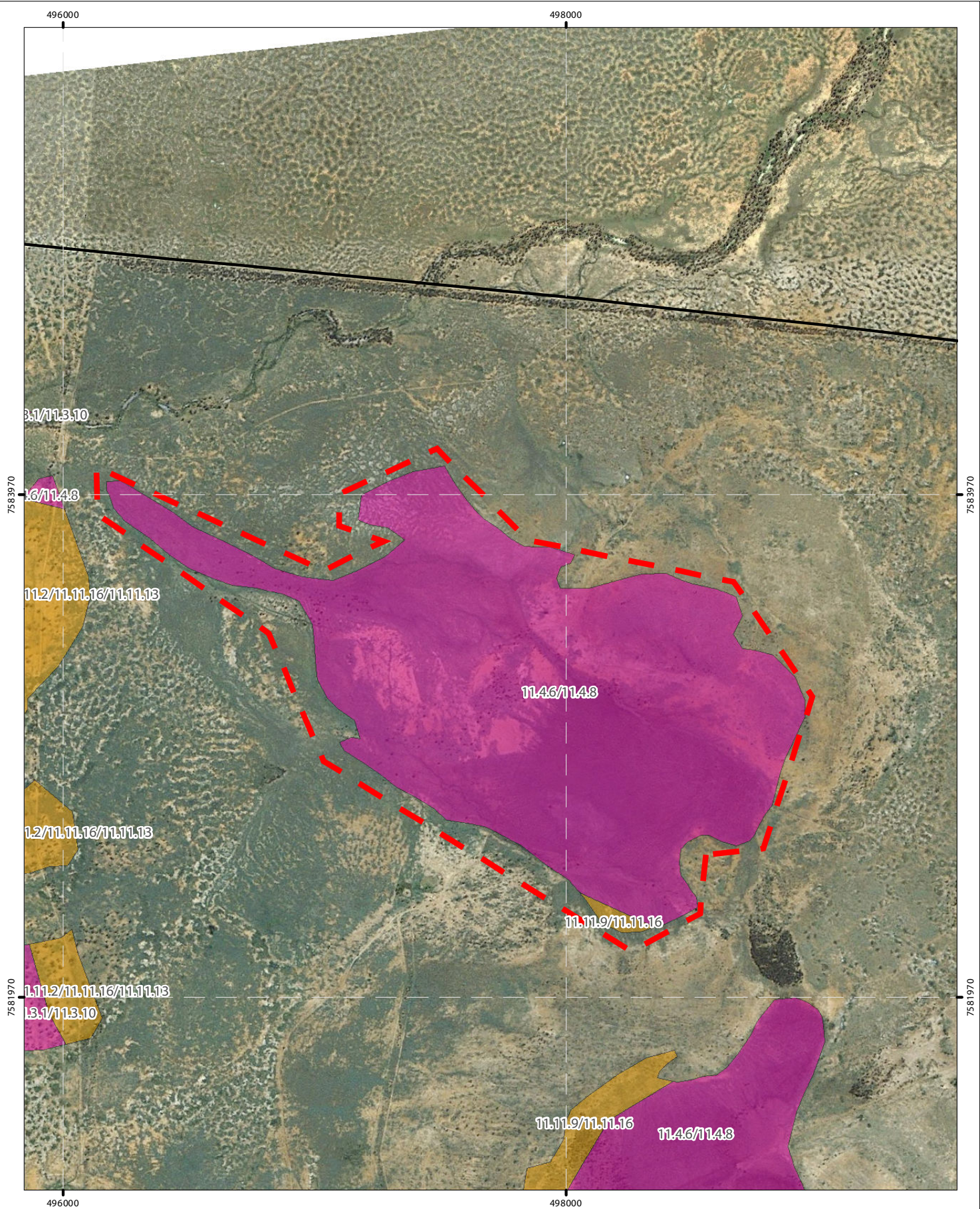
RE 11.4.6 / 11.4.8 - Endangered

Description	RE 11.4.6 – Of Concern: <i>Acacia cambagei</i> dominates the tree canopy (10-13 m high). There is a sparse to open low tree layer (7-9 m high) dominated by <i>Lysiphyllum carronii</i> , <i>Geijera parviflora</i> , <i>Acacia harpophylla</i> , and sometimes <i>A. argyrodendron</i> , <i>Terminalia oblongata</i> , and <i>Eremophila mitchellii</i> . An open shrub layer (1m high) dominated by species such as <i>Carissa ovata</i> , <i>Capparis lasiantha</i> , <i>Eremophila deserti</i> , <i>Apophyllum anomalum</i> and <i>Alectryon diversifolius</i> is also often present. The ground layer is sparse to open and dominated by grasses. Occurs on gently undulating plains formed from Cainozoic sediments. Associated soils are texture contrast with thin sandy or loamy surface horizons and strongly alkaline clay subsoils. (BVG1M: 26a)
Description	RE 11.4.8 – Endangered: Woodland to open-forest dominated by <i>Eucalyptus cambageana</i> and <i>Acacia harpophylla</i> or, sometimes in the north, <i>A. argyrodendron</i> . <i>E. thozetiana</i> is sometimes present on shallower soils. There is a moderately dense low tree layer (5 m high) layer dominated by species such as <i>Eremophila mitchellii</i> and a low shrub layer (2 m high) dominated by species such as <i>Carissa ovata</i> and <i>Geijera parviflora</i> . Occurs on level to gently undulating plains formed from Cainozoic deposits. Associated soils are usually deep texture contrast with thin loamy or sandy surface horizons overlying strongly alkaline clay subsoils. Surface or subsurface gravel is common. (BVG1M: 25a). Major vegetation communities include: 11.4.8a: Palustrine wetland (e.g. vegetated swamp). Gilgai and small depressions on clay plains usually associated with <i>Acacia harpophylla</i> ecosystems. Generally support a range of sedges, grasses and, when wet, aquatic species. (BVG1M: 34d)

RE 11.11.9 / 11.11.16 – Of Concern

Description	RE 11.11.9 – Least Concern: <i>Eucalyptus populnea</i> or <i>E. brownii</i> woodland to open-woodland. Occurs on undulating rises and lower slopes of hills formed on moderately to strongly deformed and metamorphosed sediments and interbedded volcanics. (BVG1M: 17a)
Description	RE 11.11.16 – Of Concern: <i>Eucalyptus cambageana</i> , <i>Acacia harpophylla</i> open-forest to woodland. Occurs on gently undulating plains and rises formed on moderately to strongly deformed and metamorphosed sediments and interbedded volcanics. (BVG1M: 25a)

When considering Regional Ecosystem mapping it should be noted that the mapping is compiled at a scale of 1:50,000 which may produce inaccuracies at the property scale.



Legend

DCDB

Regional Ecosystem v6.1

Remnant vegetation containing Endangered REs

Remnant vegetation containing Of Concern REs

Remnant vegetation that is a Least Concern RE

Figure 5 Regional Ecosystem v6.1

File ref. 6550 E05 REA

Date 10/04/2013

Project Carmichael Coal Rail Project

0 100 200 400 600 800 m
Scale (A4): 1:20,000 [GDA 1994 MGA Z55]



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Layer Sources DCDB, Places, Major Roads (DNRM 2012), Pre Clear (DEHP 2012), PMAV Changes (SHG 2013)



3.3. Pre Clear Mapping

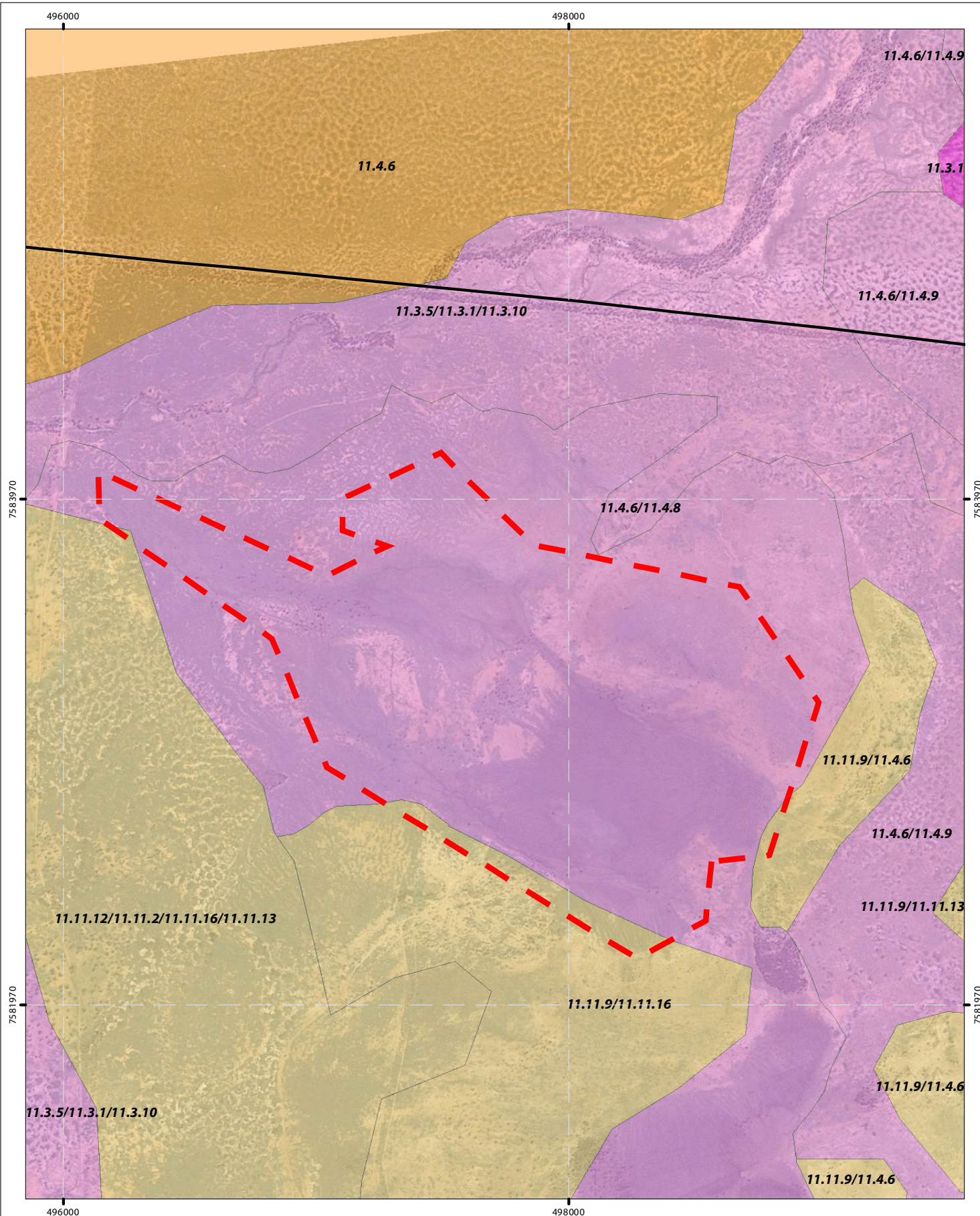
The site is overlaid by *Pre Clear Mapping* with three composite remnant vegetation polygons. The largest polygon is Endangered Sub-Dominant and comprised of Of Concern Regional Ecosystem 11.4.6 and Endangered Regional Ecosystem 11.4.8 (**Figure 6**). The smaller Of Concern Sub-Dominant polygon to the South of the site is comprised of Not Of Concern Regional Ecosystem 11.11.9 and Of Concern Regional Ecosystem 11.11.16 (**Figure 6**). A small portion of an Of Concern Sub-Dominant polygon made up of previously listed REs (RE 11.11.9 and RE 11.4.6) borders the site along its eastern boundary, and the sliver of composite Of Concern Sub-Dominant polygon at the site's far western boundary is ignored for the purpose of this PMAV (**Figure 6**).

RE 11.4.6 / 11.4.8 - Endangered

Description	RE 11.4.6 – Of Concern: <i>Acacia cambagei</i> dominates the tree canopy (10-13 m high). There is a sparse to open low tree layer (7-9 m high) dominated by <i>Lysiphyllum carronii</i> , <i>Geijera parviflora</i> , <i>Acacia harpophylla</i> , and sometimes <i>A. argyrodendron</i> , <i>Terminalia oblongata</i> , and <i>Eremophila mitchellii</i> . An open shrub layer (1m high) dominated by species such as <i>Carissa ovata</i> , <i>Capparis lasiantha</i> , <i>Eremophila deserti</i> , <i>Apophyllum anomalum</i> and <i>Alectryon diversifolius</i> is also often present. The ground layer is sparse to open and dominated by grasses. Occurs on gently undulating plains formed from Cainozoic sediments. Associated soils are texture contrast with thin sandy or loamy surface horizons and strongly alkaline clay subsoils. (BVG1M: 26a)
Description	RE 11.4.8 – Endangered: Woodland to open-forest dominated by <i>Eucalyptus cambageana</i> and <i>Acacia harpophylla</i> or, sometimes in the north, <i>A. argyrodendron</i> . <i>E. thozetiana</i> is sometimes present on shallower soils. There is a moderately dense low tree layer (5 m high) layer dominated by species such as <i>Eremophila mitchellii</i> and a low shrub layer (2 m high) dominated by species such as <i>Carissa ovata</i> and <i>Geijera parviflora</i> . Occurs on level to gently undulating plains formed from Cainozoic deposits. Associated soils are usually deep texture contrast with thin loamy or sandy surface horizons overlying strongly alkaline clay subsoils. Surface or subsurface gravel is common. (BVG1M: 25a). Major vegetation communities include: 11.4.8a: Palustrine wetland (e.g. vegetated swamp). Gilgai and small depressions on clay plains usually associated with <i>Acacia harpophylla</i> ecosystems. Generally support a range of sedges, grasses and, when wet, aquatic species. (BVG1M: 34d)

RE 11.11.9 / 11.11.16 – Of Concern

Description	RE 11.11.9 – Least Concern: <i>Eucalyptus populnea</i> or <i>E. brownii</i> woodland to open-woodland. Occurs on undulating rises and lower slopes of hills formed on moderately to strongly deformed and metamorphosed sediments and interbedded volcanics. (BVG1M: 17a)
Description	RE 11.11.16 – Of Concern: <i>Eucalyptus cambageana</i> , <i>Acacia harpophylla</i> open-forest to woodland. Occurs on gently undulating plains and rises formed on moderately to strongly deformed and metamorphosed sediments and interbedded volcanics. (BVG1M: 25a)



Legend

DCDB	Of Concern Dominant
Pre Clear	Of Concern Sub-Dominant
Endangered Dominant	Not of concern
Endangered Sub-Dominant	

Figure 6 Pre Clear Mapping

File ref. 6550 E05 Pre Clear A
Date 10/04/2013
Project Carmichael Coal Rail Project

0 100 200 400 600 800 m
 Scale (A4): 1:20,000 [GDA 1994 MGA Z55]



adaniTM

SH saunders
havill
group

THESE PLANS HAVE BEEN PREPARED FOR THE EXCLUSIVE USE
 OF THE CLIENT. SAUNDERS HAVILL GROUP CANNOT ACCEPT
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3.4. Regrowth Mapping

High Value Regrowth Mapping Version 2.1 does not overlay High Value Regrowth on the proposed quarry site.



4. Field Survey

Two (2) Senior Ecologists from the **Saunders Havill Group** traversed the site on the 14th of March 2013 to undertake a Regional Ecosystem assessment. Weather conditions were fine and breezy. The area of currently mapped remnant vegetation was traversed by foot and GPS points indicative of the area covered were recorded. Prior to undertaking the field survey, a basic desktop assessment was performed to gather baseline data.

Additional data from previous site assessments was utilised to compare vegetation in the southern portion of the polygon (Vegetation Transects 5 & 6 and Quaternary Survey Sites 1 to 4) with that assessed within the quarry footprint (Vegetation Transects 1 to 4, see **Figure 7**).

4.1. Summary

The *Vegetation Management Act Regional Ecosystem and Remnant Mapping Version 6.1* overlays two composite remnant vegetation polygons on the study site. The largest is comprised of 90% Of Concern RE 11.4.6 and 10% Endangered RE 11.4.8. This remnant polygon constitutes approximately 81% of total quarry area within this property. The remaining 19% is mapped as non-remnant vegetation. To the South of the site is a relatively small composite Of Concern polygon comprised of 80% Least Concern RE 11.11.9 and 20% Of Concern RE 11.11.16 (**Figure 7**).

The quarry site falls within a larger remnant polygon that extends South and West of the site. Four vegetation transects were completed within the proposed quarry footprint and at each transect the vegetation failed to meet remnant status due to inadequate canopy cover. In addition, species composition and Land Zone characteristics (exposed rocks with no obvious signs of clay plains) within the quarry site appear inaccurately mapped. Characteristics of clay plains were observed outside of the quarry site in areas totally cleared of vegetation values for agriculture. Additional data from previous surveys (Vegetation Transects 5 & 6 near woody regrowth and Quaternary Survey Sites 1 to 4) demonstrate these areas likewise fail to meet remnant status with most being fields of *Parthenium hysterophorus* (Parthenium Weed) and *Pennisetum ciliare* (Buffel Grass).

In general, the site was largely devoid of vegetation values due to previous clearing for agriculture. Out of necessity, transects were therefore conducted at specific locations where vegetation occurred and, as such, are not entirely representative of the surrounding landscape (see imagery, page 20).

Proposed changes to RE mapping are depicted within the attached Proposed PMAV (**Plan 1**). See **Table 2**, below, for a summary of the existing mapped RE status and observed communities.

Table 2: Summary of RE Status

Transect or Quaternary Site	Current RE Mapping Version 6.1	Current RE Mapping Area	Vegetation Observed	Observed Vegetation Area
T1 to T6 and Q1 to Q3	Endangered RE11.4.6 / 11.4.8	219.5 ha	Non-remnant	219.5 ha
Q4	Of Concern RE 11.11.9 / 11.11.16	1.6 ha	Non-remnant	1.6 ha



Photos: Borrow 7 Prevailing Landscape



4.2. Vegetation Transect and Quaternary Survey Site Data

The proposed quarry is located within an incorrectly mapped remnant polygon. On-site vegetation is described as very sparse, containing only a few scattered canopy trees and some small shrub patches, and is therefore proposed as non-remnant. A portion of the quarry site and the surrounding rural paddocks to the North are mapped as non-remnant areas previously cleared for agricultural production.

The vegetation community within the quarry site is dominated by very sparse *Eucalyptus crebra* (Narrow Leaf Ironbark) with scattered *Eucalyptus brownii* (Reid River Gum), *Corymbia dallachiana* (Ghost Gum) and *Corymbia clarksoniana* (Long Fruited Bloodwood). Shrubs are very sparse and the ground layer contains a mix of native and introduced species dominated by *Pennisetum ciliare* (Buffel Grass).

The species mix and dominance of *Eucalyptus crebra* (Narrow Leaf Ironbark) suggest that the vegetation within the quarry site, although inadequate in crown cover, is more consistent with Least Concern RE 11.5.3.

The remainder of the mapped remnant polygon, including the relatively small area of Of Concern vegetation on the southern boundary, has been previously cleared for agricultural purposes. In the few places where woody regrowth is present, the sparse canopy is predominately *Lysiphyllum carronii* (Red Bauhinia) and *Atalaya hemiglauca* (Whitewood) with associated *Acacia cambagei* (Gidgee) and *Acacia harpophylla* (Brigalow). Where species indicative of mapped REs occur, the canopy cover is inadequate to constitute remnant vegetation.

A change of status to non-remnant is therefore proposed for the entire polygon.

For Vegetation Transect and Quaternary Survey Site data and imagery please see the photo below and **Tables 3 to 12**.



Photo: Borrow 7 Vegetation



Table 3: Vegetation Transect 1 – Lot 3235 PH752 – Borrow 7

Mapped RE 11.4.6 / 11.4.8 – Observed Non-remnant

Site No.	1	Recorder:	Dr Andrew Davies / David Havill	Date:	14.03.2013
Purpose	Regional Ecosystem & Remnant Check				
Locality:	Lot 3235 PH752 Isaac Regional Council				

Vegetation Structure

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E			
T1	Absent	Absent	Absent
T2	5.0 m	4.0 - 9.0 m	Very Sparse
T3			
S1	1.5 m	1.0 - 3.0 m	Very Sparse
S2			
G	0.4 m	0 - 1.0 m	Dense
Structural formation:		Non-remnant	
Ecologically dominant layer:		Ground	

Transect – Crown Cover Measured (Transect intercept method)

GPS coordinates:	Datum:				MGA55	Transect length:		200 m
Start point:	Zone	5	5	E	498191.44		N	7583415.16
End point:	Zone	5	5	E	498370.76		N	7583326.07

Interval	Intercept	Stratum	Height	Scientific name	Common Name
0 - 6.4 m	6.4 m	T2	6.2 m	<i>Acacia harpophylla</i>	Brigalow
6.8 - 9.1 m	2.3 m	T2	5.0 m	<i>Acacia harpophylla</i>	Brigalow
25.0 - 26.3 m	1.3 m	Shrub	2.1 m	<i>Atalaya hemiglauc</i>	Whitewood
128.1 - 129.9 m	1.8 m	T2	4.2 m	<i>Grevillea striata</i>	Beefwood
165.4 - 166.4 m	1.0 m	Shrub	1.7 m	<i>Grevillea striata</i>	Beefwood
172.5 - 175.8 m	3.3 m	T2	7.0 m	<i>Ventilago viminalis</i>	Vine Tree
197.4 - 200.0 m	2.6 m	Shrub	1.2 m	<i>Corymbia dallachiana</i>	Ghost Gum



Summary:

Minimum height of plants included in the transect table:	1.7 m
Intercept of EDL 0 - 50 m:	0 m
Intercept of EDL 50 - 100 m:	0 m
Measured crown cover % of EDL 0 - 100 m:	0%
Structural formation:	Non-remnant

Conclusions/notes:

- Structure fails remnant status due to inadequate canopy cover.
- No species consistent with Endangered RE11.4.8 were recorded within the remnant polygon. Land Zone 4 characteristics were observed outside of the quarry site.
- Some cattle disturbance was recorded throughout the polygon. It is believed that this disturbance is minor as the exposed rocks across the surface provide difficult terrain for cattle movement.
- Site is proposed as non-remnant.

Plant Species (D – Dominant; C – codominant; A – associated; S – Suppressed)

Str.	Rel.	Scientific Name	Common Name
T1		Absent	Absent
T2	A	<i>Acacia harpophylla</i>	Brigalow
	A	<i>Grevillea striata</i>	Beefwood
Shrub		<i>Atalaya hemiglauca</i>	White wood
		<i>Lysiphyllum carronii</i>	Red Bauhinia
		<i>Grevillea striata</i>	Beefwood
		<i>Eremophila</i> sp.	Eremophila
		<i>Carissa ovata</i>	Current Bush
G		<i>Carissa ovata</i>	Current Bush
		<i>Pennisetum ciliare</i>	Buffel Grass
		<i>Eriocereus martinii</i>	Harrisia Cactus
		<i>Themeda triandra</i>	Kangaroo Grass
		<i>Sida cordifolia</i>	Flannel Weed
		<i>Melinis repens</i>	Red Natal Grass
		<i>Aristida latifolia</i>	Feathertop
		<i>Tragus australianus</i>	Small Burrgrass
		<i>Capparis lasiantha</i>	Wait-a-while
		<i>Eragrostis sororia</i>	Woodland Lovegrass



Vegetation Heights & DBH

Scientific Name	Common Name	Height	DBH
<i>Acacia harpophylla</i>	Brigalow	6.2 m	100 mm
<i>Acacia harpophylla</i>	Brigalow	5.8 m	130 mm
<i>Acacia harpophylla</i>	Brigalow	5.9 m	160 mm
<i>Acacia harpophylla</i>	Brigalow	4.8 m	110 mm
<i>Grevillea striata</i>	Beefwood	8.7 m	340 mm



Photo: Vegetation Transect 1 Borrow 7



Table 4: Vegetation Transect 2 – Lot 3235 PH752 – Borrow 7

Mapped RE 11.4.6 / 11.4.8 – Observed Non-remnant

Site No.	2	Recorder:	Dr Andrew Davies / David Havill	Date:	14.03.2013
Purpose	Regional Ecosystem & Remnant Check				
Locality:	Lot 3235 PH752 Isaac Regional Council				

Vegetation Structure

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E			
T1	14.0 m	11.0 - 16.0 m	Very Sparse
T2	4.5 m	3.0 - 8.0 m	Medium
T3			
S1	1.5 m	1.0 - 3.0 m	Very Sparse
S2			
G	0.5 m	0 - 1.0 m	Dense
Structural formation:	Non-remnant		
Ecologically dominant layer:	T2		

Transect – Crown Cover Measured (Transect intercept method)

GPS coordinates:	Datum:	MGA55	Transect length:	200 m
Start point:	Zone	5 5 E	498543.84	N 7583281.73
End point:	Zone	5 5 E	498737.71	N 7583239.27

Interval	Intercept	Stratum	Height	Scientific name	Common Name
4.9 - 11.5 m	6.6 m	T1	14.3 m	<i>Corymbia dallachiana</i>	Ghost Gum
11.5 - 14.1 m	3.4 m	T2	5.1 m	<i>Petalostigma pubescens</i>	Quinine Bush
18.2 - 20.6 m	2.4 m	T2	3.5 m	<i>Flindersia dissosperma</i>	Leopardwood
21.3 - 23.5 m	2.2 m	T2	3.8 m	<i>Flindersia dissosperma</i>	Leopardwood
23.8 - 27.0 m	3.2 m	T2	4.0 m	<i>Flindersia dissosperma</i>	Leopardwood
32.0 - 34.0 m	2.0 m	T2	3.4 m	<i>Acacia excelsa</i>	Ironwood
62.2 - 63.5 m	1.3 m	Shrub	2.1 m	<i>Acacia excelsa</i>	Ironwood
65.4 - 67.3 m	1.4 m	Shrub	2.8 m	<i>Acacia excelsa</i>	Ironwood
131.1 - 132.4 m	1.3 m	Shrub	1.7 m	<i>Acacia excelsa</i>	Ironwood



Interval	Intercept	Stratum	Height	Scientific name	Common Name
141.1 - 146.7 m	5.6 m	T1	7.9 m	<i>Corymbia dallachiana</i>	Ghost Gum

Summary:

Minimum height of plants included in the transect table:	1.7 m
Intercept of EDL 0 - 100 m:	6.6 m
Intercept of EDL 100 - 200 m:	5.6 m
Measured crown cover % of EDL 0 - 100 m:	6.1%
Structural formation:	Non-remnant

Conclusions/notes:

- Structure fails remnant status due to inadequate canopy cover.
- No species consistent with Endangered RE11.4.8 were recorded within the remnant polygon. Land Zone 4 characteristics were observed outside of the quarry site.
- Some cattle disturbance was recorded throughout the polygon. It is believed that this disturbance is minor as the exposed rocks across the surface provide difficult terrain for cattle movement.
- Site is proposed as non-remnant.

Plant Species (D – Dominant; C – codominant; A – associated; S – Suppressed)

Str.	Rel.	Scientific Name	Common Name
T1		<i>Corymbia dallachiana</i>	Ghost Gum
T2	A	<i>Acacia excelsa</i>	Ironwood
	A	<i>Petalostigma pubescens</i>	Quinine Bush
		<i>Planchonia careya</i>	Cocky Apple
		<i>Flindersia dissosperma</i>	Leopard wood
Shrub		<i>Atalaya hemiglauca</i>	White wood
		<i>Flindersia dissosperma</i>	Leopardwood
		<i>Petalostigma pubescens</i>	Quinine Bush
		<i>Carissa ovata</i>	Current Bush
G		<i>Carissa ovata</i>	Currant Bush
		<i>Pennisetum ciliare</i>	Buffel Grass
		<i>Themeda triandra</i>	Kangaroo Grass
		<i>Sida cordifolia</i>	Flannel Weed
		<i>Melinis repens</i>	Red Natal Grass
		<i>Aristida latifolia</i>	Feathertop
		<i>Capparis lasiantha</i>	Wait-a-while
		<i>Eragrostis sororia</i>	Woodland Lovegrass



Vegetation Heights & DBH

Scientific Name	Common Name	Height	DBH
<i>Corymbia dallachiana</i>	Ghost Gum	5.0 m	350 mm
<i>Planchonia careya</i>	Cocky Apple	12.0 m	320 mm



Photo: Vegetation Transect 2 Borrow 7



Table 5: Vegetation Transect 3 – Lot 3235 PH752 – Borrow 7

Mapped RE 11.4.6 / 11.4.8 – Observed Non-remnant

Site No.	2	Recorder:	Dr Andrew Davies / David Havill	Date:	14.03.2013
Purpose	Regional Ecosystem & Remnant Check				
Locality:	Lot 3235 PH752 Isaac Regional Council				

Vegetation Structure

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E			
T1	Absent	Absent	Absent
T2	4.5 m	3.0 - 6.0 m	Medium
T3			
S1	1.5 m	1.0 - 0.0 m	Very Sparse
S2			
G	0.4 m	0.0 - 1.0 m	Dense
Structural formation:		Non-remnant	
Ecologically dominant layer:		T2 / Ground	

Transect – Crown Cover Measured (Transect intercept method)

GPS coordinates:	Datum:			MGA55	Transect length:	100 m
Start point:	Zone	5	5	E	498849.06	N 7583148.11
End point:	Zone	5	5	E	498879.84	N 7583054.14

Interval	Intercept	Stratum	Height	Scientific name	Common Name
24.7 - 25.2 m	0.5 m	Shrub	1.3 m	<i>Atalaya hemiglauc</i>	Whitewood
25.2 - 30.4 m	5.2 m	T2	5.0 m	<i>Acacia excelsa</i>	Ironwood
44.4 - 46.5 m	2.1 m	T2	3.5 m	<i>Acacia excelsa</i>	Ironwood
93.3 - 97.8 m	4.5 m	T1	8.2 m	<i>Corymbia dallachiana</i>	Ghost Gum



Summary:

Minimum height of plants included in the transect table:	1.3 m
Intercept of EDL 0 - 50 m:	7.3 m
Intercept of EDL 50 - 100 m:	4.5 m
Measured crown cover % of EDL 0 - 100 m:	11.8 %
Structural formation:	Non-remnant

Conclusions/notes:

- Structure fails remnant status due to inadequate canopy cover.
- No species consistent with Endangered RE11.4.8 were recorded within the remnant polygon. Land Zone 4 characteristics were observed outside of the quarry site.
- Some cattle disturbance was recorded throughout the polygon. It is believed that this disturbance is minor as the exposed rocks across the surface provide difficult terrain for cattle movement.
- Site is proposed as non-remnant.

Plant Species (D – Dominant; C – codominant; A – associated; S – Suppressed)

Str.	Rel.	Scientific Name	Common Name
T1	A	<i>Corymbia dallachiana</i>	Ghost Gum
T2	A	<i>Acacia excelsa</i>	Ironwood
Shrub		<i>Atalaya hemiglauc</i>	White wood
		<i>Acacia excelsa</i>	Ironwood
		<i>Owenia acidula</i>	Emu Apple
G		<i>Carissa ovata</i>	Currant Bush
		<i>Pennisetum ciliare</i>	Buffel Grass
		<i>Sida cordifolia</i>	Flannel Weed
		<i>Melinis repens</i>	Red Natal Grass
		<i>Aristida latifolia</i>	Feathertop
		<i>Capparis lasiantha</i>	Wait-a-while
		<i>Eragrostis sororia</i>	Woodland Lovegrass



Photo: Vegetation Transect 3 Borrow 7



Table 6: Vegetation Transect 4 – Lot 3235 PH752 – Borrow 7

Mapped RE 11.4.6 / 11.4.8 – Observed Non-remnant

Site No.	4	Recorder:	Dr Andrew Davies / David Havill	Date:	14.03.2013
Purpose	Regional Ecosystem & Remnant Check				
Locality:	Lot 3235 PH752 Isaac Regional Council				

Vegetation Structure

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E			
T1	Absent	Absent	Absent
T2	3.5 m	3.0 - 5.0 m	Medium
T3			
S1	1.2 m	1.0 - 3.0 m	Very Sparse
S2			
G	0.5 m	0.0 - 1.0 m	Dense
Structural formation:	Non-remnant		
Ecologically dominant layer:	T2 / Ground		

Transect – Crown Cover Measured (Transect intercept method)

GPS coordinates:	Datum:	MGA55	Transect length:	200 m
Start point:	Zone	5 5 E	498570.00	N 7583512.50
End point:	Zone	5 5 E	498369.91	N 7583504.93

Interval	Intercept	Stratum	Height	Scientific name	Common Name
3.1 - 4.2 m	1.1 m	Shrub	2.4 m	<i>Acacia excelsa</i>	Ironwood
5.0 - 6.4 m	1.4 m	Shrub	2.1 m	<i>Acacia excelsa</i>	Ironwood
12.5 - 13.8 m	1.3 m	Shrub	1.2 m	<i>Corymbia dallachiana</i>	Ghost Gum
21.4 - 22.6 m	1.2 m	Shrub	1.5 m	<i>Acacia excelsa</i>	Ironwood
22.6 - 24.3 m	1.7 m	T2	3.2 m	<i>Acacia excelsa</i>	Ironwood
25.9 - 27.4 m	1.5 m	T2	3.6 m	<i>Acacia excelsa</i>	Ironwood
34.4 - 35.6 m	1.2 m	Shrub	1.6 m	<i>Acacia excelsa</i>	Ironwood
36.4 - 38.0 m	1.6 m	T2	4.5 m	<i>Acacia excelsa</i>	Ironwood
45.0 - 45.9 m	0.9 m	Shrub	2.0 m	<i>Atalaya hemiglauca</i>	Whitewood



Interval	Intercept	Stratum	Height	Scientific name	Common Name
45.9 - 47.6 m	1.7 m	Shrub	2.3 m	<i>Acacia excelsa</i>	Ironwood
46.6 - 50.0 m	0.4 m	Shrub	2.5 m	<i>Acacia excelsa</i>	Ironwood
50.3 - 60.5 m	2.2 m	Shrub	2.5 m	<i>Acacia excelsa</i>	Ironwood
67.6 - 69.1 m	1.5 m	Shrub	2.5 m	<i>Acacia excelsa</i>	Ironwood
70.0 - 70.6 m	0.6 m	Shrub	1.0 m	<i>Atalaya hemiglauc</i>	Whitewood
84.4 - 85.9 m	1.5 m	Shrub	1.0 m	<i>Grevillea striata</i>	Beefwood
97.0 - 98.9 m	1.9 m	Shrub	1.0 m	<i>Capparis lasiantha</i>	Wait-a-while
106.1 - 106.6 m	0.5 m	Shrub	0.8 m	<i>Atalaya hemiglauc</i>	Whitewood
111.9 - 113.9 m	2.0 m	T2	4.0 m	<i>Grevillea striata</i>	Beefwood
150.0 - 152.3 m	2.3 m	T2	5.8 m	<i>Acacia excelsa</i>	Ironwood

Summary:

Minimum height of plants included in the transect table:

0.8 m

Intercept of EDL 0 - 100 m:

4.8 m

Intercept of EDL 100 - 200 m:

4.3 m

Measured crown cover %
of EDL 0 - 100 m:

9.1%

Structural formation:

Non-remnant

Conclusions/notes:

- Structure fails remnant status due to inadequate canopy cover.
- No species consistent with Endangered RE11.4.8 were recorded within the remnant polygon. Land Zone 4 characteristics were observed outside of the quarry site.
- Some cattle disturbance was recorded throughout the polygon. It is believed that this disturbance is minor as the exposed rocks across the surface provide for difficult terrain for cattle movement.
- Site is proposed as non-remnant.

Plant Species (D – Dominant; C – codominant; A – associated; S – Suppressed)

Str.	Rel.	Scientific Name	Common Name
T1		Absent	Absent
T2	A	<i>Acacia excelsa</i>	Ironwood
	A	<i>Corymbia dallachiana</i>	Ghost gum
Shrub		<i>Atalaya hemiglauc</i>	White wood
		<i>Acacia excelsa</i>	Ironwood
		<i>Owenia acidula</i>	Emu Apple
		<i>Carissa ovata</i>	Current Bush
		<i>Capparis lasiantha</i>	Wait-a-while
G		<i>Carissa ovata</i>	Currant Bush
		<i>Pennisetum ciliare</i>	Buffel Grass



Str.	Rel.	Scientific Name	Common Name
		<i>Sida cordifolia</i>	Flannel Weed
		<i>Melinis repens</i>	Red Natal Grass
		<i>Aristida latifolia</i>	Feathertop
		<i>Capparis lasiantha</i>	Wait-a-while
		<i>Eragrostis sororia</i>	Woodland Lovegrass



Photo: Vegetation Transect 4 Borrow 7



Table 7: Vegetation Transect 5 – Lot 3235 PH752 – Borrow 7

Mapped RE 11.4.6 / 11.4.8– Observed Non-remnant

Site No.	4	Recorder:	Dr Andrew Davies / Lincoln Smith	Date:	13.11.2012
Purpose	Regional Ecosystem & Remnant Check				
Locality:	Lot 3235 PH752 Isaac Regional Council				

Vegetation Structure

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E			
T1	9.0 m	7.0 - 11.0 m	Very Sparse
T2			
T3			
S1			
S2			
G	0.5 m	0.0 - 1.0m	Dense
Structural formation:	Open Woodland		
Ecologically dominant layer:	T1		

Transect – Crown Cover Measured (Transect intercept method)

GPS coordinates:	Datum:				MGA55	Transect length:		100 m
Start point:	Zone	5	5	E	497741.34		N	7583187.01
End point:	Zone	5	5	E	497740.32		N	7583288.20

Interval	Intercept	Form /Height	Scientific name	Common Name
T1 Transect Intercept				
16.2 - 22.5 m	6.3 m	9.0 m	<i>Lysiphyllum carronii</i>	Red Bauhinia
31.4 - 33.4 m	2.0 m	8.0 m	<i>Atalaya hemiglauc</i>	Whitewood
53.5 - 56.3 m	2.8 m	9.0 m	<i>Atalaya hemiglauc</i>	Whitewood
70.0 - 71.9 m	1.9 m	8.5 m	<i>Lysiphyllum carronii</i>	Red Bauhinia



Summary:

Minimum height of plants included in the transect table:	8.5 m
Intercept of EDL 0 - 50 m:	8.3 m
Intercept of EDL 50 - 100 m:	4.7 m
Measured crown cover % of EDL 0 - 100 m:	13.0%
Structural formation:	Open Woodland

Conclusions/notes:

- Species composition within transect through centre of polygon does not match RE mapping and crown cover and vegetation patch size (1.64 ha) are marginal.
- Major cattle disturbance is recorded throughout the polygon.
- Site is proposed as non-remnant.

Plant Species (D – Dominant; C – codominant; A – associated; S – Suppressed)

Str.	Rel.	Scientific Name	Common Name
T1	A	<i>Atalaya hemiglauc</i>	Whitewood
	A	<i>Lysiphyllum carronii</i>	Red Bauhinia
	A	<i>Acacia harpophylla</i>	Brigalow
	A	<i>Acacia cambagei</i>	Gidgee
Shrub		<i>Apophyllum anomalum</i>	Warrior Bush
		<i>Eremophila mitchellii</i>	False Sandalwood
		<i>Atalaya hemiglauc</i>	Whitewood
		<i>Carissa ovata</i>	Current Bush
G		<i>Carissa ovata</i>	Currant Bush
	D	<i>Pennisetum ciliare</i>	Buffel Grass



Photos: Vegetation Transect 5 Borrow 7



Table 8: Vegetation Transect 6 – Lot 3235 PH752 – Borrow 7

Mapped RE 11.4.6 / 11.4.8– Observed Non-remnant

Site No.	4	Recorder:	Dr Andrew Davies / Lincoln Smith	Date:	13.11.2012
Purpose	Regional Ecosystem & Remnant Check				
Locality:	Lot 3235 PH752 Isaac Regional Council				

Vegetation Structure

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E			
T1	9.0 m	6.0 - 15.0 m	Very Sparse
T2			
T3			
S1			
S2			
G	0.5 m	0.0 - 1.0 m	Dense
Structural formation:	Non-remnant		
Ecologically dominant layer:	T1		

Transect – Crown Cover Measured (Transect intercept method)

GPS coordinates:	Datum:				MGA55	Transect length:		100 m
Start point:	Zone	5	5	E	498203.52		N	7583181.02
End point:	Zone	5	5	E	498168.41		N	7583275.25

Interval	Intercept	Form /Height	Scientific name	Common Name
T1 Transect Intercept				
9.7 - 15.0 m	5.3 m	11.0 m	<i>Acacia cambagei</i>	Gidgee
17.1 - 19.3 m	2.2 m	11.0 m	<i>Atalaya hemiglauc</i>	Whitewood
24.2 - 25.1 m	0.8 m	13.0 m	<i>Acacia cambagei</i>	Gidgee
26.0 - 27.3 m	1.3 m	12.0 m	<i>Atalaya hemiglauc</i>	Whitewood



Summary:

Minimum height of plants included in the transect table:	11.0 m
Intercept of EDL 0 - 50 m:	7.5 m
Intercept of EDL 50 - 100 m:	2.1 m
Measured crown cover % of EDL 0 - 100 m:	9.6%
Structural formation:	Non-remnant

Conclusions/notes:

- Structure fails remnant status due to insufficient crown cover and vegetation patch size (0.42 ha).
- Major cattle disturbance is recorded throughout the polygon.
- Site is proposed as non-remnant.

Plant Species (*D – Dominant; C – codominant; A – associated; S – Suppressed*)

Str.	Rel.	Scientific Name	Common Name
T1	D	<i>Acacia cambagei</i>	Gidgee
	A	<i>Acacia harpophylla</i>	Brigalow
	A	<i>Atalaya hemiglauc</i>	Whitewood
	A	<i>Lysiphyllum carronii</i>	Red Bauhinia
Shrub		<i>Apophyllum anomalum</i>	Warrior Bush
		<i>Eremophila mitchellii</i>	False Sandalwood
		<i>Atalaya hemiglauc</i>	Whitewood
		<i>Carissa ovata</i>	Current Bush
		<i>Lysiphyllum carronii</i>	Red Bauhinia
		<i>Eriocereus martinii</i>	Harrisia Cactus
		<i>Enchylaena tomentosa</i>	Ruby Saltbush
G	D	<i>Pennisetum ciliare</i>	Buffel Grass



Photos: Vegetation Transect 6 Borrow 7



Table 9: Quaternary Survey Site 1 – Lot 3235 PH752 – Borrow 7

Mapped RE 11.4.6 / 11.4.8– Observed Non-remnant

Str.	Rel.	Scientific name	Common name
T1	A	<i>Eucalyptus brownii</i>	Reid River Box
	A	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark
	A	<i>Corymbia dallachiana</i>	Ghost Gum
Shrub		<i>Owenia acidula</i>	Emu Apple
		<i>Atriplex muelleri</i>	Saltbush
		<i>Archidendropsis basaltica</i>	Dead Finish
		<i>Sclerolaena birchii</i>	Galvanised Burr
		<i>Salsola kali</i>	Soft Roly Poly
G		<i>Aristida latifolia</i>	Feathertop Wire Grass
		<i>Pennisetum ciliare</i>	Buffel Grass

Notes: Species **not** consistent with current RE mapping. Crown cover inadequate to meet remnant status.



Photo: Quaternary Survey Site 1 Borrow 7



Table 10: Quaternary Survey Site 2 – Lot 3235 PH752 – Borrow 7

Mapped RE 11.4.6 / 11.4.8– Observed Non-remnant

Str.	Rel.	Scientific name	Common name
T1	A	<i>Eucalyptus brownii</i>	Reid River Box
	A	<i>Corymbia clarksoniana</i>	Clarkson's Bloodwood
	A	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark
	A	<i>Archidendropsis basaltica</i>	Dead Finish
Shrub		<i>Eucalyptus brownii</i>	Reid River Box
		<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark
		<i>Acacia farnesiana</i>	Mimosa Bush
G		<i>Aristida latifolia</i>	Feathertop Wire Grass
		<i>Pennisetum ciliare</i>	Buffel Grass
		<i>Themeda triandra</i>	Kangaroo Grass
		<i>Heteropogon contortus</i>	Black Spear Grass

Notes: Species **not** consistent with current RE mapping. Crown cover inadequate to meet remnant status.



Photo: Quaternary Survey Site 2 Borrow 7



Table 11: Quaternary Survey Site 3 – Lot 3235 PH752 – Borrow 7

Mapped RE 11.4.6 / 11.4.8– Observed Non-remnant

Str.	Rel.	Scientific name	Common name
G	D	<i>Parthenium hysterophorus</i>	Parthenium Weed
		<i>Pennisetum ciliare</i>	Buffel Grass
		<i>Salsola kali</i>	Soft Roly Poly

Notes: No woody vegetation. Species **not** consistent with current RE mapping. Crown cover absent.



Photo: Quaternary Survey Site 3 Borrow 7



Table 12: Quaternary Survey Site 4 – Lot 3235 PH752 – Borrow 7

Mapped RE 11.11.9/ 11.11.16– Observed Non-remnant

Str.	Rel.	Scientific name	Common name
Shrub		<i>Atalaya hemiglauca</i>	Whitewood
		<i>Acacia farnesiana</i>	Mimosa Bush
G	D	<i>Pennisetum ciliare</i>	Buffel Grass

Notes: Species **not** consistent with current RE mapping. Crown cover absent.



Photo: Quaternary Survey Site 4 Borrow 7



5. Proposed PMAV

The changes requested to current Regional Ecosystem mapping are as follows: (Refer to **Plan 1** Proposed PMAV):

- Amendment of RE 11.4.6 / 11.4.8 to non-remnant as a result of identification at the property scale.
- Amendment of RE 11.11.9 / 11.11.16 to non-remnant as a result of identification at the property scale.
- Amendment of the entire polygon to Category X.

Please use the below email addresses to obtain relevant shape-files (.shp) for use in assessment.

Please also use the following contact details in relation to further questions and/or site visit arrangements.

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Senior Ecologist

Saunders Havill Group

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Tom Connor

Environmental Planner

Saunders Havill Group

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Facsimile: (07) 3251 9455

Email: tomconnor@saundershavill.com



Plan I

Proposed PMAV



2/11.11.16/11.11.13

3235PH752

2/11.11.16/11.11.13



1
+

2
+

3
+

4
+

5
+

PMAV Coordinate Table (GDA94 MGA z55)

Id	Description	Longitude (m)	Latitude (m)
1	Transect 4 end point	498569.818012	7583513.20092
2	Transect 5 end point	497741.343904	7583187.00803
3	Quaternary assessment site 2	497358.235247	7583016.4841
4	Property access vehicle track	497342.930196	7582294.65256
5	Quaternary site 4	498219.540787	7582298.73238

Legend

DCDB

Proposed PMAV Amendments

- Remnant vegetation containing Endangered REs (Cat. B)
- Remnant vegetation containing Of Concern REs (Cat. B)
- Remnant vegetation that is a Least Concern RE (Cat. B)
- Category X Area

SH

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havill
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surveying

town planning

urban design

environmental management

landscape architecture

Saunders Havill Group Pty Ltd

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Brisbane • Emerald • Gladstone

head office 9 Thompson St Bowen Hills Q 4006

phone 1300 123 SHG web www.saundershavill.com

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CONFIRM ALL DIMENSIONS ON SITE PRIOR TO CONSTRUCTION AND DO NOT SCALE FROM THE DRAWINGS. ALL DIMENSIONS ARE IN MILLIMETRES. ANY DISCREPANCIES SHOULD BE CLARIFIED IN WRITING WITH SAUNDERS HAVILL GROUP PRIOR TO THE COMMENCEMENT OF WORK.

PRIOR TO ANY DEMOLITION, EXCAVATION OR CONSTRUCTION ON SITE, THE RELEVANT AUTHORITY SHOULD BE CONTACTED FOR FURTHER UNDERGROUND SERVICES AND DETAILED LOCATIONS OF ALL SERVICES.

ISSUES:				
Issue	Date	Description	Drawn	Checked
A	10.11.2012	Prelim Draft	TC	RM

APPROVED COMPANY

ISO 9001

Quality Management Systems

QMS

APPROVED COMPANY

ISO 14001

Environmental Management Systems

QMS



Adani Rail Project

Complex PMAV

Date10/04/2013

Scale1:10,000 @ A3

Data Information:

Universal Transverse Mercator

GDA 1994 MGA Zone 55

ClientAdani Mining Pty Ltd

ProjectAdani Rail Project

Address / RPDIsaac Regional Council

SourceDCBD, RE (NRM, 2012), Aerial (Google, 2012)
Drill & Quarry Sites (Adani 2013)

Plan 1

Of 1

SHG File 6550 E 01 Complex PMAV - 3235P752 A

Appendix C - Temporary Infrastructure Plans



View indicative only

- Drawing List	
Sheet Number	Sheet Name
00	Title Page
01	Floor Plan
02	Elevations
03	Sectional View
04	Foundation Plan
05	Client Schedules
06	Manufacturing Schedules
07	Packing List

LR-036-H-C2
Standard Hire Specification

C2
12.0 x 3.0m Lunchroom

EXCLUDES VICTORIA

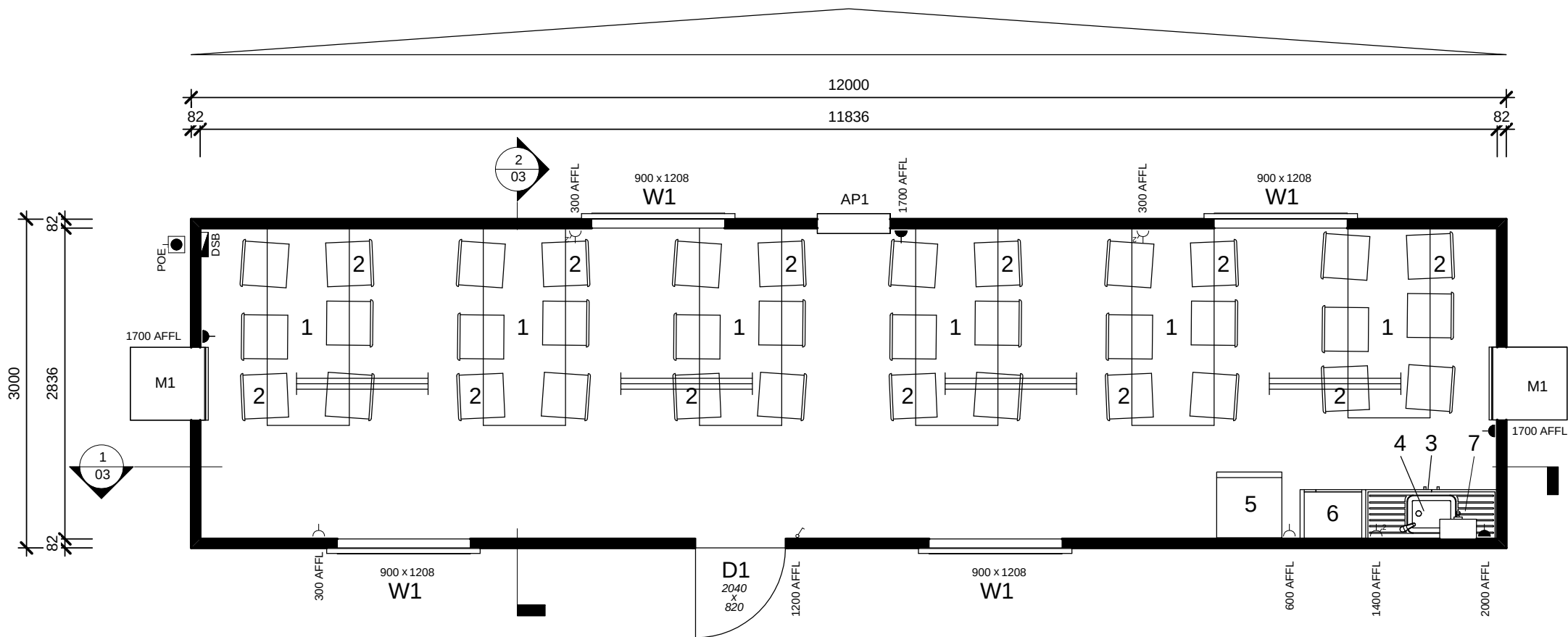


ATCO STRUCTURES & LOGISTICS PTY. LTD.
149-151 MAGNESIUM DRIVE, CRESTMEAD, QLD 4132
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E-mail: atcosales@atcosl.com.au

PHONE: (07) 3412 8600
FAX: (07) 3803 0175
ABN: 71 083 903 309

Notes

- Building Classification:
- Fire fighting equipment supplied & installed by others.
- Plans are current at the time of issue, are indicative only and are subject to change at any time without notice.
-



1 Floor Plan
1 : 50

Doors, Windows & Mechanical

D1	2040 x 820 External Door - Standard : Hollow Core MC
W1	900 x 1208 Sliding Glass Window - Grey Glass
AP1	3.56 kW R/C AC Aperture Only
M1	3.56 kW R/C Wall Mounted Air Conditioner

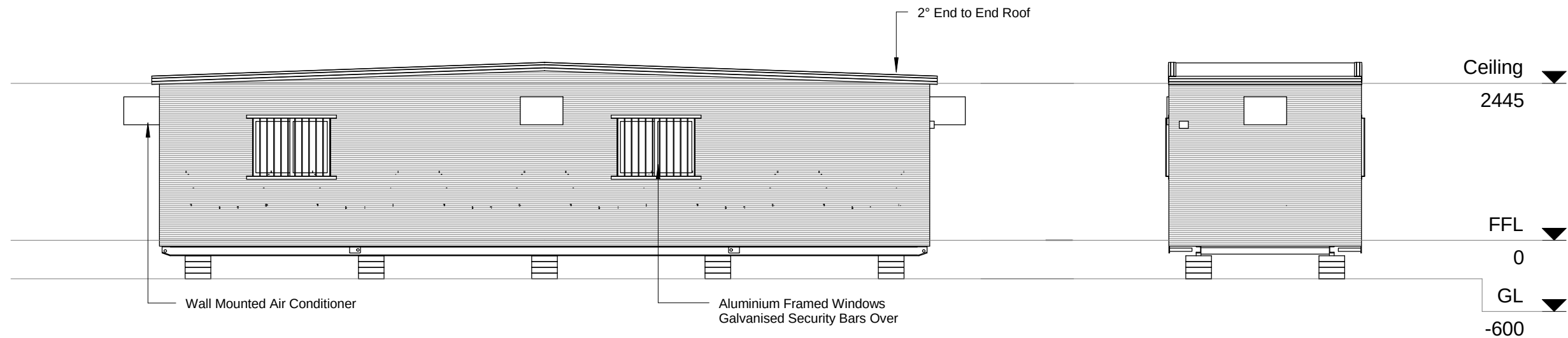
Item List

1	1800 x 750 Melamine lunch table
2	PVC Stacker chair
3	1200mm Melamine sink cupboard c/w extended top
4	1200x450 Std S/S sink
5	370 Ltr Fridge / Freezer
6	30ltr Microwave
7	5.0ltr Autoboiler

Electrical Legend

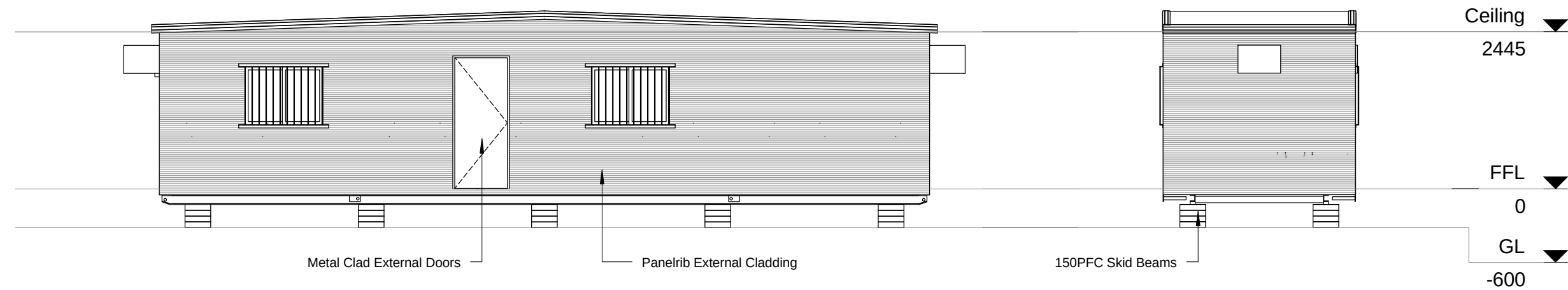
DSB	Distribution Switchboard		36W. Single Fluorescent Light
POE	POE - Point Of Entry		36W. Double Fluorescent Light
	Light Switch		36W. Emergency Back-up Fluorescent Light
	Two-way Light Switch		36W. Single Fluorescent Light - IP65 rated
	Light Switch - IPX5 rated		Emergency Exit Light
	10amp Single GPO		EXIT
	10amp Double GPO		Batten Holder
	15amp Single GPO.		External Light
	10amp GPO - IPX5 rated		18W Single Vandalite
	20amp Single GPO		Oyster Light
	- Indicates floor mounting		Photo Electric Light Switch
	- Indicates ceiling mounting		Spot Light
	Comms. - Draw Wire Only		
	'F' Type Television Outlet		
	240V Smoke Detector		

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-	-	-	-			12.0 x 3.0m Lunchroom Standard Hire Specification	April 2010			Floor Plan	C2
							SCALE 1 : 50			DRAWING NUMBER	REVISION
							DRAWN RA			LR-036-H-C2 - 01	-
							CHECKED				SHEET SIZE
											A3



1 Elevation A
1 : 75

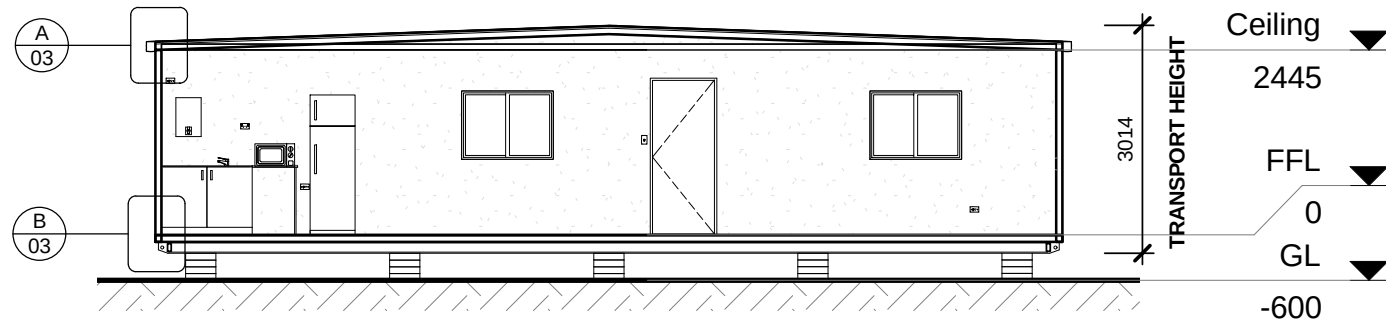
4 Elevation D
1 : 75



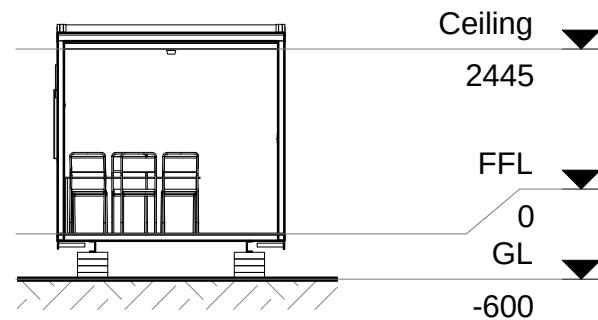
2 Elevation B
1 : 75

3 Elevation C
1 : 75

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-	-	-	-			12.0 x 3.0m Lunchroom Standard Hire Specification	April 2010			Elevations	C2
							SCALE 1 : 75			DRAWING NUMBER	REVISION
							DRAWN RA			LR-036-H-C2 - 02	-
							CHECKED				SHEET SIZE
											A3



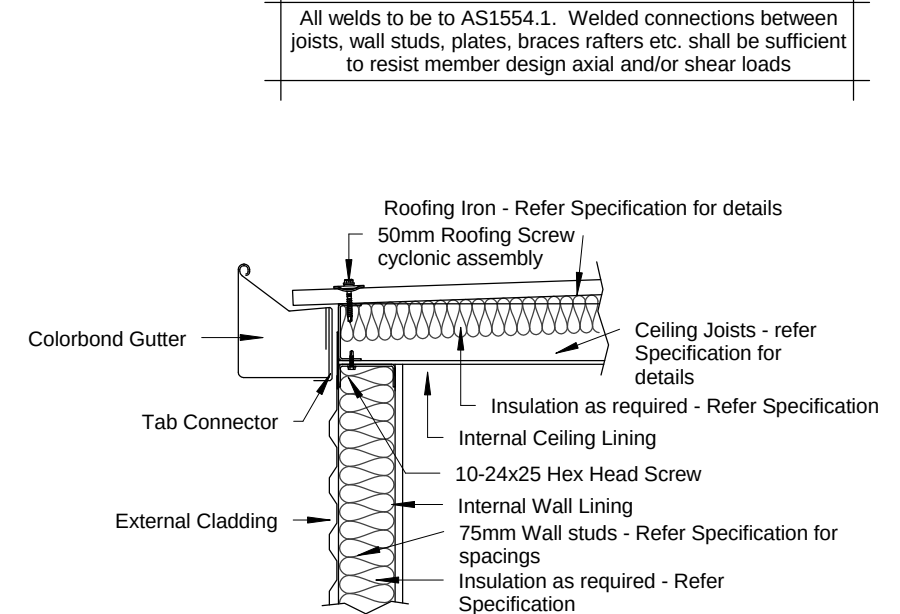
1 Section 1
1 : 100



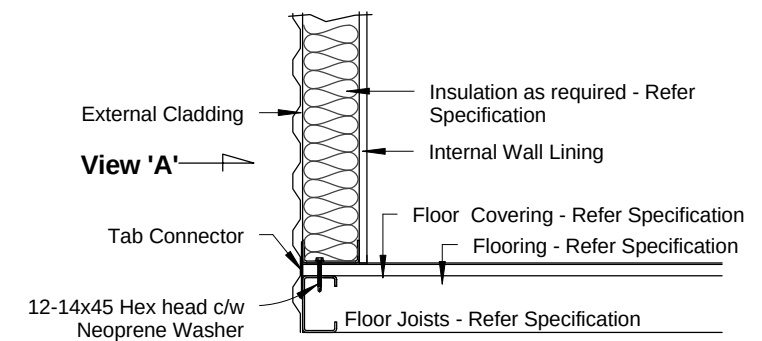
2 Section 2
1 : 100

Ceiling Joists & Purlins		
Wind Class	Ceiling Joist Material	Joist Centres
N3	C07510	611
C2	LC07512	611
Wind Class	Purlin Material	Purlin Centres
N3	LC07512	1st @ 900 then 1650 crs
C2	LC07512	1st @ 900 then 1200 crs

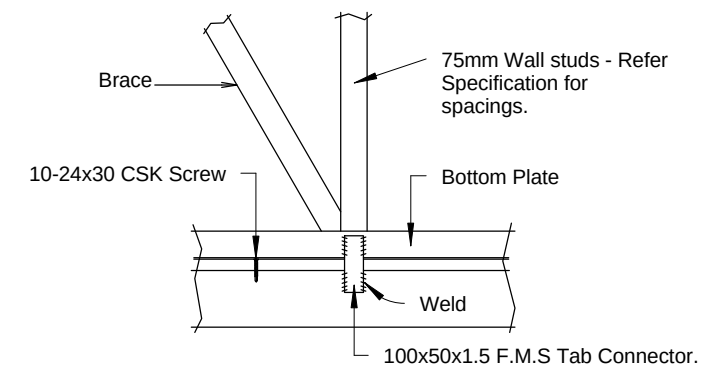
Wall To Floor & Roof Fixings			
Bldg. Width	Roof Type	Wind Class.	Fixings
2.4m	Any	N3,C2	Tabs @ 1800 crs, Screws @ 600 crs
	Any	C3	Tabs @ 1200 crs, Screws @ 600 crs
3.0m	End to End	N3,C2	Tabs @ 1800 crs, Screws @ 600 crs
	Side to Side	N3	Tabs @ 1800 crs, Screws @ 600 crs
	Side to Side	C2	Tabs @ 1200 crs, Screws @ 600 crs
	Any	C3	Tabs @ 1200 crs, Screws @ 600 crs
3.45m	Any	N3	Tabs @ 1800 crs, Screws @ 600 crs
	Any	C2,C3	Tabs @ 1200 crs, Screws @ 600 crs



DETAIL 'A' 1:10



DETAIL 'B' 1:10



VIEW 'A' 1:10

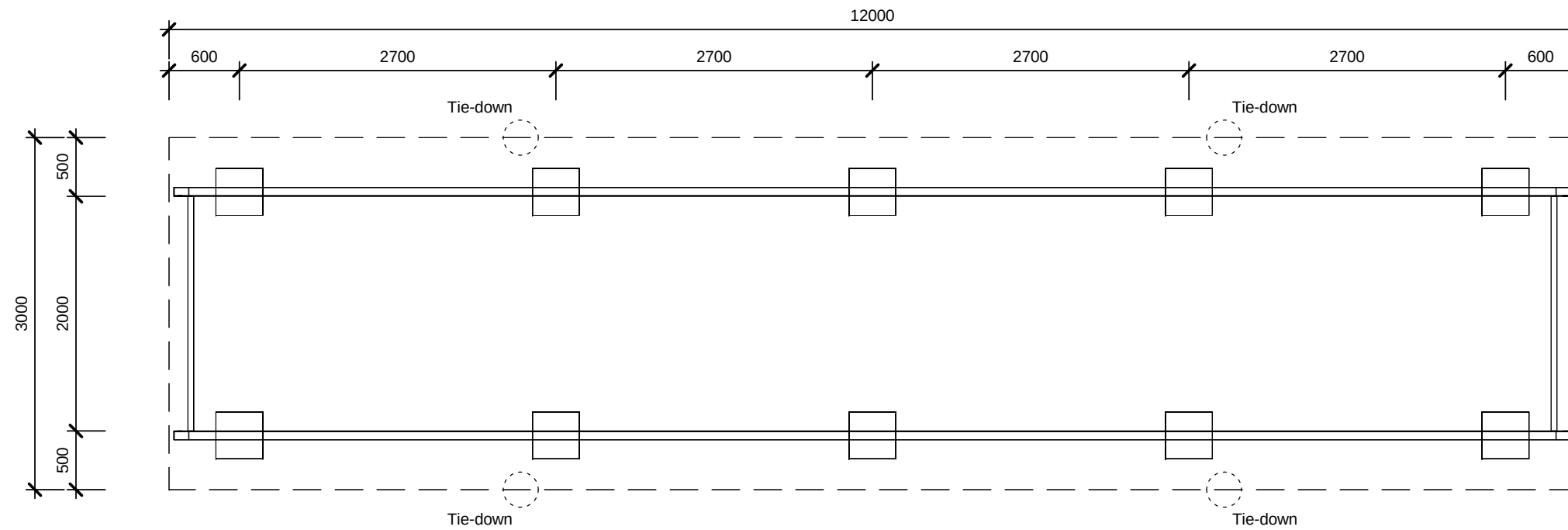
3 Connection Details - C2
1 : 10

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-	-	-	-			12.0 x 3.0m Lunchroom Standard Hire Specification	April 2010	As indicated	RA		Sectional View	C2		
											DRAWING NUMBER			
											LR-036-H-C2 - 03		-	A3

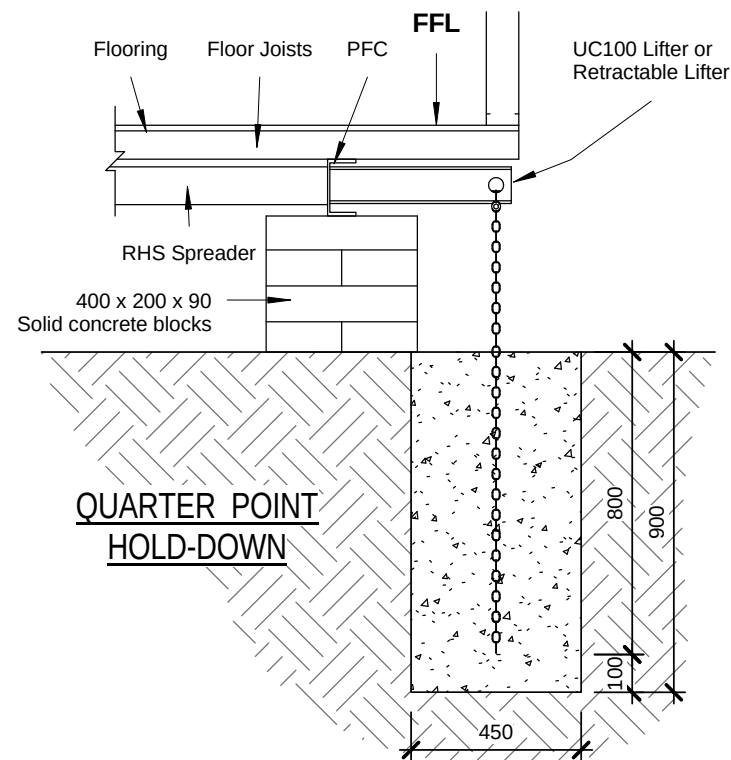


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1 Footings Layout
1 : 50



2 Hold Down - C2
1 : 20

ATCO Structures & Logistics Pty Ltd recommends that all buildings be secured appropriately. For further information on your specific project, please refer to your ATCO representative or a Registered Structural Engineer.

- Concrete strength to be 20MPa at 28 days
- Footing shown for sand & clay (Classes "A" - "E" per AS2870)
- If "rock" encountered (depth under 600mm) provide 2 x Ø16mm rock bolts - Embed at least 600mm into sound material
- Sub-structure requires minimum safe bearing pressure at founding level of 125kPa

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-	-	-	-			12.0 x 3.0m Lunchroom Standard Hire Specification	April 2010	As indicated	RA		Foundation Plan	C2
											DRAWING NUMBER	REVISION
											LR-036-H-C2 - 04	-
												SHEET SIZE
												A3

ATCO Structures & Logistics

ATCO STRUCTURES & LOGISTICS PTY. LTD.
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ABN: 71 083 903 309

Manufacturing Structural Members		
Description	Member Size	Back to Back
Skid beams c/w retractable lifters	150PFC	2000

- Floor Structure Schedule	
Floor Structure	Comments
Floor 480mm Floor Joist Centres	
Covering - 1.5mm Polyflor XL Vinyl	
Flooring - 15mm F14 T&G Plywood	
Framing - LC07512 Galvaspan	

Wall Height
2445

- Wall Schedule	
Wall Structure	Comments
External Wall - Energy Efficient 611mm STUD CENTRES	
Cladding - External - Maxirib - Horizontal	
Framing - 75x1.0mm HI-TEN Truecore	
Insulation - R1.8 Fibreglass Batts	
Lining - Internal - 3.6mm Polyester Coated Plywood	

Sales Roof Structure Schedule	
Roof Structure	Comments
2° End to End Roof SUPER/PLY LC07512 - 611 STD C2 - Energy Efficient 611mm JOIST CENTRES	
Framing - LC07512 Galvaspan	
Insulation - R2.5 Anticon	
Lining - Internal - 3.6mm Mirage Pearl Plywood	
Purlins - LC07512 Galvaspan	
Roof - 0.42mm BMT Superdek Sheeting	

Sales Door Schedule											
No.	Panel	Height	Width	Handle Type	Hardware Set	Closer	C/B Jamb	Timber Jamb	Security	Quantity	Comments
D1	Standard : Hollow Core MC	2040	820	Standard	Passage	No	Yes	No	Locking Shroud	1	E/E Seals

Sales Window Schedule							
No.	Type	Glazing	Height	Width	Sill Height	Quantity	Comments
W1	Sliding XO	Grey Glass	900	1208	1000	4	

- Security Features		
Description	Size	Quantity
Galvanised security bars	900 x 1200	4

- Furniture			
No.	Description	Quantity	Comments
1	1800 x 750 Melamine lunch table	6	
2	PVC Stacker chair	36	

- Cupboards			
No.	Description	Quantity	Comments
3	1200mm Melamine sink cupboard c/w extended top	1	

* Plumbing Fixtures			
No.	Description	Quantity	Comments
4	1200x450 Std S/S sink	1	
7	5.0ltr Autoboiler	1	

- Electrical Equipment Schedule			
No.	Description	Quantity	Comments
5	Refrigerator	1	
6	Microwave	1	

Sales Mechanical Equipment			
No.	Supplier	Description	Quantity
AP1	-	3.56 kW R/C AC Aperture Only	1
M1	TECO	3.56 kW R/C Wall Mounted Air Conditioner	2

- Electrical Fixtures	
Description	Quantity
1x10amp GPO	2
1x15amp GPO AC	3
2x10amp GPO	3
Switchboard	1

Lighting Fixtures	Quantity
2x36w Fluro & Wire guard	4
Switch - Std	1

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-	-	-	-			12.0 x 3.0m Lunchroom Standard Hire Specification	SCALE		DRAWING NUMBER		LR-036-H-C2 - 05		REVISION	C2	
							DRAWN	RA							
							CHECKED								

Manufacturing Structural Members		
Description	Member Size	Back to Back
Skid beams c/w retractable lifters	150PFC	2000

- Floor Structure Schedule	
Floor Structure	Comments
Floor 480mm Floor Joist Centres	
Covering - 1.5mm Polyflor XL Vinyl	
Flooring - 15mm F14 T&G Plywood	
Framing - LC07512 Galvaspan	

- Wall Schedule	
Wall Structure	Comments
External Wall - Energy Efficient 611mm STUD CENTRES	
Cladding - External - Maxirib - Horizontal	
Framing - 75x1.0mm HI-TEN Truecore	
Insulation - R1.8 Fibreglass Batts	
Lining - Internal - 3.6mm Polyester Coated Plywood	

Sales Roof Structure Schedule	
Roof Structure	Comments
2° End to End Roof SUPER/PLY LC07512 - 611 STD C2 - Energy Efficient 611mm JOIST CENTRES	
Framing - LC07512 Galvaspan	
Insulation - R2.5 Anticon	
Lining - Internal - 3.6mm Mirage Pearl Plywood	
Purlins - LC07512 Galvaspan	
Roof - 0.42mm BMT Superdek Sheeting	

Manufacturing Door Schedule															
No.	Panel	Height	Width	Opening Height	Opening Width	Handle Type	Hardware Set	Closer	C/B Jamb	Timber Jamb	Painted	Security	Quantity	Comments	
D1	Standard : Hollow Core MC	2040	820	2050	835	Standard	Passage	No	Yes	No	No	Locking Shroud	1	E/E Seals	

Manufacturing Window Schedule										
No.	Type	Glazing	Height	Width	Opening Height	Opening Width	Sill Height	Window Moulds	Quantity	Comments
W1	Sliding XO	Grey Glass	900	1208	903	1213	1000	PVC	4	

- Security Features		
Description	Size	Quantity
Galvanised security bars	900 x 1200	4

- Trims & Moulds			
Wall Type	Cornice	Joint	Skirting
External Wall - Energy Efficient	PVC	PVC	PVC

COLOURS

Roofing Iron Colour - Zinalume
Barge Capping Colour - ATCO Yellow
Gutter Colour - ATCO Yellow
External Cladding Colour - Surfmist
External Door Colour - Surfmist
Window Frames Colour - Architectural White

Internal Ceiling Colour - Pearl
Internal Wall Colour - Grey Embossed

Door Jamb Colour - Surfmist
Window Architrave Colour - Grey
Skirting Colour - Grey
Floor Covering Colour - Grey

Benchtop Colour - White / Grey
Cupboard Door Colour - White / Grey

Manufacturing Mechanical Equipment									
No.	Supplier	Unit	Model	Type	Comments	Opening Height	Opening Width	Sill Height	Quantity
AP1	-	2010 Teco Wall Mounted AC - Aperture Only	To suit LA1204H	3.56 kW (1.5hp)	Aperture Only	440	670	1800	1
M1	TECO	2010 Teco Wall Mounted AC	LA1204H	3.56 kW (1.5hp)	Reverse Cycle	440	670	1800	2

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-	-	-	-			12.0 x 3.0m Lunchroom Standard Hire Specification	SCALE		C2						
							DRAWN	RA							
							CHECKED								

PACKING LIST

Complexing Materials, General Packing Items	
Description	Quanityty

Furniture - Packing		
No.	Description	Quantity
1	1800 x 750 Melamine lunch table	6
2	PVC Stacker chair	36

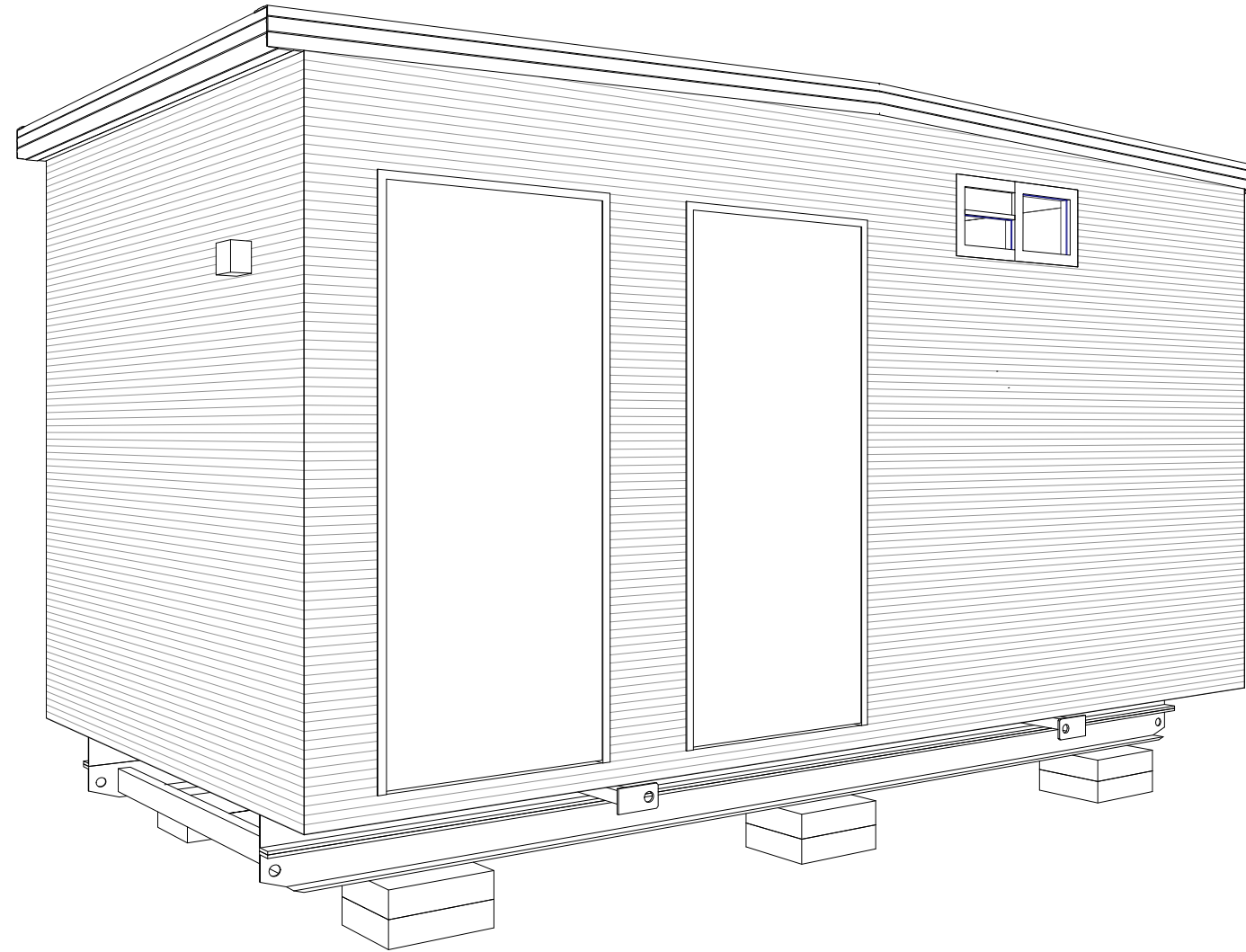
- Electrical Equipment Schedule			
No.	Description	Quantity	Comments
5	Refrigerator	1	
6	Microwave	1	

Mechanical Equipment - Packing				
No.	Manufacturer	Model	Packing	Quantity
M1	TECO	LA1204H	Wall Mounted Air Conditioner	2

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-	-	-	-			12.0 x 3.0m Lunchroom Standard Hire Specification	SCALE		Packing List		C2			
							DRAWN	RA	DRAWING NUMBER		REVISION	SHEET SIZE		
							CHECKED		LR-036-H-C2 - 07		-	A3		



View indicative only

- Drawing List	
Sheet Number	Sheet Name
00	Title Page
01	Floor Plan
02	Elevations
03	Sectional View
04	Foundation Plan
05	Client Schedules
06	Manufacturing Schedules
07	Packing List

MFT-015-H-C2
Standard Hire Specification

C2
4.8 x 3.0m Male/Female Toilet

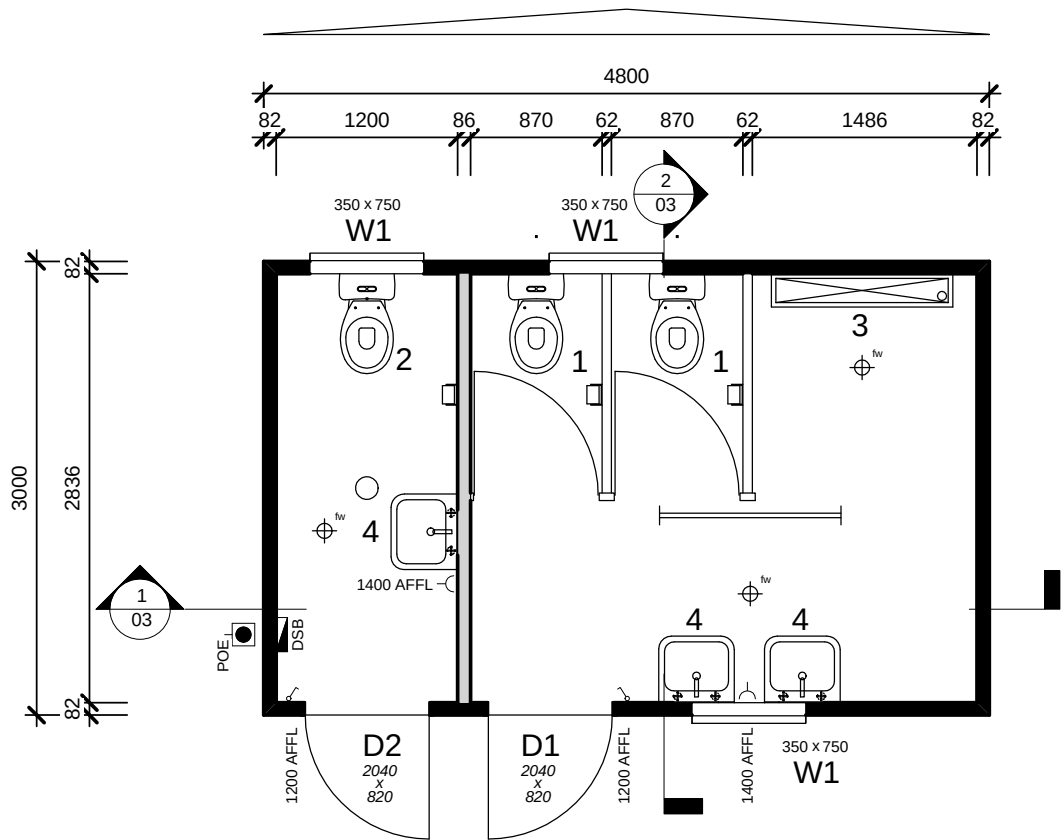


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E-mail: atcosales@atcosl.com.au

PHONE: (07) 3412 8600
FAX: (07) 3803 0175
ABN: 71 083 903 309

Notes

- Building Classification:
- Fire fighting equipment supplied & installed by others.
- Plans are current at the time of issue, are indicative only and are subject to change at any time without notice.
-



1 Floor Plan
1 : 50

Doors, Windows & Mechanical

- D1 2040 x 820 External Door - Standard : Hollow Core MC
D2 2040 x 820 External Door - Standard : Hollow Core MC
- W1 350 x 750 Sliding Glass Window - Obscure Glass

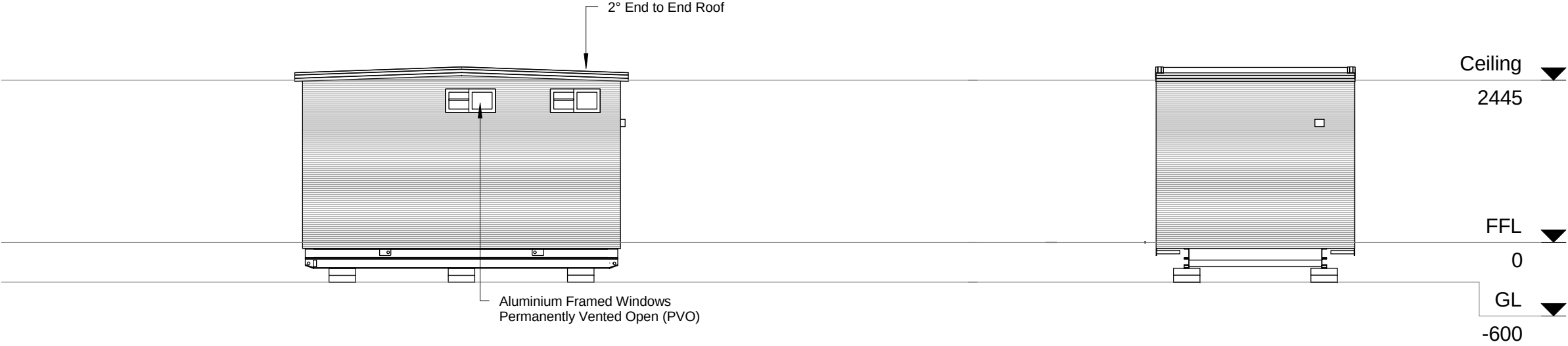
Item List

- 1 WC Cubicle c/w toilet roll holder
2 WC Suite c/w toilet roll holder
3 1200mm Wall mounted S/S urinal
4 S/S Handbasin c/w mirror over - Cold only
fw Floor Waste

Electrical Legend

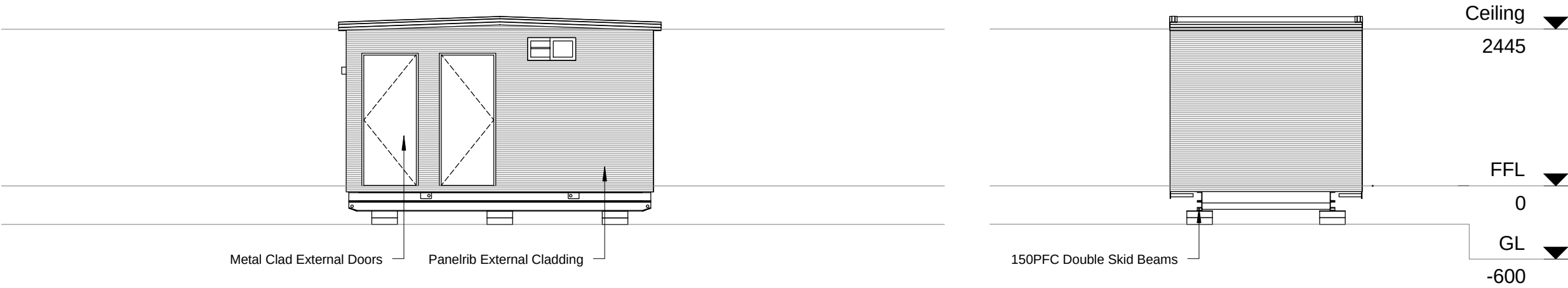
- DSB Distribution Switchboard
POE - Point Of Entry
Light Switch
Two-way Light Switch
Light Switch - IPX5 rated
10amp Single GPO
10amp Double GPO
15amp Single GPO.
10amp GPO - IPX5 rated
20amp Single GPO
- Indicates floor mounting
- Indicates ceiling mounting
Comms. - Draw Wire Only
'F' Type Television Outlet
240V Smoke Detector
- 36W. Single Fluorescent Light
36W. Double Fluorescent Light
36W. Emergency Back-up Fluorescent Light
36W. Single Fluorescent Light - IP65 rated
Emergency Exit Light
Batten Holder
External Light
18W Single Vandalite
Oyster Light
Photo Electric Light Switch
Spot Light

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-	-	-	-			4.8 x 3.0m Male/Female Toilet Standard Hire Specification	April 2010			Floor Plan	C2	
							SCALE			DRAWING NUMBER	REVISION	SHEET SIZE
							DRAWN			MFT-015-H-C2 - 01	-	A3
							CHECKED					



1 Elevation A
1 : 75

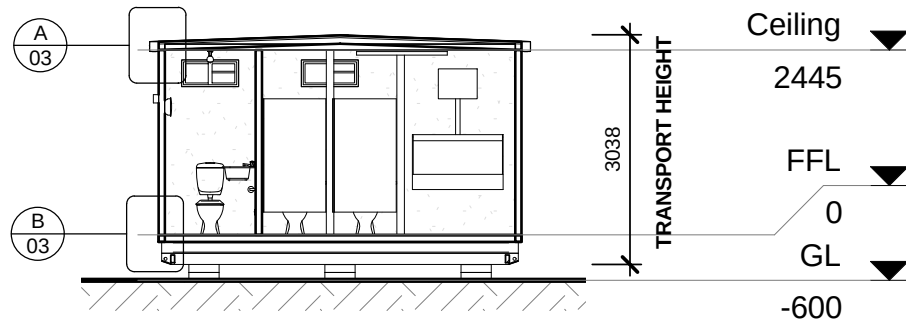
4 Elevation D
1 : 75



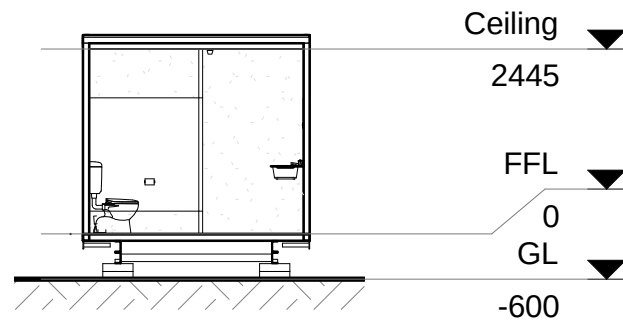
2 Elevation B
1 : 75

3 Elevation C
1 : 75

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-	-	-	-			4.8 x 3.0m Male/Female Toilet Standard Hire Specification	SCALE	1 : 75	Elevations		C2		
						DRAWN	RA	DRAWING NUMBER	REVISION		SHEET SIZE		
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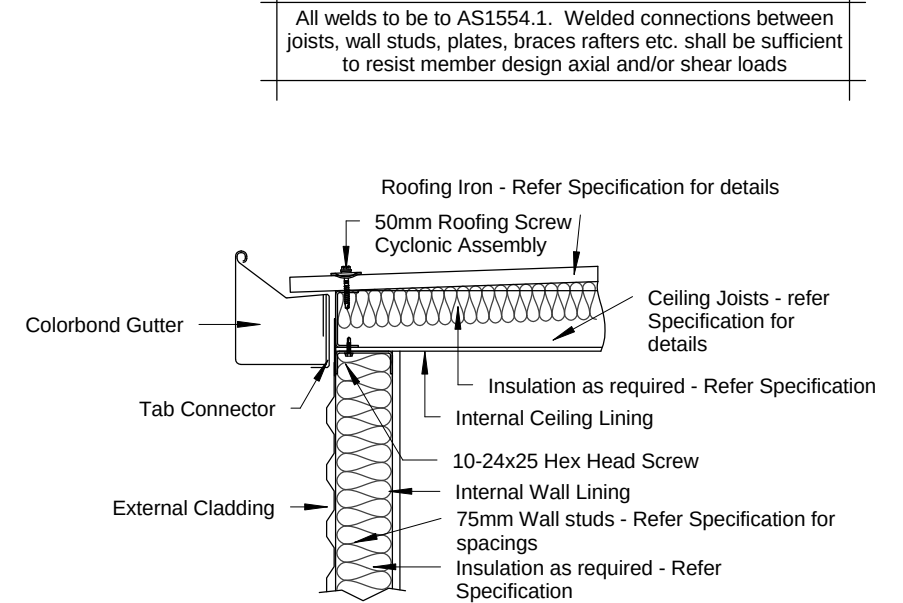
1 Section 1
1 : 100



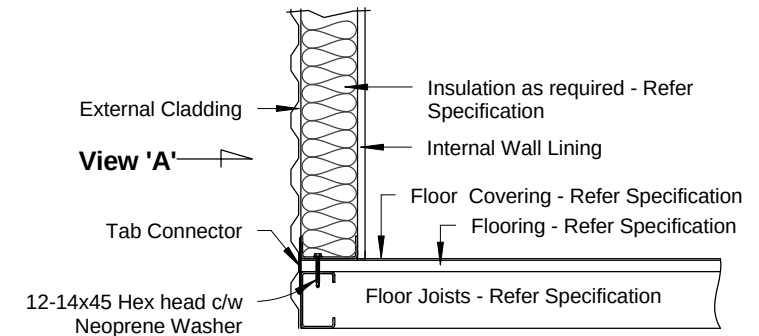
2 Section 2
1 : 100

Ceiling Joists & Purlins		
Wind Class	Ceiling Joist Material	Joist Centres
N3	C07510	611
C2	LC07512	611
Wind Class	Purlin Material	Purlin Centres
N3	LC07512	1st @ 900 then 1650 crs
C2	LC07512	1st @ 900 then 1200 crs

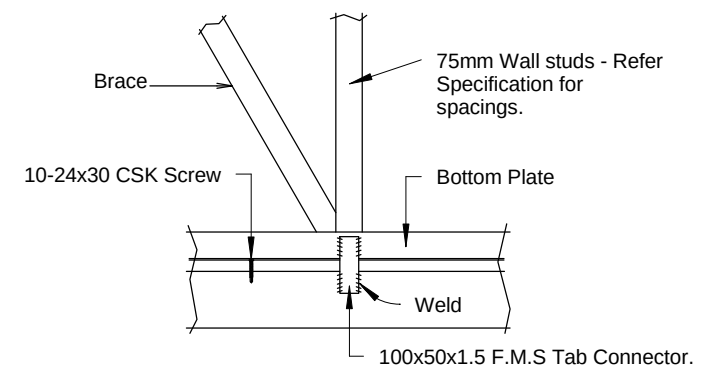
Wall To Floor & Roof Fixings			
Bldg. Width	Roof Type	Wind Class.	Fixings
2.4m	Any	N3,C2	Tabs @ 1800 crs, Screws @ 600 crs
	Any	C3	Tabs @ 1200 crs, Screws @ 600 crs
3.0m	End to End	N3,C2	Tabs @ 1800 crs, Screws @ 600 crs
	Side to Side	N3	Tabs @ 1800 crs, Screws @ 600 crs
	Side to Side	C2	Tabs @ 1200 crs, Screws @ 600 crs
	Any	C3	Tabs @ 1200 crs, Screws @ 600 crs
3.45m	Any	N3	Tabs @ 1800 crs, Screws @ 600 crs
	Any	C2,C3	Tabs @ 1200 crs, Screws @ 600 crs



DETAIL 'A' 1:10



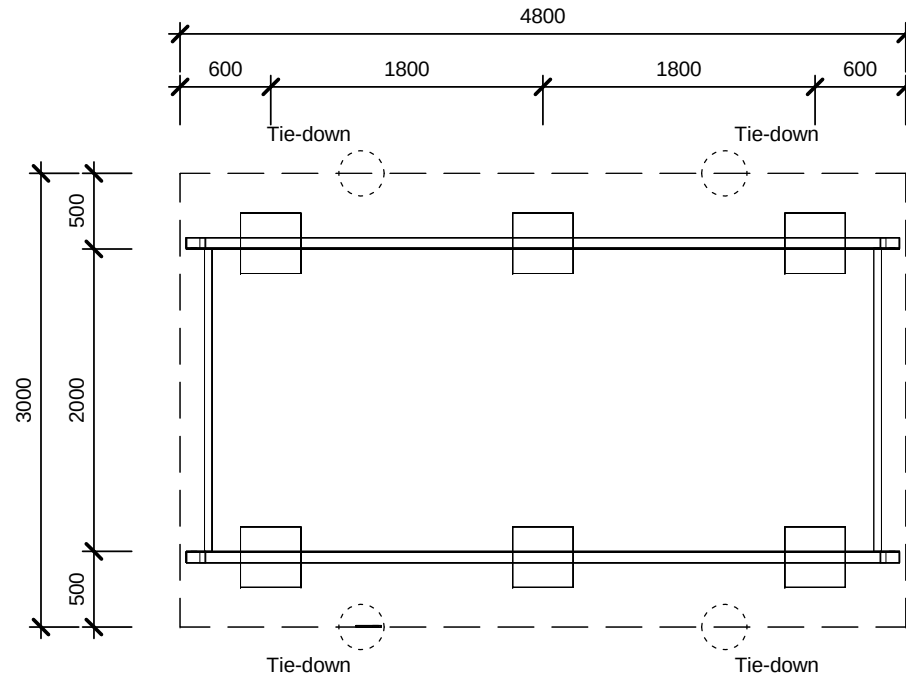
DETAIL 'B' 1:10



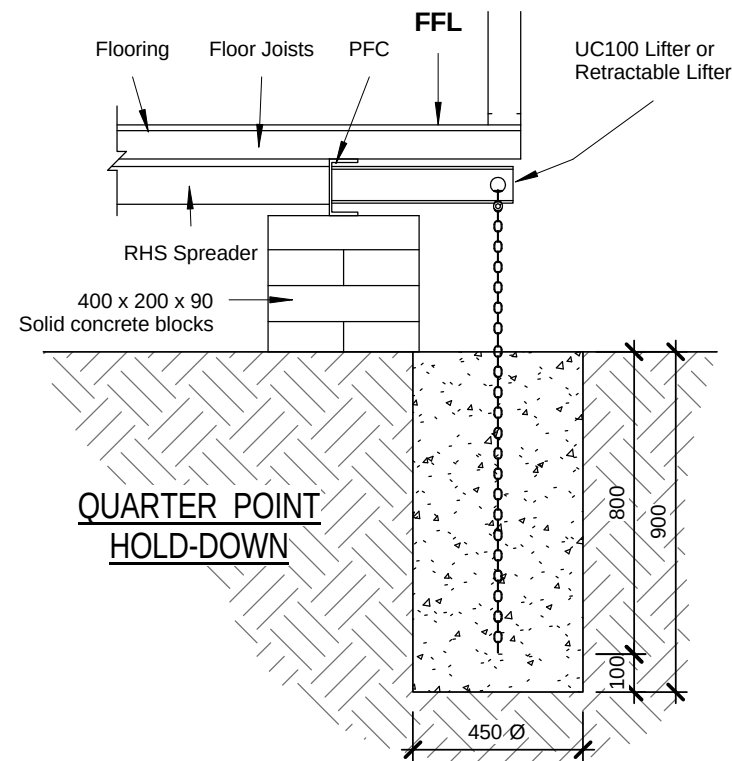
VIEW 'A' 1:10

3 Connection Details - C2
1 : 10

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-	-	-	-			4.8 x 3.0m Male/Female Toilet Standard Hire Specification	SCALE	As indicated	149-151 MAGNESIUM DRIVE, CRESTMEAD, QLD 4132 P.O. BOX 1171, BROWNS PLAINS BC, QLD 4118 E-mail: atcosales@atcosl.com.au	Sectional View	C2
							DRAWN	RA	PHONE: (07) 3412 8600 FAX: (07) 3803 0175 ABN: 71 083 903 309	DRAWING NUMBER	REVISION
							CHECKED			MFT-015-H-C2 - 03	-
											SHEET SIZE
											A3



1 Footings Layout
1 : 50



2 Hold Down - C2
1 : 20

ATCO Structures & Logistics Pty Ltd recommends that all buildings be secured appropriately. For further information on your specific project, please refer to your ATCO representative or a Registered Structural Engineer.

- Concrete strength to be 20MPa at 28 days
- Footing shown for sand & clay (Classes "A" - "E" per AS2870)
If "rock" encountered (depth under 600mm) provide 2 x Ø16mm rock bolts - Embed at least 600mm into sound material
- Sub-structure requires minimum safe bearing pressure at founding level of 125kPa

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-	-	-	-			4.8 x 3.0m Male/Female Toilet Standard Hire Specification	SCALE	As indicated	ATCO STRUCTURES & LOGISTICS PTY. LTD. 149-151 MAGNESIUM DRIVE, CRESTMEAD, QLD 4132 P.O. BOX 1171, BROWNS PLAINS BC, QLD 4118 E-mail: atcosales@atcosl.com.au	Foundation Plan	C2
							DRAWN	RA	PHONE: (07) 3412 8600 FAX: (07) 3803 0175 ABN: 71 083 903 309	DRAWING NUMBER	REVISION
							CHECKED			MFT-015-H-C2 - 04	SHEET SIZE
										-	A3

Manufacturing Structural Members		
Description	Member Size	Back to Back
Double Skid beams c/w retractable lifters	150PFC	2000

- Floor Structure Schedule	
Floor Structure	Comments
Floor 480mm Floor Joist Centres	
Covering - 1.5mm Polyflor XL Vinyl	100mm Cove
Flooring - 15mm F14 T&G Plywood	
Framing - LC07512 Galvaspan	

Wall Height
2445

- Wall Schedule	
Wall Structure	Comments
External Wall 611mm STUD CENTRES	
Cladding - External - Maxirib - Horizontal	
Framing - 75x1.0mm HI-TEN Truecore	
Lining - Internal - 3.6mm Polyester Coated Plywood	
Ply Internal Wall 611mm STUD CENTRES	
Framing - 75x1.0mm HI-TEN Truecore	
Lining - Internal - 3.6mm Polyester Coated Plywood	

Sales Roof Structure Schedule	
Roof Structure	Comments
2° End to End Roof SUPER/PLY LC07512 - 611 STD C2 - Energy Efficient 611mm JOIST CENTRES	
Framing - LC07512 Galvaspan	
Insulation - R2.5 Anticon	
Lining - Internal - 3.6mm Mirage Pearl Plywood	
Purlins - LC07512 Galvaspan	
Roof - 0.42mm BMT Superdek Sheeting	

Sales Door Schedule											
No.	Panel	Height	Width	Handle Type	Hardware Set	Closer	C/B Jamb	Timber Jamb	Security	Quantity	Comments
D1	Standard : Hollow Core MC	2040	820	Standard	Passage	Yes	Yes	No	Locking Shroud	1	
D2	Standard : Hollow Core MC	2040	820	Standard	Privacy	Yes	Yes	No	Locking Shroud	1	

Sales Window Schedule							
No.	Type	Glazing	Height	Width	Sill Height	Quantity	Comments
W1	PVO	Obscure Glass	350	750	1960	3	

* Plumbing Fixtures			
No.	Description	Quantity	Comments
1	WC Cubicle c/w toilet roll holder	2	
2	WC Suite c/w toilet roll holder	1	
3	1200mm Wall mounted S/S urinal	1	
4	S/S Handbasin c/w mirror over - Cold only	3	
fw	Floor Waste	3	

Waste Manifold Included

- Electrical Fixtures	
Description	Quantity
1x10amp GPO	2
Switchboard	1

Lighting Fixtures	Quantity
1x36w Fluro & Wire guard	1
Batten Holder	1
Switch - Std	2

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-	-	-	-			4.8 x 3.0m Male/Female Toilet Standard Hire Specification	SCALE		Client Schedules		C2			
							DRAWN	RA	DRAWING NUMBER		REVISION	SHEET SIZE		
							CHECKED		MFT-015-H-C2 - 05		-	A3		

Manufacturing Structural Members		
Description	Member Size	Back to Back
Double Skid beams c/w retractable lifters	150PFC	2000

- Floor Structure Schedule	
Floor Structure	Comments
Floor 480mm Floor Joist Centres	
Covering - 1.5mm Polyflor XL Vinyl	100mm Cove
Flooring - 15mm F14 T&G Plywood	
Framing - LC07512 Galvaspan	

Wall Height	
2445	

- Wall Schedule	
Wall Structure	Comments
External Wall 611mm STUD CENTRES	
Cladding - External - Maxirib - Horizontal	
Framing - 75x1.0mm HI-TEN Truecore	
Lining - Internal - 3.6mm Polyester Coated Plywood	
Ply Internal Wall 611mm STUD CENTRES	
Framing - 75x1.0mm HI-TEN Truecore	
Lining - Internal - 3.6mm Polyester Coated Plywood	

Sales Roof Structure Schedule	
Roof Structure	Comments
2° End to End Roof SUPER/PLY LC07512 - 611 STD C2 - Energy Efficient 611mm JOIST CENTRES	
Framing - LC07512 Galvaspan	
Insulation - R2.5 Anticon	
Lining - Internal - 3.6mm Mirage Pearl Plywood	
Purlins - LC07512 Galvaspan	
Roof - 0.42mm BMT Superdek Sheeting	

Manufacturing Door Schedule															
No.	Panel	Height	Width	Opening Height	Opening Width	Handle Type	Hardware Set	Closer	C/B Jamb	Timber Jamb	Painted	Security	Quantity	Comments	
D1	Standard : Hollow Core MC	2040	820	2050	835	Standard	Passage	Yes	Yes	No	No	Locking Shroud	1		
D2	Standard : Hollow Core MC	2040	820	2050	835	Standard	Privacy	Yes	Yes	No	No	Locking Shroud	1		

Manufacturing Window Schedule										
No.	Type	Glazing	Height	Width	Opening Height	Opening Width	Sill Height	Window Moulds	Quantity	Comments
W1	PVO	Obscure Glass	350	750	353	753	1960	PVC	3	

- Trims & Moulds			
Wall Type	Cornice	Joint	Skirting
External Wall	PVC	PVC	PVC
Ply Internal Wall	PVC	PVC	PVC

COLOURS

Roofing Iron Colour - Zincalume
Barge Capping Colour - ATCO Yellow
Gutter Colour - ATCO Yellow
External Cladding Colour - Surfmist
External Door Colour - Surfmist
Window Frames Colour - Architectural White

Internal Ceiling Colour - Pearl
Internal Wall Colour - Grey Embossed

Door Jamb Colour - Surfmist
Window Architrave Colour - Grey
Skirting Colour - Grey
Floor Covering Colour - Grey

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-	-	-	-			4.8 x 3.0m Male/Female Toilet Standard Hire Specification		SCALE			Manufacturing Schedules		C2	
						DRAWN	RA	DRAWING NUMBER			REVISION	SHEET SIZE		
						CHECKED		MFT-015-H-C2 - 06			-	A3		

PACKING LIST

Complexing Materials, General Packing Items	
Description	Quanity

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								DRAWN	RA		DRAWING NUMBER	REVISION	SHEET SIZE
								CHECKED			MFT-015-H-C2 - 07	-	A3

Appendix D - Traffic and Transport Impact Assessment

**Carmichael Coal Mine Project
Borrow 7 Quarry Proposal
Traffic Engineering Report**

Adani

Reference: 12SCT0107/01B7

24.04.2013

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ABN 65 010 868 621

Suite 9, 13 Norval Court

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Document Status

Rev No.	Author	Reviewed / Approved		Description	Date
		Name	Signature		
01	G Harris	P Penman RPEQ: 12644		Final	24.04.13

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1. Background

1.1 Introduction

TTM Consulting has been engaged by Adani undertake a Traffic and Pavement Impact Assessment in support of an Extension of Use application for an existing quarry. Borrow 7 Quarry is described as Lot 3235 on PH752 ('the site'), as shown in **Figure 1.1**. It is understood that a Development Application will be lodged with Isaac Regional Council (IRC), with the Department of Transport and Main Roads (DTMR) as a concurrence agency.

1.2 Scope

This report investigates the transport aspects associated with the proposed development. The scope of the transport aspects investigated includes:

- Identification of likely traffic volumes, distribution and composition from the future development;
- Identification of likely traffic impact of development on the public road network;
- Identification of likely pavement impact of development on the public road network;
- Road upgrades to be provided to mitigate the impact of the proposed development on the external road network, if any; and
- Access configuration to provide efficient and safe manoeuvring between the site and the public road network.

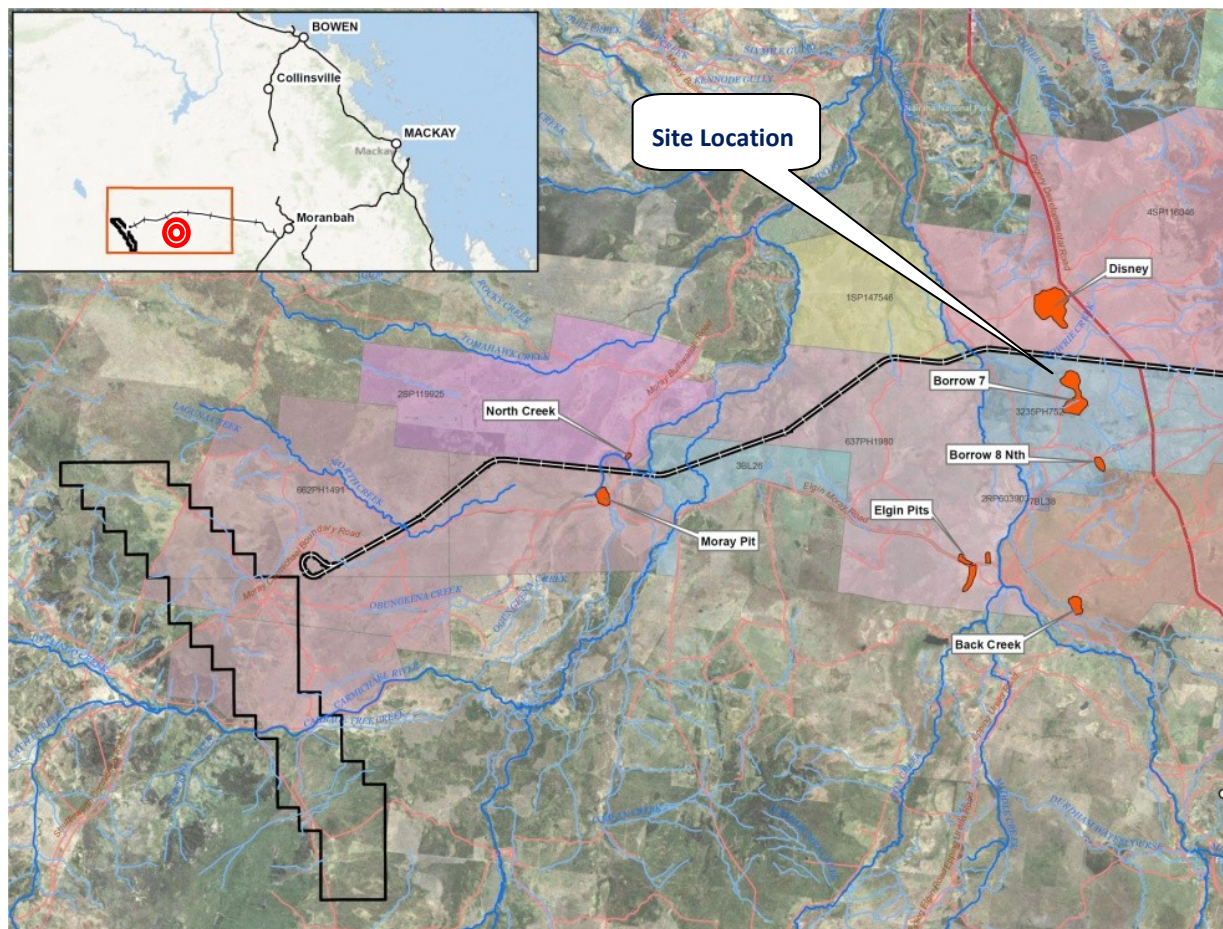


Figure 1.1: Site Location

This report investigates the transport aspects associated with the set up and on-site operations of Borrow 7 and associated quarries only. This report does not include an assessment of the following:

- Fuel requirements for haulage activities. Fuel for haulage activities will utilise a centrally located fuel farm which will be shared with other uses involved with mining and rail operations. This fuel farm will be assessed within the EIS for the Carmichael Coal Mine and Rail Project;
- Construction or use of haul road / rail maintenance road. This will be assessed with specific applications regarding the Carmichael Rail Project, including any interim use of a haulage facility crossing state or local roads;
- Use of Borrow 7 and associated quarries for commercial activities not related to the Carmichael Coal Mine and Rail Project. The use of these quarries is primarily for the construction of this project with a cumulative 1Mtpa of material required per year after this period; and
- The ultimate layout of the Gregory Development Road / Elgin Road intersection or alignment of Elgin Road.

To assess the proposed transport arrangements, the development plans have been assessed against the following guidelines and planning documents:

- Belyando Shire Planning Scheme;
- Department of Transport and Main Roads Road Planning and Design Manual; and
- Department of Transport and Main Roads Guidelines for Assessment of Road Impacts of Development (GARID).

1.3 Methodology

TTM have reviewed development traffic movements to obtain a 'Study Area'. Existing and proposed transport infrastructure within this study area was then investigated through desktop study, liaison with road authorities (IRC and DTMR) and a site visit on Tuesday 5th March 2013.

Data obtained from road authorities includes road volume and composition data, accident data, road maintenance and rehabilitation information among other information. The site visit included a basic road condition assessment, intersection movement surveys and a site distance assessment.

The traffic and pavement impacts of the proposed development within the study area were then assessed using principles in GARID.

1.4 Proposed Development

The development proposal is for new quarry operations to extract 1,900,000 tonnes per annum (tpa). Further information on the proposed quarry operations is provided in **Section 5**, with the site layout shown in **Appendix A**.

Borrow 7 Quarry will provide the following material related to the proposed Carmichael Coal Mine and Rail Project:

- Ballast and base material for the Rail component of the project;
- Aggregate for the rail project;
- Base material for the mine, village and airport; and
- Continued supply of construction material for maintenance to the project.

A review of quarry vehicle generation has identified traffic movements from the Gregory Development Road to Borrow 7 Quarry. The study area as shown in **Figure 1.2** therefore incorporates the Gregory Development Road and the route to the quarry and mine site via Elgin Road and Twin Hills Road.

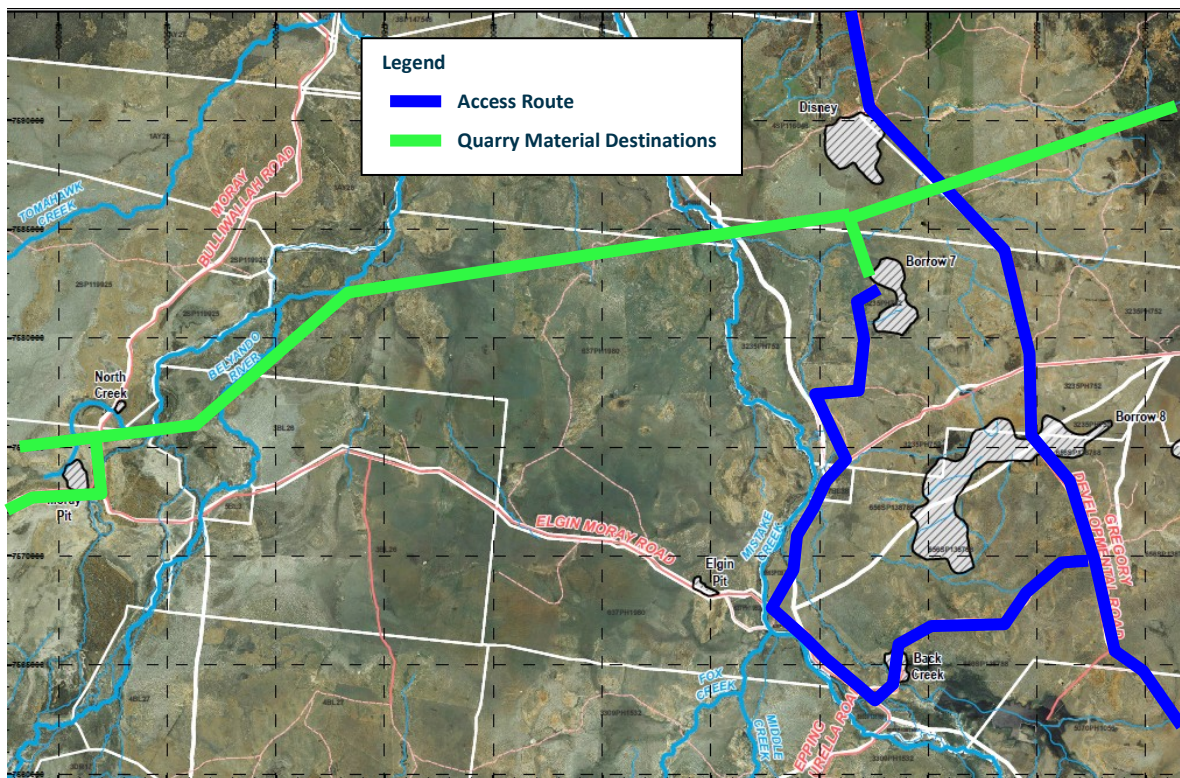


Figure 1.2: Study Area – Borrow 7 Quarry

2. Existing Transport Infrastructure

2.1 Introduction

This Chapter provides a review of the existing transport infrastructure adjacent to the proposed development site, with **Table 2.1** providing a summary of the key road characteristics.

Table 2.1: Road Hierarchy & Road Characteristics

Road	Posted Speed Limit	Road Characteristics	AADT (Source)	Road Authority and Status
Elgin Road (Elgin Moray Road)	80kph	Gravel, 8m with 2 Lanes	61 (IRC)	IRC controlled, Local Road
Bulliwallah Road (Moray Bulliwallah Road)	80kph	Gravel, 8m with 2 Lanes	10 (IRC)	IRC controlled, Local Road
Moray Carmichael Road (Moray Carmichael Boundary Road)	80kph	Gravel, 8m with 2 Lanes	56 (IRC)	IRC controlled, Local Road
Twin Hills Road	80kph	Gravel, 4-5m, 1 lane	2 (Survey)	IRC controlled, Local Road
Gregory Developmental Road (Belyando Crossing to Peak Downs Highway)	110kph	Sealed, 8m with 2 lanes	450 (DTMR)	DTMR controlled, State Strategic Road

The Council controlled roads do not have a posted speed limit and therefore 80kph has been adopted as the highest speed allowed on these gravel roads. Elgin Road is partially signed as 20kph in the vicinity of a homestead immediately south of the intersection with Bulliwallah Road. Elgin Road and Bulliwallah Road vary in carriageway width from 6m to 10m, however are generally around 8m wide. Twin Hills Road is generally one lane construction, however some sections allow vehicles to pass each other.

All intersections within the study area are 3 arm priority controlled intersections, with the exception of Gregory Development Road / Twin Hills Road / Avon Road intersection which is a four arm staggered intersection. The Elgin Road / Bulliwallah Road / Moray Carmichael Road intersection does not appear to have a specific priority route.

Section 3 reviews the access routes and intersections in more detail.

2.2 Flooding, Disaster & Relief Review

The Gregory Development Road crosses numerous floodplains and floodways, with instances of flooding close to the road at multiple locations for significant periods, which have caused multiple road closures. A 12km section of Gregory Development Road is included as part of the Reconstructing Mackay / Whitsunday – West Package. Works on this package started in April 2012 and are expected to be completed late 2013, however the specific section of Gregory Development Road to be reconstructed is unknown. DTMR identified that during significant rain events they may restrict load limits on this road to protect the pavement.

2.3 Public Transport

School bus routes may utilise roads within the study area, particularly Gregory Development Road. During the site visit however, TTM did not see evidence of school bus routes or stops on these roads. There are no dedicated foot or cycle paths within the study area.

2.4 Road Safety

A review of crash data was undertaken for the section of Gregory Developmental Road between Clermont and Belyando Crossing, approximately 158 km in length. A summary of this data is shown in **Table 2.2** with the data. The crash data reveals:

- A total of 39 accidents over a 5 year period (includes non serious crashes for 3.5 years only);
- 87% were single vehicle crashes, and 13% were multi-vehicle crashes;
- 46% of accidents were single vehicle accidents where the vehicle left the carriageway; and
- Fatigue was recorded as a contributing factor in 31% of the crashes, with driver inattention contributing to 18% of accidents.

Table 2.2: Crash History – Gregory Developmental Road (2005-2009)

Year	Single Vehicle	Multiple Vehicles	Fatal	Total
2007	6	1	1	7
2008	11	1	1	12
2009	9	1	-	10
2010	-	1	-	1
2011	4	-	1	4
2012	4	1	-	5
Total	34	5	3	39

Elgin Road experienced three single vehicle accidents during the above period which resulted in hospitalisations. No other vehicle accidents were recorded within the study area.

2.5 Road Planning & Scheduled Road Improvements

TTM have reviewed the Queensland Transport and Roads Investment Program 2012-13 to 2015-16 for the Mackay / Whitsunday region. It is understood that Gregory Development Road will be rehabilitated from 6km north of the Twin Hills Road intersection for a distance of approximately 71km in a southerly direction. It is further understood signage will be installed or replaced at the Gregory Development Road / Bowen Development Road intersection.

Following a review of Council's 2011-2012 budget, it is understood that the following roads were subject to being re-sheeted during this period:

- Twin Hills Road;
- Bulliwallah Road; and
- Avon Road.

2.6 Development and Mine Planning

TTM are also involved in five other quarry applications within the local region as part of development of the Carmichael Coal Mine and Rail Project. The cumulative impact of these quarries within the study area will also be reviewed. DTMR have advised that other developments such as other mine projects do not have to be included in the cumulative impact review.

It is understood that Elgin Road and Moray Carmichael Road will be upgraded, realigned and maintained by Adani as part of the Carmichael Coal Mine and Rail Project. This upgrade will also include the provision of turn treatments at the Gregory Development Road / Elgin Road intersection.

TTM have been advised that discussions relating to contributions with DTMR for the Carmichael Coal Mine and Rail Project are still ongoing and may be influenced by the conclusions in this report.

The ultimate layout of the upgraded Elgin Road is shown in **Figure 2.1**. It is understood that the Moray Carmichael Road / Bulliwallah Road intersection will be reconfigured for this upgrade with Bulliwallah Road forming the minor and northern leg of a standard T intersection.

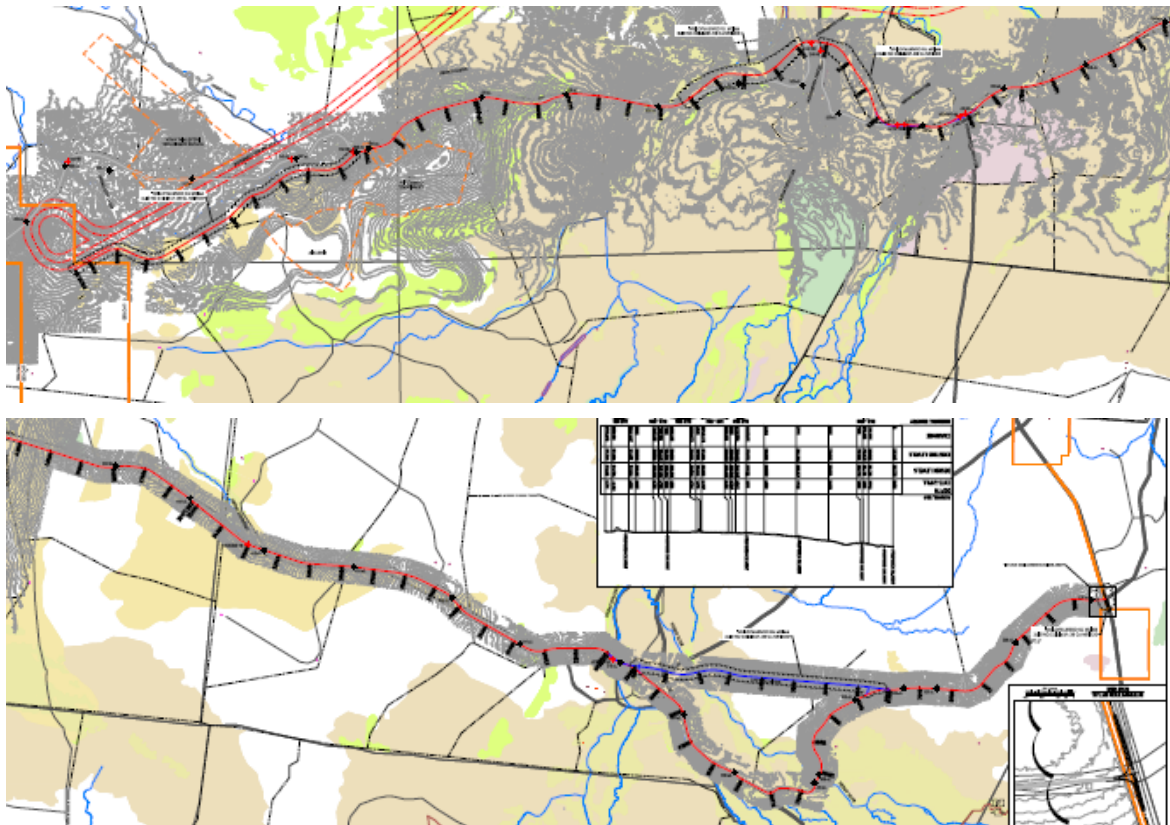


Figure 2.1: Elgin Road / Moray Carmichael Road Upgrade

3. Access Route Review

3.1 Gregory Development Road / Elgin Road Intersection

The intersection layout is a typical priority 3-arm intersection as shown in **Figure 3.1**, with no turn treatments provided. This intersection has good visibility in both the north and south directions, with the following traffic and geometric attributes:

- A posted speed limit of 110km/hr;
- A 7 metre wide carriageway with 0.5m wide shoulders;
- Minimum 350m site distance in each direction;
- A wide 31 metre entry width to Elgin Road for large turning vehicles;
- Elgin Road is sealed to 25.5m from Gregory Development Road; and
- A cattle grid on Elgin Road, 35m from Gregory Development Road restricts movement at this location to one lane only.



Figure 3.1: Intersection Aerial and Site Photographs

3.2 Elgin Road / Twin Hills Road Intersection

The intersection layout is a typical priority 3-arm intersection as shown in **Figure 3.2**, with no turn treatments provided. This intersection has good visibility in both the east and west directions, with the following traffic and geometric attributes:

- Speed limit not posted;
- Elgin Road has a 7m wide gravel carriageway with grass verges;
- Twin Hills Road has a 5m wide gravel carriageway with grass verges; and
- Minimum 350m site distance in each direction.



Figure 3.2: Intersection Aerial and Site Photographs

3.3 Elgin Road / Moray Carmichael Road / Bulliwallah Road Intersection

The intersection layout is a non-standard 3-arm intersection. No turn treatments are provided at this intersection however the radius from each leg is wide enough to enable two-way traffic flow along each leg. The intersection is large and photographs do not adequately show the intersection geometry. Aerial imaging in this region is also poor and therefore **Figure 3.3** only shows photographs of the intersection to each leg.

This intersection has good visibility in both the north and south directions, with the following traffic and geometric attributes:

- No posted speed limit;
- Elgin Road (southern approach) narrows to 5m wide at a bridge / culvert immediately south of the intersection;
- Moray Carmichael Road (western approach) and Bulliwallah Road (northern approach) are approximately 7m wide from the intersection; and
- Minimum 150m site distance in each direction.



Figure 3.3: Intersection Aerial and Site Photographs

3.4 Other Intersections

There are other intersections along the access route (Elgin Road) with Mt Gregory Road and Waltham Road. These intersections are all gravel with the minor roads including a 3m wide carriageway, and minimum 200m sight distances in each direction.

3.5 Elgin Road / Moray Carmichael Road / Bulliwallah Road

These roads are gravel and generally 8m wide. The road geometry does not include any sharp curves or steep inclines and reasonable sight distance is provided along most of the route. There are a number of cattle grids between property boundaries which restrict the road to one lane. These cattle grids have advanced warning signs. There are also 4 one lane bridges along the route. These bridges also have advanced warning signage with give way controls on the western approach to provide priority.

4. Traffic Volumes

4.1 Existing Peak Hour Volumes

DTMR have provided 2012 Annual Average Daily Traffic (AADT) data for the Gregory Development Road. A summary of this traffic data is provided in **Appendix B**.

TTM conducted 24 hour intersection movement surveys at the following intersections on Tuesday 5th March 2013:

- Gregory Development Road / Elgin Road;
- Gregory Development Road / Twin Hills Road / Avon Road; and
- Elgin Road / Bulliwallah Road / Moray Carmichael Road.

The peak hours were generally found to be 9:15-10:15am and 3:30-4:30pm. The level of truck (i.e. non-car) content on the Gregory Development Road was found to be 29%. The peak hour results of these surveys are shown in **Figure 4.1**.

4.2 Future Year Traffic Growth

It has been agreed with DTMR that a 10% growth is suitable for the 10 year design horizon (till 2024) with a 5% growth rate for further assessment after this year.

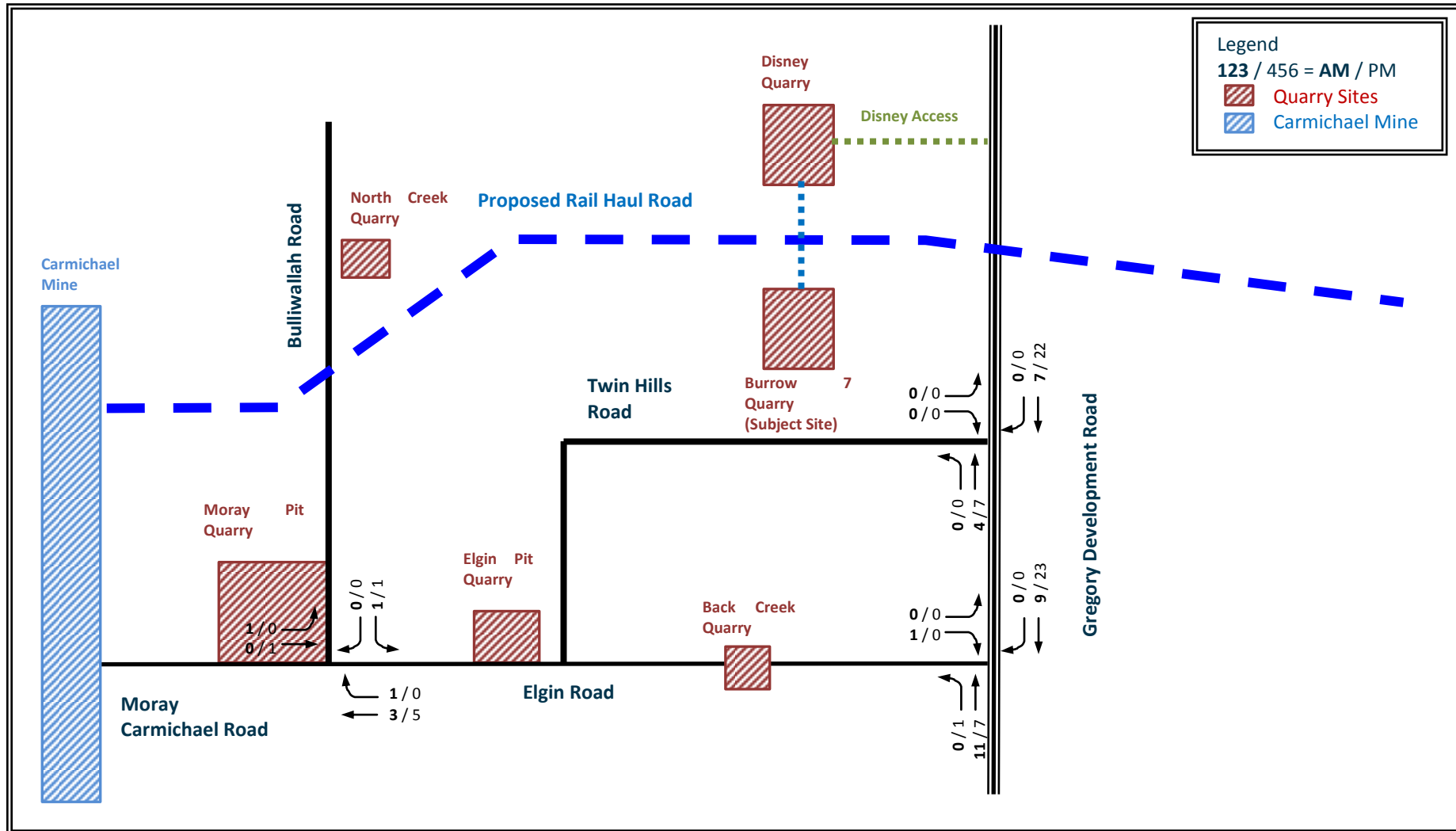


Figure 4.1: Study Area Peak Hour Traffic 2013

4.3 Existing ESA's

Advice from DTMR identifies an ESA value of 3.2 per heavy vehicle for all roads other than the Bruce Highway. This ESA value will be used for all existing heavy vehicles noted within the study area.

Table 4.1 provides the existing levels of ESAs on roads within the study area with the level of ESA's based on existing traffic data noted in **Table 2.1**, with heavy vehicle composition based on DTMR and Council advice.

Table 4.1: Existing ESAs within Study Area

Road	Number of Vehicles per Class	ESA Total	
		Daily	Annual
Gregory Development Road	450vpd with 28.7%HV @ 3.2 ESA / HV	413	150,700
Elgin Road	61vpd with 35.7% HV @ 3.2 ESA / HV	69.7	25,400
Moray Carmichael Road	56vpd with 53.5% HV @ 3.2 ESA / HV	95.9	35,000
Bulliwallah Road	10vpd with 22.4% HV @ 3.2 ESA / HV	7.2	2,620

5. Quarry Operations

5.1 Existing (Proposed) Quarry Site Operations

The following existing operational parameters have been considered for the traffic and pavement impact assessments:

- The expanded operations are intended for a short term period only (approx 2 years); and will remain operational at a significantly reduced capacity for mine operations only;
- The site will operate 24 hours;
- Typical annual quarry operations are 360 working days per year;
- An AB Triple vehicle with an average payload of 75t will be used;
- Truck movements will be split 50% in and 50% out during peak traffic periods;
- It is predicted that there will be 33-34 staff working on site; and
- The site peak traffic periods are between 07:00 and 08:00 and 16:00 and 17:00.

5.2 Development Truck ESA Loading

5.2.1 Haul Vehicles

It is likely that a typical AB Triple will haul the material from the quarry. The payload will be approximately 75t for each vehicle. TTM have reviewed the "Review of Heavy Vehicle Axle Load Data – Information Paper" (NTC Australia, July 2005). This document provides ESA values for an unloaded A Triple vehicle (1.67 ESA / vehicle) and an equation to derive ESA values for various loads (9.2 ESA / vehicle with a 75t payload).

The highest predicted annual haulage from Borrow 7 Quarry will be 1,900,000t. Haulage will be restricted to the local road network and a private haul road. As this quarry will provide material for the rail line on the west of the Gregory Development Road, some haulage movements will cross the state controlled road network. The operation of the Gregory Development Road / haul road intersection will be assessed by other parties. The predicted daily level and peak hour number of trucks generated shown in **Table 5.1**.

Table 5.1: Estimated Daily & Peak Hour Haul Vehicle Generation

Tonnage/day	Average tonnes per load	Trucks in (load bearing)	Trucks out (non load bearing)	Total daily truck movements	Peak hour truck movements
Total Average: 2,584t	75	34 (313 ESA)	34 (57 ESA)	68 (370 ESA)	14
Total Peak Month: 6,997t	75	93 (856 ESA)	93 (155 ESA)	186 (1,011 ESA)	38
Crossing GDR Average: 2,160t	75	30 (276 ESA)	30 (50 ESA)	60 (326 ESA)	12
Crossing GDR Peak: 4,198	75	56 (515 ESA)	56 (94 ESA)	112 (609 ESA)	22

Based on the assumptions shown in **Table 5.1** (combination of unloaded and loaded trips) the following calculations establish the daily and equivalent ESA's generated annually:

- Average Annual ESA: 68 daily two-way trucks = 133,200 ESA;
- Peak Annual ESA = 275,373 ESA (Maximum permissible haulage based on 1,900,000tpa); and
- An annual ESA value of 118,990 crossing the Gregory Development Road, with a peak of 112 daily movements and 22 peak hour movements

5.2.2 Service Vehicles

TTM have been advised that service vehicles for site set up and operation will be as indicated in **Table 5.2**. Traffic Reports for other quarry applications should be reviewed for detail regarding service vehicle movements for other individual quarries.

Quarry operations may generate some additional minor and infrequent heavy vehicle movements, such as trucks collecting waste from site. These movements are however expected to be low in number and utilise smaller trucks, which would involve small ESA increases. **Table 5.2** includes conservative values for water and maintenance deliveries which should offset the non-inclusion of these other heavy vehicles.

Fuel requirements are based on 93,106L per week needed for Borrow 7 Quarry and 257,685L for all quarries collectively. Fuel will be transported in B-doubles with a 50,000L capacity, with a conservative ESA value of 8 per delivery accounting for entry (loaded) and exit (unloaded) movements of each vehicle. It is reiterated that this fuel is for the operation of the quarry / quarries only and does not include haulage activities, which will be serviced via a communal fuel farm and assessed through the EIS for the Carmichael Coal Mine and Rail Project.

Table 5.2: Estimated Number of Service Vehicles For Site Set Up and Operation

Service Vehicles	Borrow 7 Deliveries (in + out movements)	Borrow 7 Deliveries (ESA)	Borrow 7 (Annual ESA)	All Quarry Deliveries (in + out movements)	All Quarry Deliveries (ESA)	All Quarry (Annual ESA)
Site Set up	180	540	540	400	1,200	1,200
Operations: From Townsville	Fuel: 4 per week	Fuel: 16 per week	Fuel: 832	Fuel: 12 per week	Fuel: 48 per week	Fuel: 2,496
Operations: From Mackay / Clermont	Water: 2 per week Maintenance: 8 per week	Water: 6 per week Maintenance: 20 per week	Water: 312 Mtnce: 1,040	Water: 12 per week Maintenance: 14 per week Total: 26 per week	Water: 36 per week Maintenance: 42 per week Total: 78 per week	Water: 1,872 Maintenance: 2,184 Total: 4,056
Total (Annual)	908 trips		2,724 ESA	2,376 trips		7,752 ESA

5.3 Site Truck Distribution

TTM have consulted with Adani to determine likely distributions of quarry material. This includes not only the Borrow 7 Quarry, but also all other quarries related to the Carmichael Coal Mine and Rail Project. The defined study area for Borrow 7 Quarry includes the following road sections:

- Gregory Development Road from Peak Downs Highway to Belyando Crossing;
- Elgin Road;
- Moray Carmichael Road from Elgin Road to the Mine Site
- Bulliwallah Road; and
- Twin Hills Road from Elgin Road to Borrow 7 access.

The anticipated truck distributions from the Borrow 7 and associated quarries within this study area only are shown in **Table 5.3**. Route sections identified in this Table are shown in **Figure 5.1**. Heavy vehicles associated with site set up have been included in the route from the Peak Downs highway to provide a robust assessment (worst case scenario).

Table 5.3: Key Service Vehicle Routes

Haulage Routes		Borrow 7 Truck Distribution (VPD)	Annual Borrow 7 ESA's	All Quarry Truck Distribution (VPD)	All Quarry Annual ESA's
Key Routes	Study Ref				
Elgin Road (Gregory Development Road to Back Creek)	Section A	100% Service Vehicles (2.5)	2,724	92% Service Vehicles (6.0)	7,112
Elgin Road (Back Creek to Twin Hills Road)	Section B	100% Service Vehicles (2.5)	2,724	70% Service Vehicles (4.5)	5,394
Elgin Road (Twin Hills Road to Elgin Pits)	Section C	-	-	34% Service Vehicles (2.0)	2,670
Elgin Road (Elgin Pits to Bulliwallah Road)	Section D	-	-	15% Service Vehicles (0.6)	1,130
Moray Carmichael Road (Bulliwallah Road to Moray Pit)	Section E	-	-	7% Service Vehicles (0.5)	580
Twin Hills Road (Elgin Road to Borrow 7 Access)	Section F	100% Service Vehicles (2.5)	2,724	35% Service Vehicles (2.5)	2,724
Bulliwallah Road (Elgin Road to North Creek)	Section G	-	-	7% Service Vehicles (0.5)	550
Gregory Development Road (Belyando Crossing to Disney)	Section H	31% Service Vehicles (0.6)	832	32% Service Vehicles (1.7)	2,496
Gregory Development Road (Disney to Haul Road)	Section I	31% Service Vehicles (0.6)	832	36% Service Vehicles (2.2)	2,810
Gregory Development Road (Haul Road to Elgin Road)	Section J	31% Service Vehicles (0.6)	832	36% Service Vehicles (2.2)	2,810
Gregory Development Road (Elgin Road to Peak Downs Highway)	Section K	69% Service Vehicles (1.9)	1,892	68% Service Vehicles (4.3)	5,256

5.4 Site Staff

It is anticipated that the quarry staff will be transferred by bus between the workers accommodation village and quarry site. The transfer route used will generally follow the proposed rail haulage route and then access the local road network towards each quarry site location.

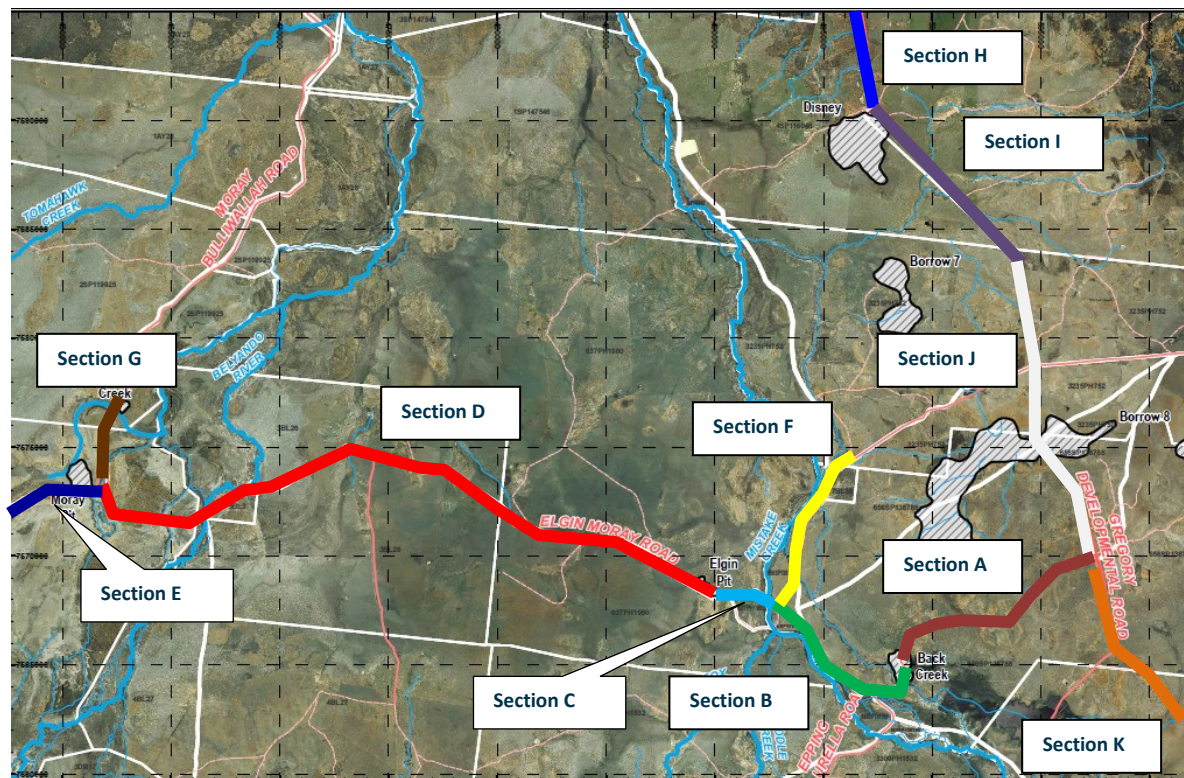


Figure 5.1: Study Area Road Sections – Borrow 7 Quarry

6. Traffic Impact Assessment

6.1 Introduction

This Chapter reviews the traffic operation and capacity performance within the study area.

6.2 Road Corridor Capacity Assessment

6.2.1 Assessment Criteria

The AUSTROADS Guide to Traffic Management indicates that two-lane rural highways have a capacity of 2,800 passenger cars per hour total for both directions of flow, under ideal conditions where there are no restrictive roadway, terrain or traffic conditions.

AUSTROADS defines level of service as a qualitative measure describing operational conditions within a traffic stream. The term Level of Service (LOS) and its characteristics for rural roads is defined in **Table 6.1**.

Table 6.1: Two Lane Rural Road Capacity – Rolling Terrain Two-Way Flow

LOS	Description	Rating
A	Free, unrestrictive flow	Very Good
B	Mostly free flow, few disruptions	Very Good
C	Stable flow	Good
D	Mostly stable flow, some delays	Acceptable
E	Congested flow, delays common	Bad
F	Forced flow	Bad

The volume and composition of traffic on a given road determines the level of interaction between vehicles and is measured as its LOS. LOS decreases with increasing traffic volumes. LOS 'A', LOS 'B', LOS 'C' in a rural context are satisfactory, with a LOS 'D' satisfactory in some circumstances.

In cases where traffic, terrain or geometric data may not be precisely known, the AUSTROADS Guide provides planning guidance on maximum AADT values that two-lane, two-way rural roads can accommodate under various terrain conditions.

Table 6.2 shows the values for various Levels of Service for a rural road in rolling terrain with varying ratios of design hour volume to AADT.

Table 6.2: Maximum AADT's for Various LOS on Two-Lane Two-Way Rural Roads

Design Hour Volume to AADT Ratio	Level of Service				
	A	B	C	D	E
0.10	1,100	2,800	5,200	8,000	14,800
0.11	1,000	2,500	4,700	7,200	13,500
0.12	900	2,300	4,400	6,600	12,300
0.13	900	2,100	4,000	6,100	11,400
0.14	800	1,480	3,700	5,700	10,600
0.15	700	1,800	3,500	5,300	9,900

6.2.2 Study Area Operational Performance

The highest volume road within the study area is Gregory Development Road which carries 450vpd. This volume is significantly less than the AADT threshold for a Level of Service 'A'.

Borrow 7 Quarry traffic is expected to increase traffic on the roads in the study area by no more than 200vpd vehicles during peak operations and as such the Level of Service 'A' is expected to be retained on all roads.

Cumulative development traffic will be highest on Elgin Road and Moray Carmichael Road with an average of 320 extra vehicles per day. As such, Level of Service 'A' is expected to be retained however some sections along this route may experience Level of Service 'B' roadway capacities in peak periods.

Roads operating at a LOS 'B' should have no significant road capacity issues with the predicted level of development traffic having a negligible impact on overall road corridor performance.

6.3 Intersection Capacity Assessment

6.3.1 Assessment Requirements

In a review of the GARID Guidelines Criteria 3: Traffic Operation Assessment, traffic operation impacts need to be considered for any section of a State Controlled Road (SCR) where the construction or operational traffic generated by the development equals or exceeds 5% of the existing AADT on the road section, intersection movements or turning movements.

6.3.2 Intersection Capacity Review

In a review of existing and future year traffic volumes at all intersections within the study area the highest trafficked road is Gregory Development Road with 31vph in the PM peak. TTM considers that all intersections within the study area will operate under uninterrupted flow conditions, which is based on guidance from the DTMR: Road Planning and Design Manual (RPDM) Chapter 13: Intersections at Grade: 13.5.4 Unsignalised Minor Road Intersections.

Table 13.4 Intersection Capacity - Uninterrupted Flow Conditions, is shown in **Figure 6.1**, with the level of peak hour traffic well below the criteria set in the table. TTM can therefore assume that uninterrupted flow conditions will occur, that the site access and local intersections will operate with nominal delays and queuing and no further capacity assessment is required.

**Table 13.4 Intersection Capacity –
Uninterrupted Flow Conditions**

Major Road Types ¹	Major Road Flow (vph) ²	Minor Road Flow (vph) ³
Two-Lane	400	250
	500	200
	650	100
Four-Lane	1000	100
	1500	50
	2000	25

Notes

1. Major road is through road i.e. has priority
2. Major road design volumes include through and turning movements
3. Minor road design volumes include through and turning volumes

Figure 6.1: RPDM Chapter 13: Table 13.4

6.4 Access Route Intersection Review

TTM have reviewed the sight distance of all intersections within the study area in accordance with DTMR requirements as shown in **Figure 6.2**. Assessment of the required turn treatments at all intersections are also included in this review.

Table 13.5 Intersection Sight Distance for Level Pavement

Design Speed (km/h)	Deceleration (g) ⁽¹⁾	Entering Sight Distance 1.15m to 1.15m (m) ⁽³⁾	ASD - Approach Sight Distance (1.15m to 0.0m)				SISD - Safe Intersection Sight Distance (1.15m to 1.15m)			
			Absolute Minimum 2.0 secs ⁽⁵⁾		Desirable 2.5 secs ⁽⁵⁾		Absolute Minimum 2.0 secs ⁽⁵⁾		Desirable 2.5 secs ⁽⁵⁾	
			m ⁽²⁾	min R ⁽⁴⁾	m ⁽²⁾	min R ⁽⁴⁾	m ⁽²⁾	min R ⁽⁴⁾	m ⁽²⁾	min R ⁽⁴⁾
40	0.56	100	33	500	39	700	66	500	72	600
50	0.52	125	47	1000	54	1300	89	900	96	1000
60	0.48	160	63	1800	71	2200	113	1400	121	1600
70	0.45	220	82	2900	91	3600	140	2200	149	2500
80	0.43	305	103	4600	114	5700	170	3200	181	3600
90	0.41	400	128	7200	140	8600	203	4500	215	5100
100	0.39	500	157	10800	170	12600	240	6300	253	7000
110	0.37	500	190	15700	205	18300	282	8700	297	9600
120	0.35	500	229	22800	245	26100	329	11800	345	13000

Notes:

1. Average deceleration adopted, given in terms of acceleration due to gravity (g).
2. For grade corrections to ASD and SISD, see Table 13.6.
3. Limiting values of ESD based on the assumption that drivers are unlikely to seek gaps greater than 500m.
4. Crest vertical curve radius (m).
5. Reaction times.

Figure 6.2: RPDM Chapter 13: Intersections at Grade: Table 13.5

6.4.1 Gregory Development Road / Elgin Road

As noted in **Section 3.1**, the sight distance in each direction at this intersection exceeds 350m as shown in **Figure 3.1**. This sight distance is higher than the 345m sight distance noted in **Figure 6.2** for a road with a 120kph design speed and is therefore considered suitable.

Figure 6.3 identifies required turn treatments at this intersection based on base and project movement volumes for the Gregory Development Road / Elgin Road intersection on opening day (2014). **Figure 6.4** shows the required turn treatments in 2024. For a conservative assessment, it has been assumed that all daily vehicles will arrive in a single peak hour with double the average daily deliveries during peak periods. Existing movements at this intersection have been increase by 10% pa as noted earlier in this report.

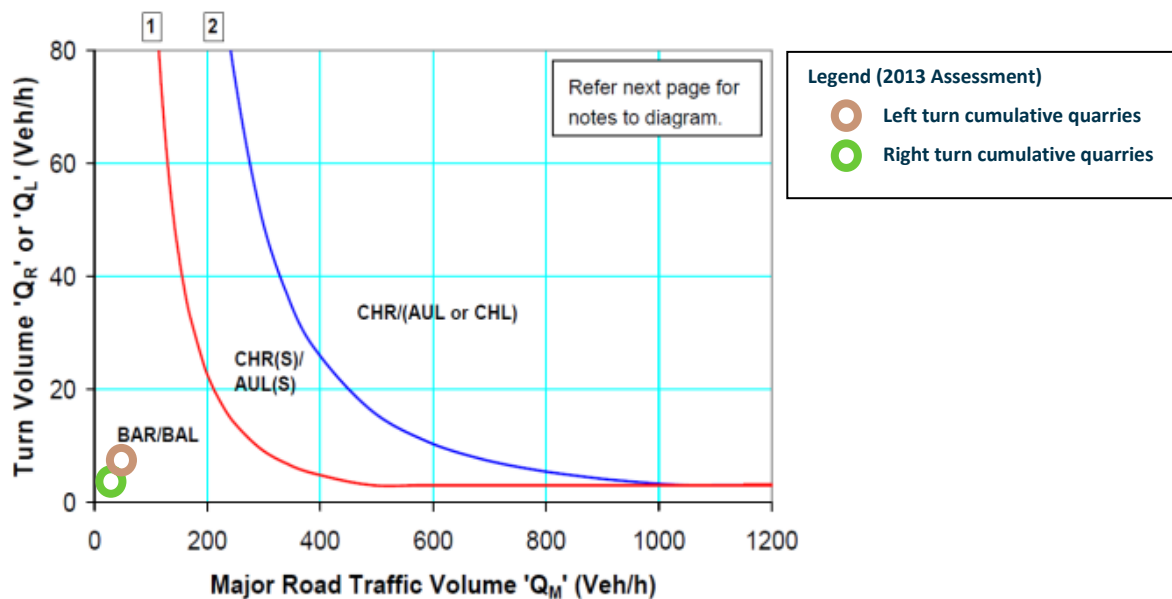


Figure 6.3: Gregory Development / Elgin Road: Warrants for Turn Treatments (2014)

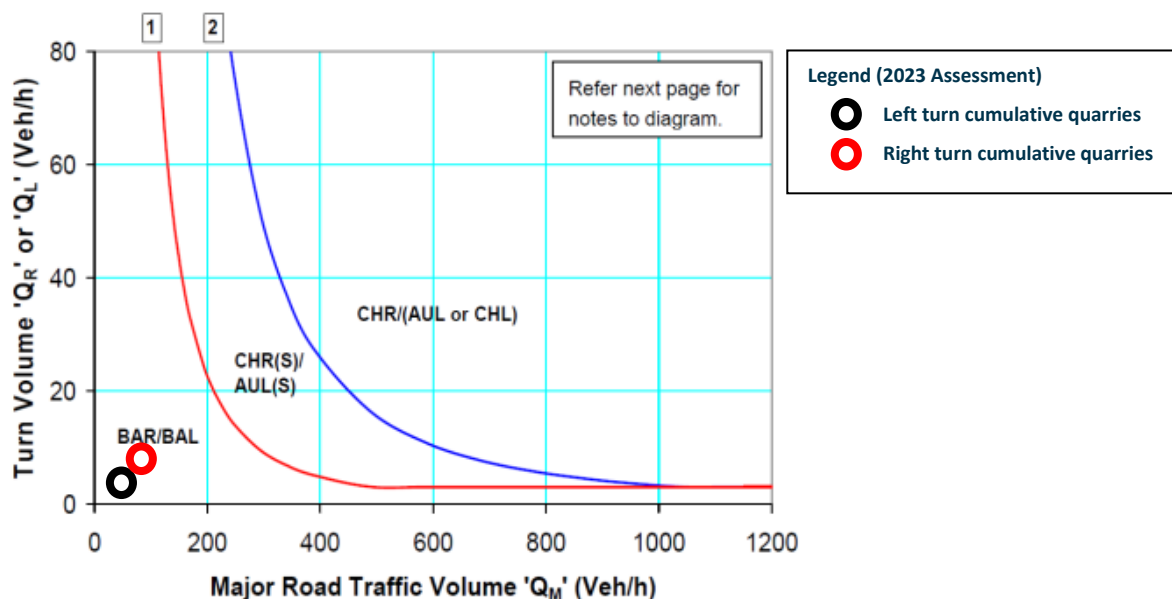


Figure 6.4: Gregory Development / Elgin Road: Warrants for Turn Treatments (2024)

This analysis identifies that basic left (BAL) and basic right (BAR) turn treatment are required at the Gregory Development Road / Elgin Road intersection prior to quarry operations. Higher order intersection treatments may be required due to other development in the area, however, these types of turn treatments only are required for the Borrow 7 and associated quarries.

6.4.2 Other Intersections

Other intersections along the access route are predicted to carry lower through volumes than the Gregory Development Road / Elgin Road intersection. As such, BAL and BAR treatments should be suitable for minor intersections along this route. This should be confirmed when designing the final alignment of Elgin Road / Moray Carmichael Road.

Turn movements associated with Borrow 7 should at the Elgin Road / Twin Hills Road intersection are predicted to be low however peak and long term movements associated with this quarry should be considered for the upgrade of this intersection.

Sight distances at all upgraded intersections should meet Austroads sight distances for the design speed of the road (10kph above the posted speed limit).

7. Pavement Impact Assessment

7.1 Introduction

Department of Transport and Main Roads (DTMR) has produced Guidelines for Assessment of Road Impacts of Developments Proposals, which aids in the assessment of impacts on state controlled roads (SCR).

In general terms, DTMR considers that an impact on a road is insignificant if there is a less than 5% increase in traffic, measured either as annual average daily traffic (AADT) or equivalent standard axles (ESAs). Haulage from Borrow 7 Quarry will utilise a private haul road with some haul vehicles crossing the Gregory Development Road. The interim and ultimate use of this crossing facility will be address in the planning process for the rail line. As such only service vehicles identified in **Table 5.2** and **Table 5.3** will be assessed within this report.

Table 7.1 shows the anticipated impact on the Gregory Development Road relating to predicted quarry movements for Borrow 7 Quarry and the five other quarries related to the Carmichael Coal Mine and Rail Project.

Table 7.1: Development ESA Impact

Road Segment /Site AADT Survey Location	Existing Annual ESA's (2012)	Borrow 7 ESA	Borrow 7 ESA Impact (2014)	Cumulative Quarry ESA	Cumulative Quarry ESA Impact (2014)
Section H	150,700	832	0.6%	2,496	1.6%
Section I	150,700	832	0.6%	2,810	1.9%
Section J	150,700	832	0.6%	2,810	1.9%
Section K	150,700	1,892	1.3%	5,256	3.5%

This assessment is based on 2012 volumes on the Gregory Development Road. As such the impact of quarry operations on the state controlled road network is expected to reduce over time.

7.2 Access Route Pavement Condition Assessment

7.2.1 Gregory Development Road

TTM has sourced the existing pavement condition from two sources. TTM undertook a visual assessment in 5th March 2013. This assessment identified the existing pavement configuration and indicative current surface condition, with a road summary shown in **Table 7.2**.

Table 7.2: Pavement Condition Summary

Road	Section	Length	Width	Condition
Gregory Development Road	Clermont to Belyando Crossing	157.8km	8m	Good surface, with minor rutting / roughness

The Gregory Development Road is a sealed road with a good standard from Clermont through to Belyando Crossing. Sealed shoulders between 0.5-1.0m wide are provided along this length.

7.2.2 IRC Controlled Roads

All Council roads within the study area are gravel with a general width of approximately 8m. Whilst there was some level of potholing, rutting and roughness on the local roads, the access route on the whole was in reasonable to good condition. Road defects were generally located in the vicinity of cattle grids, bridges and near water pooling. A Traffic Management and Maintenance Plan will be implemented as part of the Operational Works, as further noted in **Chapter 8**.

8. Site Access and Parking Arrangements

8.1 Site Access Arrangements

TTM understand that the site access arrangements will be designed in accordance with both Council and AUSTROAD's requirements and submitted as part of the Operation Works Application.

In developing a site access layout into the Borrow 7 from Twin Hills Road, TTM recommend the following access layout characteristics:

- A posted speed limit of 80km/hr with suitable site distances to approaching vehicles;
- A 7 metre wide carriageway;
- Lane flares at the access to allow haul vehicles to enter and exit simultaneously without conflict;
- BAR treatments and shoulder provisions; and
- A cattle grid at the property boundary to remove dust and gravel from vehicle tyres.

The sight distance at the existing Borrow 7 (Old Twin Hills) access appears to be in excess of 200m and as such the existing access location should be suitable.

8.2 Parking Arrangements and On-site Manoeuvring

TTM recommend that formal parking areas are provided for vehicles that are required to wait on-site, including parking areas dedicated for the anticipated peak number of buses, private vehicles and service vehicles on site at any given time. Formal parking areas should also be kept clear of haul vehicle manoeuvring with a preference to segregate haul vehicle routes from other vehicle movements as soon as possible within the property boundary.

It is also recommend that on-site haul vehicle swept paths are reviewed to ensure for adequate internal manoeuvring and clearance zones between any pedestrian, operational and parking requirements.

TTM note that Adani will incorporate the above recommendations into their site plan for Borrow 7 Quarry.

9. Traffic Management & Maintenance Plan

TTM recommend for a Traffic Management and Maintenance Plan to be implemented for the duration of quarry haulage activities, which would be in place prior to any on-site activity. This plan will be developed in conjunction with both Council and DTMR and will likely to cover the following areas:

- Interim haulage of quarry material along Elgin Road, Moray Carmichael Road and Bulliwallah Road;
- Interim haulage of quarry material onto the Gregory Development Road;
- Construction of the Gregory Development Road overpass;
- Upgrade of Elgin Road / Moray Carmichael Road;
- Construction of haul route intersections with local roads (Bulliwallah Road); and
- Maintenance Plan to be developed for designated quarry routes on both Local and State controlled roads.

10. Developer Contributions

10.1.1 DTMR

Table 7.1 indicates that the proposed operations of all quarries, including Borrow 7 Quarry, will not have a significant impact on the state controlled road network. As such no assessment of contributions is required. Any upgrade of the Gregory Development Road / Elgin Road intersection should be at the cost of Adani. It is understood that the upgrade of this intersection will incorporate higher order turn treatments than included in this report and as such the intersection layout should suitably mitigate traffic impacts from quarry operations.

10.1.2 IRC

It is understood that Adani will be responsible for all costs associated with the upgrade and maintenance of the access route from the Gregory Development Road to Carmichael Coal Mine. This agreement is considered suitable in lieu of direct contributions to Council.

It is anticipated that contributions or a similar agreement would be required for Twin Hills Road between Elgin Road and the Borrow 7 access. This should be discussed with Council if other arrangements have not already been made.

11. Summary

The predicted development traffic has been reviewed, with capacity and pavement assessments undertaken, with the main assessment conclusions as follows:

11.1 Existing Traffic Review

The existing background traffic data has been reviewed, with existing peak hour and ESA values calculated.

11.2 Development Traffic Generation and Distribution

TTM has undertaken a detailed estimate of the likely development traffic generation and distribution, with the site predicted to generate a maximum daily traffic generation 310 vehicles (in / out).

11.3 Development Traffic Impacts

A detailed assessment of the development traffic impacts in accordance with the GARID guidelines has established that Borrow 7 Quarry and associated quarries will not have a significant or assessable pavement impact on the state controlled road network.

A minimum of BAR / BAL treatment should be provided at the Gregory Development Road / Elgin Road intersection prior to the commencement of quarry operations.

The proposed operations will have pavement impacts on Elgin Road / Moray Carmichael Road / Twin Hills Road and will require turn treatments.

11.4 Developer Contributions

Adani will fully fund the upgrade of the Gregory Development Road / Elgin Road intersection which is considered suitable to mitigate impacts at this intersection.

Adani will be responsible for the maintenance and upgrade of Elgin Road / Moray Carmichael Road, which is considered suitable to mitigate development impacts along this route.

11.5 Road Safety School Route, Pedestrian and Cyclist Review

TTM consider that there will no school route, pedestrian or cyclist impacts associated with the development proposal.

11.6 Conclusion

From a review of this report, TTM are of the view that there are no traffic planning or engineering reasons why the proposed development should not proceed as planned.

Appendix E – Vegetation Clearing Report

environmental management



Material Change of Use Concurrence Agency
Policy Response

and

Regional Vegetation Management Code Response
Brigalow Belt and New England Tablelands Bioregion



Borrow 7 Quarry

Old Twin Hills, Elgin Moray Road, Clermont

6867

11 July 2013

Adani Mining Pty Ltd





Document Control

Title	Borrow 7 Quarry - MCU Policy & Regional Vegetation Management Code Response - Brigalow Belt and New England Tablelands Bioregion
Address	Old Twin Hills, Elgin Moray Road, Clermont
Job Number	6867
Client	Adani Mining Pty Ltd

Document Issue

Issue	Date	Prepared By	Checked By
Draft	26.04.2013	Renee Wallerstein	Dr Andrew Davies
Client Issue	02.05.2013	Dr Andrew Davies	Murray Saunders
Final V1	08.05.2013	Dr Andrew Davies	Murray Saunders
Final V2	08.07.2013	Tom Connor	Dr Andrew Davies
Final V3	11.07.2013	Ross Marshall	Ross Marshall

Disclaimer

This report has been prepared for **Adani Mining Pty Ltd**. **Saunders Havill Group** cannot accept responsibility for any use of or reliance upon the contents of this report by any third party.

Reports and/or Plans by Others

Reports and/or plans by others may be included within this Environmental Management report to support the document.



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I. Introduction

The *Environmental Management Division* of the **Saunders Havill Group** was engaged by **Adani Mining Pty Ltd** to respond to the *2009 MCU Concurrence Agency Policy* for works associated with the Borrow 7 Quarry site on Old Twin Hills, Elgin Moray Road, Clermont. A Response to the Regional Vegetation Management Code (RVMC) to clear remnant vegetation associated with Extractive Industry that is not in a key resource area is provided with this application. The purpose of the quarry is to provide structural material for the Carmichael Coal Mine and Rail Project.

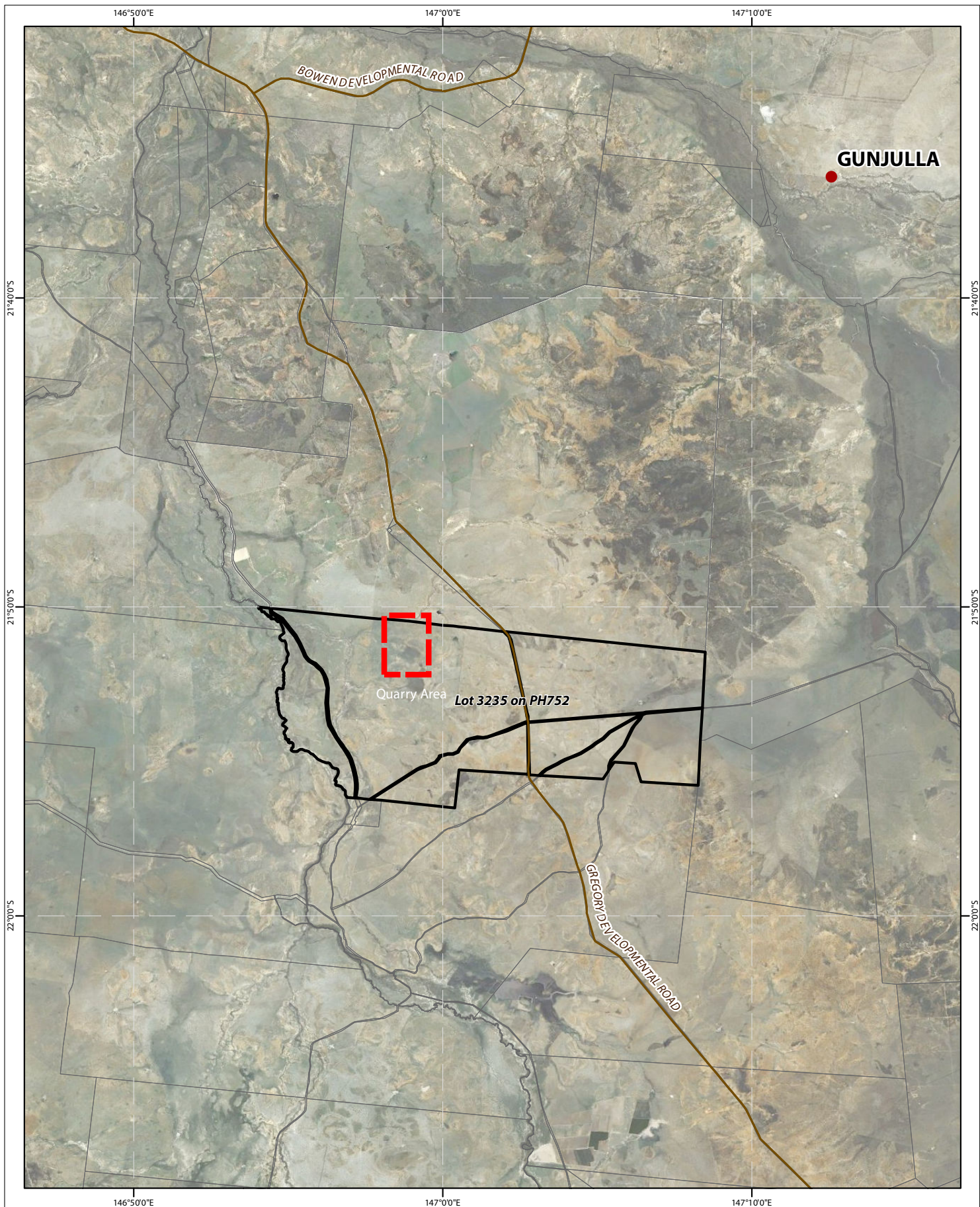
This report addresses Assessment Table F-2 (refer herein to **Table 2**) of the *Concurrence Agency Policy for Material Change of Use (MCU) – version 2, 2009* as the proposed clearing is in Least Concern remnant vegetation. A response to Part Xb of the *Regional Vegetation Management Code for Brigalow Belt and New England Tablelands Bioregion* (refer herein to **Table 3**) is provided. Please see **Appendix A** for the Property Vegetation Management Plan.

The total area of disturbance is approximately 54.6 ha. Contextually, the assessment site is located approximately 120 kilometres North-West of Clermont (refer to **Figures 1 & 2**). The surrounding land use is rural.

I.I. Key Site Details

Table 1: Property Summary

Address	Old Twin Hills, Eglin Moray Road, Clermont
RPD	Lot 3235 on PH752
Area	Approximately 54.6 ha (Quarry and access road)
Local Government Area	Isaac Regional Council
Planning Scheme	<i>Belyando Shire Planning Scheme 2009</i>
Local Plan Zoning	Rural
Vegetation Management Act 1999 (VMA)	Endangered RE 11.4.6 / 11.4.8 and non-remnant
Topography	Gentle Undulating Rise
Existing Land Use	Rangelands
Proposed Land Use	Quarry / Extraction
Land Tenure	Leasehold



Legend

- Town / Place Name
- Major Roads
- Lot 3235 on PH752
- Isaac DCDB

Figure 1 Site Context

File ref. 6550 E 01 Aerial Site Context B
Date 8/07/2013
Project Carmichael Coal Rail Project

0 1 2 4 6 8 10 km
 Scale (A4): 1:300,000 [GDA 1994 MGA Z55]



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Legend

- Lot 3235 on PH752
- Quarry Disturbance Extent

Figure 2 Site Aerial

File ref. 6550 E 02 Site Aerial B
Date 8/07/2013
Project Carmichael Coal Rail Project

0 100 200 400 600 m
 Scale (A4): 1:15,000 [GDA 1994 MGA Z55]



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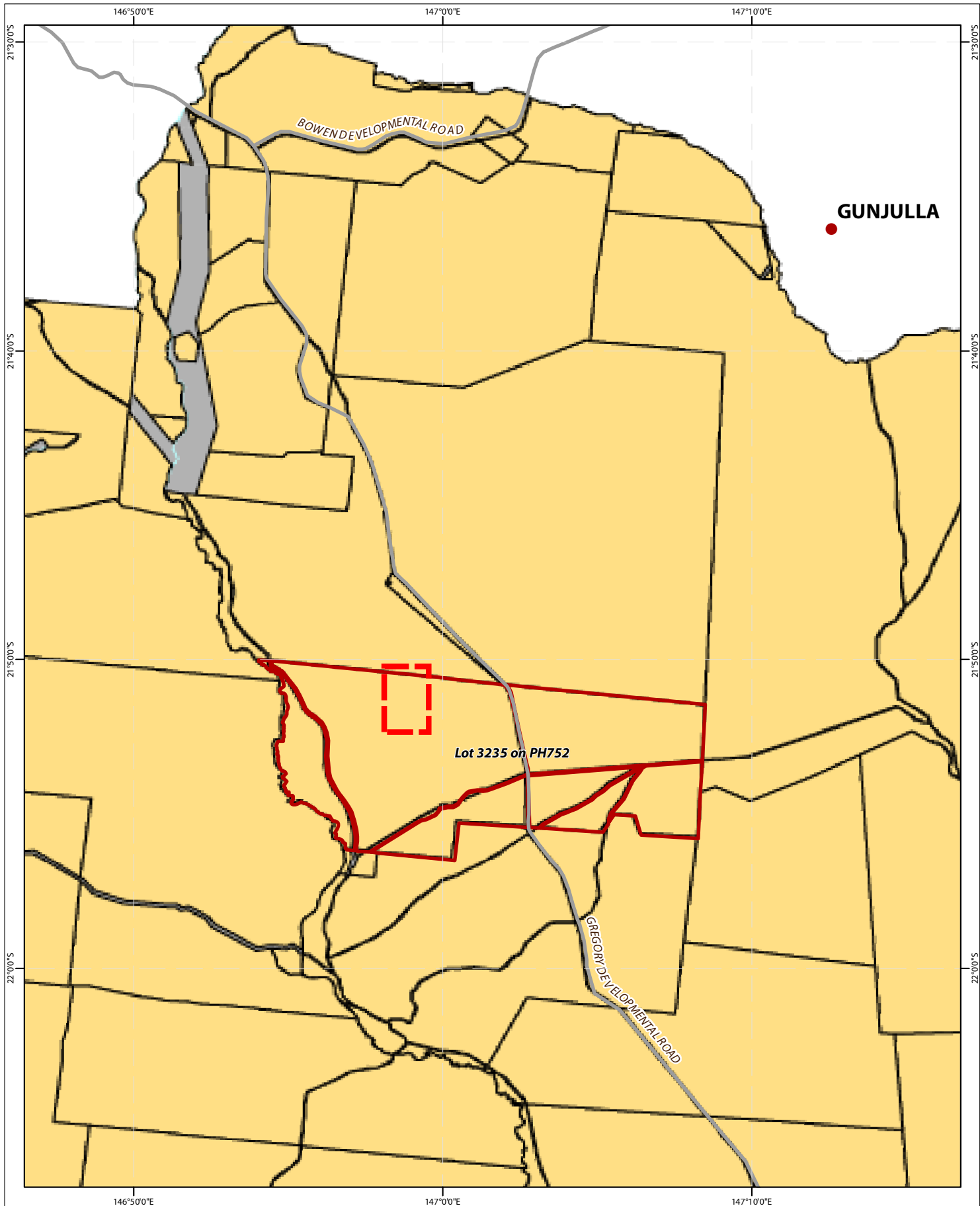
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1.2. Background

This application covers the proposed Borrow 7 Quarry and represents a site currently zoned Rural under the *Belyando Shire Planning Scheme 2009* (see **Figure 3**) where excavation cannot occur without clearing of vegetation protected under the VMA. The location and extent of the required quarry were determined post extensive geotechnical and environmental investigations across a range of potential sites. The Borrow 7 Quarry site is currently overlaid with a remnant vegetation polygon by *Regional Ecosystem and Remnant Mapping Version 6.1* (see **Section 2** Flora Assessment). A Complex Property Map of Assessable Vegetation (PMAV) application has been prepared which reflects species identified on-ground as consistent with Least Concern RE 11.5.3 yet not of sufficient structure to meet remnant status (see **Section 2**). Ground-proofing supports a change from Endangered Regional Ecosystem to non-remnant vegetation in the polygon overlaid by the proposed Quarry disturbance area (see **Section 2**). The Complex PMAV should be read in conjunction with this application.

Despite the proposed lack of remnant vegetation on-site, a response to the RVMC has been prepared. From *Assessment Table 1* of the *Concurrence Agency Policy for Material Change of Use (MCU) – version 2, 2009*, clearing as a result of the MCU in an area to which a PMAV category does not apply - vegetation shown on a regional ecosystem or remnant map as remnant vegetation (1(b)) for Applications for any other purpose (e) requires assessment against *Criteria Table F-1 or F-2* of this Policy. As clearing is proposed in Least Concern vegetation (that does not meet remnant status) only, a response to Table F-2 (Clearing as a result of the MCU) is provided (please see **Section 3** Response to Criteria Table F-2 and **Section 4** Response to the Regional Vegetation Management Code).



Legend:

ZONING

- Commercial
- Industry
- Open Space and Recreation
- Rural
- Urban

- Road
- Waterway

Figure 3 Belyando Shire Planning Scheme Zoning Map

File ref. 6550 E 03 Zoning B

Date 8/07/2013

Project Carmichael Coal Rail Project

0 1 2 4 6 8 10 km
Scale (A4): 1:300,000 [GDA 1994 MGA Z55]



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2. Flora Assessment

The vegetation community within the quarry site is dominated by very sparse *Eucalyptus crebra* (Narrow Leaf Ironbark) with scattered *Eucalyptus brownii* (Reid River Gum), *Corymbia dallachiana* (Ghost Gum) and *Corymbia clarksoniana* (Long Fruited Bloodwood). Shrubs are sparse and the ground layer contains a mix of native and introduced species dominated by *Pennisetum ciliare* (Buffel Grass).

The species mix suggests that the vegetation within the quarry site, although inadequate in crown cover to meet remnant status, is most consistent with Least Concern RE 11.5.3.

RE 11.5.3 - Least Concern

Description

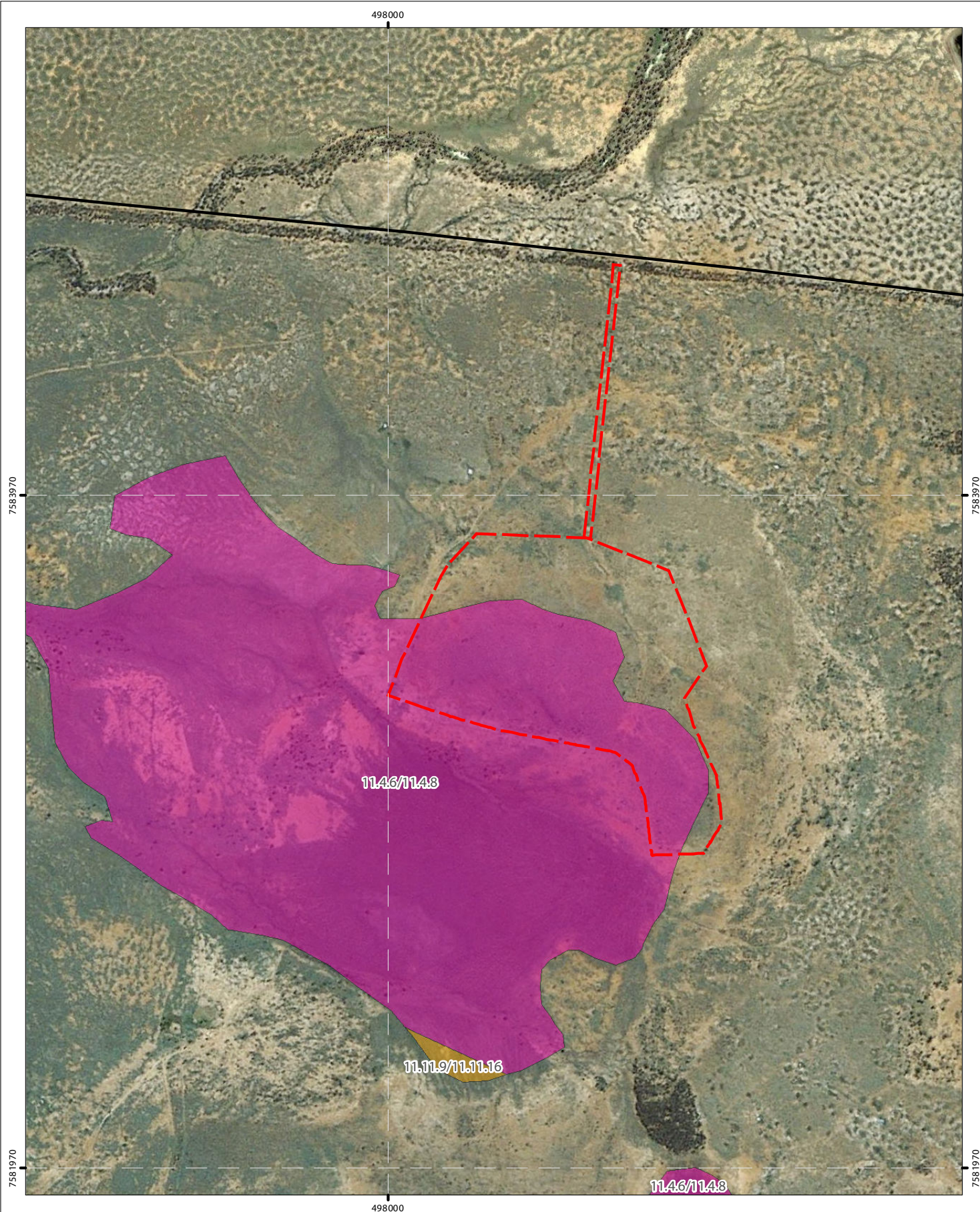
Eucalyptus populnea +/- *E. melanophloia* +/- *Corymbia clarksoniana* +/- *C. dallachiana* and occasionally *E. cambageana* or *E. brownii* dominate the tree layer (14 m median height and 11 - 15 m range) woodland. Localised areas may be dominated by *E. melanophloia*, occasionally *E. crebra* and other canopy species. There is generally a distinctive low tree layer (8, 6 - 11 m high) dominated by species such as *Eremophila mitchellii*, *Geijera parviflora*, *Archidendropsis basaltica*, *Erythroxylum australe*, *Cassia brewsteri*, *Ventilago viminalis* and occasionally *Allocasuarina luehmannii* or *Callitris glaucophylla*. A low shrub layer (2 - 6 m high) dominated by species such as *Carissa ovata*, *Erythroxylum australe*, *Capparis lasiantha* is also often present. Occurs on flat to gently undulating plains formed from Cainozoic sediments. Associated soils are generally deep texture contrast with thick sandy surface horizons with some deep red earths. (BVG1M: 17a). Major vegetation communities include: 11.5.3a: *E. melanophloia* +/- *Corymbia clarksoniana* +/- *C. dallachiana* dominate the tree layer (14m median height and 11-15m range) woodland. There is generally a low tree layer (8, 6 - 11 m high) present. (BVG1M: 17b). 11.5.3b: Palustrine wetland (e.g. vegetated swamp). *Eucalyptus populnea* on closed depressions Occurs on closed depressions in sandplains. (BVG1M: 17a).



Photos: Borrow 7 Vegetation



On-ground surveying verified the presence of species consistent with Least Concern RE 11.5.3 within the quarry footprint. This refutes *Regional Ecosystem and Remnant Mapping Version 6.1* (**Figure 4**, next page) which classifies a portion of the quarry area as within an Endangered Regional Ecosystem. A complex PMAV which accurately reflects vegetation communities on-ground and requests a change in status for this polygon from Endangered to non-remnant (**Figure 5**) has been prepared. This complex PMAV should be read in conjunction with this application.



Legend

- DCDB
- Quarry Disturbance Extent
- Remnant vegetation containing Endangered REs
- Remnant vegetation containing Of Concern REs
- Remnant vegetation that is a Least Concern RE

Regional Ecosystem v6.1

Figure 4 Regional Ecosystem v6.1

File ref. 6550 E 05 REB

Date 8/07/2013

Project Carmichael Coal Rail Project

0 100 200 400 600 m
Scale (A4): 1:15,000 [GDA 1994 MGA Z55]



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Legend

- | | |
|---------------------------|--|
| DCDB | Proposed PMAV REs |
| Quarry Disturbance Extent | Remnant vegetation containing Endangered REs (Cat. B) |
| Category X Area | Remnant vegetation containing Of Concern REs (Cat. B) |
| | Remnant vegetation that is a Least Concern RE (Cat. B) |

Figure 5 Proposed PMAV

File ref. 6550 E 05 Proposed PMAV B
Date 8/07/2013
Project Carmichael Coal Rail Project

0 100 200 400 600 800 m
 Scale (A4): 1:20,000 [GDA 1994 MGA Z55]



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3. Response to Criteria Table F-2.

The following is a response to Criteria Table F-2. Performance requirements for 'clearing as a result of the MCU involves clearing of *least concern* regional ecosystems' as per *Concurrence Agency Policy for Material Change of Use (MCU) – version 2, 2009*

Table 2: Criteria Table F-2

Performance requirement
PR F1 To regulate the clearing of <u>vegetation</u> in a way that ensures the conservation of regional ecosystems, <u>clearing as a result of the MCU</u> only occurs where the applicant has demonstrated that the development has first avoided and minimised the impacts of the development. Response Extensive geotechnical and ecological surveys (including vegetation surveys) have been completed along and adjoining the alignment of Adani's Carmichael Coal Mine and Rail Project. This included the investigation of a large volume of properties for potential use to supply necessary quarry material for construction requirements of the rail and mine facility. Through constraint analyses and detailed geotechnical review these quarry areas have been refined to the most suited locations relative to where the rail and mine construction works are occurring. Through ground proofing, the Borrow 7 Quarry avoids clearing of any remnant vegetation. Substantially more suitable quarry material is available in areas which would have required clearing of Of Concern and Endangered communities, however, these have been avoided to minimise impacts. PR F1 is achieved.
PR F2 <u>Clearing as a result of the MCU</u> assessed under this Table may occur only where the MCU meets: a) Performance Requirements 2 to 10 of the <u>relevant code</u>, Part Xb for an extractive purpose Response



Please see **Section 4** Response to the Regional Vegetation Management Code, below, which demonstrates how **PR F2 is achieved**.



4. Response to Regional Vegetation Management Code

Table 1: Part Xb: Requirements for clearing for an extractive industry in an area that is not a Key Resource Area

Performance Requirement	Comment
PR Xb.2: Clearing is staged To regulate the clearing of vegetation in a way that conserves remnant vegetation that are regional ecosystems, does not cause land degradation, prevents the loss of biodiversity and maintains ecological processes — clearing — a) is staged in line with operational needs that restricts clearing to the current operational area; and b) is limited to the area from which material will be extracted within the term of the permit; and c) cannot occur until all required permits are obtained.	Clearing will be staged in line with operational needs. Refer to Appendix 1 for detailed plans showing the proposed Quarry works. PR Xb. 2 is achieved.

Performance Required	Acceptable Solutions	Comments
PR Xb.3: Wetlands To regulate the clearing of vegetation in a way that prevents the loss of biodiversity and maintains ecological processes — assessable vegetation associated with any natural significant wetland and/or natural wetland is protected to maintain n—	AS Xb.3 Xb.3.1 Clearing does not occur — a) in any natural wetland; and b) within 100 metres from any natural wetland; and	The site does not contain a wetland, nor is it in proximity to a wetland. PR Xb 3 is achieved.



Performance Required	Acceptable Solutions	Comments
a) water quality by filtering sediments, nutrients and other pollutants; and b) aquatic habitat; and c) terrestrial habitat.	c) in any natural significant wetland; and d) within 200 metres from any natural significant wetland.	
PR Xb.4: Watercourses To regulate the clearing of vegetation in a way that does not cause land degradation, prevents the loss of biodiversity and maintains ecological processes — assessable vegetation associated with any watercourse is protected to maintain — a) bank stability by protecting against bank erosion; and b) water quality by filtering sediments, nutrients and other pollutants; and c) aquatic habitat; and d) terrestrial habitat.	AS Xb.4 Xb.4.1 Clearing does not occur — a) in any watercourse; and b) within the relevant distance stipulated in Table 2, of each high bank of each watercourse.	The site does not contain a watercourse, nor is it in proximity to a watercourse. PR Xb 4 is achieved.



Performance Required	Acceptable Solutions	Comments
PR Xb.5: Connectivity To regulate the clearing of vegetation in a way that prevents the loss of biodiversity and maintains ecological processes — areas of mapped remnant vegetation are retained that are — a) of sufficient size and configured in a way to maintain ecosystem functioning; and b) of sufficient size and configured in a way to remain in the landscape in spite of any threatening processes; and c) located on the lot(s) that are the subject of the application to maintain connectivity to mapped remnant vegetation on adjacent properties.	AS Xb.5 Xb.5.1 Where clearing is less than — a) 10 metres wide in the coastal subregions of the Brigalow Belt Bioregion; or b) 2 hectares in the coastal subregions of the Brigalow Belt Bioregion; or c) 25 metres wide in the non-coastal subregions of the Brigalow Belt and the New England Tableland Bioregion; or d) is less than 5 hectares in the non-coastal subregions of the Brigalow Belt and the New England Tableland Bioregion; clearing does not— i) reduce the width of mapped remnant vegetation	Vegetation clearing for the quarry will not impact upon ecological process in the area. The quarry will not impact on connectivity given the limited ecological values within the proposed quarry area. PR Xb 5 is achieved.



Performance Required	Acceptable Solutions	Comments
	to less than 200 metres; and ii) occur where the width of mapped remnant vegetation is less than 200 metres; OR Xb.5.2 Clearing does not — a) reduce areas of contiguous mapped remnant vegetation to less than 10 hectares in the coastal subregions of the Brigalow Belt Bioregion; and b) occur in areas of contiguous mapped remnant vegetation that are less than 10 hectares, in the coastal subregions of the Brigalow Belt Bioregion; and c) reduce areas of contiguous mapped remnant vegetation to less than 50 hectares in the non-coastal subregions of the Brigalow Belt and the New England Tableland Bioregion; and	



Performance Required	Acceptable Solutions	Comments
	d) occur in areas of contiguous mapped remnant vegetation that are less than 50 hectares, in the non-coastal subregions of the Brigalow Belt and the New England Tableland Bioregion; and e) reduce the width of mapped remnant vegetation to less than 200 metres; and f) occur where the width of mapped remnant vegetation is less than 200 metres; and reduce the total extent of mapped remnant vegetation to less than 30%; and h) occur where the total extent of mapped remnant vegetation is less than 30%.	
PR Xb.6: Salinity To regulate the clearing of vegetation in a way that does not cause land degradation and maintains ecological processes — clearing does not contribute to — a) waterlogging; or b) the salinisation of groundwater, surface water or soil.	AS Xb.6 Xb.6.1 Where clearing is less than — a) 2 hectares; or b) 10 metres wide.	Site investigations of the expansion area found no evidence of salt scalds, seepage or waterlogging in the area. Clearing in the quarrying expansion areas is not considered to cause any land degradation and will be managed through the construction, operational and rehabilitation phase via the site Integrated Environmental Management System. PR Xb 6 is achieved.



Performance Required	Acceptable Solutions	Comments
	OR Xb.6.2 Clearing does not occur— a) in any discharge area; and b) within 200 metres of any discharge area.	
PR Xb.7 Conserving remnant vegetation that are <i>endangered</i> regional ecosystems and of concern regional ecosystems To regulate the clearing of vegetation in a way that conserves remnant vegetation that are <i>endangered</i> regional ecosystems and <i>of concern</i> regional ecosystems — maintain the current extent of <i>endangered</i> regional ecosystems and <i>of concern</i> regional ecosystems.	AS Xb.7 Xb.7.1 Clearing — a) does not occur in an <i>endangered</i> regional ecosystem or an <i>of concern</i> regional ecosystem that is listed in Table 4; and b) in an <i>endangered</i> regional ecosystem or an <i>of concern</i> regional ecosystem that is not listed in Table 4 only occurs where the clearing is less than 10 metres wide or 0.5 hectares.	The site vegetation is classified as <i>non remnant</i> and does not contain any <i>endangered</i> or <i>of concern</i> regional ecosystems. PR Xb 7 is achieved.



Performance Required	Acceptable Solutions	Comments
PR Xb.8: Essential habitat To regulate the clearing of vegetation in a way that prevents the loss of biodiversity — maintain the current extent of essential habitat.	AS Xb.8 Xb.8.1 Clearing does not occur in an area which is shown as essential habitat on the essential habitat map.	The regional ecosystems on site are not mapped as providing essential habitat. PR Xb 8 is achieved.
PR Xb.9: Conservation status thresholds To regulate the clearing of vegetation in a way that conserves remnant vegetation that are regional ecosystems and prevents the loss of biodiversity — maintain the current extent of regional ecosystems listed in Table 5.	AS Xb.9 Xb.9.1 Clearing in a regional ecosystem listed in Table 5, does not occur unless the clearing is less than 2 hectares.	Not Applicable. PR Xb 9 is achieved.
PR Xb.10: Acid sulphate soils To regulate the clearing of vegetation in a way that does not cause land degradation and maintains ecological processes in the coastal subregions of the Brigalow Belt Bioregion, and the Marlborough Plains subregion (11.14) — clearing activities do not result in disturbance of acid sulphate soils or changes to the hydrology of the location that will either-	AS Xb.10 Xb.10.1 In the coastal subregions of the Brigalow Belt Bioregion, and the Marlborough Plains subregion (11.14), clearing in land zone 1, land zone 2 or land zone 3 in areas below 5 metre Australian Height Datum— a) is carried out in accordance with an acid sulphate soils environmental management	Extractive resource activities will occur within Land Zone 5 and above AHD 5m. PR Xb 10 is achieved.



Performance Required	Acceptable Solutions	Comments
a) aerate horizons containing iron sulphides; or b) mobilise acid and/or metals.	plan as outlined in the State Planning Policy 2/02 Guideline: Planning and Managing Development involving Acid Sulphate Soils; and b) follows management principles in accordance with the Soil Management Guidelines in the Queensland Acid Sulphate Soil Technical Manual.	



5. Appendices

Appendix A

Property Vegetation Management Plan

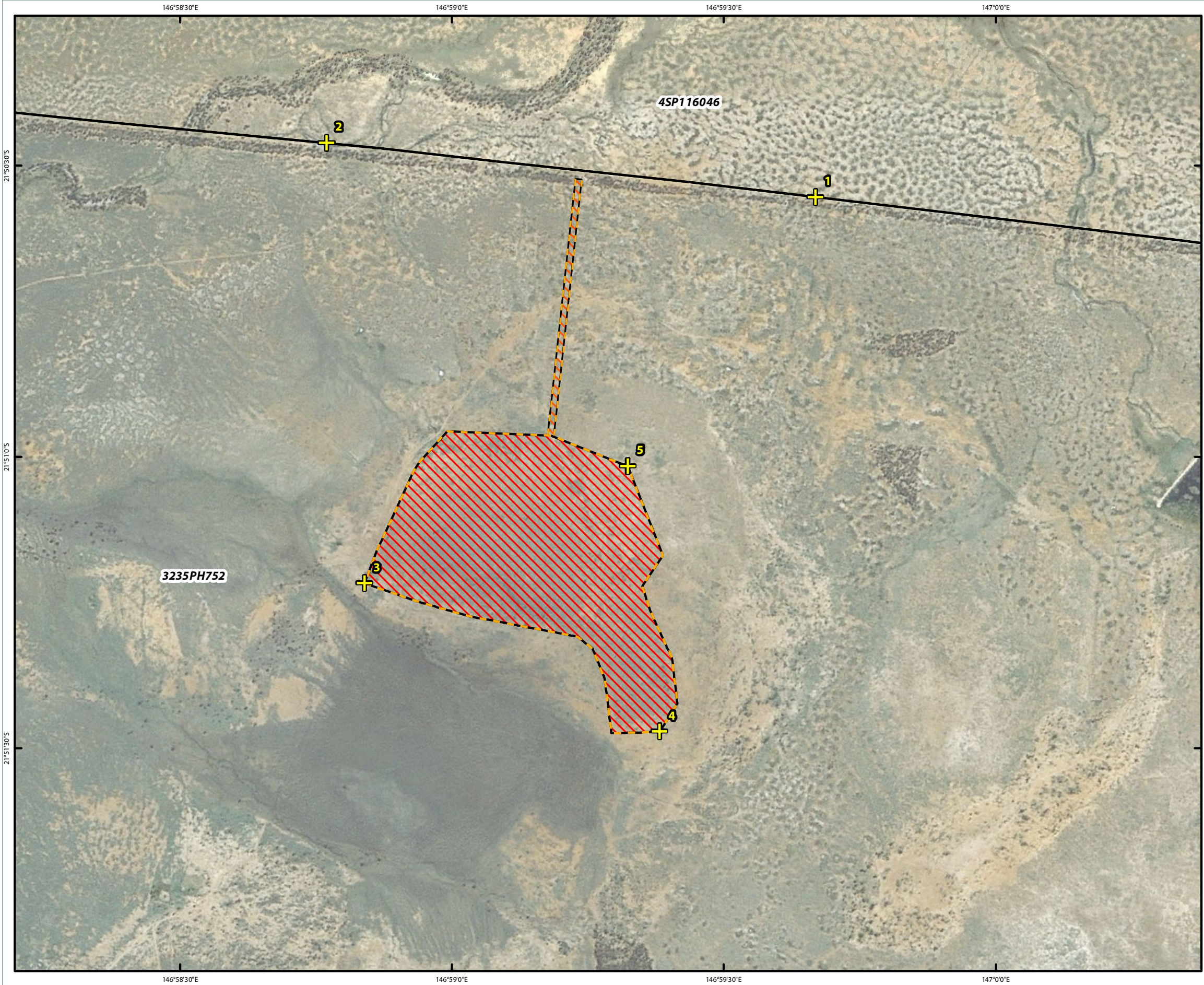
Appendix B

Species List



Appendix A

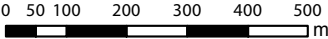
Property Vegetation Management Plan



PVMP Coordinate Table (GDA94 MGA z55)			
ID	Description	Longitude (m)	Latitude (m)
1	Site DCDB	499429.850232	7584597.81545
2	Site DCDB	497881.079277	7584768.80161
3	Disturbance Area Boundary	498000.528747	7583374.25227
4	Disturbance Area Boundary	498936.120493	7582904.66992
5	Disturbance Area Boundary	498834.194887	7583745.62221

Legend

- DCDB
- PVMP Coordinates
- Quarry disturbance extent
- Area to be Cleared / Disturbed
- Proposed PMAV REs
- Remnant vegetation containing Endangered REs
- Remnant vegetation containing Of Concern REs
- Remnant vegetation that is a Least Concern RE



APPROVED COMPANY

ISO 9001
Quality Management Systems

QMS

APPROVED COMPANY

ISO 14001
Environmental Management Systems

QMS

ISSUES:				
Issue	Date	Description	Drawn	Checked
A	9.01.2013	Prelim Draft	TC	RM

Carmichael Coal Rail Project

Borrow 7 Quarry - Property Vegetation Management Plan

Date8/07/2013

Scale1:12,500 @ A3

Data Information:
Universal Transverse Mercator
GDA 1994 MGA Zone 56

ClientAdani Mining Pty Ltd

ProjectCarmichael Coal Rail Project

Address/RPDIsaac Regional Council

SourceDCBD (DNRM, 2012), Aerial (Google, 2012)
RE & HVR (EHP, 2013)

Plan 1
Of 1

SHG File
6550 E 01 Borrow 7 Quarry B



Appendix B

Species List



Scientific Name	Common Name	Conservation Status (NCA)	EPBCA Status
<i>Acacia cambagei</i>	Gidgee	Least Concern	Not Listed
<i>Acacia excelsa</i>	Ironwood	Least Concern	Not Listed
<i>Acacia harpophylla</i>	Brigalow	Least Concern	Not Listed
<i>Apophyllum anomalum</i>	Warrior Bush	Least Concern	Not Listed
<i>Archidendropsis basaltica</i>	Dead Finish	Least Concern	Not Listed
<i>Aristida latifolia</i>	Feathertop Wiregrass	Least Concern	Not Listed
<i>Atalaya hemiglaucia</i>	Whitewood	Least Concern	Not Listed
<i>Capparis lasiantha</i>	Wait-a-While	Least Concern	Not Listed
<i>Carissa ovata</i>	Currant Bush	Least Concern	Not Listed
<i>Corymbia dallachiana</i>	Ghost Gum	Least Concern	Not Listed
<i>Enchylaena tomentosa</i>	Ruby Saltbush	Least Concern	Not Listed
<i>Eragrostis sororia</i>	Love Grass	Least Concern	Not Listed
<i>Eremophila deserti</i>	Turkey Bush	Least Concern	Not Listed
<i>Eremophila mitchellii</i>	False Sandalwood	Least Concern	Not Listed
<i>Eriocereus martinii</i>	Harrisia Cactus	Not Listed	Not Listed
<i>Erythroxylum australe</i>	Dogwood	Least Concern	Not Listed
<i>Flindersia dissosperma</i>	Leopard Wood	Least Concern	Not Listed
<i>Grevillea striata</i>	Beefwood	Least Concern	Not Listed
<i>Grewia latifolia</i>	Dogs Balls	Least Concern	Not Listed
<i>Heteropogon contortus</i>	Black Spear Grass	Least Concern	Not Listed
<i>Lysiphyllum carronii</i>	Native Bauhinia	Least Concern	Not Listed
<i>Owenia acidula</i>	Emu Bush	Least Concern	Not Listed
<i>Petalostigma pubescens</i>	Quinine Bush	Least Concern	Not Listed
<i>Salsola kali</i>	Soft Roly Poly	Not Listed	Not Listed
<i>Themeda triandra</i>	Kangaroo Grass	Least Concern	Not Listed
<i>Tragus australianus</i>	Small Burrgrass	Least Concern	Not Listed

Appendix F – EHP Wildlife Online Search



Queensland Government

Wildlife Online Extract

Search Criteria: Species List for a Specified Point

Species: All

Type: All

Status: All

Records: All

Date: All

Latitude: 21.8534

Longitude: 146.9858

Distance: 15

Email: kinnytp@cdmsmith.com

Date submitted: Wednesday 03 Apr 2013 10:59:23

Date extracted: Wednesday 03 Apr 2013 11:00:07

The number of records retrieved = 277

Disclaimer

As the DSITIA is still in a process of collating and vetting data, it is possible the information given is not complete. The information provided should only be used for the project for which it was requested and it should be appropriately acknowledged as being derived from Wildlife Online when it is used.

The State of Queensland does not invite reliance upon, nor accept responsibility for this information. Persons should satisfy themselves through independent means as to the accuracy and completeness of this information.

No statements, representations or warranties are made about the accuracy or completeness of this information. The State of Queensland disclaims all responsibility for this information and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs you may incur as a result of the information being inaccurate or incomplete in any way for any reason.

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	amphibians	Bufonidae	<i>Rhinella marina</i>	cane toad	Y			1
animals	amphibians	Limnodynastidae	<i>Notaden bennettii</i>	holy cross frog		C		1
animals	birds	Acanthizidae	<i>Smicromis brevirostris</i>	weebill		C		4
animals	birds	Acanthizidae	<i>Acanthiza chrysorrhoa</i>	yellow-rumped thornbill		C		4/1
animals	birds	Acanthizidae	<i>Gerygone albogularis</i>	white-throated gerygone		C		3
animals	birds	Acanthizidae	<i>Acanthiza apicalis</i>	inland thornbill		C		2
animals	birds	Acanthizidae	<i>Acanthiza nana</i>	yellow thornbill		C		2/2
animals	birds	Accipitridae	<i>Aquila audax</i>	wedge-tailed eagle		C		2
animals	birds	Accipitridae	<i>Lophoictinia isura</i>	square-tailed kite		NT		1
animals	birds	Accipitridae	<i>Haliastur sphenurus</i>	whistling kite		C		1
animals	birds	Accipitridae	<i>Hieraaetus morphnoides</i>	little eagle		C		1
animals	birds	Acrocephalidae	<i>Acrocephalus australis</i>	Australian reed-warbler		C		1
animals	birds	Anatidae	<i>Nettapus coromandelianus</i>	cotton pygmy-goose		NT		1
animals	birds	Anatidae	<i>Anas superciliosa</i>	Pacific black duck		C		1
animals	birds	Ardeidae	<i>Nycticorax caledonicus</i>	Nankeen night-heron		C		1
animals	birds	Ardeidae	<i>Ardea pacifica</i>	white-necked heron		C		1
animals	birds	Ardeidae	<i>Ardea modesta</i>	eastern great egret		C		1
animals	birds	Artamidae	<i>Cracticus tibicen</i>	Australian magpie		C		2
animals	birds	Artamidae	<i>Artamus minor</i>	little woodswallow		C		2
animals	birds	Artamidae	<i>Artamus personatus</i>	masked woodswallow		C		1
animals	birds	Artamidae	<i>Cracticus nigrogularis</i>	piebald butcherbird		C		6/1
animals	birds	Artamidae	<i>Artamus leucorhynchus</i>	white-breasted woodswallow		C		1
animals	birds	Artamidae	<i>Cracticus torquatus</i>	grey butcherbird		C		2
animals	birds	Artamidae	<i>Strepera graculina</i>	piebald currawong		C		1
animals	birds	Cacatuidae	<i>Calyptorhynchus funereus</i>	yellow-tailed black-cockatoo		C		1
animals	birds	Cacatuidae	<i>Cacatua galerita</i>	sulphur-crested cockatoo		C		4
animals	birds	Cacatuidae	<i>Eolophus roseicapillus</i>	galah		C		4
animals	birds	Cacatuidae	<i>Nymphicus hollandicus</i>	cockatiel		C		1
animals	birds	Campephagidae	<i>Lalage sueurii</i>	white-winged triller		C		1
animals	birds	Campephagidae	<i>Coracina novaehollandiae</i>	black-faced cuckoo-shrike		C		5
animals	birds	Casuariidae	<i>Dromaius novaehollandiae</i>	emu		C		1
animals	birds	Cisticolidae	<i>Cisticola exilis</i>	golden-headed cisticola		C		1
animals	birds	Climacteridae	<i>Climacteris picumnus</i>	brown treecreeper		C		3
animals	birds	Columbidae	<i>Geopelia humeralis</i>	bar-shouldered dove		C		1
animals	birds	Columbidae	<i>Phaps chalcoptera</i>	common bronzewing		C		2
animals	birds	Columbidae	<i>Ocyphaps lophotes</i>	crested pigeon		C		1
animals	birds	Columbidae	<i>Geopelia striata</i>	peaceful dove		C		2
animals	birds	Columbidae	<i>Geophaps scripta scripta</i>	squatter pigeon (southern subspecies)		V	V	6/3
animals	birds	Coraciidae	<i>Eurystomus orientalis</i>	dollarbird		C		1
animals	birds	Corvidae	<i>Corvus sp.</i>					1
animals	birds	Corvidae	<i>Corvus orru</i>	Torresian crow		C		4
animals	birds	Corvidae	<i>Corvus bennetti</i>	little crow		C		3
animals	birds	Corvidae	<i>Corvus coronoides</i>	Australian raven		C		1
animals	birds	Cuculidae	<i>Scythrops novaehollandiae</i>	channel-billed cuckoo		C		2
animals	birds	Cuculidae	<i>Centropus phasianinus</i>	pheasant coucal		C		1
animals	birds	Estrildidae	<i>Taeniopygia bichenovii</i>	double-barred finch		C		9

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Eurostopodidae	<i>Eurostopodus mystacalis</i>	white-throated nightjar		C		1
animals	birds	Eurostopodidae	<i>Eurostopodus argus</i>	spotted nightjar		C		1
animals	birds	Falconidae	<i>Falco peregrinus</i>	peregrine falcon		C		1
animals	birds	Falconidae	<i>Falco berigora</i>	brown falcon		C		4
animals	birds	Halcyonidae	<i>Dacelo novaeguineae</i>	laughing kookaburra		C		1
animals	birds	Jacanidae	<i>Irediparra gallinacea</i>	comb-crested jacana		C		1
animals	birds	Maluridae	<i>Malurus lamberti</i>	variegated fairy-wren		C		4
animals	birds	Maluridae	<i>Malurus melanocephalus</i>	red-backed fairy-wren		C		4
animals	birds	Megaluridae	<i>Cincloramphus mathewsi</i>	rufous songlark		C		2
animals	birds	Meliphagidae	<i>Philemon corniculatus</i>	noisy friarbird		C		5
animals	birds	Meliphagidae	<i>Philemon citreogularis</i>	little friarbird		C		3
animals	birds	Meliphagidae	<i>Acanthagenys rufogularis</i>	spiny-cheeked honeyeater		C		1
animals	birds	Meliphagidae	<i>Melithreptus albogularis</i>	white-throated honeyeater		C		4
animals	birds	Meliphagidae	<i>Plectorhyncha lanceolata</i>	striped honeyeater		C		4
animals	birds	Meliphagidae	<i>Entomyzon cyanotis</i>	blue-faced honeyeater		C		1
animals	birds	Meliphagidae	<i>Manorina flavigula</i>	yellow-throated miner		C		5
animals	birds	Meliphagidae	<i>Ptilotula plumulus</i>	grey-fronted honeyeater		C		1
animals	birds	Meliphagidae	<i>Gavicalis virescens</i>	singing honeyeater		C		7/1
animals	birds	Meliphagidae	<i>Lichmera indistincta</i>	brown honeyeater		C		8
animals	birds	Meropidae	<i>Merops ornatus</i>	rainbow bee-eater		C		4
animals	birds	Monarchidae	<i>Myiagra rubecula</i>	leaden flycatcher		C		1
animals	birds	Monarchidae	<i>Grallina cyanoleuca</i>	magpie-lark		C		1
animals	birds	Nectariniidae	<i>Dicaeum hirundinaceum</i>	mistletoebird		C		7
animals	birds	Neosittidae	<i>Daphoenositta chrysoptera</i>	varied sittella		C		3
animals	birds	Otididae	<i>Ardeotis australis</i>	Australian bustard		C		3
animals	birds	Pachycephalidae	<i>Colluricincla harmonica</i>	grey shrike-thrush		C		3
animals	birds	Pachycephalidae	<i>Pachycephala rufiventris</i>	rufous whistler		C		8/2
animals	birds	Pardalotidae	<i>Pardalotus striatus</i>	striated pardalote		C		7
animals	birds	Petroicidae	<i>Microeca fascinans</i>	jacky winter		C		8/1
animals	birds	Phalacrocoracidae	<i>Microcarbo melanoleucos</i>	little pied cormorant		C		1
animals	birds	Phalacrocoracidae	<i>Phalacrocorax sulcirostris</i>	little black cormorant		C		1
animals	birds	Podargidae	<i>Podargus strigoides</i>	tawny frogmouth		C		4
animals	birds	Pomatostomidae	<i>Pomatostomus temporalis</i>	grey-crowned babbler		C		3
animals	birds	Psittacidae	<i>Aprosmictus erythropterus</i>	red-winged parrot		C		4
animals	birds	Psittacidae	<i>Trichoglossus haematodus moluccanus</i>	rainbow lorikeet		C		1
animals	birds	Psittacidae	<i>Platycercus adscitus</i>	pale-headed rosella		C		5
animals	birds	Rallidae	<i>Fulica atra</i>	Eurasian coot		C		2
animals	birds	Rhipiduridae	<i>Rhipidura leucophrys</i>	willie wagtail		C		3
animals	birds	Rhipiduridae	<i>Rhipidura albiscapa</i>	grey fantail		C		3
animals	birds	Strigidae	<i>Ninox boobook</i>	southern boobook		C		1
animals	insects	Lycaenidae	<i>Zizeeria karsandra</i>	spotted grass-blue				1
animals	insects	Nymphalidae	<i>Junonia orithya albicincta</i>	blue argus				1
animals	mammals	Canidae	<i>Canis lupus dingo</i>	dingo				1
animals	mammals	Emballonuridae	<i>Saccolaimus flaviventris</i>	yellow-bellied sheath-tail bat		C		1/1
animals	mammals	Leporidae	<i>Oryctolagus cuniculus</i>	rabbit	Y			1
animals	mammals	Macropodidae	<i>Macropus rufus</i>	red kangaroo		C		1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	mammals	Macropodidae	<i>Macropus robustus</i>	common wallaroo		C		1
animals	mammals	Macropodidae	<i>Macropus giganteus</i>	eastern grey kangaroo		C		3
animals	mammals	Muridae	<i>Pseudomys sp.</i>					1
animals	mammals	Suidae	<i>Sus scrofa</i>	pig	Y			1
animals	reptiles	Diplodactylidae	<i>Strophurus williamsi</i>	soft-spined gecko		C		1
animals	reptiles	Diplodactylidae	<i>Amolosa rhombifer</i>	zig-zag gecko		C		1
animals	reptiles	Diplodactylidae	<i>Lucasium steindachneri</i>	Steindachner's gecko		C		2
animals	reptiles	Gekkonidae	<i>Gehyra catenata</i>			C		1/1
animals	reptiles	Gekkonidae	<i>Heteronotia binoei</i>	Bynoe's gecko		C		4/1
animals	reptiles	Pygopodidae	<i>Lialis burtonis</i>	Burton's legless lizard		C		1
animals	reptiles	Scincidae	<i>Morethia taeniopleura</i>	fire-tailed skink		C		1
animals	reptiles	Scincidae	<i>Ctenotus robustus</i>			C		2
animals	reptiles	Scincidae	<i>Menetia timlowi</i>			C		1/1
animals	reptiles	Scincidae	<i>Lerista punctatovittata</i>			C		3/1
animals	reptiles	Scincidae	<i>Carlia rubigo</i>	orange-flanked rainbow skink		C		1/1
animals	reptiles	Scincidae	<i>Carlia pectoralis sensu lato</i>			C		3/1
animals	reptiles	Scincidae	<i>Cryptoblepharus pannosus</i>	ragged snake-eyed skink		C		2
plants	ferns	Adiantaceae	<i>Cheilanthes distans</i>	bristly cloak fern		C		1/1
plants	ferns	Adiantaceae	<i>Cheilanthes sieberi</i>			C		1
plants	higher dicots	Acanthaceae	<i>Brunoniella australis</i>	blue trumpet		C		2/2
plants	higher dicots	Amaranthaceae	<i>Alternanthera nodiflora</i>	joyweed		C		1/1
plants	higher dicots	Amaranthaceae	<i>Ptilotus polystachyus</i>			C		1/1
plants	higher dicots	Amaranthaceae	<i>Alternanthera denticulata var. micrantha</i>			C		1/1
plants	higher dicots	Apocynaceae	<i>Parsonsia lanceolata</i>	northern silkpod		C		1
plants	higher dicots	Apocynaceae	<i>Carissa lanceolata</i>			C		2/1
plants	higher dicots	Apocynaceae	<i>Carissa ovata</i>	currantbush		C		5
plants	higher dicots	Apocynaceae	<i>Marsdenia</i>			C		1
plants	higher dicots	Asteraceae	<i>Brachyscome</i>			C		1/1
plants	higher dicots	Asteraceae	<i>Blumea diffusa</i>			C		1/1
plants	higher dicots	Asteraceae	<i>Sonchus oleraceus</i>	common sowthistle	Y			1/1
plants	higher dicots	Asteraceae	<i>Senecio depressicola</i>			C		1/1
plants	higher dicots	Asteraceae	<i>Coronidium lanuginosum</i>			C		1/1
plants	higher dicots	Asteraceae	<i>Pterocaulon serrulatum</i>			C		1
plants	higher dicots	Asteraceae	<i>Parthenium hysterophorus</i>	parthenium weed	Y			2/2
plants	higher dicots	Asteraceae	<i>Peripleura hispidula var. hispidula</i>			C		1/1
plants	higher dicots	Byttneriaceae	<i>Keraudrenia collina</i>			C		1/1
plants	higher dicots	Cactaceae	<i>Opuntia tomentosa</i>	velvety tree pear	Y			3
plants	higher dicots	Cactaceae	<i>Harrisia martinii</i>		Y			1
plants	higher dicots	Caesalpiniaceae	<i>Senna</i>			C		1
plants	higher dicots	Caesalpiniaceae	<i>Senna circinnata</i>			C		2/2
plants	higher dicots	Caesalpiniaceae	<i>Lysiphyllum carronii</i>	ebony tree		C		5
plants	higher dicots	Caesalpiniaceae	<i>Senna coronilloides</i>			C		1
plants	higher dicots	Caesalpiniaceae	<i>Senna artemisioides</i>			C		1
plants	higher dicots	Capparaceae	<i>Apophyllum anomalum</i>	broom bush		C		4/1
plants	higher dicots	Capparaceae	<i>Capparis umbonata</i>			C		1/1
plants	higher dicots	Capparaceae	<i>Capparis lasiantha</i>	nipan		C		4

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Caryophyllaceae	<i>Polycarpaea corymbosa</i> var. <i>minor</i>			C		1
plants	higher dicots	Celastraceae	<i>Denhamia oleaster</i>			C		1
plants	higher dicots	Chenopodiaceae	<i>Dysphania rhadinostachya</i> subsp. <i>inflata</i>			C		1/1
plants	higher dicots	Chenopodiaceae	<i>Enchylaena tomentosa</i>			C		1
plants	higher dicots	Chenopodiaceae	<i>Maireana villosa</i>			C		1/1
plants	higher dicots	Chenopodiaceae	<i>Sclerolaena muricata</i> var. <i>muricata</i>			C		1/1
plants	higher dicots	Chenopodiaceae	<i>Maireana microphylla</i>			C		1
plants	higher dicots	Combretaceae	<i>Terminalia oblongata</i>			C		2
plants	higher dicots	Convolvulaceae	<i>Polymeria pusilla</i>			C		1/1
plants	higher dicots	Convolvulaceae	<i>Evolvulus alsinoides</i>			C		2
plants	higher dicots	Convolvulaceae	<i>Jacquemontia paniculata</i>			C		1/1
plants	higher dicots	Cucurbitaceae	<i>Cucumis melo</i>			C		1/1
plants	higher dicots	Erythroxylaceae	<i>Erythroxylum australe</i>	cocaine tree		C		5
plants	higher dicots	Euphorbiaceae	<i>Euphorbia dallachyana</i>			C		1/1
plants	higher dicots	Euphorbiaceae	<i>Euphorbia stevenii</i>	bottle tree spurge		C		1/1
plants	higher dicots	Euphorbiaceae	<i>Croton phebaloides</i>	narrow-leaved croton		C		2/1
plants	higher dicots	Fabaceae	<i>Fabaceae</i>			C		1
plants	higher dicots	Fabaceae	<i>Tephrosia</i>			C		1
plants	higher dicots	Fabaceae	<i>Hovea lanceolata</i>			C		1
plants	higher dicots	Fabaceae	<i>Hovea parvicalyx</i>			C		3/3
plants	higher dicots	Fabaceae	<i>Zornia floribunda</i>			C		1/1
plants	higher dicots	Fabaceae	<i>Tephrosia astragaloides</i> var. <i>(Belyando Crossing E.J.Thompson+ 139)</i>			C		3/3
plants	higher dicots	Fabaceae	<i>Jacksonia ramosissima</i>			C		3/2
plants	higher dicots	Fabaceae	<i>Indigofera haplophylla</i>			C		1/1
plants	higher dicots	Fabaceae	<i>Desmodium campylocaulon</i>			C		1/1
plants	higher dicots	Fabaceae	<i>Tephrosia filipes</i> subsp. <i>filipes</i>			C		2/2
plants	higher dicots	Fabaceae	<i>Sesbania cannabina</i> var. <i>cannabina</i>			C		1/1
plants	higher dicots	Fabaceae	<i>Glycine tomentella</i>	woolly glycine		C		1/1
plants	higher dicots	Goodeniaceae	<i>Goodenia hirsuta</i>			C		1/1
plants	higher dicots	Goodeniaceae	<i>Goodenia strangfordii</i>			C		1/1
plants	higher dicots	Goodeniaceae	<i>Goodenia armitiana</i>			C		1/1
plants	higher dicots	Goodeniaceae	<i>Brunonia australis</i>	blue pincushion		C		1
plants	higher dicots	Lamiaceae	<i>Basilicum polystachyon</i>			C		1/1
plants	higher dicots	Loranthaceae	<i>Amyema quandang</i> var. <i>bancroftii</i>	broad-leaved grey mistletoe		C		1
plants	higher dicots	Lythraceae	<i>Ammannia multiflora</i>	jerry-jerry		C		1/1
plants	higher dicots	Malvaceae	<i>Malvastrum americanum</i>		Y			1
plants	higher dicots	Malvaceae	<i>Gossypium australe</i>			C		1/1
plants	higher dicots	Malvaceae	<i>Malvastrum americanum</i> var. <i>americanum</i>		Y			1/1
plants	higher dicots	Meliaceae	<i>Owenia acidula</i>	emu apple		C		1
plants	higher dicots	Menyanthaceae	<i>Nymphoides crenata</i>	wavy marshwort		C		1/1
plants	higher dicots	Mimosaceae	<i>Acacia sericophylla</i>			C		1/1
plants	higher dicots	Mimosaceae	<i>Acacia multisiliqua</i>			C		2/1
plants	higher dicots	Mimosaceae	<i>Acacia leptostachya</i>	Townsville wattle		C		1/1
plants	higher dicots	Mimosaceae	<i>Acacia dietrichiana</i>			C		1
plants	higher dicots	Mimosaceae	<i>Acacia harpophylla</i>	brigalow		C		2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Mimosaceae	<i>Acacia tenuissima</i>			C		1/1
plants	higher dicots	Mimosaceae	<i>Acacia hyaloneura</i>			C		1/1
plants	higher dicots	Mimosaceae	<i>Archidendropsis basaltica</i>	red lancewood		C		1
plants	higher dicots	Mimosaceae	<i>Acacia excelsa subsp. excelsa</i>			C		1/1
plants	higher dicots	Mimosaceae	<i>Acacia lazardis</i>			C		1/1
plants	higher dicots	Mimosaceae	<i>Acacia ramiflora</i>			C	V	1/1
plants	higher dicots	Mimosaceae	<i>Acacia cambagei</i>	gidgee		C		3
plants	higher dicots	Mimosaceae	<i>Acacia salicina</i>	doolan		C		1
plants	higher dicots	Myoporaceae	<i>Eremophila mitchellii</i>			C		4
plants	higher dicots	Myoporaceae	<i>Eremophila longifolia</i>	berrigan		C		2/2
plants	higher dicots	Myoporaceae	<i>Eremophila deserti</i>			C		2/1
plants	higher dicots	Myoporaceae	<i>Myoporum acuminatum</i>	coastal boobialla		C		3/1
plants	higher dicots	Myrtaceae	<i>Eucalyptus melanophloia</i>			C		1
plants	higher dicots	Myrtaceae	<i>Thryptomene parviflora</i>			C		1/1
plants	higher dicots	Myrtaceae	<i>Eucalyptus xanthoclada</i>	yellow-branched ironbark		C		2/2
plants	higher dicots	Myrtaceae	<i>Melaleuca tamariscina</i>			C		1/1
plants	higher dicots	Myrtaceae	<i>Eucalyptus persistens</i>			C		1/1
plants	higher dicots	Myrtaceae	<i>Eucalyptus drepanophylla</i>			C		3/3
plants	higher dicots	Myrtaceae	<i>Corymbia clarksoniana</i>			C		2/2
plants	higher dicots	Myrtaceae	<i>Melaleuca pallescens</i>			C		1/1
plants	higher dicots	Myrtaceae	<i>Corymbia dallachiana</i>			C		2
plants	higher dicots	Myrtaceae	<i>Eucalyptus brownii</i>	Reid River box		C		3
plants	higher dicots	Myrtaceae	<i>Melaleuca nervosa</i>			C		1
plants	higher dicots	Myrtaceae	<i>Corymbia lamprophylla</i>			C		3/1
plants	higher dicots	Oleaceae	<i>Jasminum didymum</i>			C		2
plants	higher dicots	Phyllanthaceae	<i>Phyllanthus collinus</i>			C		2/2
plants	higher dicots	Phyllanthaceae	<i>Phyllanthus sp. (Pentland R.J.Cumming 9742)</i>			C		1/1
plants	higher dicots	Phyllanthaceae	<i>Phyllanthus maderaspatensis</i>			C		1/1
plants	higher dicots	Phyllanthaceae	<i>Flueggea leucopyrus</i>			C		2/1
plants	higher dicots	Phyllanthaceae	<i>Phyllanthus fuernrohrii</i>			C		1
plants	higher dicots	Pittosporaceae	<i>Bursaria incana</i>			C		1/1
plants	higher dicots	Portulacaceae	<i>Calandrinia pickeringii</i>			C		1/1
plants	higher dicots	Portulacaceae	<i>Portulaca oleracea</i>	pigweed	Y			1
plants	higher dicots	Proteaceae	<i>Grevillea striata</i>	beefwood		C		1
plants	higher dicots	Proteaceae	<i>Grevillea hilliana</i>			C		1
plants	higher dicots	Proteaceae	<i>Grevillea decora subsp. decora</i>			C		2/2
plants	higher dicots	Rhamnaceae	<i>Ventilago viminalis</i>	supplejack		C		2/1
plants	higher dicots	Rubiaceae	<i>Psydrax attenuata</i>			C		1
plants	higher dicots	Rubiaceae	<i>Psydrax johnsonii</i>			C		3/1
plants	higher dicots	Rutaceae	<i>Geijera salicifolia</i>	brush wilga		C		2
plants	higher dicots	Rutaceae	<i>Geijera parviflora</i>	wilga		C		1
plants	higher dicots	Rutaceae	<i>Citrus glauca</i>			C		1
plants	higher dicots	Santalaceae	<i>Santalum lanceolatum</i>			C		1
plants	higher dicots	Sapindaceae	<i>Dodonaea lanceolata var. subsessilifolia</i>			C		1/1
plants	higher dicots	Sapindaceae	<i>Alectryon oleifolius subsp. elongatus</i>			C		1/1
plants	higher dicots	Sapindaceae	<i>Dodonaea dodecandra</i>			C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Sapindaceae	<i>Atalaya hemiglauc</i>			C		5/1
plants	higher dicots	Sapindaceae	<i>Alectryon diversifolius</i>	scrub boonaree		C		1
plants	higher dicots	Scrophulariaceae	<i>Peplidium foecundum</i>			C		1/1
plants	higher dicots	Solanaceae	<i>Solanum cleistogamum</i>			C		1/1
plants	higher dicots	Solanaceae	<i>Solanum esuriale</i>	quena		C		1/1
plants	higher dicots	Sparrmanniaceae	<i>Grewia latifolia</i>	dysentery plant		C		2
plants	higher dicots	Violaceae	<i>Hybanthus monopetalus</i>			C		1
plants	higher dicots	Vitaceae	<i>Clematicissus opaca</i>			C		1
plants	higher dicots	Zygophyllaceae	<i>Tribulus micrococcus</i>	yellow vine		C		1/1
plants	lower dicots	Menispermaceae	<i>Tinospora smilacina</i>	snakevine		C		1
plants	monocots	Commelinaceae	<i>Commelina lanceolata</i>			C		1/1
plants	monocots	Cyperaceae	<i>Fimbristylis dichotoma</i>	common fringe-rush		C		1/1
plants	monocots	Cyperaceae	<i>Cyperus isabellinus</i>			C		1/1
plants	monocots	Cyperaceae	<i>Scleria</i>			C		1
plants	monocots	Johnsoniaceae	<i>Caesia chlorantha</i>			C		1/1
plants	monocots	Orchidaceae	<i>Cymbidium canaliculatum</i>			C		1
plants	monocots	Poaceae	<i>Panicum effusum</i>			C		1
plants	monocots	Poaceae	<i>Triodia pungens</i>			C		1/1
plants	monocots	Poaceae	<i>Dinebra ligulata</i>			C		2/2
plants	monocots	Poaceae	<i>Themeda triandra</i>	kangaroo grass		C		2/1
plants	monocots	Poaceae	<i>Astrelia lappacea</i>	curly mitchell grass		C		1/1
plants	monocots	Poaceae	<i>Cenchrus ciliaris</i>		Y			4
plants	monocots	Poaceae	<i>Digitaria brownii</i>			C		1/1
plants	monocots	Poaceae	<i>Enneapogon virens</i>			C		2/2
plants	monocots	Poaceae	<i>Sporobolus caroli</i>	fairy grass		C		1/1
plants	monocots	Poaceae	<i>Thellungia advena</i>	coolibah grass		C		1/1
plants	monocots	Poaceae	<i>Triodia longiceps</i>	giant grey spinifex		C		1/1
plants	monocots	Poaceae	<i>Aristida latifolia</i>	feathertop wiregrass		C		1/1
plants	monocots	Poaceae	<i>Chrysopogon fallax</i>			C		2
plants	monocots	Poaceae	<i>Eriachne mucronata</i>			C		2
plants	monocots	Poaceae	<i>Cymbopogon refractus</i>	barbed-wire grass		C		1
plants	monocots	Poaceae	<i>Cymbopogon bombycinus</i>	silky oilgrass		C		1
plants	monocots	Poaceae	<i>Digitaria breviglumis</i>			C		1/1
plants	monocots	Poaceae	<i>Heteropogon contortus</i>	black speargrass		C		2/1
plants	monocots	Poaceae	<i>Iseilema membranaceum</i>	small flinders grass		C		1/1
plants	monocots	Poaceae	<i>Bothriochloa ewartiana</i>	desert bluegrass		C		1
plants	monocots	Poaceae	<i>Enneapogon lindleyanus</i>			C		2/1
plants	monocots	Poaceae	<i>Enneapogon polyphyllus</i>	leafy nineawn		C		1/1
plants	monocots	Poaceae	<i>Eriochloa pseudoacrotricha</i>			C		1/1
plants	monocots	Poaceae	<i>Hyparrhenia rufa subsp. rufa</i>		Y			1/1
plants	monocots	Poaceae	<i>Aristida jerichoensis var. subspinulifera</i>			C		1/1
plants	monocots	Poaceae	<i>Panicum simile</i>			C		1
plants	monocots	Poaceae	<i>Paspalidium</i>			C		1
plants	monocots	Poaceae	<i>Leptochloa</i>			C		1
plants	monocots	Poaceae	<i>Eragrostis</i>			C		1
plants	monocots	Poaceae	<i>Digitaria</i>			C		2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	monocots	Poaceae	<i>Triodia</i>			C		2
plants	monocots	Poaceae	<i>Aristida</i>			C		4

CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992*. The codes are Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (C) or Not Protected ().

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999*. The values of EPBC are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW) and Vulnerable (V).

Records – The first number indicates the total number of records of the taxon for the record option selected (i.e. All, Confirmed or Specimens).

This number is output as 99999 if it equals or exceeds this value. The second number located after the / indicates the number of specimen records for the taxon.

This number is output as 999 if it equals or exceeds this value.

Appendix G – Conservation Significant Species

Predicted conservation significant fauna species and potential to occur on Borrow 7 site

Scientific name	Common name	EPBC Act ¹	NC Act ²	Preferred habitat	Potential to occur
EVNT fauna species					
<i>Ctenotus capricorni</i>	Capricorn Ctenotus		NT	Occurs in semi-arid sandy areas with Spinifex associated with woodland communities.	Unlikely. No suitable habitat on quarry site. Single WildNet record from wider area.
<i>Egernia rugosa</i>	Yakka Skink	V	V	Occurs in a variety of dry sclerophyll woodlands largely in the Brigalow Belt. Constructs burrows in a variety of soil types.	Unlikely. No suitable habitat occurs onsite. No survey or database records. EPBC online search only.
<i>Antairoserpens warro</i>	Robust Burrowing Snake		NT	Secretive burrowing species. Prefers loose soils in tropical woodlands with tussock grass.	Unlikely. No suitable habitat on quarry site. Two WildNet records from wider area.
<i>Denisonia maculata</i>	Ornamental Snake	V	V	Prefers seasonally inundated areas on deep cracking clay soils and adjacent habitat. Feeds exclusively on frogs. Rare to absent where Cane Toads are abundant.	Potential to occur south of quarry area although not on site. Individual recorded 2.1 km south of quarry area during site inspection. Single WildNet record and EPBC online search.
<i>Furina dunmalli</i>	Dunmall's Snake	V	V	Rarely encountered. Forests to woodlands, associated with Brigalow scrub.	Unlikely. Species at the edge of predicted range in quarry area. Habitat generally highly degraded. No survey or database records. EPBC online search only.
<i>Nettapus coromandelianus</i>	Cotton Pygmy-goose	M	NT	May occur on a variety of waterbodies but prefers those with abundant floating vegetation which it feeds on.	Occurs in area. At least 30 individuals observed on large farm dam. Will not occur on quarry site. Also WildNet records.
<i>Stictoneeta naevosa</i>	Freckled Duck		NT	Occurs on large well-vegetated swamps.	Unlikely. Quarry area not in species normal range. Single WildNet record is likely rare vagrant occurrence.
<i>Geophaps scripta scripta</i>	Squatter Pigeon (southern)	V	V	Occurs in dry woodland. Generally on sandy soils close to water.	Occurs in area. Five individuals recorded at two sites. Potential to occur on quarry site however substrate is unsuitable (rocky). Also GHD (2012a;b) and WildNet records. EPBC online search

Scientific name	Common name	EPBC Act ¹	NC Act ²	Preferred habitat	Potential to occur
<i>Erythrotriorchis radiatus</i>	Red Goshawk	V	V	Prefers areas close to the coast featuring extensive open forest and woodland with a mosaic of vegetation types. Nests in tall emergent trees close to water.	Unlikely. No survey or database records. EPBC online search only. Landscape throughout quarry area is predominantly cleared.
<i>Lophoictinia isura</i>	Square-tailed Kite		NT	Occurs in a variety of forested habitats where it forages on birds and eggs.	Unlikely. Habitat is unsuitable (heavily cleared). Two WildNet records.
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork		NT	Large species that occurs on a variety of wetlands. Carnivorous feeding on a variety of vertebrates, crustaceans, mollusks and invertebrates.	Occurs in area. Individual observed on large farm dam. Will not occur on quarry site. Also GHD (2012a) and WildNet records.
<i>Rostratula australis</i>	Australian Painted Snipe	V, M	V	Prefers temporary shallow wetlands. Nests in freshly flooded wetlands with low vegetation.	Will not occur on quarry site. Potential to occur on wetlands in area but no database records. EPBC online search only.
<i>Grantiella picta</i>	Painted Honeyeater		V	Occurs in a variety of forests/woodlands that contain mistletoes. Winter visitor to Queensland.	Unlikely. Habitat unsuitable (heavily cleared). May sporadically occur wherever there are mistletoes. Single WildNet record.
<i>Poephila cincta cincta</i>	Black-throated Finch (southern)	E	E	Occurs in grassy open woodlands near water. Prefers areas of intact woodlands.	Unlikely. No suitable habitat onsite or adjacent. Many records in mine area to west by GHD (2012a) and several WildNet records. EPBC online search.
<i>Neochmia ruficauda ruficauda</i>	Star Finch (eastern)	E	E	Occurs in grassy flats/woodlands near water.	Unlikely. Species present range is much further north. No database records. EPBC online search only.
<i>Phascolarctos cinereus</i>	Koala	V	S	Occurs in a variety of eucalypt woodlands and open forest.	Unlikely. Habitat is unsuitable (heavily cleared). Tree scratches recorded in wider area. One record by GHD (2012a) and six WildNet database records within 50 km radius of quarry area.
<i>Chalinolobus picatus</i>	Little Pied Bat		NT	Occurs in a variety of dry woodland forest types including mallee, eucalypt, <i>Callitris</i> and <i>Casuarina</i> .	Unlikely. Habitat is unsuitable (heavily cleared). Recorded by GHD (2012a;b) and WildNet records.
<i>Lasiorhinus krefftii</i>	Northern Hairy-nosed Wombat	E	E	Occurs in sandy, grassy woodland.	Unlikely. Species almost entirely restricted to Epping Forest south of quarry area. Single Wildnet record.
Migratory species					
<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle	M	S	Occurs in coastal areas including beaches, estuaries and lagoons, but may range well inland on larger rivers. Predominantly feeds on fish.	Unlikely. No suitable habitat in quarry area or surrounds. No database records. EPBC search only.

Scientific name	Common name	EPBC Act ¹	NC Act ²	Preferred habitat	Potential to occur
<i>Apus pacificus</i> <i>Hirundapus caudacutus</i>	Fork-tailed Swift White-throated Needletail	M	S	Aerial foraging species that occur over a variety of landscapes including highly modified environments.	White-throated Needletail Occurs in area . Both species may seasonally occur over the area.
<i>Ardea modesta</i>	Eastern Great Egret	M	S	Eastern Great Egret occurs on a variety of wetlands and intertidal habitats.	Occurs in area . Several individuals observed on large farm dam. Will not occur on quarry site . Three WildNet records. EPBC online search.
<i>Ardea ibis</i>	Cattle Egret	M	S	Cattle Egret prefers damp grassy areas for feeding, particularly pasture.	Will not occur on quarry site . Potential to occur in paddocks after heavy rains. Single database record. EPBC online search.
<i>Plegadis falcinellus</i>	Glossy Ibis	M	S	Prefers shallow freshwater habitats. Sometimes occurs in intertidal habitat.	Occurs in area . Several individuals observed on large farm dam. Will not occur on quarry site .
<i>Tringa stagnatilis</i>	Marsh Sandpiper	M	S	May be found in both freshwater and estuarine habitats.	Will not occur on quarry site . Potential to occur on wetlands in area. Single database record.
<i>Gallinago hardwickii</i>	Latham's Snipe	M	S	Occurs in generally low numbers in a variety of permanent or ephemeral wetlands across eastern Australia.	Will not occur on quarry site . Potential to occur on wetlands in area. Single database record. EPBC online search.
<i>Merops ornatus</i>	Rainbow Bee-eater	M	S	Widespread species that may occur in a variety of habitats. Nests in burrows in sandy banks.	Potential to occur although habitat is heavily cleared. Recorded throughout area during site inspection . Common in area at time of survey. Also GHD (2012a;b) and database records
<i>Rhipidura rufifrons</i>	Rufous Fantail	M	S	Prefers dense habitats including rainforest, riparian habitats and vine-thicket.	Unlikely . Habitat is generally poor. Two database records.
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	M	S	Prefers dense habitats. Generally migrates through coastal forests where it may occur in more open habitats.	Unlikely . Habitat is generally poor. Also GHD (2012a) and single database record.

¹ EPBC Act: E = Endangered; V = Vulnerable; M = Migratory.

² NC Act: E = Endangered; V = Vulnerable; NT = Near Threatened; S = Special least concern.

Appendix H – Conceptual Erosion & Sediment Control Plan

Borrow 7

Conceptual Erosion and Sediment Control Plan

1.1 Introduction

CDM Smith Australia Pty Ltd (CDM Smith) has been engaged by Adani Mining Pty Ltd (Adani) to prepare the development application and relevant supporting documentation for Borrow 7. As part of the supporting documentation, a Conceptual Erosion and Sediment Control Plan (ESCP) has been prepared to outline proposed environmental management measures regarding water runoff and erosion prevention.

Borrow 7 is a new hard rock quarry proposed to be located on Lot 3235 PH752. The site is approximately 5 km west of the Gregory Development Road, and approximately 120 km north-west of Clermont in the Isaac Regional Council (IRC) area. The lot is zoned Rural under the *Belyando Shire Planning Scheme 2009* and is primarily used for agricultural activities.

1.2 Scope

This Conceptual ESCP applies to the three stages of vegetation clearing, overburden stripping and extraction for the quarry, associated with the proposed Carmichael Coal Mine and Rail Project. This Conceptual ESCP has been prepared as an overview to demonstrate possible Erosion and Sediment Control (ESC) Planning options and is not intended as a final design.

1.3 Purpose

The purpose of this Conceptual ESCP is to characterise the risk of erosion during construction and operation of Borrow 7, and demonstrate that water management and erosion and sediment control requirements of the quarry can be met within the proposed quarry site. The main objectives of the Conceptual ESCP are to:

- Identify the likely need for the construction of sediment basins;
- Identify that adequate space has been made available for the construction and operation of major sediment traps and essential flow diversion systems;
- Demonstrate to the regulatory authority that there is a feasible means of constructing the Project while still protecting key environmental values;
- Identify problem soil areas including dispersive soils, acid sulphate soils, areas of potential mass movement; and
- Identify protected environmental features on the site such as protected vegetation.

This Conceptual ESCP will assist the preparation of the Adani Site Based Management Plan (SBMP) and subsequent detailed construction phase ESCPs. This Conceptual ESCP has been prepared in reference to the Best Practice Erosion and Sediment Control, International Erosion Control Association (Australasia) (IECA, 2008).

1.4 Relevant Legislation

This Conceptual ESC Plan has been prepared to satisfy environmental management requirements for new developments under the:

- *Environmental Protection Act 1994*; and
- *Belyando Shire Planning Scheme 2009*.

1.5 Hazard and Risk Definitions

- Soil erosion hazard is a prediction of the susceptibility of a parcel of land to erosion, based on the predicted rainfall, soil type and gradient. Wind erosion is considered in dry areas.
- Soil erosion risk is the likelihood of environmental harm occurring due to disturbance activities occurring for the quarry.

Both erosion hazard and erosion risk have been considered in this assessment to determine appropriate controls to be implemented as part of the Borrow 7 construction and operation works.

1.6 Erosion Hazard Assessment

There are a number of different methodologies available to assess erosion hazard within the IECA Guidelines, however no single method considers all of the parameters which may influence the erosion hazard, due to the inherent complexity of erosion hazard assessment. Over the course of the quarry operating life the areas of the site are likely to change in shape, slope and ground cover, and rainfall hazard constantly changes throughout the year. This section discusses the main aspects of erosion hazard.

Slope steepness, slope length, soil type, rainfall erosivity and ground cover type are the main determinants of erosion. To overcome this limitation, site parameters have been assessed by adopting different methodologies from various best practice guidelines including the Sunshine Coast Regional Council (SCRC) Guidelines. This approach allows for the consideration of the site's soil type, slope as well as seasonal changes in rainfall erosivity and wind erosion potential.

1.6.1 Soil Erosion Hazard

Soil erosion hazard for an exposed soil surface is a function of surface roughness, infiltration rate, soil chemistry, and soil particle size. The Geological Survey of Queensland Interactive Resource Tenure Map broadly indicates that pockets of different soils exist locally. The dominant soil types present local to the Borrow 7 area include:

- Uniform clays – non-cracking to heavy cracking with potentially a sandy crust and variable quantity of mulch;
- Duplex soils – hard setting sandy loams; and
- Deep uniform sandy materials – loose to firm and predominant in sand.

In the absence of detailed soil data for the site, particularly exchangeable sodium percentage, Emerson Class Testing and particle size, it has been assumed that the soils are dispersive and highly erodible. This assumption increases predicted erosion rates and, subsequently, increases the size and cost of sediment basins and other erosion and sediment controls. If a soil survey is completed before the Construction ESCP is developed, detailed soil data can be used to refine the design details for sediment controls.

There is an extremely low chance of encountering acid sulphate soils in the quarry area. Acid sulfate soils are rarely encountered away from coastal areas.

Given the relatively low slopes in the area, the risk of mass movement outside the confines of the quarry pit is low. Soil and rock movement within the quarry is a geotechnical consideration and outside the scope of this document.

1.6.2 Slope and Rainfall Erosivity Erosion Hazard

Figure 1, sourced from SCRC (2008), provides a tool to classify the erosion hazard of the site based on slope and rainfall erosivity. Rainfall erosivity is applicable to all climates. The adopted rainfall erosivity (R factor) for the quarry area is 1804 (Emerald – in the absence of comprehensive Clermont data) with a typical slope ranging from <1% to 15% equating to a medium to low erosion hazard for slopes below 12% and a high to very high erosion hazard for slopes above 12%, as defined by the 'A' line.

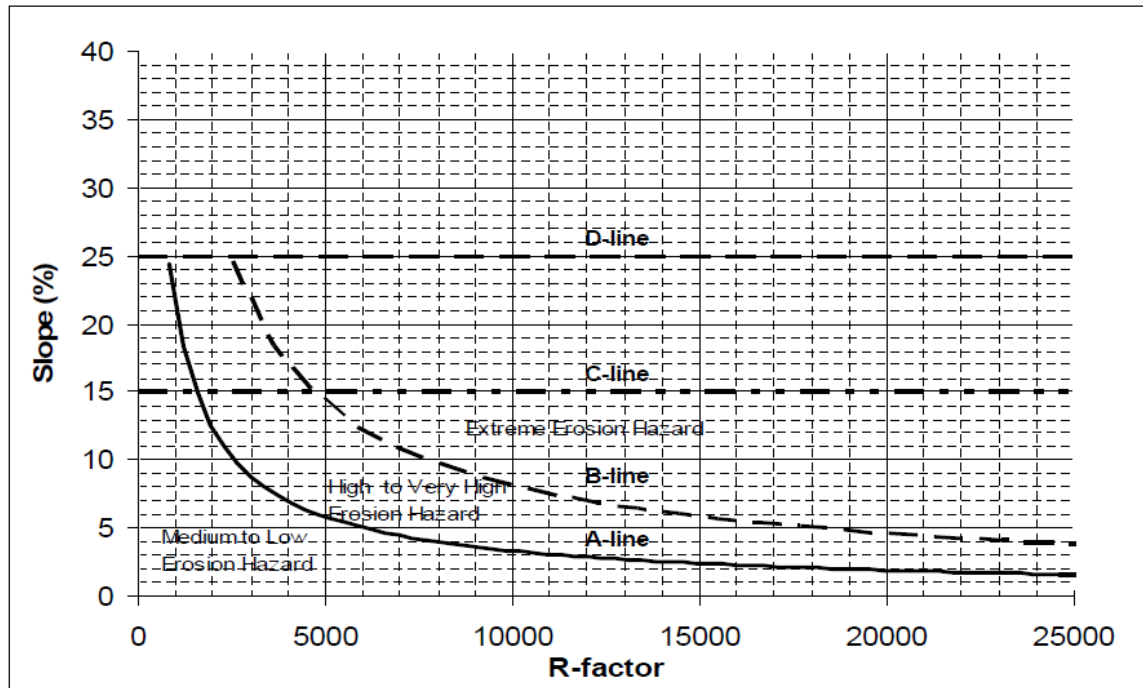


Figure 1 Slope and Rainfall Erosivity Erosion Hazard

1.6.3 Seasonal Erosion Hazard

Table 1, sourced from IECA 2008, illustrates the seasonal change in erosion hazard experienced within the Charters Towers region, based on monthly rainfall erosivity. The Charters Towers data was chosen as it is the closest available in IECA 2008 and provides similar climate and rainfall erosivity. Construction works occurring in the dry season, (April to November) when rainfall is unlikely, have an erosion hazard rating of very low. Construction works occurring in the wet season, (December to March) when rainfall is likely, have an erosion hazard of moderate to high.

Table 1 Erosion Hazard Based on Monthly Rainfall Erosivity

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	High	High	Low	V low	V low	V low	V low	V low	V low	Low	Mod

Wind erosion is a key contributor to dust generation, which has the potential to impact on the construction workforce on the quarry, vegetation communities and local sensitive receptors. Areas of the site that have exposed soil that are susceptible to wind erosion must be covered using a soil binder, mulch or vegetation to achieve 75% cover. Maintaining 75% cover on exposed soils reduces the wind erosion hazard to very low in the dry season and, depending on the technique chosen will also reduce the water erosion hazard.

If construction activities associated with the excavation of the foundations and service trenches is undertaken onsite these will have a moderate wind erosion hazard if conducted in the dry season.

1.6.4 Summary of Erosion Hazard Assessments

Taking into account the various different erosion hazard assessment methods based on soil characteristics, slope, rainfall erosivity and seasonality experienced at the site, the erosion hazard assessment is summarised as follows:

- A low hazard for land disturbance activities which occur within the dry season;
- A moderate to high hazard for land disturbance activities which occur within the wet season;
- A medium to low hazard rating for most areas based on slope, with small isolated areas of high hazard; and
- A moderate wind erosion hazard for construction activities associated with excavation during construction and operation.

Based on the hazard assessment erosion protection required for dry season construction works can be significantly less than if construction occurs during the wet season.

1.7 Erosion Risk

Erosion risk is a function of the likelihood and intensity of expected rainfall, the estimated rate of soil loss and the anticipated period of soil disturbance.

For this assessment the TASK method has been adopted (IECA 2008). The TASK method is a modification of the Revised Universal Soil Loss Equation (RUSLE) and is preferred because it is the simplest and most easily understood method.

TASK considers soil loss rates by calculating the soil erosivity (K Factor), slope factor together with the area of disturbance and the amount of time the area is to be disturbed. The method categorises disturbances as either a low erosion risk (TASK number < 200) or a high erosion risk (TASK Number > 200). The formula for calculating the erosion risk using the TASK method is:

$$H = TASK$$

Where:

H= Numerical Value of the TASK number

T = Duration of soil disturbance (months)

A = Total area of soil disturbance (m²)

S = Slope factor (Table F2 or Equation F3 IECA 2008)

K = Soil erosivity factor (RUSLE K-factor)

The assessment has been undertaken on the four catchment areas proposed to be disturbed during the four stages of the Borrow 7 construction and operation, and refers to sediment ponds and sediment sumps¹.

¹ A sump is a hollow or depression in which liquid collects especially on the floor of a mine or cave (Oxford Dictionary 2013)

Table 2 provides a summary of the TASK parameters adopted to determine the subsequent erosion risk for each catchment area. All catchment areas are considered to be classified as a high risk.

Table 2 Erosion Risk Assessment per Catchment Area

H= TASK	Stage 1			Stage 2			Stage 3				Stage 4	
	MPS1	ASA1	SUMP	MPS1	ASA1	SUMP	MPS1	ASA1	ASA2	SUMP	ASA1	ASA2
T – Duration (months)	9	9	9	9	9	9	36	36	36	36	9	9
A – Disturbance area (Ha)	10.5	6	3	14.75	8.25	10	10	4.5	10	13.75	5	3
S – Slope factor	0.9649	0.7285	0.3454	0.9649	0.7285	0.3454	0.9649	0.7285	0.4769	0.3454	0.7285	0.4769
K - Soil erosivity factor	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066
H Number	60181	25964	6155	84540	35700	20517	112510	225019	1343528	71826	19473	28328

1.8 Sediment Controls Requirements

RUSLE is used as the primary method for determining sediment control standard and sediment basin size (IECA 2008, section 4.5 and section E3).

IECA (2008) recommends the use of Type 1 sediment traps with a catchment area exceeding 2 500 m² and an estimated soil loss rate that exceeds the equivalent of 150t/ha/yr (refer to Table 1.5.2).

All catchment areas are greater than 2,500m² and an estimated soil loss exceeds 150t/ha/yr indicating that sediment basins are warranted for the Borrow 7 construction activities. Sump sizing is also included based on a 1 in 1 year, 120hr rain event. The sumps are considered best practice and are not mandatory. Type 1 sediment control devices will be adopted to manage the erosion risk of each catchment area. The indicative volume of each Basin is provided in the Conceptual ESCP drawing attached.

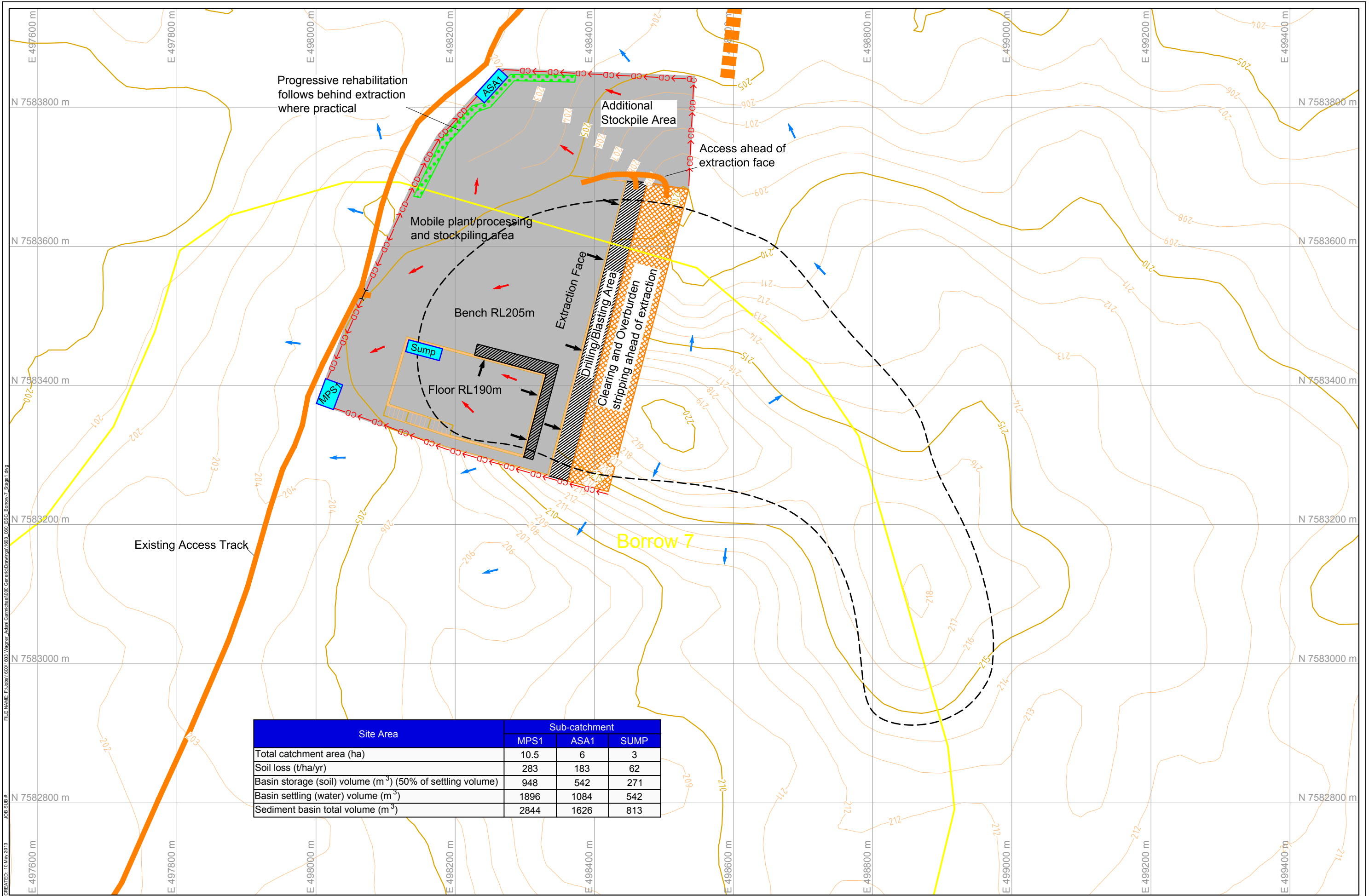
Table 3 RUSLE Calculation

RUSLE Parameters	Stage 1			Stage 2			Stage 3				Stage 4		Comments
	MPS1	ASA1	SUMP	MPS1	ASA1	SUMP	MPS1	ASA1	ASA2	SUMP	ASA1	ASA2	
Rainfall erosivity (R-factor)	1804	1804	1804	1804	1804	1804	1804	1804	1804	1804	1804	1804	IECA 2008 Table E1 (Emerald)
Soil erodibility (K-factor)	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	IECA 2008 Table E4
Slope length (m)	80	80	80	80	80	80	80	80	80	80	80	80	
Slope gradient (%)	7	5	2	7	5	2	7	5	3	2	5	3	
Length/gradient (LS-factor)	1.83	1.18	0.40	1.83	1.18	0.40	1.83	1.18	0.63	0.40	1.18	0.63	IECA 2008 Table F2 or Equation F3
Erosion control practice (P-factor)	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	IECA 2008 E11
Ground cover (C-factor)	1	1	1	1	1	1	1	1	1	1	1	1	IECA 2008 Table E6
Soil Loss (t/ha/yr)	283	183	62	283	183	62	283	183	98	62	183	98	

1.9 Conclusion

The Conceptual ESCP for Borrow 7 indicates that;

- Sediment basins will be required;
- Adequate space is available for the sediment basins. At this stage of planning the size and location of basins is indicative, and can be adjusted in the Construction ESCP to suit site requirements when further detail becomes available;
- Based on the information available, all ESC requirements can be adequately managed in the Construction ESCP;
- Problem soils are likely in this area, and the assumptions used in this report reflect a worst case scenario. Acid sulfate soils are unlikely to occur, and mass movement of soil is likely to be contained within the quarry pit; and
- The ESC devices can be accommodated without impacting on protected vegetation or other environmental constraints as identified in Section 4 of the overarching Development Application.



Site Area	Sub-catchment		
	MPS1	ASA1	SUMP
Total catchment area (ha)	10.5	6	3
Soil loss (t/ha/yr)	283	183	62
Basin storage (soil) volume (m ³) (50% of settling volume)	948	542	271
Basin settling (water) volume (m ³)	1896	1084	542
Sediment basin total volume (m ³)	2844	1626	813

REV	DESCRIPTION	DATE	BY

Data Sources:

Photography: 1s SRTM 2008 DEM-S © Commonwealth of Australia (Geoscience Australia) 2012

Cadastral: Cadastre

Ecosystem: Other

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Legend:	
	Site Boundary (Adani)
	Cadastral Boundary
	Edge of basalt outcrop
	Access Road
	Access Road (Supplied by Adani)

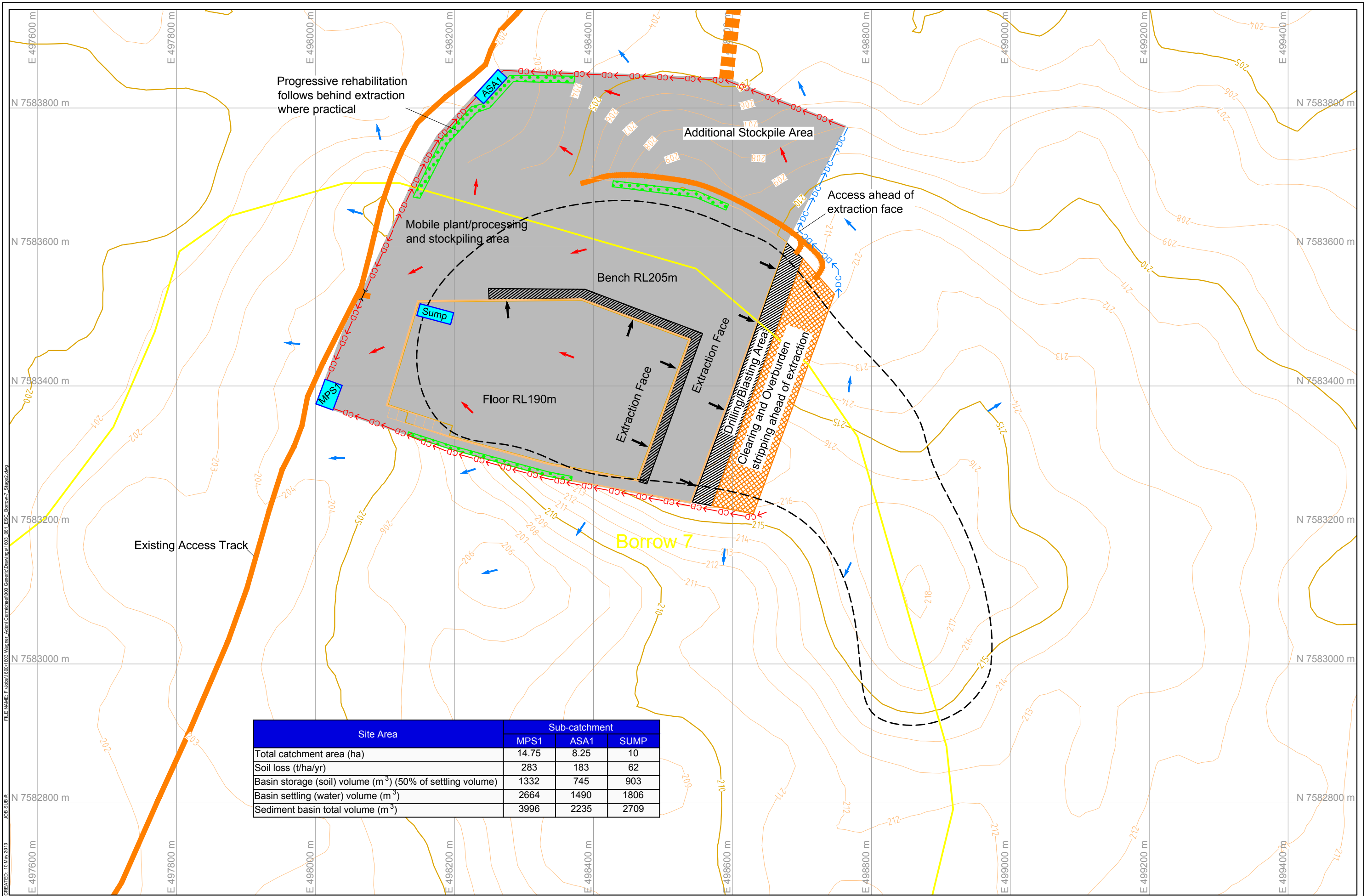
	Overburden Stripping
	Progressive Rehabilitation
	Drilling/Blasting Area
	Basin Location

	Clean Water Flow
	Dirty Water Flow
	Dirty Water Catch Drain
	Culvert



PROJECT:	Carmichael Coal Project
CLIENT:	Wagner Quarries Pty Ltd

TITLE:		Borrow 7 - Water Management Strategy Erosion and Sediment Controls Plan - Stage 1	
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PH: +61 7 3871 0411 WWW.GROUNDWORK.COM.AU		DATE: 14 May 2013 PRINTED: 30 May 2013	DRAWN: LT CHECKED: MGA / AHD / 55



REV

DESCRIPTION

DATE

BY

1

2

Legend:

Site Boundary (Adani)

Cadastral Boundary

Edge of basalt outcrop

Access Road

Access Road (Supplied by Adani)

Overburden Stripping

Progressive Rehabilitation

Drilling/Blasting Area

Basin Location

Clean Water Flow

Dirty Water Flow

Clean Water Diversion Channel

Dirty Water Catch Drain

Culvert

PROJECT:

Carmichael Coal Project

CLIENT:

Wagner Quarries Pty Ltd

TITLE:

Borrow 7 - Water Management Strategy
Erosion and Sediment Controls Plan - Stage 2

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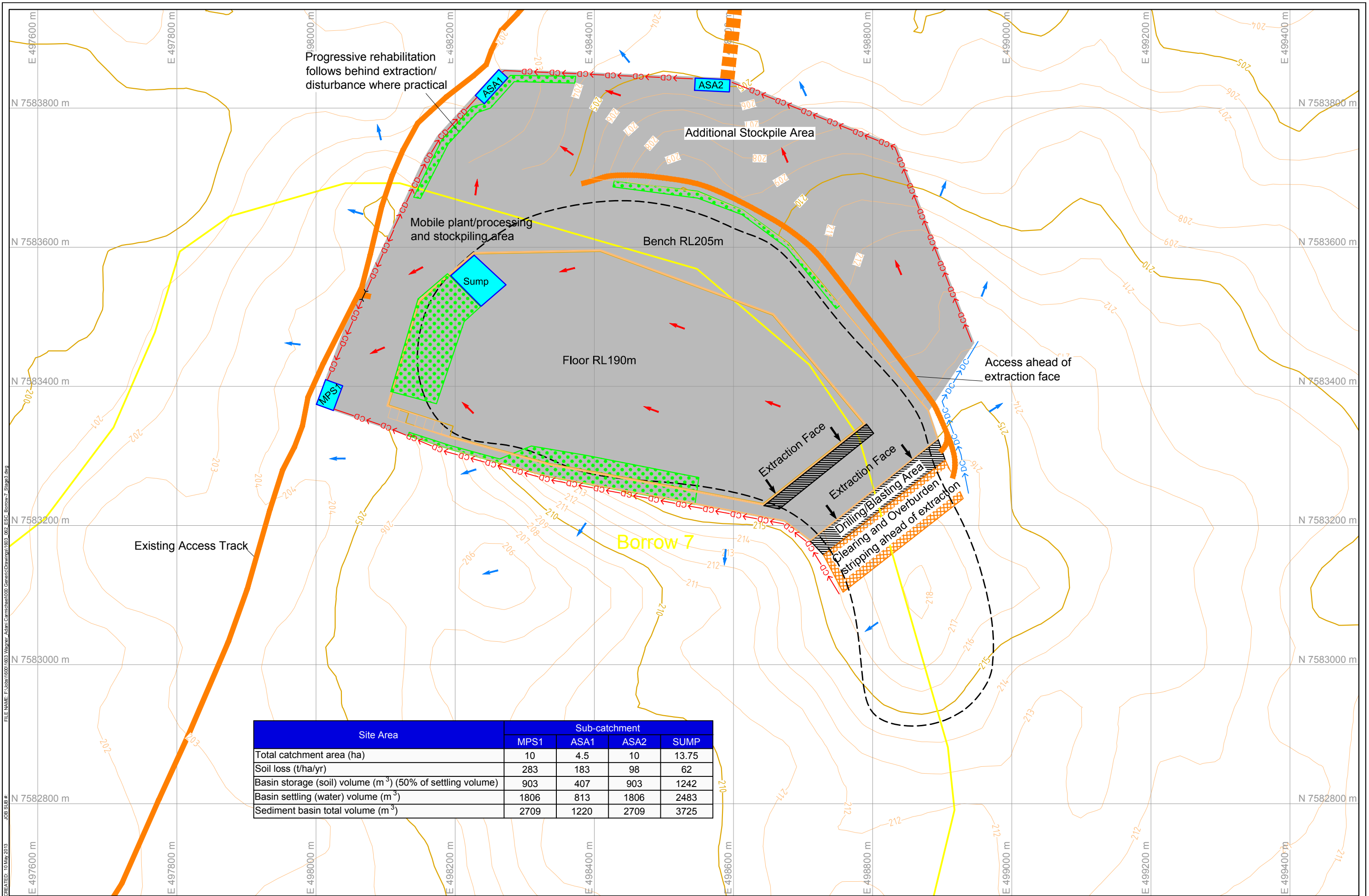
1603.061

REVISION:

DATUM:

HORIZONTAL / VERTICAL / ZONE

MGA / AHD / 55



Site Area	Sub-catchment			
	MPS1	ASA1	ASA2	SUMP
Total catchment area (ha)	10	4.5	10	13.75
Soil loss (t/ha/yr)	283	183	98	62
Basin storage (soil) volume (m ³) (50% of settling volume)	903	407	903	1242
Basin settling (water) volume (m ³)	1806	813	1806	2483
Sediment basin total volume (m ³)	2709	1220	2709	3725

REV	DESCRIPTION	DATE	BY

Data Sources:

Photography: 1s SRTM 2008 DEM-S © Commonwealth of Australia (Geoscience Australia) 2012

Cadastral: Cadastre

Ecosystem: Other

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Legend:

- Site Boundary (Adani)
- Cadastral Boundary
- Edge of basalt outcrop
- Access Road
- Access Road (Supplied by Adani)
- Overburden Stripping
- Progressive Rehabilitation
- Drilling/Blasting Area
- Basin Location
- Clean Water Flow
- Dirty Water Flow
- Clean Water Diversion Channel
- Dirty Water Catch Drain
- Culvert

PROJECT: Carmichael Coal Project

CLIENT: Wagner Quarries Pty Ltd

TITLE: Borrow 7 - Water Management Strategy
Erosion and Sediment Controls Plan - Stage 3

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DRAWING NUMBER: 1603.062

REVISION:

DATUM: HORIZONTAL / VERTICAL / ZONE

MGA / AHD / 55

Appendix I – AMU Summary

AMU summary sheets 4

Read this in conjunction with a set of the green sheets

The following sheets provide summary information about each AMU, and its associated land use suitability and management. Soil and site descriptions presented here are directly relevant to decisions on land use and management. A set of limitations to land use have been deduced from these descriptions. Recommendations are given for crop suitability, land conservation practices and stocking rates.

AMU information

The sheets provide photographs of the landscape and a representative soil profile for each AMU. These are accompanied by summary information on the representative soil's characteristics and chemical and physical properties.

Site description: summarises the environmental characteristics that relate to the AMU. The landscape photograph shows a typical example of the AMU landscape in as close to its natural state as possible.

Representative soil profile: it must be stressed that this comprises a photograph and description of a *representative* soil within the range of soils of the named AMU. The representative soil is usually the most commonly occurring within the AMU.

The soil description is simplified from the profile descriptions contained in Appendix III of the *Resource Information*, but is detailed enough to identify the soil. Soil colour, structure and types of inclusions are defined in the Glossary.

Distinguishing soil properties: briefly summarises the chemical and physical attributes of the soil which are relevant to land use.

Chemical properties

Statements are made on the natural availability of the three major nutrient elements (nitrogen - N, phosphorus - P and potassium - K) in the top 10 cm of the soil. The availability of micronutrients is also mentioned if they are significant. The general ratings used for the interpretation of soil chemical analyses are given in Table 4.1.

A measure of soil acidity or alkalinity is given as pH for the surface soil. pH7 is neutral, less than 7 is acid and greater than 7 is alkaline. The pH trend with an increase in depth is also given. Further explanation of pH is given in the Glossary.

Salinity and sodicity within the profile are based on the chemical analyses of the soil samples taken for each representative soil. Salinity is based on the electrical conductivity (EC) value and relates to inherent salinity (that is, presence of salts in the profile). Sodicity relates to the exchangeable sodium percentage (ESP) value. The terms are defined in the Glossary.

Physical properties

Statements are made on the following if relevant:

- surface condition - the character of the topsoil in its natural, uncultivated state;
- workability - the ease or otherwise of working the soil with machinery;
- infiltration and permeability - how readily water enters the top soil and moves through the profile;
- effective rooting depth - depth to which most plant feeder roots will penetrate;
- PAWC - Plant Available Water Capacity, or the ability of the soil to retain moisture for use by the crop or pasture within the rooting zone.

- drainage
 - how freely water moves through and out of, the soil; the drainage categories are defined in the Glossary and are given as:
 - very poorly drained
 - poorly drained
 - imperfectly drained
 - moderately well drained
 - well drained
 - rapidly drained

Table 4.1. Ratings used for interpretation of soil analyses

		Ratings				
Soil Test	Units	Very low	Low	Medium	High	Very high
EC	(dS/m)	<0.1 5.	0.15-0.45	0.45-0.90	0.90-2.0	>2.0
Cl	(%)	<0.01	0.01-0.03	0.03-0.06	0.06-0.20	>0.20
P	(mg/kg)	<10	10-20	20-40	40-100	>100
Extr. K	(m.eq%)	<0.1	0.1-0.2	0.2-0.5	0.5-1.0	>1.0
Total N	(%)	<0.05	0.05-0.15	0.15-0.25	0.25-0.50	>0.50
Total P	(%)	<0.005	0.005-0.02	0.02-0.05	0.05-0.10	>0.10
Total K	(%)	<0.1	0.1-0.5	0.5-1.0	1.0-3.0	>3.0
PAWC	(%)	<5	5.1-8.0	8.1-12	12.1-15	>15

Source: Bruce and Rayment, 1982 (chemical analyses) Reid et al, 1979 (physical analyses)

¹ See reference list in Resource Information

Land use information	Land use suitability:	suitability for irrigated or dryland cropping and sown pastures is presented; commonly recommended crops and pastures are listed.
	Land use limitations:	includes aspects important to soil management.
	Land conservation:	includes statements on water erosion hazard and surface runoff; this information is provided because of the erratic nature of the rainfall, its short duration and high intensity.

Soils are identified as *suitable*, of *limited suitability*, or *unsuitable* for conservation structures, strip cropping and dams. Soil conservation structures are otherwise classed as not applicable (*n.a.*) where soils are not suitable for cropping. This information is for guidance only - local DPI Land Conservation Officers should be consulted for more detailed advice.

Stocking rates: recommendations are given for cattle in Adult Equivalents (AE) which represents a 450 kg live weight, non-lactating bovine, and are guidelines only, as rates will vary depending on such factors as the intensity of management, pasture type, browse availability and seasonal conditions.

Estimated stocking rates are given for native pastures in both cleared and uncleared states, as well as sown legume and grass pastures. These estimates are the best figures that can be provided as general recommendations given current knowledge. Graziers should seek advice concerning stocking in specific areas.

Where a grazing management system is not practised for the given AMU the stocking rate is stated as being not applicable (*n.a.*).

Management recommendations: lists important recommendations for responsible land management which allow optimal land use with minimum land degradation.

These recommendations are based on the known inherent properties of the soils and the limitations they present to any land use.

AMU summary sheets



Land use suitability

Irrigated (all types) cropping	: <i>all crops and pastures</i>
Dryland cropping	: <i>sorghum, sunflower, mungbeans, wheat, cotton, chickpea, safflower</i>
Forage cropping	: <i>all forage sorghums, oats, dolichos, cowpea</i>
Grazing native pastures	: <i>low productivity of bluegrasses and annuals under scrub; reasonable productivity when cleared</i>
Grazing sown pastures	: <i>highly productive purple pigeon</i>

Land use limitations

- flooding
- brigalow, yellowwood, coolibah regrowth
- waterlogging
- frost

Land conservation

Water erosion hazard	: medium
Surface runoff	: medium
Contour banks	: broad based
Waterways	: suitable, grass with African Star grass or purple pigeon, angleton, creeping and native bluegrasses
Strip cropping	: suitable
Diversion banks	: suitable
Dams	: suitable (some sand lenses)

Stocking rates

Uncleared native pasture	: 25 to 50 ha / AE
Cleared native pasture	: 10 to 12 ha / AE
Sown pasture	: 3 to 5 ha / AE

Management recommendations

- When spelling cultivation, sown pastures are needed because native pastures won't regenerate
- Use minimum tillage techniques to retain stubble
- Rotate crops
- Use press-wheels to assist establishment
- Contour banks and waterways necessary on cultivation greater than 0.5% slope

AMU description:

Self-mulching, dark or grey cracking clay of brigalow / coolabah scrub with yellowwood on alluvial plains

Site description

Landform

Wide, level, alluvial plains of major drainage lines. Low lying clay plains and interchannel areas are prone to flooding. Characterised by low local relief and slopes below 1%.

Vegetation

Extensively cleared for farming. Dense brigalow scrub with coolibah and yellowwood and associated wilga and belah.



Representative soil profile

Depth (m)	Description
0 to 0.05	Brownish grey, heavy clay; self-mulching surface; strong, fine blocky structure; abrupt change to:
0.05 to 0.35	Greyish brown, heavy clay; strong blocky structure; a few carbonate nodules; gradual change to:
0.35 to 1.5	Greyish brown, heavy clay; strong lenticular structure; a few carbonate nodules.

Distinguishing soil properties

Chemical

- N: low to medium K: very high
- P: low to very high
- surface pH 7.5, tending more alkaline with depth
- sodic below 1.2 m
- low salinity below 1.2 m

Physical

- self-mulching to weak crusting surface; heavy clay difficult to work when wet
- effective rooting depth greater than 1.0 m
- high to very high PAWC
- imperfectly drained

AMU description:

Coarse self-mulching or crusting, grey and brown cracking and non-cracking clays on alluvial plains and levees

Site description**Landform**

Elevated levees, terraces and relict alluvial plains often in small, localised occurrences.

Vegetation

Shrubby woodlands of brigalow, poplar box, silver leaved ironbark, sandalwood and Dawson gum.

**Representative soil profile**

Depth (m)	Description
0 to 0.05	Greyish brown, heavy clay; cracking surface; moderate, coarse blocky structure; abrupt change to:
0.05 to 0.25	Greyish brown, heavy clay; strong, coarse blocky structure; gradual change to:
0.25 to 0.8	Dull brown, heavy clay; strong blocky structure; some soft and nodular carbonate; gradual change to;
0.8 to 1.5	Dull brown, heavy clay; lenticular structure; a few carbonate nodules.

Distinguishing soil properties**Chemical**

- N: low to very low P: very low
K: medium
- surface pH 7.5, tending acid by 1.0 m depth
- high sodicity below 0.3 m to 0.5 m
- high salinity below 0.4 m

Physical

- either coarse mulching, crusting or hard setting surface; coarse cloddy surface with tillage, poor workability
- restricted infiltration and low permeability
- effective rooting depth 0.2 m to 0.4 m
- low PAWC
- poor drainage
- high dispersion below 0.2 m

Land use suitability

Irrigated (all types) cropping	: <i>all crops</i>
Dryland cropping	: <i>all types</i>
Forage cropping (short term)	: <i>all forage sorghums</i>
Grazing native pastures	: <i>reasonably productive bluegrasses and other natives in uncleared state; highly productive when cleared</i>
Grazing sown pastures	: <i>highly productive buffel grass</i>

Land use limitations

- crusting and sealing surface
- sodic and saline
- narrow moisture range for successful cultivation (poor workability)
- low PAWC
- restricted effective rooting depth
- very low P

Land conservation

Water erosion hazard	: low
Surface runoff	: medium to high
Contour banks	: n.a.
Waterways	: n.a.
Strip cropping	: n.a.
Diversion banks	: suitable
Dams	: suitable

Stocking rates

Uncleared native pasture	: 15 to 20 ha / AE
Cleared native pasture	: 5 to 10 ha /AE
Sown pasture	: 5 to 6 ha / AE

Management recommendations

- Largely unsuitable for dryland cropping
- Requires more frequent irrigation than other cracking clay soils
- Use minimum tillage techniques on irrigated land
- Sow pasture seed after clearing when using for grazing

Land use suitability

Grazing native pastures : *highly productive bluegrasses, bull mitchell and others*

Land use limitations

- low fertility
- salinity
- very coarse surface
- low PAWC
- waterlogging
- frost

Land conservation

Water erosion hazard : low
Surface runoff : medium to high
Contour banks : n.a.
Waterways : n.a.
Strip cropping : n.a.
Diversion banks : suitable
Dams : unsuitable (saline and sodic soil)

Stocking rates

Native pasture : 6 to 7 ha / AE

Management recommendations

- Do not cultivate
- Do not overgraze

AMU description:

Coarse cracking grey clays on level plains with tussock grasslands and clumps of stunted brigalow and coolibah

Site description

Landform

Level plains in the north-west.

Vegetation

Tussock grasslands with occasional clumps of stunted brigalow and coolibah.



Representative soil profile

Depth (m)	Description
0 to 0.05	Greyish brown, heavy clay; crusting and cracking surface; very coarse, blocky structure; abrupt change to:
0.05 to 0.3	Greyish brown, heavy clay; strong, coarse blocky structure; gradual change to:
0.3 to 1.3	Greyish brown, heavy clay; strong lenticular structure; some gypsum below 0.8 m; diffuse change to:
1.3 to 1.5	Greyish brown, heavy clay; distinct red and grey mottles.

Distinguishing soil properties

Chemical

- N: very low P: very low
- K: very low
- low zinc
- surface pH 7.0, acid below 0.5 m
- strongly sodic below 0.3 m
- high salinity below 0.3 m to 0.6 m

Physical

- coarse self-mulching surface; very cloddy if cultivated, poor workability
- restricted infiltration and low permeability
- effective rooting depth 0.3 m to 0.6 m
- low PAWC
- very poor drainage and high dispersion below 0.3 m

AMU description:

Deep, red and yellow sandy earths and duplex soils with a deep A horizon of plateaus, rises and fans

Site description

Landform

Elevated plateaus, tablelands and rises of relict streams and old land surfaces. Slopes generally between 1% and 4%.

Vegetation

Tall open woodlands comprising bloodwood, silver leaved ironbark, Moreton Bay ash, ghost gum and poplar box with areas of cypress pine, yellowjack and bonewood scrub. Wide range of understorey shrubs including desert oak and various wattles.



Representative soil profile

Depth (m)	Description
0 to 0.25	Dull reddish brown, coarse sandy loam; firm to hard setting surface; massive structure; clear change to:
0.25 to 0.6	Dark reddish brown, coarse sandy clay loam; massive structure; gradual change to:
0.6 to 1.2	Red, coarse sandy clay; diffuse change to:
1.2 to 1.8	Red, coarse sandy clay, rounded quartz gravel common.

Distinguishing soil properties

Chemical

- N: very low P: low
- K: medium to high
- surface pH 5.0, tending alkaline with depth
- non sodic and non saline

Physical

- coarse sandy, firm to hard setting surface; quite abrasive on tillage implements
- effective rooting depth greater than 1.0 m
- very high infiltration and permeability
- low to medium PAWC
- well drained

Land use suitability

Irrigated (all types) cropping	: <i>peanuts, horticultural crops and pastures</i>
Forage cropping (short term)	: <i>all forage sorghums</i>
Grazing native pastures	: <i>reasonably productive speargrass, desert bluegrasses, other native grasses in uncleared state; highly productive when cleared</i>
Grazing sown pastures	: <i>reasonable productive buffel grass, stylo</i>

Land use limitations

- very low fertility
- excessive regrowth
- low to medium PAWC
- sensitive recharge area for groundwater
- weed infestation
- surface sealing

Land conservation

Water erosion hazard	: medium to low
Surface runoff	: low to medium
Contour banks	: narrow based
Waterways	: suitable, grass with buffel grass and native grasses
Strip cropping	: n.a.
Diversion banks	: suitable
Dams	: generally suitable

Stocking rates

Uncleared native pasture	: 12 to 15 ha / AE
Cleared native pasture	: 8 ha /AE
Sown pasture	: 8 ha / AE

Management recommendations

- Not suitable for dryland cropping
- P supplementation usually required, particularly if using stylos for production gains
- Do not destroy trees if on groundwater intake area
- Do not clear if shrubby understorey present
- Marginally suitable for improved pasture grasses

Land use suitability**Forage cropping (short term)**: *all forage sorghums, oats***Grazing native pastures**: *low producing bluegrasses, speargrass, wiregrasses and other native grasses in uncleared state; reasonably productive when cleared***Grazing sown pastures**: *reasonably productive buffel grass, stylo***Land use limitations**

- low fertility
- very low PAWC
- sodic subsoil
- poorly drained
- hard setting surface
- excessive regrowth

Land conservation**Water erosion hazard**

: extremely high

Surface runoff

: high

Contour banks

: unsuitable

Waterways

: With buffel grass

Strip cropping

: unsuitable

Diversion banks

: suitable if subsoil not exposed

Dams

: generally suitable

Stocking rates

Uncleared native pasture

: 40 ha / AE

Cleared native pasture

: 10 to 15 ha / AE

Sown pasture

: 7 to 8 ha / AE

Management recommendations

- Cultivate only in short-term to control regrowth
- Do not expose subsoil because of erodibility hazard
- Topsoil dam walls to prevent piping and gully erosion

AMU description:

Thin, sandy-surfaced yellow-brown duplex soils; hard setting surface overlies coarse, impervious clay subsoils under brigalow/eucalypt scrub

Site description

Landform

Undulating plains of low local relief with most slopes below 1%.

Vegetation

Brigalow scrub with emergent eucalypts (Dawson gum, poplar box, yapunyah) and understorey of currant bush and sandalwood.



Representative soil profile

Depth (m)	Description
0 to 0.18	Dark brown, sandy clay loam; hard setting surface; weak, blocky to massive structure; abrupt change to:
0.18 to 0.2	Sandy clay loam; bleached A2 horizon; massive structure; abrupt change to:
0.2 to 0.5	Brown, sandy medium clay; strong, medium columnar structure; gradual change to:
0.5 to 1.25	Brown, sandy medium clay; strong, coarse prismatic structure; soft carbonate; a few orange mottles; clear change to:
1.25 to 1.5	Greyish red, sandy medium heavy clay.

Distinguishing soil properties

Chemical

- N: very low P: low to medium
- K: medium
- low zinc
- surface pH 6.5, tending alkaline with depth
- strongly sodic below 0.2 m
- low salinity

Physical

- hard setting structureless surface, highly susceptible to plough pan development; poor workability; surface seals and sets hard after rain
- very low infiltration and permeability
- very poor drainage
- effective rooting depth less than 0.2 m
- very low PAWC
- highly dispersive below 0.2 m

AMU description:

Red to brown duplex soils which are moderately structured and well drained under brigalow scrub

Site description**Landform**

Undulating and gently undulating plains of low local relief with slopes generally less than 2% but can be greater than 20%.

Vegetation

A range including brigalow with associated bauhinia, ooline, Dawson gum, yapunyah; silver leaved ironbark, gidgee and bonewood scrub.

**Representative soil profile**

Depth (m)	Description
0 to 0.3	Dark reddish brown, clay loam; firm surface; weak, fine blocky structure; clear change to:
0.3 to 0.55	Dark reddish brown, medium clay; moderate prismatic structure; gradual change to:
0.55 to 1.0	Dull reddish brown, medium clay; strong prismatic structure; few yellow and grey mottles; clear change to:
1.0 +	Weathered basalt.

Distinguishing soil properties**Chemical**

- N: low P: medium
- K: medium
- low zinc
- surface pH 7.0, tending alkaline with depth
- non sodic
- low salinity

Physical

- firm to hard setting surface; seals with rain after tillage
- infiltration and permeability restricted below 0.5 m
- effective rooting depth 0.5 m to 0.8 m
- medium PAWC
- moderate dispersion below 0.5 m

Land use suitability

Irrigated (all types) cropping	: <i>all crops and pastures</i>
Dryland farming (small areas only)	: <i>winter crop only, wheat, chickpea, safflower</i>
Forage cropping	: <i>oats</i>
Grazing native pastures	: <i>very low producing wiregrasses and speargrasses in uncleared state; reasonably productive when cleared</i>
Grazing sown pastures	: <i>highly productive buffel grass, rhodes grass, stylo, green panic</i>

Land use limitations

- low N
- medium PAWC
- hard setting surface
- excessive regrowth

Land conservation

Water erosion hazard	: medium
Surface runoff	: medium to high
Contour banks	: narrow based
Waterways	: suitable, grass with buffel grass, Katambora rhodes, native grasses
Strip cropping	: n.a.
Diversion banks	: suitable
Dams	: suitable

Stocking rates

Uncleared native pasture	: 40 ha / AE
Cleared native pasture	: 10 to 12 ha / AE
Sown pasture	: 3 to 5 ha / AE

Management recommendations

- Do not overgraze because of susceptibility to wind erosion
- Control regrowth
- Do not clear bonewood scrub and slopes greater than 20%

Land use suitability

Grazing native pastures : *very low producing black speargrass, bluegrasses and other native grasses*

Land use limitations

- very low PAWC
- restricted effective rooting depth
- shallow soil
- hard setting surface

Land conservation

Water erosion hazard : medium
Surface runoff : high
Contour banks : n.a.
Waterways : n.a.
Strip cropping : n.a.
Diversion banks : suitable
Dams : unsuitable

Stocking rates

Uncleared native pasture : 50 ha / AE
 Cleared native pasture : n.a.
 Sown pasture : n.a.

Management recommendations

- Do not develop
- Maintain timber for property use, wildlife abd catchment protection

AMU description:

Shallow, gravelly soils on rugged uplands and dissected ridges

Site description

Landform

Mountains, hills and dissected plateaus.

Vegetation

Eucalypt woodlands or open forest (narrow leaved ironbark, silver leaved ironbark, yapunyah, lemon scented gum) and a range of understorey vegetation including lancewood, bendee, rosewood and other wattles.



Representative soil profile

Depth (m)	Description
0 to 0.35	Reddish brown, sandy clay loam; massive structure; large amount of rock and gravel; diffuse change to:
0.35+	Fresh rock (variable).

Distinguishing soil properties

Chemical

- N: very low P: very low
- K: very low
- neutral pH trend
- non sodic and non saline

Physical

- firm to hard setting; often very gravelly
- high infiltration and permeability
- very shallow rooting depth less than 0.3 m
- very low PAWC

AMU description:

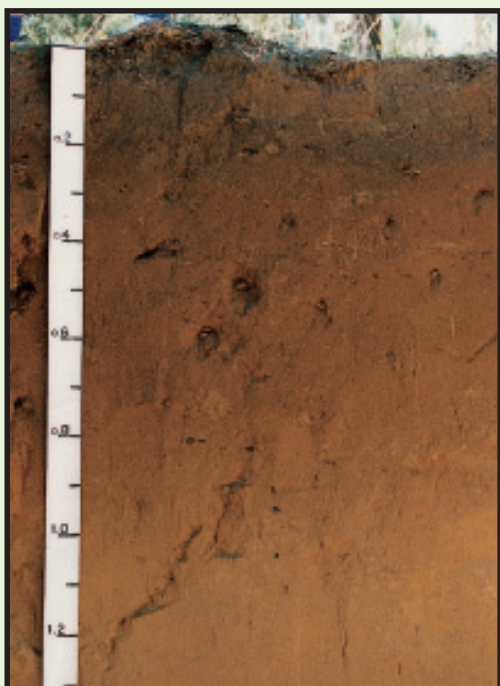
Deep, coarse and medium textured soils associated with alluvial levees and interchannel areas

Site description**Landform**

Narrow levees and alluvial plains of low relief associated mainly with major streams.

Vegetation

Tall woodlands of blue gum and Moreton Bay ash.

**Representative soil profile**

Depth (m)	Description
0 to 0.1	Brownish grey, sandy clay loam; firm surface; weak blocky structure; clear change to:
0.1 to 0.6	Brownish black, sandy clay loam; weak blocky structure; gradual change to:
0.6 to 1.45	Brown, sandy loam; clear change to:
1.45+	Brownish grey, sandy light medium clay.

Distinguishing soil properties**Chemical**

- N: very low P: high
- K: medium
- neutral pH trend
- non sodic and non saline

Physical

- loose to firm, deep sandy surface
- very high infiltration and permeability
- effective rooting depth greater than 1.0 m
- low to medium PAWC
- well drained

Land use suitability

- Grazing native pastures** : *moderately productive native grasses in uncleared state; highly productive when cleared*
- Grazing sown pastures** : *highly productive green panic, buffel grass and stylo*

Land use limitations

- flooding
- low to medium PAWC
- access because of wetness
- weed invasion
- frost

Land conservation

- Water erosion hazard** : low
- Surface runoff** : low
- Contour banks** : n.a.
- Waterways** : n.a.
- Strip cropping** : n.a.
- Diversion banks** : n.a.
- Dams** : n.a.

Stocking rates

- Uncleared native pasture : 8 to 10 ha / AE
- Cleared native pasture : 6 to 8 ha / AE
- Sown pasture : 5 to 6 ha / AE

Management recommendations

- Do not develop for cropping
- Add stylos to native pasture
- Stock conservatively to prevent weed invasion, particularly by parthenium
- Observe clearing guidelines with respect to distances from creeks and rivers

Land use suitability

- Grazing native pastures** : *highly productive bluegrasses and others in uncleared state; highly productive when cleared*
- Grazing sown pastures** : *moderately productive purple pigeon*

Land use limitations

- shallow soil depth
- low to medium PAWC

Land conservation

- Water erosion hazard** : high
- Surface runoff** : medium to high
- Contour banks** : n.a.
- Waterways** : suitable, grass with African Star grass, purple pigeon, creeping bluegrass or angelton
- Strip cropping** : n.a.
- Diversion banks** : suitable
- Dams** : unsuitable

Stocking rates

- Uncleared native pasture : 7 to 15 ha / AE
- Cleared native pasture : 6 to 10 ha / AE
- Sown pasture : 6 to 10 ha / AE

Management recommendations

- Do not develop

AMU description:

Shallow cracking and non-cracking clays on undulating open downs formed on basalt

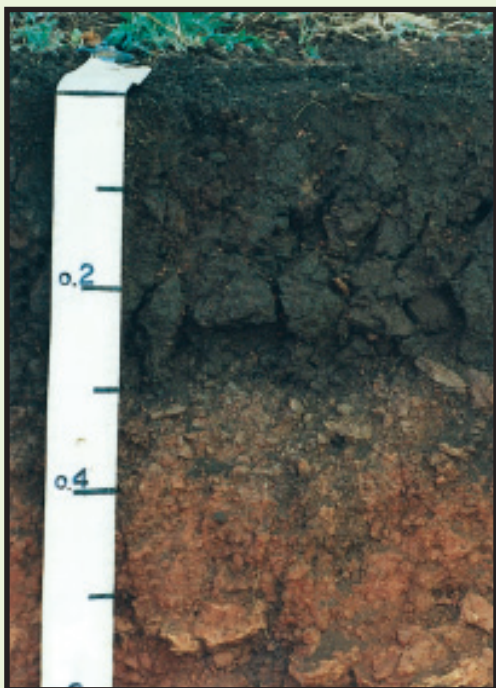
Site description

Landform

Often occurs within Orion or Kia-Ora AMUs on ridgelines and crests of gently undulating open downs.

Vegetation

Open woodlands of mountain coolibah, silver leaved ironbark or bloodwood. Ground cover of bluegrass, mitchell grass, black speargrass and wiregrass.



Representative soil profile

Depth (m)	Description
0 to 0.05	Brownish black, medium heavy clay; strong blocky structure; self-mulching and cracking; abrupt change to:
0.05 to 0.3	Brownish black, medium heavy clay; strong blocky structure; some carbonate concretions; clear change to:
0.3+	Weathered basalt.

Distinguishing soil properties

Chemical

- N: low to medium
- P: low to medium
- K: high
- low copper
- surface pH 7.5, tending slightly more alkaline with depth
- non sodic and non saline

Physical

- self-mulching surface, often stony
- moderate infiltration and permeability
- effective rooting depth less than 0.45 m
- low to medium PAWC

AMU description:

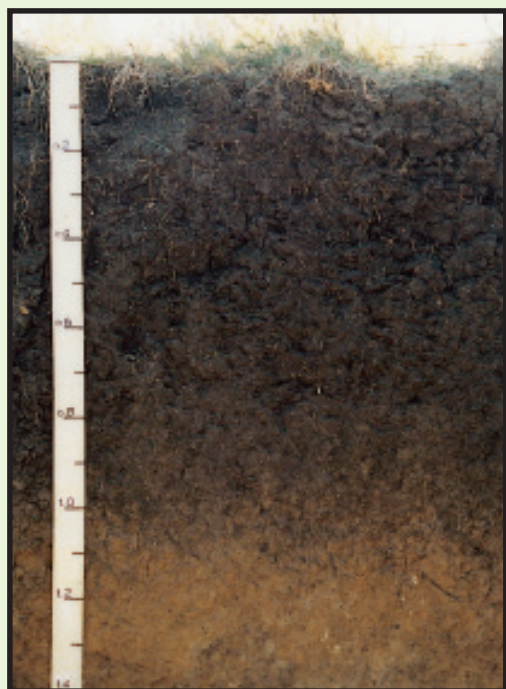
Black cracking clays with a strong fine granular surface mulch on undulating open downs formed on shales

Site description**Landform**

Undulating plains in the south-west on generally higher slopes (>1.5%) than Orion AMU.

Vegetation

Bluegrass tussock grasslands.

**Representative soil profile**

Depth (m)	Description
0 to 0.2	Dark grey brown, medium heavy clay; strong, medium granular structure; self-mulching and cracking surface; abrupt change to:
0.2 to 0.8	Brownish black, heavy clay; strong blocky structure; gradual change to:
0.8 to 1.1	Brownish black, heavy clay; a few carbonate nodules; clear change to:
1.1 to 1.4	Brown, medium heavy clay; large amounts of soft carbonate (lime); abrupt change to:
1.4+	Weathered shale.

Distinguishing soil properties**Chemical**

- N: medium P: very high
- K: high
- low zinc
- surface pH 8.0, tending more alkaline with depth
- non sodic and non saline

Physical

- strong and fine mulching surface, sealing in places with moderate to good workability
- moderate infiltration and permeability
- effective rooting depth 0.45 m to 1.5 m
- high to very high PAWC

Land use suitability

Irrigated (all types) cropping	: <i>all crops and pastures</i>
Dryland cropping	: <i>sorghum, sunflower, chickpea, mungbeans, wheat, safflower, cotton</i>
Forage cropping	: <i>all forage sorghums, oats, dolichos, cowpea</i>
Grazing native pastures	: <i>very highly productive bluegrasses, and other native grasses</i>
Grazing sown pastures	: <i>highly productive buffel grass, rhodes grass, purple pigeon</i>

Land use limitations

- soil erosion
- surface sealing

Land conservation

Water erosion hazard	: high
Surface runoff	: medium to high
Contour banks	: broad based
Waterways	: suitable, grass with African Star grass, Indian bluegrass, purple pigeon, buffel grass, Katambora rhodes, creeping bluegrass, angleton and native grasses
Strip cropping	: suitable
Diversion banks	: suitable
Dams	: suitable

Stocking rates

Uncleared native pasture	: 4 to 5 ha / AE
Cleared native pasture	: n.a
Sown pasture	: 5 ha / AE

Management recommendations

- Contour banks on cultivated land over 0.5%
- Use minimum tillage techniques
- Rotate crops
- Waterways stabilisation requires care
- When spelling cultivation, sown pastures are needed because native pastures won't regenerate

Land use suitability

- Grazing native pastures** : *low to very low producing black speargrass, desert bluegrass and other native grasses uncleared; moderate grass production when cleared*
- Grazing sown pastures** : *low producing buffel grass and stylo*

Land use limitations

- very low to low PAWC
- low fertility
- sodic subsoil
- very high erodibility of subsoil
- excessive regrowth
- hard setting surface

Land conservation

- Water erosion hazard** : extremely high
- Surface runoff** : high
- Contour banks** : unsuitable
- Waterways** : suitable if topsoil intact, grass with buffel grass
- Strip cropping** : n.a.
- Diversion banks** : unsuitable
- Dams** : generally suitable

Stocking rates

- Uncleared native pasture : 15 to 20 ha / AE
- Cleared native pasture : 15 ha / AE
- Sown pasture : 12 to 15 ha / AE

Management recommendations

- Do not mechanically clear
- Use chemical treatment to selectively clear areas
- Do not expose sodic soils

AMU description:

Hard setting, yellow-brown sandy duplex soils with hard, impervious clay subsoils

Site description

Landform

Undulating plains of low local relief with slopes generally less than 1%.

Vegetation

Woodlands of poplar box, narrow leaved ironbark and silver leaved ironbark, with understorey of sandalwood, currant bush and wattles (occasionally without shrubby understorey).



Representative soil profile

Depth (m)	Description
0 to 0.2	Yellowish brown, sandy loam; hard setting surface; very coarse, massive structure; clear change to:
0.2 to 0.3	Sandy loam; conspicuous bleach; massive structure; abrupt change to:
0.3 to 0.8	Yellowish brown, medium heavy clay; strong, coarse columnar structure; gradual change to:
0.8 to 1.5	Yellowish brown, medium clay; strong blocky structure; carbonate nodules common.

Distinguishing soil properties

Chemical

- N: very low P: very low to medium
K: medium
- low to medium copper and zinc
- surface pH 6.5, tending alkaline with depth
- strongly sodic below 0.4 m to 0.6 m
- low salinity below 0.5 m

Physical

- hard setting sandy surface; seals and sets hard with rain following tillage
- initial high infiltration but tends to waterlog once wetting front encounters subsoil clay layer
- effective rooting depth 0.2 m to 0.5 m
- very low to low PAWC
- highly dispersive below 0.4 m to 0.6 m

AMU description:

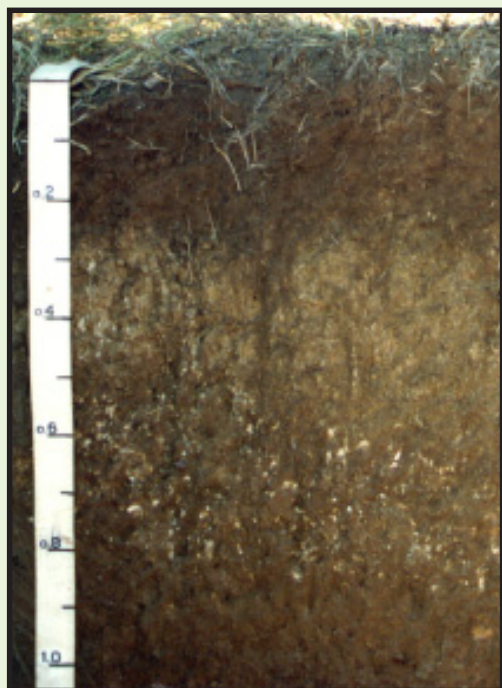
Melonholed grey and brown clays on brigalow scrub plains

Site description**Landform**

Level or gently undulating plains with melonhole gilgai.

Vegetation

Brigalow scrub which may include yapunyah. Areas of blackwood and gidgee occur to the north of the area.

**Representative soil profile**

Depth (m)	Description (gilgai mound)
0 to 0.05	Brown, light clay; moderate granular structure; self-mulching and cracking surface; clear change to:
0.05 to 0.3	Brown, medium clay; moderate blocky structure; some soft carbonate; clear change to:
0.3 to 0.85	Yellow-brown, medium heavy clay; moderate prismatic structure; soft carbonate common; gradual change to:
0.85 to 1.5	Brown, heavy clay; strong blocky structure; grey and red mottles common.

Distinguishing soil properties**Chemical**

- N: low P: low
- K: medium to high
- low zinc
- surface pH 8.0, tending acidic below 0.2 m
- strongly sodic below 0.2 m (mounds); 0.6 m (depressions)
- salinity below 0.3 m (mounds); 0.6 m (depressions)

Physical

- gilgais over 0.4 m deep; mounds are sandy crusting; depressions are coarse mulching, remaining waterlogged for extended periods
- very low infiltration and permeability
- very poorly drained
- effective rooting depth 0.2 m mounds; 0.6 m depressions
- medium PAWC (depressions); very low PAWC (mounds)
- highly dispersive below 0.2 m mounds; 0.6 m depressions

Land use suitability

- Grazing native pastures** : *very low producing bluegrasses and other native grasses when uncleared; low producing when cleared*
- Grazing sown pastures** : *moderately productive purple pigeon, buffel grass, rhodes grass and para grass*

Land use limitations

- gilgais
- coarse self-mulching surface
- high salinity and sodicity
- shallow effective rooting depth

Land conservation

- Water erosion hazard** : low
- Surface runoff** : low to medium
- Contour banks** : n.a.
- Waterways** : n.a.
- Strip cropping** : n.a.
- Diversion banks** : suitable
- Dams** : suitable

Stocking rates

- Uncleared native pasture : 40 to 50 ha / AE
- Cleared native pasture : 15 to 20 ha / AE
- Sown pasture : 6 to 10 ha / AE

Management recommendations

- Develop only for sown pasture
- Gilgais may support para grass

Land use suitability

Irrigated (all types) cropping	: <i>all crops</i>
Dryland cropping	: <i>sorghum, sunflower, wheat, mungbeans, chickpea, safflower, cotton</i>
Forage cropping	: <i>all forage sorghums, oats, dolichos, cowpea</i>
Grazing native pastures	: <i>highly productive bluegrasses and other native grasses uncleared; highly productive when cleared</i>
Grazing sown pastures	: <i>highly productive purple pigeon</i>

Land use limitations

- flooding
- salinity
- frost

Land conservation

Water erosion hazard	: medium
Surface runoff	: medium
Contour banks	: broad based
Waterways	: suitable, grass with African Star grass, purple pigeon, Indian bluegrass, creeping bluegrass, angleton or native grasses
Strip cropping	: suitable
Diversion banks	: suitable
Dams	: suitable

Stocking rates

Uncleared native pasture	: 12 to 15 ha / AE
Cleared native pasture	: 4 to 6 ha / AE
Sown pasture	: 3 to 5 ha / AE

Management recommendations

- Do not clear black tea tree
- Use minimum tillage techniques to retain stubble
- Rotate crops
- Use press wheels to assist establishment
- Contour banks and waterways necessary on cultivated slopes over 0.5%
- When spelling cultivation, sown pastures are needed because native pastures won't regenerate

AMU description:

Deep red, brown to grey uniform clays on broad to narrow, occasionally deeply incised, alluvial plains draining basalt landscapes

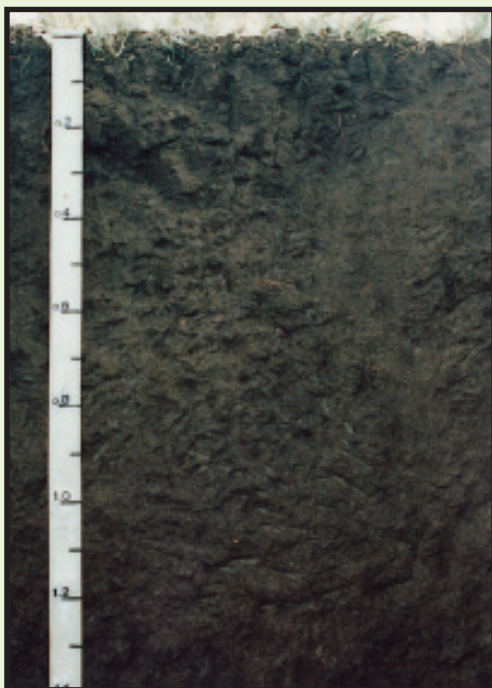
Site description

Landform

Alluvial plains along streams draining the basalt areas.

Vegetation

Tall open woodlands of coolibah with associated black tea tree, brigalow and yellowwood.



Representative soil profile

Depth (m)	Description
0 to 0.2	Grey brown, medium heavy clay; strong, fine granular structure; self-mulching surface; gradual change to:
0.2 to 0.4	Grey brown, medium heavy clay; strong, medium blocky structure; gradual change to:
0.4 to 1.5+	Grey brown, medium heavy clay; strong lenticular structure; a few carbonate nodules.

Distinguishing soil properties

Chemical

- N: low P: very low to low
- K: medium
- low zinc
- surface pH 7.5, tending more alkaline with depth
- non sodic
- occasional high salinity below 0.5m; otherwise very low salinity apart from seepage areas

Physical

- fine self-mulching surface; good workability
- moderate infiltration and permeability;
- moderately well drained
- effective rooting depth greater than 1.0 m
- high PAWC

AMU description:

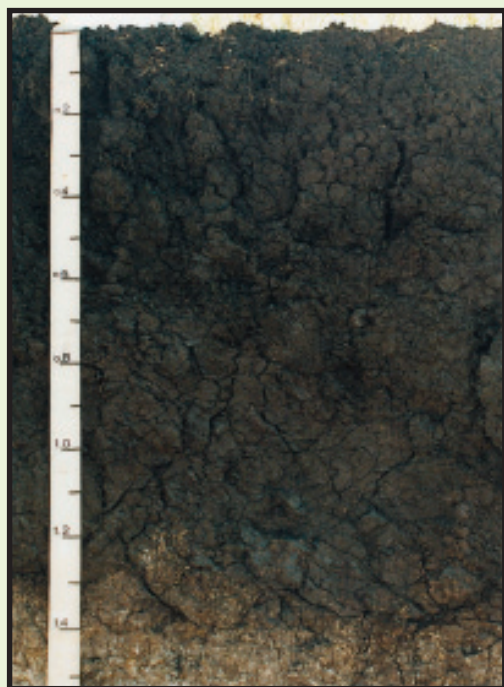
Deep, cracking dark clays on undulating downs on basalt

Site description**Landform**

Undulating plains and rises on basalt.

Vegetation

Open grasslands of bluegrass, mitchell grass, black speargrass and wiregrass with scattered mountain coolibah, bloodwood, silver leaved ironbark and wattles.

**Representative soil profile**

Depth (m)	Description
0 to 0.05	Brownish black, medium clay; self mulching and cracking surface; strong blocky structure; clear change to:
0.05 to 0.35	Brownish black, heavy clay; strong blocky structure; gradual change to:
0.35 to 1.3	Brown, heavy clay; strong lenticular structure; a few carbonate nodules; gradual change to:
1.3+	Weathered basalt.

Distinguishing soil properties**Chemical**

- N: low P: very low to low K: medium to high
- low zinc
- surface pH 7.5, tending more alkaline with depth
- non sodic and non saline

Physical

- strong self-mulching surface; surface stone can occur
- heavy clay difficult to work when wet
- low to moderate infiltration and permeability
- imperfect drainage
- effective rooting depth greater than 0.45 m (governed by depth to parent material)
- high PAWC

Land use suitability

Irrigated (all types) cropping	: <i>all crops and pastures</i>
Dryland cropping	: <i>sorghum, sunflower, wheat, mungbeans, chickpea, safflower, cotton</i>
Forage cropping	: <i>all forage sorghums, oats, dolichos, cowpea</i>
Grazing native pastures	: <i>very highly productive bluegrasses and other native grasses</i>
Grazing sown pastures	: <i>highly productive purple pigeon</i>

Land use limitations

- soil erosion
- fertility
- coarse and thin surface mulch
- surface sealing
- surface stone
- variability of depth and PAWC

Land conservation

Water erosion hazard	: high
Surface runoff	: medium to high
Contour banks	: broad based
Waterways	: suitable, grass with African Star grass, purple pigeon, Indian bluegrass, creeping bluegrass, and native grasses
Strip cropping	: suitable
Diversion banks	: suitable
Dams	: unsuitable

Stocking rates

Uncleared native pasture	: 4 to 5 ha / AE
Cleared native pasture	: n.a.
Sown pasture	: 5 ha / AE

Management recommendations

- Contour banks on cultivation over 0.5% slope
- Use minimum tillage techniques
- Rotate crops
- Do not clear black tea tree
- Waterways stabilisation requires care
- Use press wheels to assist crop establishment

Land use suitability

- Irrigated (all types) cropping** : *all crops and pastures*
- Dryland cropping** : *sorghum, sunflower, wheat, mungbeans, chickpea, safflower, cotton*
- Forage cropping** : *all forage sorghums, oats, dolichos, cowpea*
- Grazing native pastures** : *low producing bluegrasses and scrub grasses when uncleared; moderately productive when cleared*
- Grazing sown pastures** : *highly productive buffel grass, rhodes grass and purple pigeon*

Land use limitations

- soil erosion
- surface sealing

Land conservation

- Water erosion hazard** : high
- Surface runoff** : medium to high
- Contour banks** : broad based
- Waterways** : suitable, grass with African Star grass, buffel grass, purple pigeon, Indian bluegrass, Katambora rhodes, creeping bluegrass, angleton and native grasses
- Strip cropping** : suitable
- Diversion banks** : suitable
- Dams** : suitable

Stocking rates

- Uncleared native pasture : 25 ha / AE
- Cleared native pasture : 13 ha / AE
- Sown pasture : 3 to 4 ha / AE

Management recommendations

- Contour banks on cultivated land over 0.5%
- Use minimum tillage techniques
- Rotate crops

AMU description:

Deep red, brown to grey cracking clays under brigalow, softwood scrub or gidgee scrub

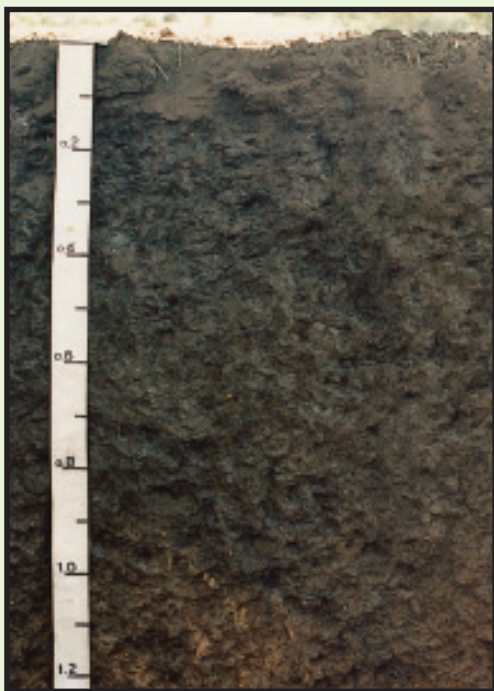
Site description

Landform

Level to undulating plains.

Vegetation

Fairly dense scrub consisting of brigalow, yellowwood and associated softwood species or gidgee; mostly cleared for cultivation.



Representative soil profile

Depth (m)	Description
0 to 0.1	Brown, medium clay; strong, fine granular structure; self-mulching and cracking surface; abrupt change to:
0.1 to 0.35	Brown, medium heavy clay; strong, medium blocky structure; gradual change to:
0.35 to 1.0	Greyish brown, medium heavy clay; strong lenticular structure; a few carbonate nodules; a gradual change to:
1.0 to 1.5+	Yellow-brown, medium heavy clay; soft carbonate common; basalt often encountered before 2 m.

Distinguishing soil properties

Chemical

- N: medium P: medium to high K: medium to high
- low zinc
- surface pH 8.0, tending more alkaline with depth
- possible medium sodicity below 1.2 m
- possible medium salinity below 1.2 m

Physical

- strong granular self-mulching surface; easy workability; occasional tendency to seal following cultivation
- moderate infiltration and permeability
- imperfect drainage below 0.5 m
- effective rooting depth greater than 0.9 m
- high to very high PAWC

AMU description:

Deep, cracking grey to brown clays formed from highly weathered sediments under brigalow / eucalypt scrub

Site description**Landform**

Level and lower sloping areas of undulating plains. Includes areas of normal gilgai with less than 0.4 m vertical interval.

Vegetation

Commonly brigalow and Dawson gum scrub with areas of gidgee and blackwood to the north.

**Representative soil profile**

Depth (m)	Description
0 to 0.05	Greyish brown, heavy clay; crusting and cracking surface; moderate, fine granular structure; clear change to:
0.05 to 0.3	Greyish brown, heavy clay; moderate blocky structure; some soft carbonate; gradual change to:
0.3 to 1.2	Dull brown, heavy clay; strong lenticular structure; a few carbonate nodules and manganese veins; gradual change to:
1.2 to 1.5	Dull brown, heavy clay.

Distinguishing soil properties**Chemical**

- N: very low to medium
- P: very low to medium
- K: high
- surface pH 8.0, tending acid below 0.6 m
- sodic below 0.5 m
- very low to medium salinity below 0.5 m

Physical

- crusting to coarse mulching; often gilgais less than 0.4 m deep with depressions remaining wet for extended periods
- slow infiltration and permeability
- poorly drained
- effective rooting depth 0.5 m
- medium to high PAWC
- moderately dispersive below 0.5 m

Land use suitability

Irrigated (all types) cropping	: <i>all crops and pastures</i>
Dryland cropping (short term)	: <i>sorghum, wheat, chickpea</i>
Forage cropping	: <i>forage sorghums, oats, dolichos, cowpea and millets</i>
Grazing native pastures	: <i>low producing bluegrasses, wire-grasses and other native grasses uncleared; moderately productive when cleared</i>
Grazing sown pastures	: <i>moderately productive buffel grass, rhodes grass and purple pigeon</i>

Land use limitations

- sodic and salinity
- gilgais
- coarse surface mulch
- regrowth

Land conservation

Water erosion hazard	: low to medium
Surface runoff	: low to medium
Contour banks	: broad based
Waterways	: suitable, grass with African Star grass, buffel grass, Katambora rhodes, purple pigeon, Indian bluegrass, creeping bluegrass, angleton and native grasses
Strip cropping	: unsuitable
Diversion banks	: suitable
Dams	: suitable

Stocking rates

Uncleared native pasture	: 25 ha / AE
Cleared native pasture	: 10 to 15 ha / AE
Sown pasture	: 7 to 8 ha / AE

Management recommendations

- Contour banks on cultivated land over 0.5%
- Rotate forage crops
- Use minimum tillage techniques
- Land levelling required insome areas

Land use suitability

- Irrigated (all types) cropping** : all crops and pastures
- Forage cropping** : all forage sorghums, oats, dolichos, cowpea, millets
- Grazing native pastures** : very low producing bluegrass and scrub grasses when uncleared; moderately productive when cleared
- Grazing sown pastures** : highly productive buffel grass, green panic and rhodes grass

Land use limitations

- restricted soil depth
- low to moderate PAWC
- sodic subsoil
- soil erosion
- workability; crusting and sometimes hard setting surface

Land conservation

- Water erosion hazard** : medium
- Surface runoff** : medium to high
- Contour banks** : broad based
- Waterways** : suitable, grass with African Star grass, buffel grass, Indian bluegrass, Katambora rhodes, creeping bluegrass, angleton and native grasses
- Strip cropping** : unsuitable
- Diversion banks** : suitable
- Dams** : suitable

Stocking rates

- Uncleared native pasture : 30 to 40 ha / AE
- Cleared native pasture : 10 to 12 ha / AE
- Sown pasture : 4 to 5 ha / AE

Management recommendations

- Contour banks on cultivated land over 0.5%
- Use minimum tillage techniques
- Rotate forage crops
- Retain all organic matter to reduce soil structural damage

AMU description:

Red to brown cracking and non-cracking clays usually on upper slopes of undulating scrub country

Site description

Landform

Mid and upper sloping areas of undulating landscapes in association with Turkey Creek AMU.

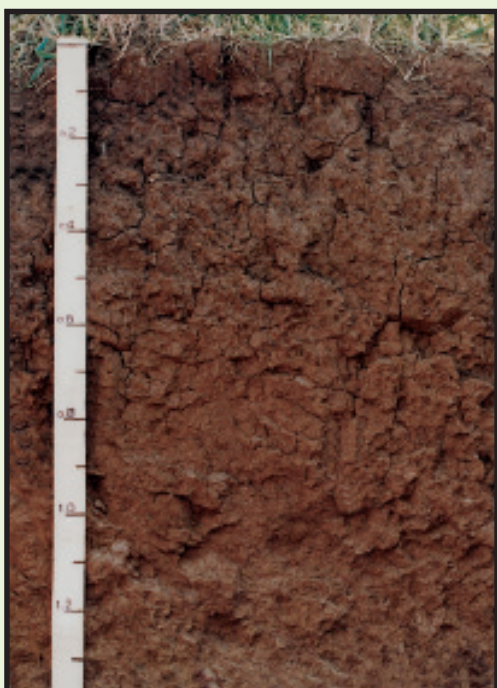
Vegetation

Woodlands or scrub with a range of species including brigalow, bonewood, wilga, belah, bendee, yellowwood, gidgee, silver leaved ironbark, Dawson gum and bottle tree.



Representative soil profile

Depth (m)	Description
0 to 0.2	Dull reddish brown, medium clay; moderate, fine to medium blocky structure; abrupt change to:
0.2 to 0.4	Dull reddish brown, medium heavy clay; coarse blocky structure; a few carbonate nodules; clear change to:
0.4 to 1.4	Reddish brown, medium heavy clay; coarse blocky structure; a few carbonate nodules; clear change to:
1.4+	Weathered basalt.



Distinguishing soil properties

Chemical

- N: low to medium
- P: low to medium K: medium
- low zinc
- surface pH 8.0, tending more alkaline
- strongly sodic below 0.5 m
- low to medium salinity below 0.6 m

Physical

- crusting to hard setting surface; cloddy after cultivation
- slow infiltration and permeability
- poorly drained below 0.5 m
- effective rooting depth 0.4 to 1.0 m (often quite variable)
- low to medium PAWC
- high dispersion below 0.5 m

AMU description:

Grey to brown duplex soils with thin sandy surfaces on undulating brigalow scrub country

Site description**Landform**

Midslope positions of undulating landscapes in association with Springton and Picardy AMUs.

Vegetation

Brigalow, belah, Dawson gum and yellow-wood scrub.

**Representative soil profile****Depth (m)**

0 to 0.05

Description

Brown, sandy clay loam; weak granular structure; clear change to:

0.05 to 0.25

Grey brown, medium clay; strong, medium blocky structure; gradual change to:

0.25 to 1.5+

Grey brown, heavy clay; strong lenticular structure; a few carbonate nodules.

Distinguishing soil properties**Chemical**

- N: low to medium K: medium
- P: very low to medium
- low copper and zinc (in virgin state)
- surface pH 8.0, tending more alkaline with depth
- medium sodicity below 0.7 m
- low salinity below 0.7 m

Physical

- hard setting sandy surface becoming a sandy clay following tillage; vulnerable to plough pan formation
- moderate infiltration and permeability
- imperfect drainage
- effective rooting depth 0.6 m to 1.0 m
- medium to high PAWC
- slight tendency for clay dispersion below 0.6 m

Land use suitability

Irrigated (all types) cropping	: <i>all crops and pastures</i>
Dryland cropping	: <i>sorghum, sunflower, cotton, mungbeans, wheat, chickpea, safflower</i>
Forage cropping	: <i>all sorghum forages, oats, dolichos,</i>
Grazing native pastures	: <i>very low producing bluegrass and other native grasses uncleared; moderately productive when cleared</i>
Grazing sown pastures	: <i>highly productive buffel grass, green panic, rhodes grass and purple pigeon</i>

Land use limitations

- rapid nutrient decline
- plough pan development
- weed infestation

Land conservation

Water erosion hazard	: high
Surface runoff	: medium
Contour banks	: broad based
Waterways	: suitable, grass with African Star grass, buffel grass, Katambora rhodes, purple pigeon and native grasses
Strip cropping	: n.a.
Diversion banks	: suitable
Dams	: suitable

Stocking rates

Uncleared native pasture	: 40 ha / AE
Cleared native pasture	: 10 to 15 ha / AE
Sown pasture	: 3 to 4 ha / AE

Management recommendations

- Contour banks on cultivated land over 0.5%
- Practice reduced tillage techniques on all cultivation
- Good weed control is vital (particularly parthenium)
- When spelling cultivation, sown pastures are needed because native pastures won't regenerate

Appendix J – EMR/CLR Search



Department of Environment and Heritage Protection (EHP)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.ehp.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Tim Kinny
21 McLachlan Street
Fortitude Valley QLD 4006

Transaction ID: 49050805 EMR Site Id: 27 February 2013
Cheque Number:
Client Reference:

This response relates to a search request received for the site:
Lot: 3235 Plan: PH752
472 TWIN HILLS Road
CLERMONT

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

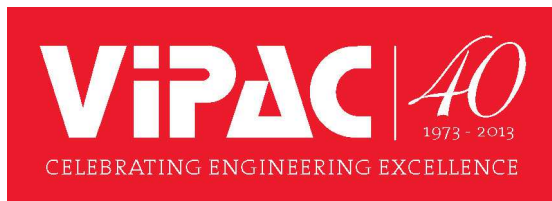
ADDITIONAL ADVICE

From the 1st August 2012, the price of an EMR/CLR search will increase to \$41.55 per lot for internet based searches and \$48.85 per lot for EMR/CLR searches done by means other than the internet.

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

Registrar
Administering Authority

Appendix K – Air Quality Impact Assessment



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CDM Smith Australia Pty Ltd

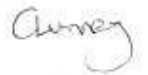
Borrow 7 Quarry Air Quality Assessment



Report No. 70Q-12-0427-TRP-514286-3

8 July 2013

DOCUMENT CONTROL

Borrow 7 Quarry Air Quality Assessment		
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	QA Representative	
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EXECUTIVE SUMMARY

This report has evaluated the potential impacts of dust generated from various activities and has provided recommendations to mitigate and minimise any potential impacts that might have an effect on the surrounding community.

This assessment has used the worst-case output month, November 2015 and modelled over a full year to ensure compliance during the life of the quarry.

The emission factors for various quarrying activities were derived from US EPA AP42 and Environment Australia (2012) National Pollutant Inventory (NPI) - *Emissions Estimation Technique (EET) Manual for Mining*.

The modelling has predicted no exceedences of the Queensland Department of Environmental and Heritage (EPP (Air)) objectives at either the Disney receptor or Old Twin Hills receptor. High background levels dominate the dust deposition and TSP rather than emissions from the various quarry activities, whereas the smaller particles, PM₁₀ and PM_{2.5} are a direct result of the quarry activities.

The highest contribution for all pollutants is the emissions from haul truck movements and the quarry itself; the haul road movements are based on the highest output in November 2015 and will be lower during all other months of the quarry life. As such, the emissions from vehicle movements will be lower as less material will be transported from the quarry. The duration of the maximum output, upon which this assessment is based is only one month therefore, the levels presented are the worst case for one month and it can therefore be concluded that the impacts predicted are conservative.

The Borrow 7 Quarry is one of five (5) proposed Adani quarries as part of the development of the Carmichael Coal Mine and Rail Project. The cumulative impacts of the Borrow 7 quarry and the Disney Quarry are not expected to exceed the relevant criteria at the Disney Receptor. ±λLJl-Ō l-Ōly2ŌtŠŘĚŠă ūKI-ŭ ljdzi-ŪNUNĕ ŠĚŪNl-ŌŪā2y LJN2zŠŌŪă ōĕ 2ŪKŠŪ 2LJŠŪl-Ū2Ūă Y l-ĕ l-fā2 ōŠ LJl-yŷŠŘ λy ūKŠ l-ŪŠl- λy ƦdzŪdzNŪŠ ϕKlă l-ăăŠăăYŠy ū Kl-ă 2yĕ ŌzyăĀRŠŪŠŘ ūKŠ ŌdzYdzl-ŪĀŌŠ λY LJl-ŌŪă 2Ʀ LJN2LJ2ăŠŘ ljdzi-ŪNUNĀŠă 2LJŠŪl-ŪŠŘ ōĕ !Řl-yλŌ !yĕ ƦdzŪdzNŪŠ l-LJLJN2Ōl-fă āK2dzƦ ŌzyăĀRŠŪ l-ff ŌdzYdzl-ŪĀŌŠ λY LJl-ŌŪă

The modelling results have identified that the criteria was not exceeded at either sensitive receptor during the life of the quarry for dust deposition, TSP PM₁₀ or PM_{2.5} concentrations. Best practice mitigation recommendations to suppress dust dispersal are employed to ensure compliance with the criteria at all times.

To conclude, this assessment has determined that the operation of this site as a quarry will not adversely impact nearby sensitive receptors and is suitable for development.

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1. INTRODUCTION

Vipac Engineers & Scientists Ltd (Vipac) was commissioned to prepare an air quality assessment for the proposed quarry known as Borrow 7 Quarry. The purpose of this report is to evaluate the potential impacts from various activities and to provide recommendations to mitigate and minimise any potential impacts that might have an effect on the surrounding community.

Due to the distances between the quarry and the nearby sensitive receptors, the emissions from vehicle exhausts and generators are insignificant compared to the potential impacts of dust and particles from the quarrying activities.

2. PROJECT DESCRIPTION

2.1 OVERVIEW

To facilitate development of the Carmichael Coal Mine and Rail Project, a quarry, referred to as Borrow 7 is to be developed to provide material for:

- Embankment fill for the rail corridor; and
- Capping and ballast materials for the rail corridor.

The Borrow 7 quarry is to be located approximately 4.8 km west of the Gregory Development Road and at its closest, approximately 800 m south of the proposed rail line, which will service the Carmichael Coal Mine and Rail. A location map is shown in Figure 2-1.

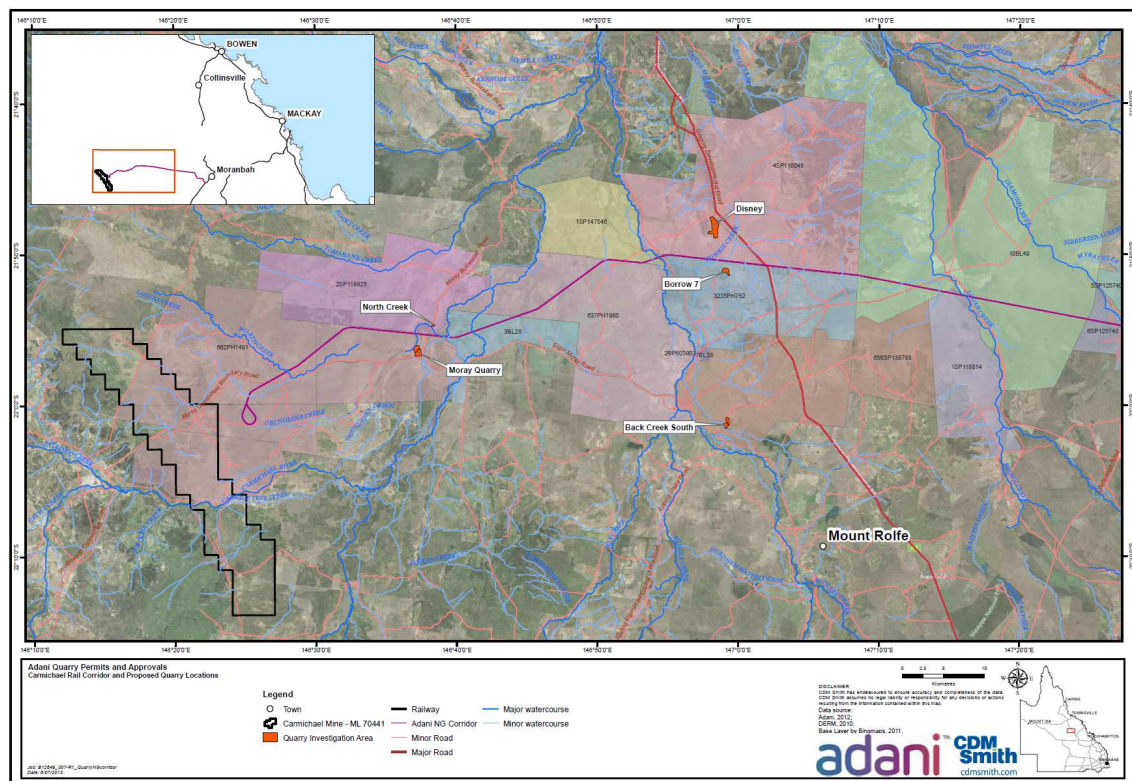


Figure 2-1: Location of Adani Quarries

2.2 EXTRACTION METHODS

Processing of the material will occur at the quarry face with an excavator loading into a jaw followed by a suitable secondary and tertiary screening and crushing process. Stockpiling of the material will occur generally off the resource area although once the quarry has expanded significantly, stockpiling of materials will likely also occur primarily on the quarry floor at 190 m AHD.

The extraction will involve development of a 15 m high working bench between 220 and 205 m AHD. This material will be removed primarily by drill and blast. The site layout is shown in Figure 2-2 to Figure 2-4.

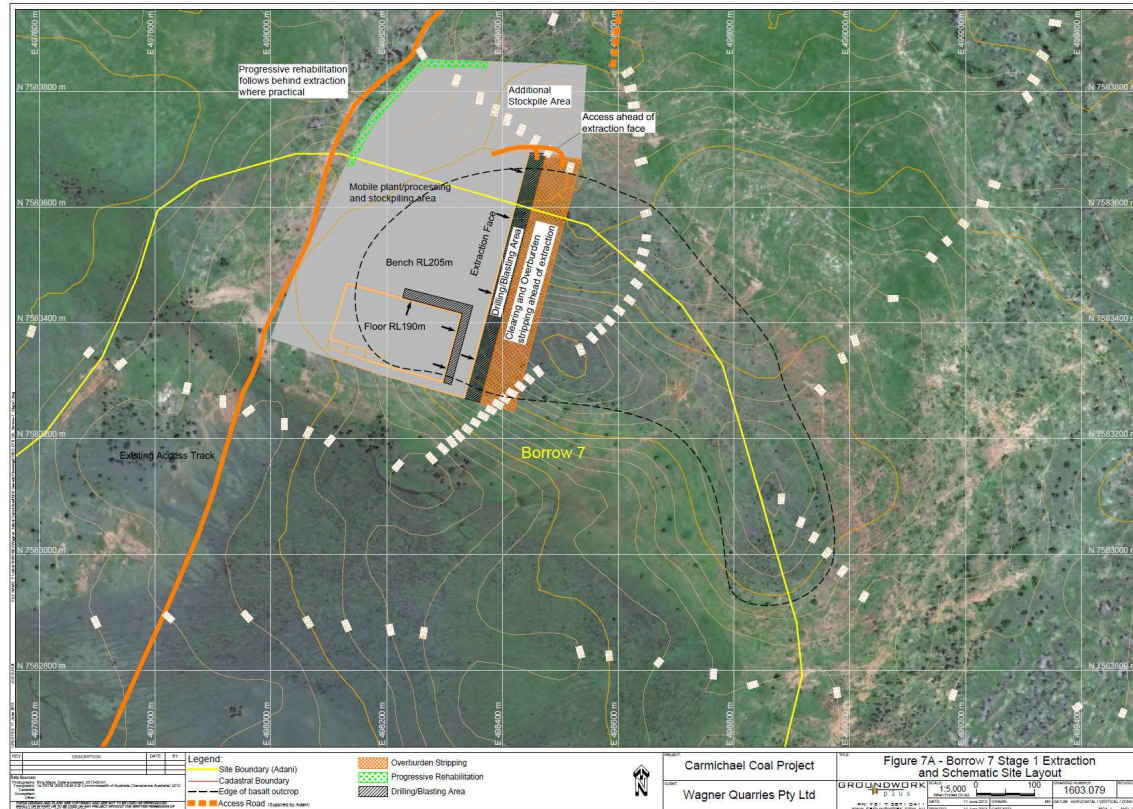


Figure 2-2: Borrow 7 Stage 1 Layout

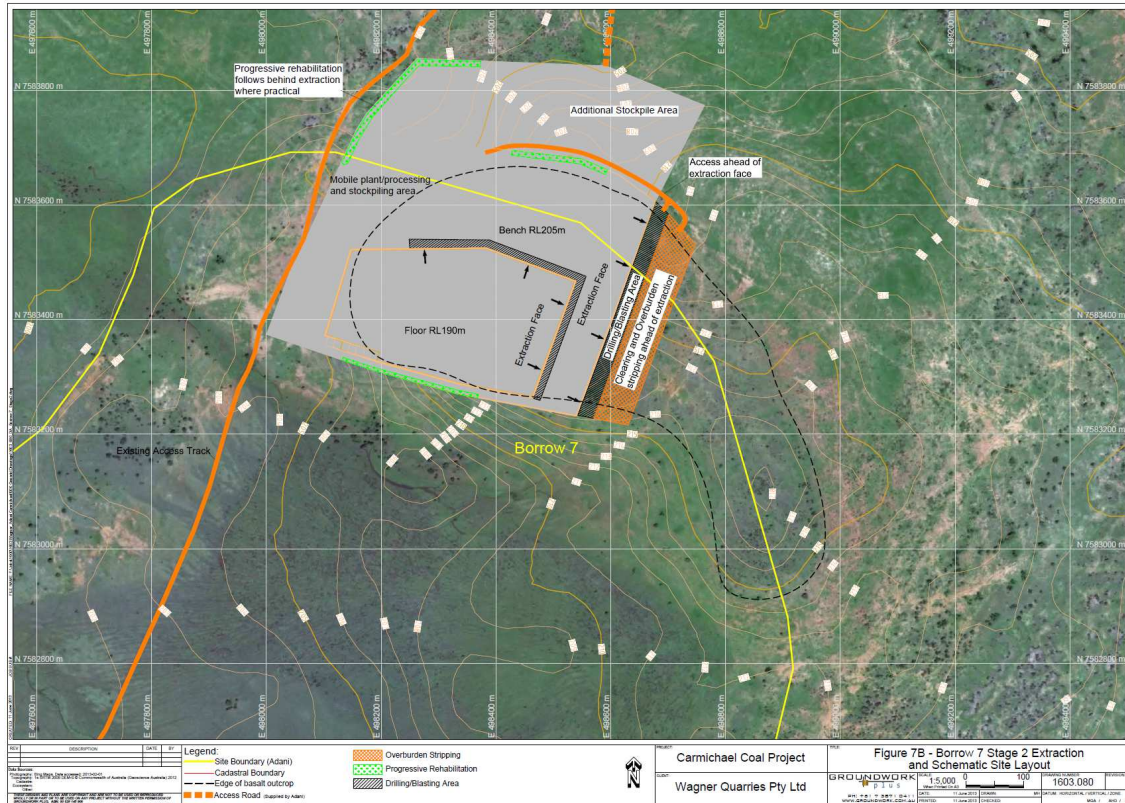


Figure 2-3: Borrow 7 Stage 2 Layout

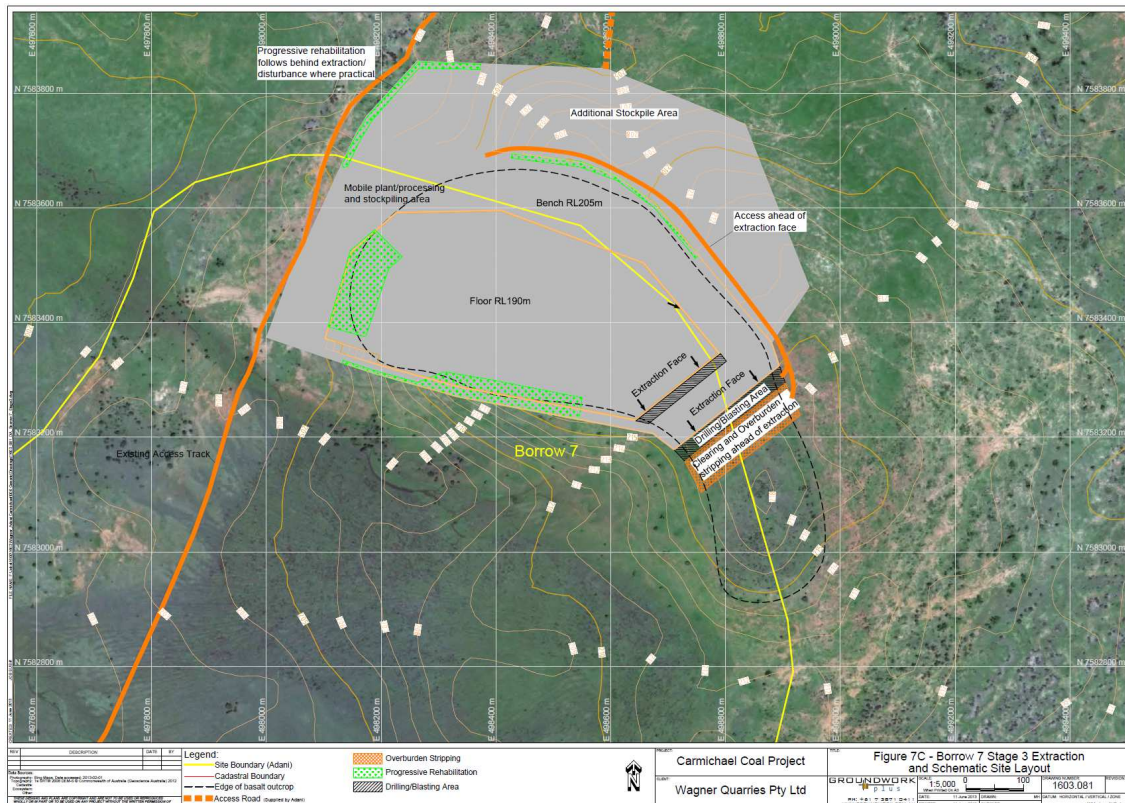


Figure 2-4: Borrow 7 Stage 3 Layout

The height of the stockpile has been calculated to be seven metres high, based on the 'just in time' principle to accommodate the amount of material quarried during peak production.

2.3 SITE ACTIVITIES

2.3.1 Equipment

The following equipment will be used at the Borrow 7 Quarry, which is of concern for this assessment is:

- 2x Jaw Crushers (LT 120/LT3054) – Primary Crushers;
- 4x Cone Crushers (Metso HPS 300) – Secondary and Tertiary Crushers;
- 3x Screens (1x ST4.8, 2x 2400 Series Warrior Screens);
- 6x Excavators (CAT 349DL);
- 4x Loaders (CAT980H);
- 1x Water truck (Mack 8x4 Wheeler);
- 6x light vehicles (Ford Ranger);
- 1x 100 kVA Genset;
- 1 x 70,000L Fuel Pod (Transtank T69);
- 7+12 Light plants;
- 6x Dump Trucks (CAT 740B);
- 1x Grader (CAT- 14M);
- 1x Service Trucks (Hino);
- 1x Cranes (20T Franna);
- 1x Elevated Work Platform (GENIE);
- 1x Bobcats (CAT242B3);
- 1x 4 Tonne Site Truck (Tilt Tray);
- 1x Tele handler (TH414);
- 1x Fuel /Oil Service Truck (MACK 8x4);
- 1x Hammer (SANDVIK);
- 1x 70,000 LTR Fuel Pod (Transtank T69); and
- 1x Precoat Plant+ Radial Stacker (Thomas Manufacturing).

Blasting activities will release around 60,000-80,000 tonnes of material and occur approximately once or twice a month in high production months. The depth will be approximately 8-10 m and occur generally in the afternoon period.

2.3.2 Operational Hours

The quarry will operate 24 hours a day, 360 days per year and there is a wet weather contingency in the schedule.

2.3.3 Transportation

The haul road will be 40 km/h speed limit and approximately 10 trucks will haul a maximum 209,906 tonnes per month during peak production in November 2015.

2.3.4 Site Illumination and Electrical Generation

ALLIGHT mobile lighting towers (7+12) powered by approximately 21 kW generators shall be used to illuminate the site. The lights will run approximately between 5 pm to 7 am. One (1) 10kVA enclosed genset will be used to power the site facilities. These generators will run 24 hours.

2.3.5 Production Schedule

The expected output is 2,363,705 tonnes over a 24-month operational life. The monthly output is shown in Figure 2-5, with the highest extraction of 209,906 tonnes expected to occur in November 2015. This schedule is subject to change with the construction schedule, delays in approvals or other factors impacting construction, which may extend the operating period of the Borrow 7 Quarry.

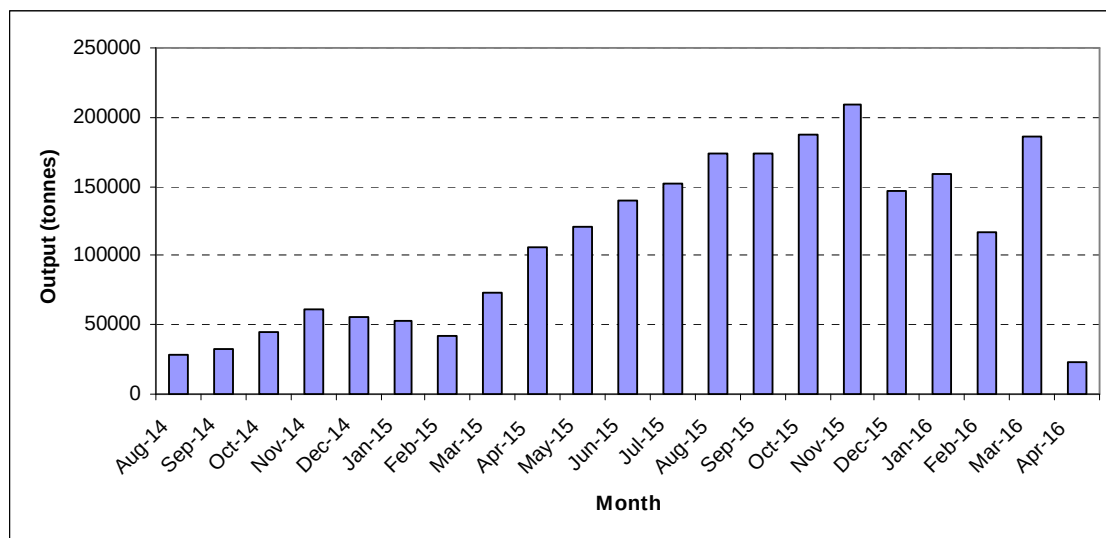


Figure 2-5: Expected Output by Month

3. SITE DESCRIPTION

3.1 LOCAL METEOROLOGY

Local meteorology has been generated for the Disney Quarry using the 2006 database from The Air Pollution Model (TAPM), which is a 3-dimensional prognostic model developed and verified for air pollution studies by the CSIRO (Figure 3-1).

Winds occur predominantly from the north east during spring and summer, often no greater than 5 m/s (18 km/h). In autumn and winter, the dominant winds occur from the south east with the highest wind speed of 8 m/s (28 km/h). The cooler, drier air is characteristic of the dominant southeast winds of moderate strength, usually with long calm periods in the winter.

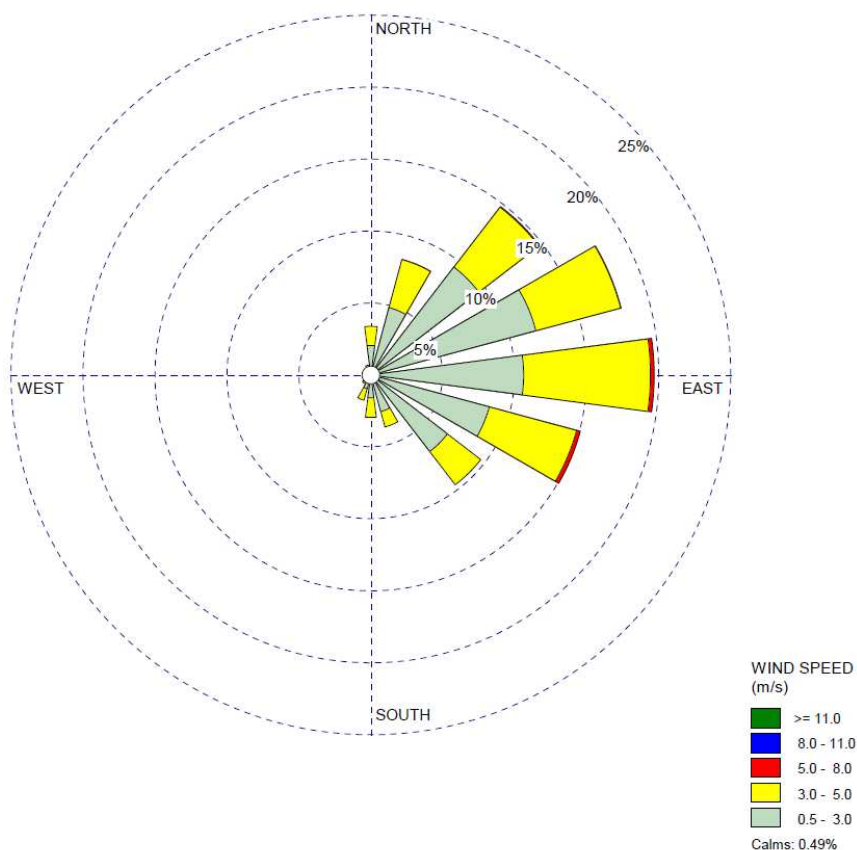


Figure 3-1: Annual Wind Rose (2006)

3.2 SENSITIVE RECEPTORS

The nearest sensitive receptor is Old Twin Hills, approximately 6.6 km southwest of the Borrow 7 Quarry. The Disney Homestead is located approximately 7.1 km north east and Twin Hills is located approximately 10.9 km south west of the Borrow 7 Quarry, as shown in Figure 3-2.

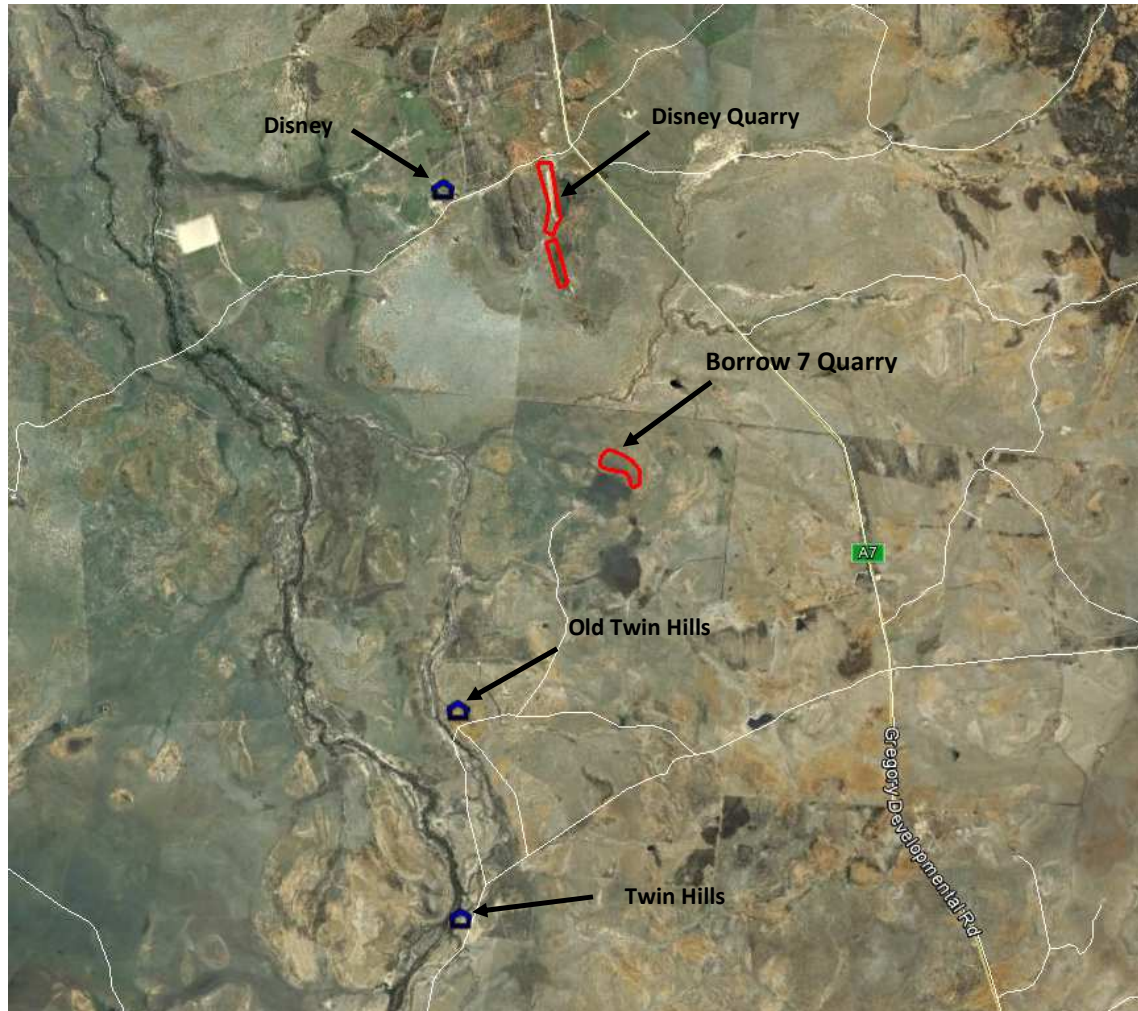


Figure 3-2: Sensitive Receptors near Borrow 7 Quarry

4. DUST POLLUTION - ACTIVITIES & SIGNIFICANCE

The total suspended particulates (TSP) consist of coarse and fine particles. In the atmosphere particles range in size from 0.1 to 50 μm ; the size of the particles determines how far into the respiratory system the particles penetrate. Particles with an aerodynamic diameter greater than 10 μm are screened out in the upper respiratory tract while particles smaller than 10 μm (PM_{10}) may penetrate into the lower respiratory tract.

4.1 ACTIVITIES

Activities that can generate dust include ripping, stockpiling, blasting, loading and unloading, and haulage. The relevance of each of these activities is influenced by quantity, duration and location, as well as site topography, meteorology and proximity of local receptors.

4.2 SIGNIFICANCE

Larger particles are associated with public nuisance, being particularly noticeable on clean surfaces such as cars, windows and window ledges, or surfaces that are usually expected to remain free of dust. Deposition may impact dust-sensitive locations such as schools, retirement homes, and hospitals and deter the use of amenity areas by local residents.

The potential significance of dust is influenced by the size of particles:

- Large dust particles (greater than 30 μm) make up the greatest proportion of dust and largely deposit within 100 metres of the source;
- Intermediate sized particles (10 to 30 μm) are likely to travel 200 to 500 metres; and
- Smaller dust particles (less than 10 μm , also known as PM_{10}) make up a smaller proportion of the dust and remain airborne for longer, dispersing more widely and depositing more slowly over a wider area, although impacts beyond 1 km are unlikely.

4.3 CUMULATIVE IMPACTS

During the excavation of the Borrow 7, activities will also be occurring at the Disney Quarry (please refer to Figure 2-1). For this assessment the cumulative affect of Borrow 7 and Disney Quarries will be quantified. The activities associated with the Back Creek South, Moray, and North Creek quarries will also be occurring at the same time. The distances between these quarries are significant, therefore cumulative impacts of dust will not occur at the closest receptors as identified in Figure 3-2.

5. REGULATORY FRAMEWORK & PROJECT CRITERIA

5.1 NATIONAL LEGISLATION

In 1998, the National Environment Protection Council (NEPC) made Australia's first national ambient air quality standards as part of the National Environment Protection Measure for Ambient Air Quality (known as 'Air NEPM'). The Air NEPM sets national standards for the key air pollutants; carbon monoxide, ozone, sulphur dioxide, nitrogen dioxide, lead and particles (PM₁₀ and PM_{2.5}). The Air NEPM requires the state governments to monitor air quality and to identify potential air quality problems.

5.2 STATE LEGISLATION

The *Environmental Protection Act (1994)* has an extremely broad objective "to achieve ecologically sustainable development in Queensland", however in practice the legislation concentrates primarily on point-source pollution and land contamination. This is partly due to the existence of a range of other legislation that deals with protection of other aspects of the environment.

Subordinate to the *Environmental Protection Act 1994* is the Queensland *Environmental Protection (Air) Policy 2008* (EPP Air). Section 7 of the EPP (Air) states "The environmental values of the air environment to be enhanced or protected under this policy are the qualities of the air environment that are conducive to suitability for the life, health and wellbeing of humans."

Ambient air quality goals relevant to this Project are prescribed by the EPP. Provided are criteria for PM₁₀ (particulate matter less than 10 microns in diameter), PM_{2.5} (particulate matter less than 2.5 microns in diameter). The most critical of these is the PM₁₀ criterion as the fraction of PM_{2.5} against PM₁₀ emissions from mining operations is small (typically less than 10%).

Deposited dust is commonly used as a measure of the potential for dust nuisance. If present at high levels deposited dust can reduce the amenity of an area. No formal criteria for dust deposition exist within Queensland, however the Department of Environment and Heritage Protection (EHP) has recommended a nuisance guideline of 120 mg/m²/day.

5.3 PROJECT CRITERIA

From all of the regulations, the strictest applicable criteria have been selected for this assessment and are presented in Table 5-1.

Table 5-1: Project Air Quality Goals

Pollutant	Basis	Criteria	Averaging Time	Exceedences*
TSP	Human Health	90 µg/m ³	1-year	-
PM ₁₀	Human Health	50 µg/m ³	24-hour	Five days per year
PM _{2.5}	Human Health	25 µg/m ³	24-hour	-
Dust deposition	Amenity	120 mg/m ² /day	30 days	-

* Allowance intended for natural events such as dust storms or bushfires

6. EXISTING AIR QUALITY

In line with common practice, to assess the impact of a quarry the incremental impact is quantified and added to existing background pollutant concentrations. Monitoring was conducted for particulate matter (PM₁₀) for a period of six (6) days and the daily averages derived for comparison to long term monitoring conducted by DERM in similar locations.

The weather observations during the monitoring period were obtained from the Bureau of Meteorology for the Emerald, located on Emerald Airport (station number 035264). During this time no rainfall was recorded as shown below in Table 6-1.

Table 6-1: Weather Observations During Monitoring Period

Date	9:00 AM			3:00 PM			Daily
	Temp (°C)	Direction	Speed (km/h)	Temp (°C)	Direction	Speed (km/h)	Rainfall (mm)
27/3/2013	24.9	ESE	17	30.8	ENE	19	0
28/3/2013	24.9	ESE	17	30.9	E	17	0
29/3/2013	24.2	NNE	11	30.8	ESE	17	0
30/3/2013	25.5	E	7	31.0	NE	15	0
31/3/2013	24.8	N	13	31.3	NNE	15	0
1/4/2013	21.8	ESE	13	26.5	NE	9	0

The existing levels of particulate matter were monitored at Disney Homestead between the 27th March and 1st April 2013. This receiver was chosen, in order to measure regional concentrations. The monitoring was carried out using an environmental dust monitor, which records a particulate matter value every five minutes. Analysis of the data determined the background PM₁₀ concentration to be 10 µg/m³, which is the 70th Percentile, in line with common practice and the Environmental Impact Statement for the Carmichael Coal Mine and Rail Project.

The chart of the monitoring data is shown in Appendix A.

The PM₁₀ concentration has been used to derive appropriate background concentrations for PM_{2.5} and TSP. The Australian Coal Review states that an average of 40% of TSP was found to consist of particles in the size range of PM₁₀. Particles in the size range of PM_{2.5} were found to comprise only 4% of TSP or equivalently 10% of PM₁₀.

The following estimates of background levels of dust will be used:

- Annual average concentration of TSP of 30 µg/m³;
- 24-hour average concentration of PM₁₀ of 10 µg/m³;
- 24-hour average concentration of PM_{2.5} of 1 µg/m³; and
- Dust deposition of 50 mg/m²/day.

7. METHODOLOGY

7.1 MODELLING

A 3-dimensional dispersion wind field model, CALPUFF, has been used to simulate the impacts from the mine. CALPUFF is an advanced non-steady-state meteorological and air quality modelling system developed and distributed by Earth Tech, Inc. The model has been adopted by the U.S. Environmental Protection Agency (U.S. EPA) in its '*Guideline on Air Quality Models*' as the preferred model for assessing near-field applications involving complex meteorological conditions such as calm conditions.

To generate the broad scale meteorological inputs to run CALPUFF, this study has used the model The Air Pollution Model (TAPM), which is a 3-dimensional prognostic model developed and verified for air pollution studies by the CSIRO.

The default TAPM databases for terrain, land use and meteorology were used in the model. The meteorological modelling year was 2006 and four nested grid domains were used with grid spacing of 30 km, 10 km, 3 km and 1 km.

7.2 EMISSION RATES

The emission rates for individual quarrying activities were obtained from Environment Australia (2012)-National Pollutant Inventory (NPI) - *Emissions Estimation Technique (EET) Manual for Mining*. The EET for mining contains emission factors covering a range of mining and extraction activities and the NPI emission factors are derived from the USEPA AP-42. These emission rates were then implemented into the CALPUFF model taking into consideration the phases of the quarry and the emission area (m²) for representative predictions. Table 7-1 lists the emission rates for the equipment and activities associated with the Borrow 7 Quarry with an output of 209,906 tonnes in November 2015.

Table 7-1: Emission Factors for Borrow 7 Activities (g/second)

Source	NPI based Emission Factor (gram/second)			Controls Assumed
	TSP	PM ₁₀	PM _{2.5}	
Bobcat CAT 242B3	2.9289	0.7556	0.3075	None Applied
Loader CAT 980H	1.6177	0.4173	0.1699	None Applied
Excavator	0.3207	0.1149	0.0337	None Applied
Water Truck/Fuel Truck	0.3532	0.0911	0.0371	Watering – 2 litres/m ² /hour
Stockpile	0.0001	0.0001	0.00001	None Applied
RIP 2	0.4445	0.1306	0.0467	None Applied
Haul Trucks	3.879	1.001	0.407	Watering – 2 litres/m ² /hour
Railway Deposition	0.972	0.348	0.102	None Applied
Screening	0.025	0.009	0.003	None Applied
Crushing	0.002	0.001	0.000	None Applied
Grader CAT 14M	0.132	0.059	0.014	None Applied
Dump trucks CAT 740B	0.729	0.261	0.077	None Applied

The emission rates for dust and PM₁₀ from various quarrying activities are listed in Table 7-1. These emission factors are derived from the NPI and shown here in grams per second. It can be seen from the Table that the haul road movements and maintenance generates the greatest TSP, PM₁₀ and PM_{2.5} emissions per second.

The emissions from blasting have not been predicted due to the short nature of the event and the large fragments displaced during the blast, which immediately return to the ground.

8. IMPACT ASSESSMENT

This section details the quantitative assessment of dust deposition, TSP, PM₁₀ and PM_{2.5} concentration impacts for each scenario, as described below, of the quarry activities upon the Disney and Old Twin Hills Receptors.

Whilst the outputs may change significantly, the majority of the activities will remain the same, with the number and frequency of the haul trucks changing to reflect the output rates.

Activities associated with the initial construction phase are not expected to be a source of dust or particulate emissions therefore this phase has not been modelled. In order to predict the worst-case scenario the maximum output of 209,906 tonnes in November 2015 which has been modelled over a full year. The chart in Figure 2-5 identifies that for the majority of the quarry's life, the output will be significantly less and thus the impacts will be lower than the predictions in this Section.

The TSP, PM₁₀, PM_{2.5} and dust deposition results for the closest sensitive receptor are detailed in Table 8-1 and the modelling plots are shown in Appendix A.

Table 8-1: Borrow 7 Quarry Dust Results at Disney Receptor

Pollutant	Background Levels	Quarry Related Activities	Total	Criteria	Compliance
Dust Deposition (mg/m ² /day)	50	7.5	57.5	120 mg/m ² /day (30 days)	✓
TSP (µg/m ³)	30	0.8	30.08	90 µg/m ³ (1-year)	✓
PM ₁₀ (µg/m ³)	10	11.96	21.96	50 µg/m ³ (24-hour)	✓
PM _{2.5} (µg/m ³)	1	6.76	7.76	25 µg/m ³ (24-hour)	✓

Table 8-2: Borrow 7 Quarry Dust Results at Old Twin Hills Receptor

Pollutant	Background Levels	Quarry Related Activities	Total	Criteria	Compliance
Dust Deposition (mg/m ² /day)	50	7.61	57.61	120 mg/m ² /day (30 days)	✓
TSP (µg/m ³)	30	1.27	31.27	90 µg/m ³ (1-year)	✓
PM ₁₀ (µg/m ³)	10	8.57	18.57	50 µg/m ³ (24-hour)	✓
PM _{2.5} (µg/m ³)	1	3.77	4.77	25 µg/m ³ (24-hour)	✓

It can be seen from Table 8-1 and Table 8-2 that there are no predicted exceedences of the EHP (EPP (Air)) objectives at either Disney Receptor or Old Twin Hills Receptor. High background levels dominate the dust deposition, TSP and PM₁₀ concentrations rather than emissions from the various quarry activities, whereas the concentration of PM_{2.5} are a direct result of the quarry activities at both receptors.

The highest contribution for all pollutants is the emissions from haul truck movements and the quarry itself; the haul road movements are based on the highest output in November 2015 and will be lower during all other months of the quarry life. As such, the emissions from vehicle movements will be lower as less material will be transported from the quarry. The duration of the maximum output, upon which this assessment is based is only one month therefore, the levels presented in Table 8-1 are the worst case for one month and it can therefore be concluded that the impacts predicted are conservative.

Traffic movements of the staff vehicles arriving and leaving site were not available at the time of writing this report, however, these emissions will be negligible compared to the haul road emissions. As such, these were not modelled. The ambient air monitoring data suggests that the existing air quality at the Project location is good. This assessment has incorporated conservative background concentrations in the model to incorporate other emission sources.

The Victorian EPA has defined buffer guidelines for a variety of industries as a risk management tool. It is acknowledged that separation distances provide an additional level of protection by allowing more distance and space in which emissions may dissipate without adversely affecting sensitive receptors.

Applying the guidelines assesses the suitability of proposed development locations and the potential impacts of development. These guidelines assume a good standard of dust management is carried out on site. The recommended buffer distances for quarrying are as follows:

- a) Hard rock with blasting – 500 m; and
- b) Any material without blasting – 200 m.

The distance between the quarry and the sensitive receptors are significantly greater than the recommended buffer distances; therefore impacts from the quarry upon the sensitive receptors are not expected.

8.1 CUMULATIVE IMPACTS

During the excavation of the Borrow 7 Quarry, activities associated with the Disney Quarry will also be occurring. The assessments for both quarries were based on peak output, with these peak outputs occurring in May 2015 for Disney Quarry and in November 2015 for Borrow 7. In order to consider the cumulative impacts, two things need to be taken into account:

- 1) The main contribution from the Disney Quarry is from the haul road movements that are related to output. The output of the Disney Quarry in November 2015 will be 287,277 tonnes, which is five times lower than the maximum output, therefore the concentrations from the Disney Quarry significantly reduced; and

2) The Disney Quarry is located east whereas the Borrow 7 Quarry is located south east of the Disney Homestead. As the wind cannot flow in two directions simultaneously throughout the day, the receptor will receive emissions from either the Disney Quarry or the Borrow 7 Quarry, but not emissions from both at the same time.

As such, the combined emissions from the quarries are not expected to exceed the relevant criteria at the Disney Receptor.

9. MITIGATION

The modelling results have identified that the criteria was not exceeded for any Sensitive Receptors during the life of the quarry for dust deposition or PM₁₀ concentration. It is recommended that best practice mitigation to suppress dust dispersal be employed to ensure compliance with the criteria at all times.

Best practice mitigation measures described in this section will further minimise the potential for health issues and nuisance from an air quality perspective:

- Minimising the extent of clearing which bares earth;
- Water trucks should be summoned based on visual dust inspection;
- As a good management practice, on haul and access roads moderate level watering ($>2\text{L/m}^2/\text{h}$) to be adopted wherever there is a potential for emissions to exceed the criteria limits such as during high winds;
- Where it is apparent moderate watering frequency is not being effective high level watering ($\sim 4\text{L/m}^2/\text{h}$) is to be adopted or operations reduced or ceased;
- Water sprays should be used for excavation activities where necessary;
- Water spraying of stockpiles should be done on a frequent basis in order to keep the raw material moist to suppress fugitive dust release. The frequency of watering will depend on weather conditions;
- Light and heavy vehicle speed restriction of 40 km/hour should be imposed on unpaved surfaces within the quarry;
- Using sealed roads where the option exists for the purpose of transporting materials;
- Public sealed roads used by the Project should be regularly cleaned and swept;
- Worked areas should be stabilised as soon as possible after earthworks have been completed (example: re-vegetation, paving, mulch);
- General awareness of minimising dust levels and its benefits should be instructed to workforce personnel;
- Where appropriate public consultation processes should be implemented that inform residents of the potential duration and extent of impacts, thereby allowing them to take appropriate action (such as not hanging out their washing on those days); and
- Complaint management processes that ensure complaints are readily registered and rapidly addressed.

10. CONCLUSION

This report has evaluated the potential impacts of dust generated from various activities and has provided recommendations to mitigate and minimise any potential impacts that might have an effect on the surrounding community.

This assessment has used the worst-case output month, November 2015 and modelled over a full year to ensure compliance during the life of the quarry.

The emission factors for various quarrying activities were derived from US EPA AP42 and Environment Australia (2012) National Pollutant Inventory (NPI)- *Emissions Estimation Technique (EET) Manual for Mining*.

The modelling has predicted no exceedences of the EHP (EPP (Air)) objectives at either the Disney receptor or Old Twin Hills receptor. High background levels dominate the dust deposition and TSP rather than emissions from the various quarry activities, whereas the smaller particles, PM₁₀ and PM_{2.5} are a direct result of the quarry activities.

The highest contribution for all pollutants is the emissions from haul truck movements and the quarry itself; the haul road movements are based on the highest output in November 2015 and will be lower during all other months of the quarry life. As such, the emissions from vehicle movements will be lower as less material will be transported from the quarry. The duration of the maximum output, upon which this assessment is based is only one month therefore, the levels presented are the worst case for one month and it can therefore be concluded that the impacts predicted are conservative.

The cumulative impacts of the Borrow 7 quarry and the Disney Quarry are not expected to exceed the relevant criteria at the Disney Receptor.

The modelling results have identified that the criteria was not exceeded at either sensitive receptor during the life of the quarry for dust deposition, TSP PM₁₀ or PM_{2.5} concentrations. Best practice mitigation recommendations to suppress dust dispersal are employed to ensure compliance with the criteria at all times.

To conclude, this assessment has determined that the operation of this site as a quarry will not adversely impact nearby sensitive receptors and is suitable for development.

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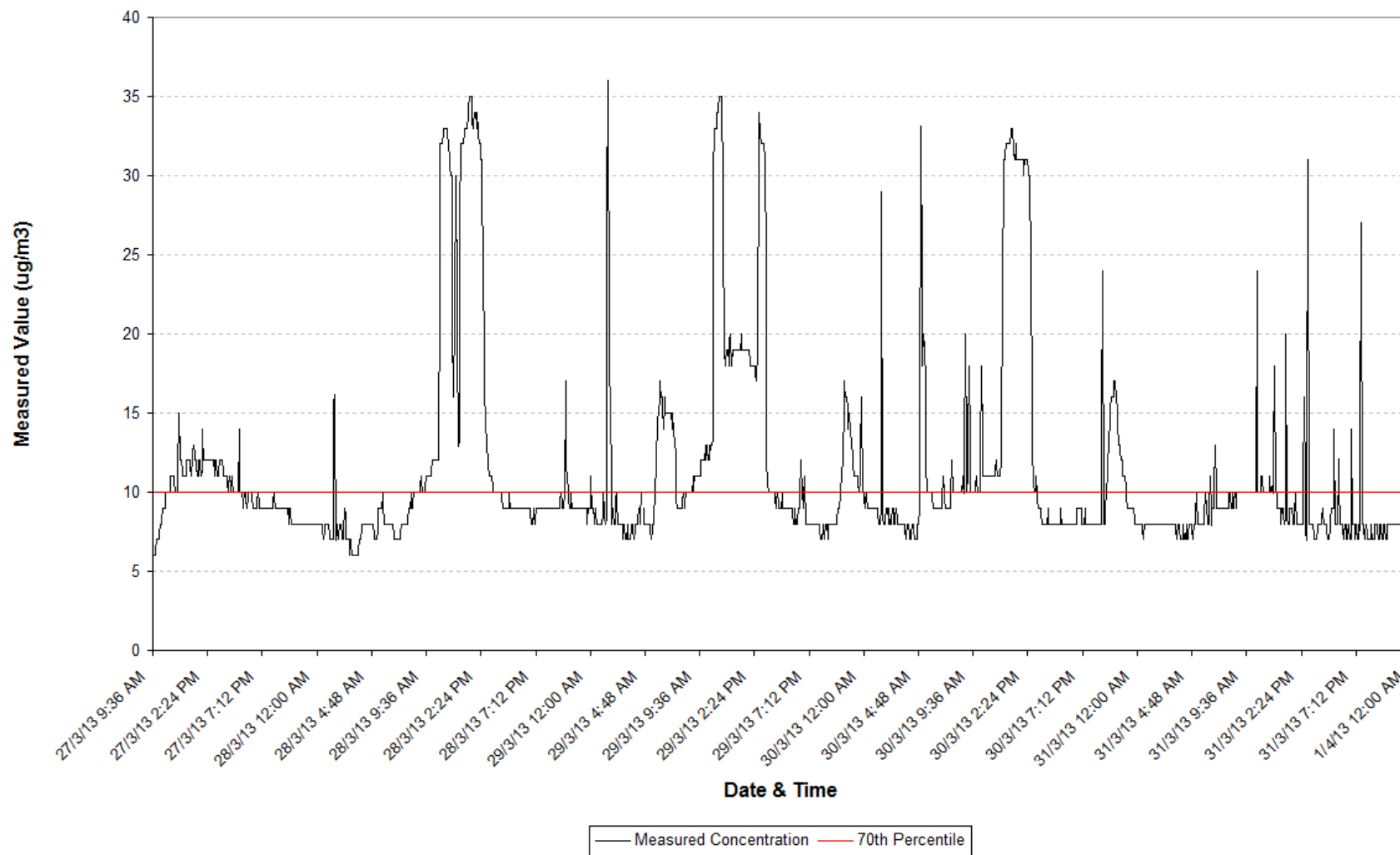
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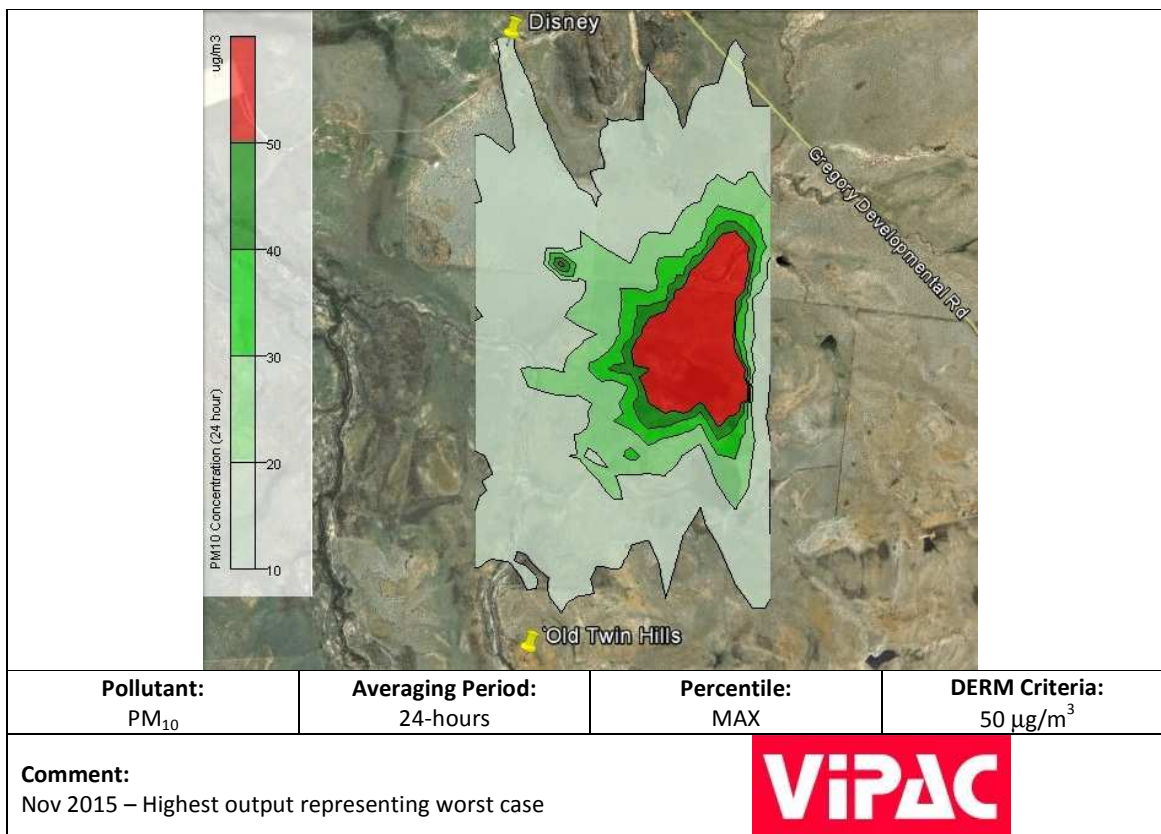
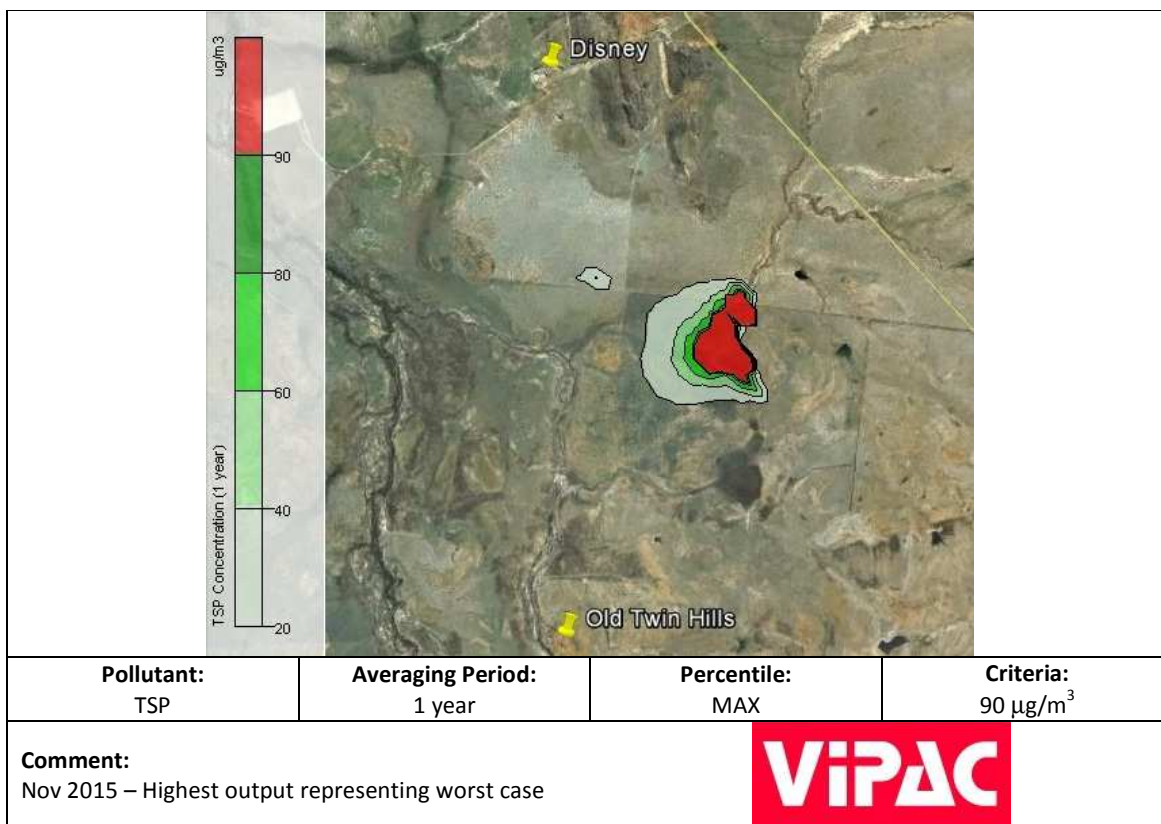
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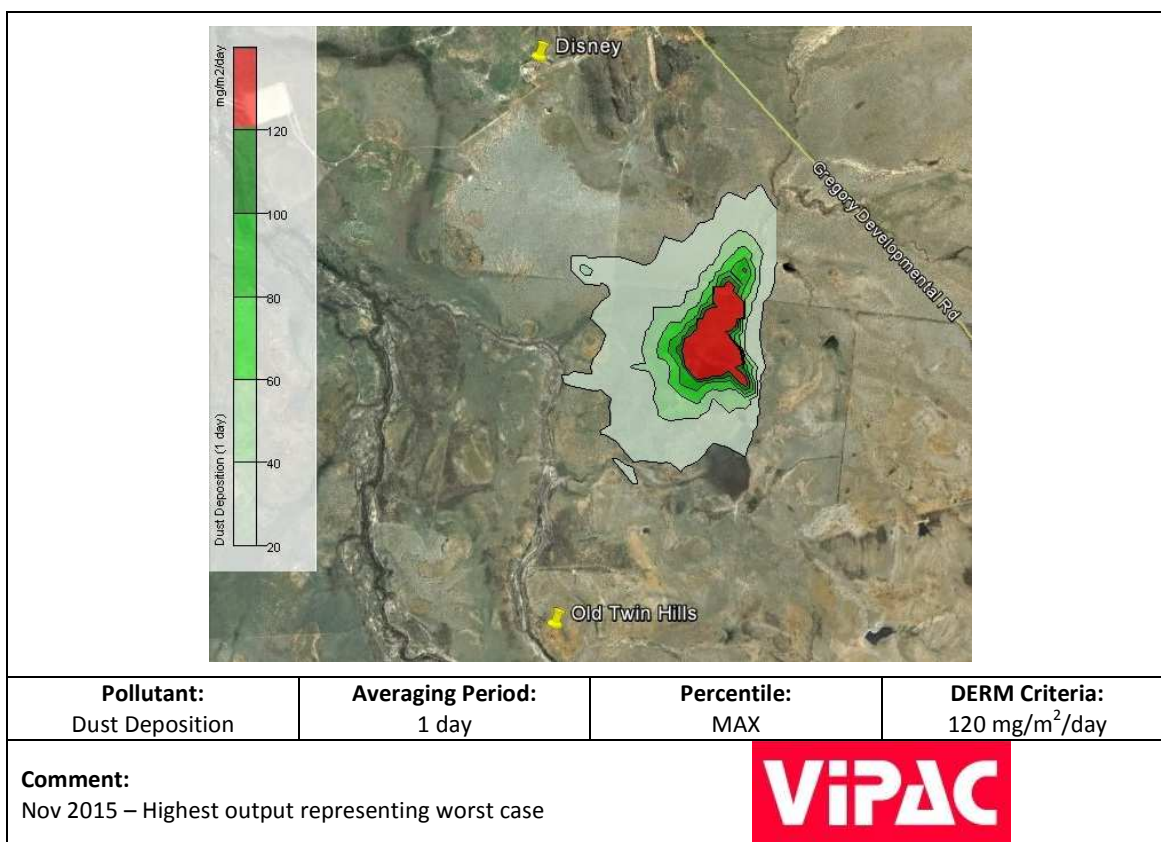
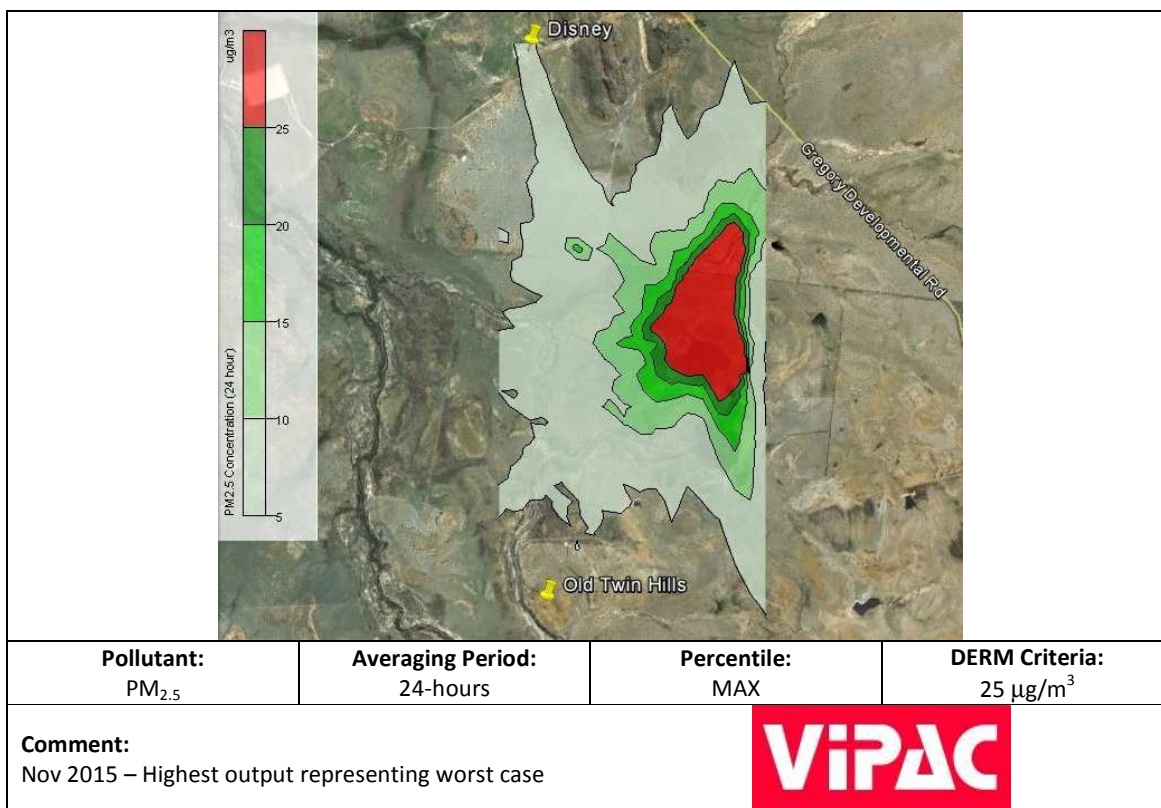
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APPENDIX A: MONITORING DATA

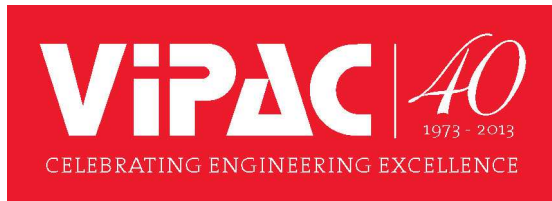


APPENDIX B: CONTOUR PLOTS





Appendix L – Noise Impact Assessment



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CDM Smith Australia Pty Ltd

Borrow 7 Quarry Noise Assessment



Report No. 70Q-12-0427-TRP-514285-2

8 July 2013

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EXECUTIVE SUMMARY

Vipac Engineers & Scientists Ltd (Vipac) was commissioned to prepare a noise assessment for the proposed operation of a quarry known as Borrow 7 Quarry. The purpose of this report is to evaluate the potential impacts of noise generated from various activities and to provide recommendations to mitigate and minimise any potential impacts that might have an effect on the surrounding community.

The EPP (Noise) Policy 2008 Acoustic Quality Objectives have been applied to this Project. The dwelling (indoors) day-time and night-time criteria have been applied. Where the Acoustic Quality Objective is an indoor level, a façade transmission loss of 7 dB(A) has been applied to obtain an outdoor noise criterion.

Noise predictions have been conducted using SoundPLAN noise modelling software. For this assessment, the CONCAWE noise prediction methodology has been used to take into consideration the weather conditions at the site. The significant operational noise sources used for this assessment have been obtained from Vipac's own database of noise emissions based on the type and number of noise generating equipment and plant advised by Adani Mining Pty Ltd.

The existing noise environment has been determined through attended and unattended ambient noise monitoring between 27th March and 4th April 2013. The noise monitoring locations have been identified as Disney Receptor and Old Twin Hills Receptor.

Whilst the quarry extraction output may change significantly, the majority of the activities will remain the same, with the number and frequency of the haul trucks changing to reflect the output rates.

The worst-case scenario of 209,906 tonnes to be extracted and hauled from the Borrow 7 site in November 2015 has been assessed. The noise assessment has considered the extraction and hauling activities separately and in combination. Predictions for the combined activities have indicated that exceedances of the external day-time and night-time $L_{Aeq,adj,1hr}$ criteria would not be expected for the operation of the Borrow 7 Quarry alone during neutral and adverse weather conditions at noise sensitive receptors.

A conservative L_{Amax} noise level was calculated for adverse weather conditions to compare with the outdoor $L_{A1,adj,1hr}$ Acoustic Quality Objective. Under the worst-case adverse noise propagation, the maximum noise levels are expected to comply with the 47 dB(A) $L_{A1,adj,1hr}$ noise criterion.

A conservative cumulative noise assessment has also been conducted to include the operation of the Borrow 7 and Disney Quarries, allowing for the possibility that the peak production months of these quarries may coincide. Vipac notes that this noise impact assessment is conservative, as according to the production schedules, peak production months of Borrow 7 and Disney Quarries are not expected to coincide.

Under neutral, a marginal exceedence (1 dB(A)) of the night-time $L_{Aeq,Adj,1hr}$ noise criteria at the Disney receptor was found when Borrow 7 and Disney are operating (coinciding peak production months). Noise levels at this receptor are dominated by the extraction activities of the Disney Quarry, however the Borrow 7 quarry does contribute to the exceedence.

Under adverse weather conditions, the night-time $L_{Aeq,Adj,1hr}$ noise criteria is exceeded by 4 dB(A) at the Disney receptor during coinciding peak production months. The highest contributor of noise causing the exceedence is the extraction activities from Disney. Borrow 7 noise emissions contribute only 1 dB(A) to this noise level.

Recommendations have been provided in this report to mitigate the noise impacts.

It is also concluded that ground vibration and airblast overpressure from blasting can be controlled to acceptable levels at the currently identified residential receptor locations using standard blasting practices.

Damage to infrastructure by blasting (vibration and fly rock) must be avoided by limiting the MIC. A risk analysis would be required to limit the blast impact on the infrastructure.

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Overall, the Borrow 7 Quarry will have an intensive use for a limited period of time to produce materials for road upgrades and the Carmichael mine, after which it will drop to nominal amounts required for road maintenance and use by Council. As such, noise impacts will be temporary.

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1. INTRODUCTION

Vipac Engineers & Scientists Ltd (Vipac) was commissioned to prepare a noise assessment for the proposed quarry known as Borrow 7 Quarry. The purpose of this report is to evaluate the potential impacts from various activities and to provide recommendations to mitigate and minimise any potential impacts that might have an effect on the surrounding community.

2. PROJECT DESCRIPTION

2.1 OVERVIEW

To facilitate development of the Carmichael Coal Mine and Rail Project, a quarry, referred to as Borrow 7 is to be developed to provide material for the embankment fill for an infrastructure corridor.

The Borrow 7 quarry is to be located approximately 4.8 km west of the Gregory Development Road and at its closest, approximately 800 m south of the proposed rail line, which will service the Carmichael Coal Mine. A location map is shown in Figure 2-1.

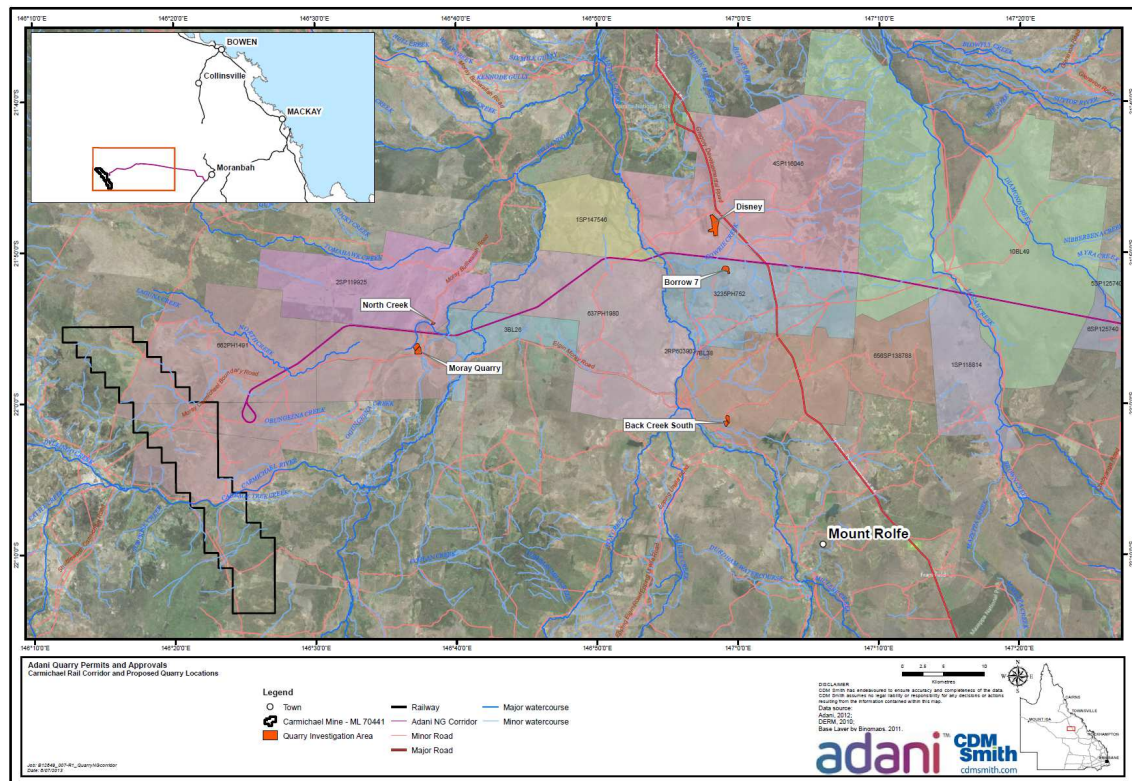


Figure 2-1: Location of Quarries

2.2 EXTRACTION METHODS

Processing of the material will occur at the quarry face with an excavator loading into a jaw followed by a suitable secondary and tertiary screening and crushing process. Stockpiling of the material will occur generally off the resource area although once Borrow 7 Quarry has expanded significantly, stockpiling of materials will likely also occur primarily on the quarry floor at 190 m AHD.

Stage 1 of extraction will involve development of a 15 m high working bench between 220 and 205 m AHD. This material will be removed primarily by drill and blast.

The site layout is shown in Figure 2-2 to Figure 2-4.

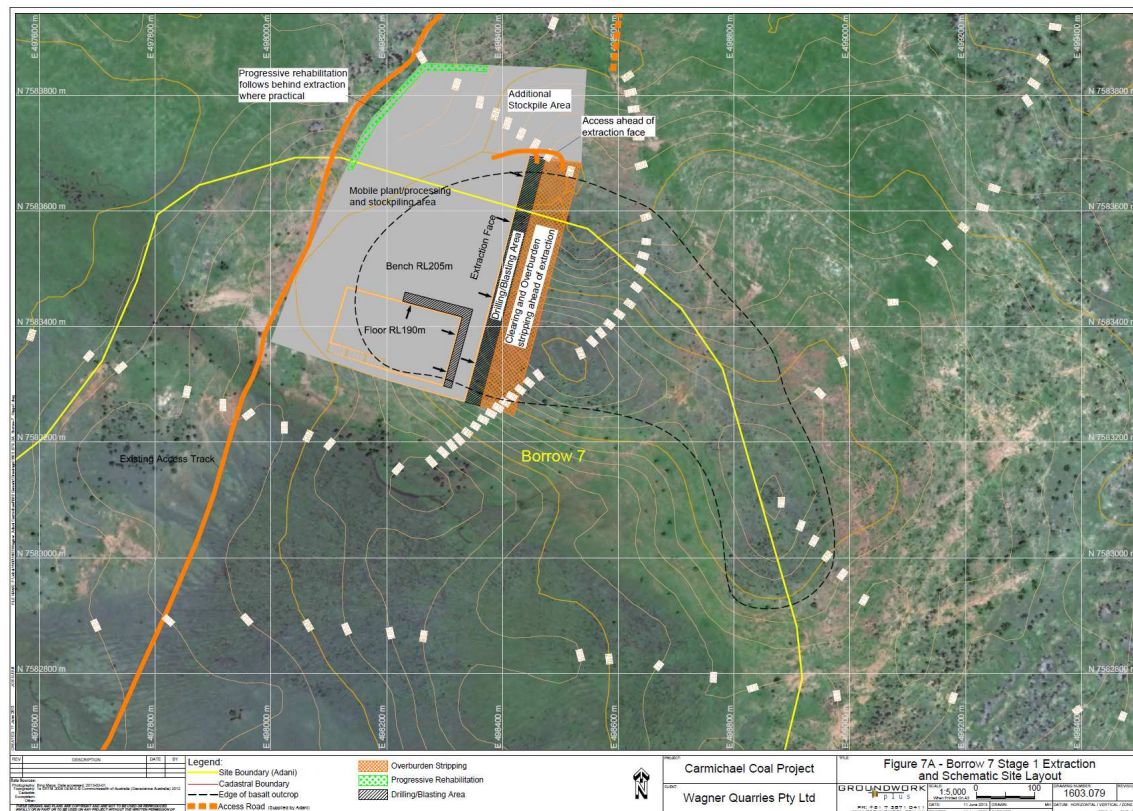


Figure 2-2: Borrow 7 Stage 1 Layout

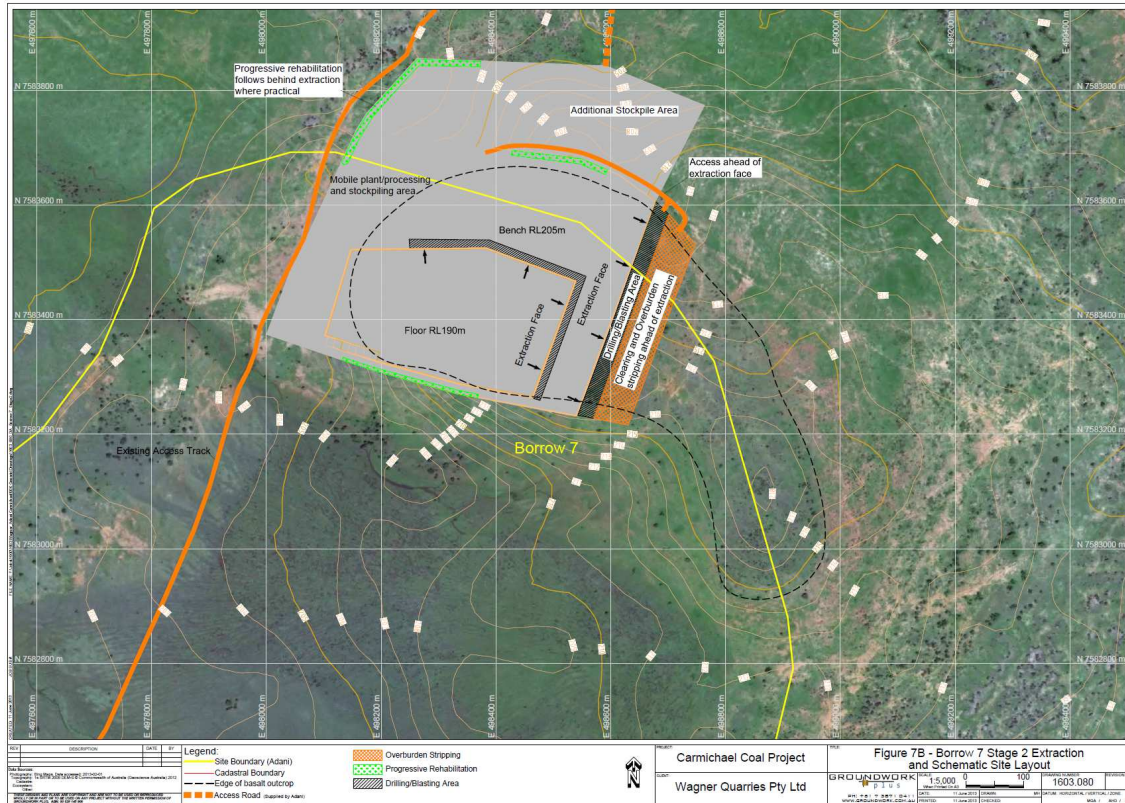


Figure 2-3: Borrow 7 Stage 2 Layout

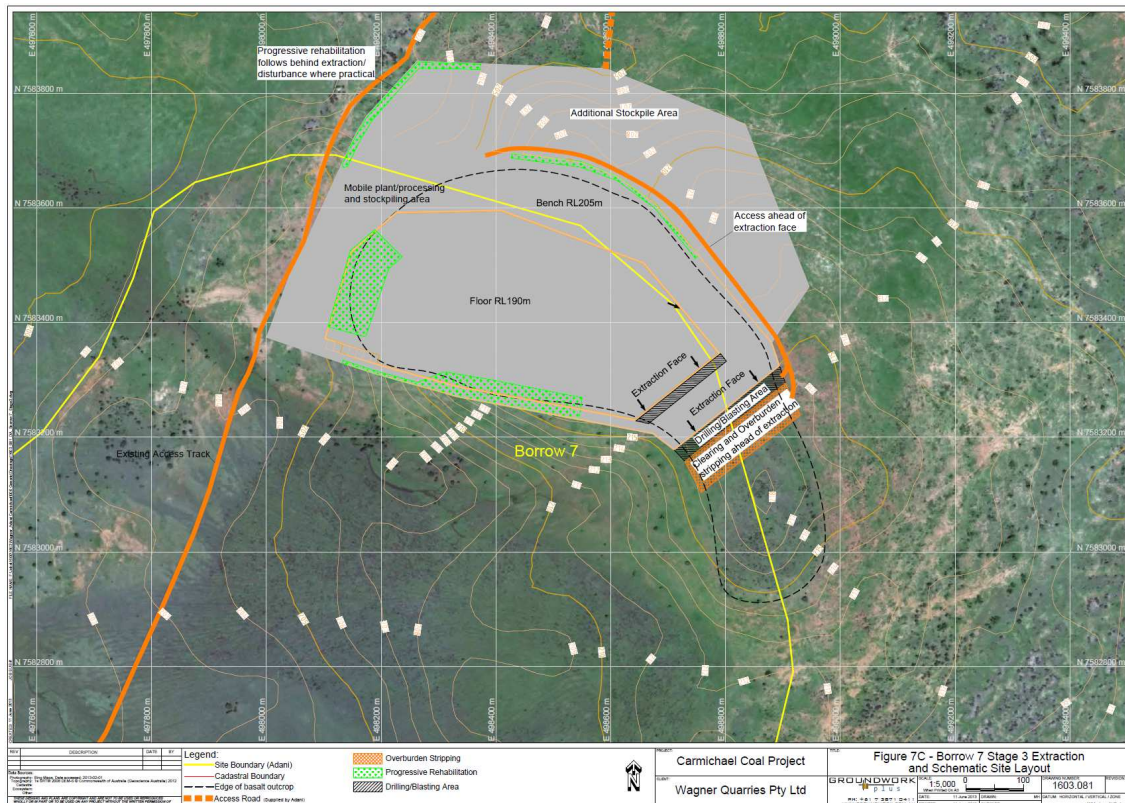


Figure 2-4: Borrow 7 Stage 3 Layout

2.3 SITE ACTIVITIES

2.3.1 Equipment

The following equipment will be used at the Borrow 7 Quarry, which is of concern for this assessment:

- 2x Jaw Crushers (LT 120/LT3054) – Primary Crushers;
- 4x Cone Crushers (Metso HPS 300) – Secondary and Tertiary Crushers;
- 3x Screens (1x ST4.8, 2x 2400 Series Warrior Screens);
- 6x Excavators (CAT 349DL);
- 4x Loaders (CAT980H);
- 1x Water truck (Mack 8x4 Wheeler);
- 6x light vehicles (Ford Ranger);
- 1x 100 kVA Genset;
- 1 x 70,000L Fuel Pod (Transtank T69);
- 7+12 Light plants;
- 6x Dump Trucks (CAT 740B);
- 1x Grader (CAT- 14M);
- 1x Service Trucks (Hino);
- 1x Cranes (20T Franna);
- 1x Elevated Work Platform (GENIE);
- 1x Bobcats (CAT242B3);
- 1x Fuel /Oil Service Truck (MACK 8x4); and
- 1x Hammer (SANDVIK).

Blasting activities will release around 60,000-80,000 tonnes of material and occur approximately once or twice a month in high production months. The depth will be approximately 8-10 m and occur generally in the afternoon period.

2.3.2 Operational Hours

The quarry will operate 24 hours a day, 360 days per year and there is a wet weather contingency in the schedule.

2.3.3 Transportation

The haul road will have a 40 km/h speed limit and approximately 10 trucks will haul a maximum 209,906 tonnes per month during peak production in November 2015.

The number of trucks has been determined from the amount of haulage material, the distance travelled and expected turn-around times of loading/unloading.

2.3.4 Site Illumination and Electrical Generation

ALLIGHT mobile lighting towers (7+12) powered by approximately 21 kW generators shall be used to illuminate the site. The lights will run approximately between 5 pm to 7 am. One (1) 10 kVA enclosed genset will be used to power the site facilities. These generators will run 24 hours.

2.3.5 Production Schedule

The expected output of Borrow 7 Quarry is 2,363,705 tonnes over a 24-month operational life. The monthly output is shown in Figure 2-5, with the highest extraction of 209,906 tonnes expected to occur in November 2015.

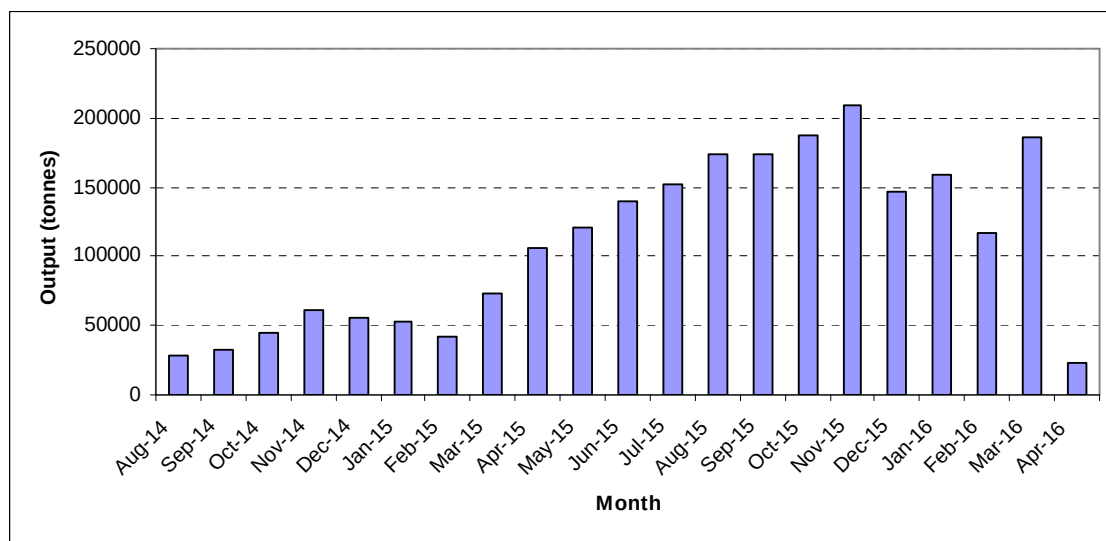


Figure 2-5: Expected Output by Month

3. SITE DESCRIPTION

3.1 LOCAL METEOROLOGY

Local meteorology has been generated for the Disney Quarry using the 2006 database from The Air Pollution Model (TAPM), which is a 3-dimensional prognostic model developed and verified for air pollution studies by the CSIRO (Figure 3-1).

Winds occur predominantly from the north east during spring and summer, often no greater than 5 m/s (18 km/h). In autumn and winter, the dominant winds occur from the south east with the highest wind speed of 8 m/s (28 km/h). The cooler, drier air is characteristic of the dominant southeast winds of moderate strength, usually with long calm periods in the winter.

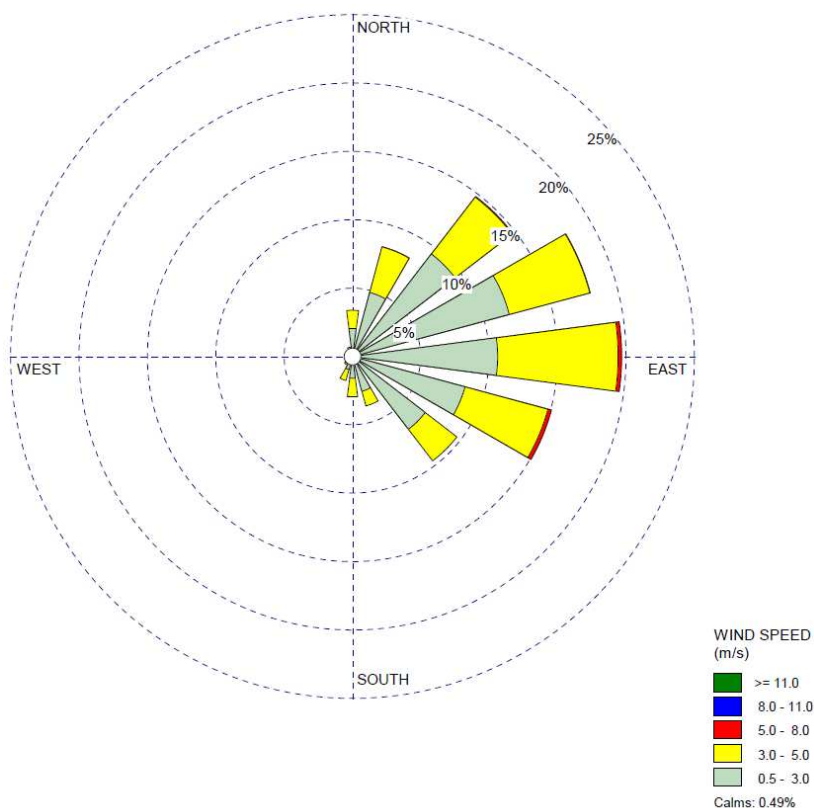


Figure 3-1: Annual Wind Rose (2006)

Local meteorology used in the modelling methodology is discussed in Section 5.2.

3.2 SENSITIVE RECEPTOR

The nearest sensitive receptor is Old Twin Hills, approximately 6.6 km southwest of the Borrow 7 Quarry. The Disney Homestead is located approximately 7.1 km northeast and Twin Hills is located approximately 10.9 km south west of the Borrow 7 Quarry, as shown in Figure 3-2.

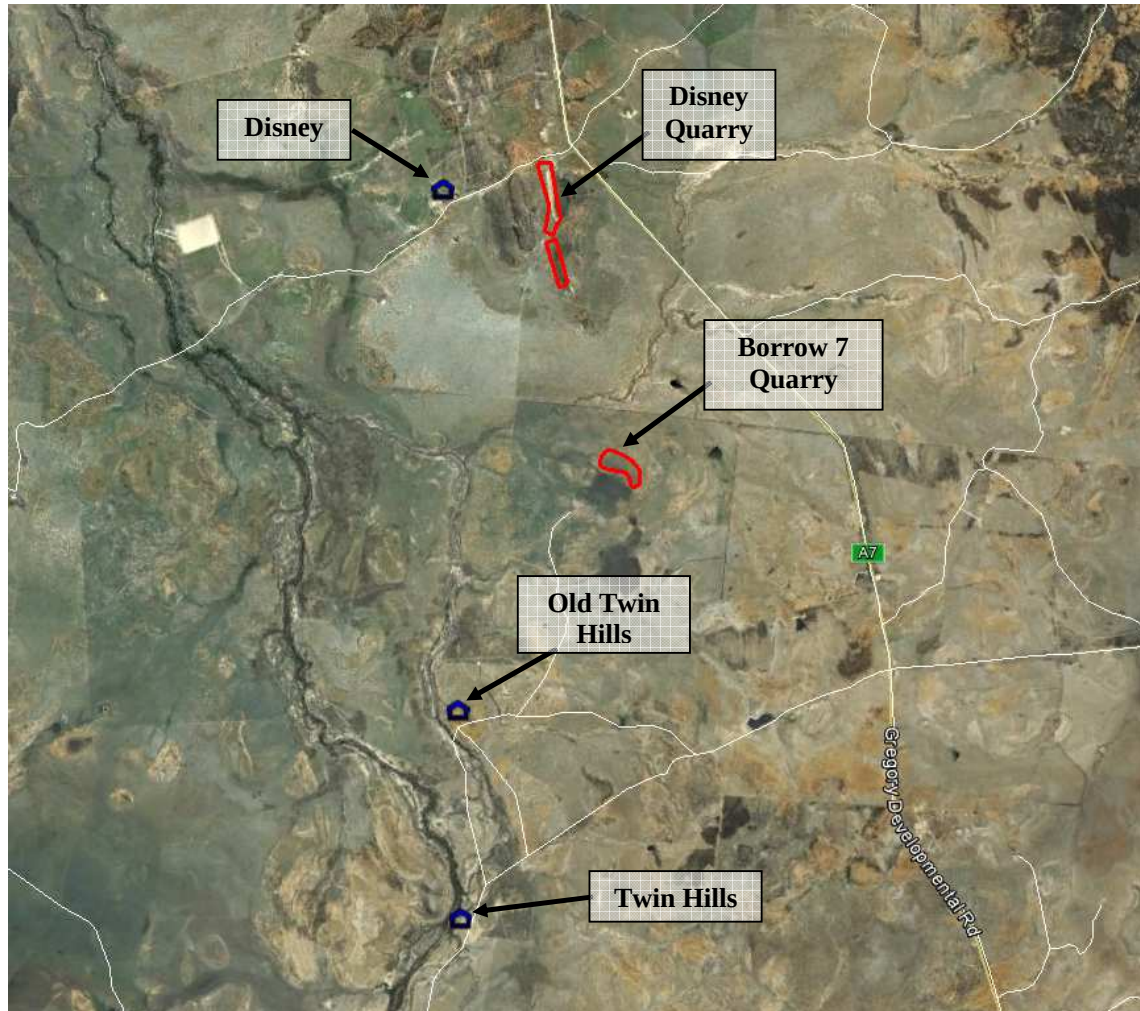


Figure 3-2: Sensitive Receptors Near Borrow 7 Quarry

4. REGULATORY FRAMEWORK & PROJECT CRITERIA

When determining noise level criteria, the Isaac Regional Council refer to the Mackay, Isaac and Whitsunday Regional Plan (2012), which lists the following legislative documents and guidelines:

- *Environmental Protection Act 1994;*
- *Environmental Protection Regulation 2008;*
- *Environmental Protection (Noise) Policy 2008 (EPP); and*
- *State Planning Policy 5/10: Air, Noise and Hazardous Materials.*

4.1 CONSTRUCTION AND OPERATION

The *Environmental Protection (Noise) Policy 2008* (EPP Noise) is designed to protect the acoustic environment for health and well-being. Section 8 and Schedule 1 of the EPP (Noise) outlines these acoustic quality objectives as shown in Table 4-1.

Table 4-1: EPP (Noise) Acoustic Quality Objectives for Dwellings

Sensitive Receptor	Time of Day	Acoustic Quality Objectives (measured at receptor) dB(A)			Environmental Value
		L _{Aeq,adj,1hr}	L _{A10,adj,hr}	L _{A1,adj,1hr}	
Dwelling (outdoor)	Daytime & evening	50	55	65	Health & Wellbeing
Dwelling (indoor)	Daytime & evening	35	40	45	Health & Wellbeing
	Night-time	30	35	40	Sleeping

The time periods referred to in the EPP (2008) are defined as: Day: 7 am to 6 pm, Evening: 6 pm to 10 pm, Night: 10 pm to 7 am

The strictest Acoustic Quality Objectives applicable to this Project are the Dwelling (indoor) values. In order to predict the outdoor levels, a façade transmission loss of 7 dB(A) has been applied. As such, the noise limits applicable to the projects are presented in Table 4-2.

Table 4-2: Noise Criteria Applicable to the Project

Sensitive Receptor	Time of Day	Noise Limit (measured at the receptor) dB(A)			Environmental Value
		L _{Aeq,adj,1hr}	L _{A10,adj,hr}	L _{A1,adj,1hr}	
Dwelling (outdoor)	Daytime & evening	50	55	65	Health & Wellbeing
Dwelling (outdoor noise level to comply with indoor Acoustic Quality Objective)	Daytime & evening	42	47	52	Health & Wellbeing
	Night-time	37	42	47	Sleeping

The L_{Aeq,Adj,1hr} and the L_{A1,Adj,1hr} acoustic parameters described in the Acoustic Quality Objectives are appropriate for considering the noise emissions associated with continuous noise sources and time-varying noise sources respectively.

4.2 BLASTING

The noise and vibration impact of blasting and air-blast overpressure can be assessed in accordance with:

- DERM's Ecoaccess (2006) '*Noise and vibration from blasting*';
- ANZEC (1990) '*Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration*';

- Section 440ZB 'Blasting' of Environmental Protection Act 1994 (Amended); and,
- Australian Standard AS 2187.2 – 2006 'Explosives – Storage and Use. Part 2: Use of Explosives'.

It should be noted that the blasting criteria outlined in the Environmental Protection Act 1994 is less stringent than the Ecoaccess criteria, therefore for this assessment the Ecoaccess guidelines will be applied. The Ecoaccess guidelines for blasting noise and vibration criteria are as follows.

"Blasting activities must be carried out in such a manner that if blasting noise should propagate to a noise sensitive place, then:

- a) The air blast overpressure must not be more than 115 dB(linear) peak for nine out of any 10 consecutive blasts initiated, regardless of the interval between blasts; and*
- b) The air blast overpressure must not exceed 120 dB(linear) peak for any blast"*

"Blasting operations must be carried out in such a manner that if ground vibration should propagate to a noise-sensitive place:

- a) The ground-borne vibration must not exceed a peak particle velocity of 5 mm per second for nine out of any 10 consecutive blasts initiated, regardless of the interval between blasts; and*
- b) The ground-borne vibration must not exceed a peak particle velocity of 10 mm per second for any blast."*

Here the "nine out of any 10 consecutive blasts" is considered practically equivalent to achieving "95% of all blasts" according to Australian Standard AS 2187-2 and ANZEC document 'Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration'.

5. METHODOLOGY

5.1 NOISE PREDICTION SOFTWARE

The prediction of noise in the environment requires the definition of the noise sources including associated directivity for each source; SoundPLAN noise modelling software has been used for this analysis.

For this assessment, the CONCAWE prediction methodology has been used to take into consideration the weather conditions at the site. The frequency of inversions has been determined by obtaining the weather conditions at the proposed Project site from The Air Pollution Model (TAPM), which uses detailed meteorological data from the Bureau of Meteorology (BOM), land use and terrain data to produce complex wind fields that account for large and short scale meteorological effects.

5.2 METEOROLOGICAL CONDITIONS

The weather conditions for the site at night-time (18:00-07:00 hours) during the winter months and annual conditions have been analysed. It was determined that the worst-case conditions (Stability Class F) occur for 30% of the time during the year.

The wind roses for each season were analysed and for the whole year and it has been determined that wind speeds do not occur at or below 3 m/s for more than 30% in any season or full year between any source-to-receiver. As a result, wind was not included in the prediction methodology, as it is not considered to be a feature at this site.

5.3 MODELLED SOUND POWER LEVELS

The significant construction and operational noise sources used for this assessment are identified in Table 5-1. The noise sources have been obtained from Vipac's own database of noise emissions.

Table 5-1: Sound Power (L_w) of the Noise Sources used in Noise Modelling

Noise Source	Sound Power Level, L_w / L_{Amax} in dB(A)
Metso LT120 jaw crushers	122
Metso HPS 300 cone crusher	121
Metso ST 3.8 screen	121
Warrior 2400 Screen	121
CAT 349DL excavator	125 / 127 (breaking rock)
	113 (loading haul trucks)
	108 (earthworks)
CAT 980H front end loader	117
Mack 8x4 wheeler water truck	112
100 kVA genset	99
ALLIGHT mobile lighting towers	107
CAT 740B articulated dump truck	118 (dumping load)
	124 (travelling)
CAT 14M Grader	110
CAT 242B3 Bobcat	101
20T Franna Crane	110
Precoat Plant+ Radial Stacker	103
75 tonne AB triple trucks (road trains)	112 / 112 (travelling)

6. EXISTING ENVIRONMENT

The existing noise environment has been determined through attended and unattended ambient noise monitoring between 27th March and 4th April 2013. The noise monitoring locations have been identified as Disney Receptor (approximately 7.1 km from Borrow 7) and Old Twin Hills Receptor (approximately 6.6 km from Borrow 7), as indicated in Figure 2-1.

6.1 EQUIPMENT

The measurements at Disney receptor were carried out using a Larson Davis 831 environmental noise logger whilst a 01db-Metravib DUO was utilised for the noise monitoring at Old Twin Hills approximately 6.6 km from Borrow 7 Quarry.

Table 6-1: Noise Measurement Parameters

Measurement Details	DUO	LD831
Weighting	A	A
Measurement Parameters	60 minute	60 and 15 minute
Microphone height	1.5 m	1.5 m
Location & Position	-21° 57.012, 146° 57,026	-21° 47.990, 146° 56,907
	Free field – mixture of soft and hard ground	Free field – mixture of soft and hard ground
Last Date of Lab Calibration	23/9/2011	7/12/2011
Site Calibration	94 dB(A) pre/post measurement	94 dB(A) pre/post measurement

6.2 WEATHER CONDITIONS

The weather observations during the monitoring period were obtained from the Bureau of Meteorology for the Emerald, located on Emerald Airport (station number 035264). During this time no rainfall was recorded as shown below in Table 6-2.

Table 6-2: Weather Observations During Monitoring Period

Date	9:00 AM			3:00 PM			Daily
	Temp (°C)	Direction	Speed (km/h)	Temp (°C)	Direction	Speed (km/h)	Rainfall (mm)
27/3/2013	24.9	ESE	17	30.8	ENE	19	0
28/3/2013	24.9	ESE	17	30.9	E	17	0
29/3/2013	24.2	NNE	11	30.8	ESE	17	0
30/3/2013	25.5	E	7	31.0	NE	15	0
31/3/2013	24.8	N	13	31.3	NNE	15	0
1/4/2013	21.8	ESE	13	26.5	NE	9	0
2/4/2013	24.6	SE	20	30.0	E	15	0
3/4/2013	24.6	SSE	13	30.5	ENE	11	0
4/4/2013	24.1	ESE	15	30.3	E	11	0

The Pasquill stability classes during monitoring period could not be accurately determined, as cloud cover data is not collected during the night-time period.

6.3 NOISE MONITORING DATA

Table 6-3 provides the noise monitoring results for all of the days captured at each location. It should be noted that all of the monitoring locations are free-field positions. The noise monitoring data for individual days is shown in tabulated and graphical form in Appendix B.

Table 6-3: Summary of Noise Monitoring Results

Noise Descriptor	Old Twin Hills			Disney		
	Day (07:00- 18:00)	Evening (18:00- 22:00)	Night (22:00- 07:00)	Day (07:00- 18:00)	Evening (18:00- 22:00)	Night (22:00- 07:00)
L _{Aeq} (Average)	43.5	43.8	32.5	41.5	42.3	37.3
L _{Aeq, 1 Hour} (Max)	47.4	47.1	38.4	47.0	45.2	43.2
L _{A90} (Average)	32.8	33.5	24.5	29.2	35.7	28.1
L _{Amax} (24 hour)	76.3			76.3		
L _{A90} Average (22:00 – 06:00)	24.5			27.8		
L _{A10} Average (06:00- 00:00)	42.6			40.3		

7. IMPACT ASSESSMENT

The predicted noise levels contained within this Section are based on the maximum output of 209,906 tonnes, which is scheduled to occur in November 2015, as shown in Figure 2-5.

7.1 BORROW 7 QUARRY ACTIVITIES

Regardless of the quarry output, the majority of noise sources will remain constant throughout the life of the Borrow 7 Quarry. These sources will be around the quarry and generally be operating for 100% of the time. As such, the noise from these activities has been predicted separately to provide a worst-case scenario for the extraction activities. The predicted external noise levels are presented in Table 7-1 (neutral weather).

The noise contour maps for night-time noise levels are shown in Appendix C.

Table 7-1: Predicted Noise Levels

Sensitive Receptor	Noise Criteria (outdoors)*	Predicted Noise Levels (dB $L_{Aeq, 1hr}$)		
		Extraction Activities Only	Haul Road Only	Combined Noise Levels
Disney	37	30	17	30
Old Twin Hills	37	30	16	30
Twin Hills	37	24	10	24

* A facade transmission loss of 7 dB(A) taken into consideration to evaluate the outdoor noise level based on indoors Acoustic Quality Objectives.

Based on the results in Table 7-1, the predicted noise levels comply with the $L_{Aeq, Adj, 1hr}$ noise criteria during neutral weather conditions.

Noise predictions were also conducted for adverse weather. Results indicate that during adverse weather conditions the night-time $L_{Aeq, Adj, 1hr}$ noise criteria would not be exceeded.

Conservative L_{Amax} noise levels were calculated for adverse weather conditions (i.e. temperature inversions) to compare with the $L_{A1, adj, 1hr}$ Acoustic Quality Objective outdoor. The results are shown in Table 7-2.

Table 7-2: Predicted L_{Amax} Noise Levels During Temperature Inversions

Sensitive Receptor	$L_{A1,1hr}$ Noise Criteria (outdoor)*		Predicted Noise Levels (dB L_{Amax})		
	Day	Night	$L_{A1,Adj,1hr}$ **	Source with Highest Noise Level	Complies with $L_{A1,Adj,1hr}$ Criteria
Beenboona	52	47	16	Loader	YES
Cassiopeia	52	47	17	Loader	YES
Elgin Downs	52	47	19	Loader	YES
Disney	52	47	26	Loader	YES
Laurel Hills	52	47	18	Loader	YES
Middle Creek	52	47	17	Loader	YES
Moray Downs	52	47	15	Loader	YES
Mount Gregory	52	47	15	Loader	YES
Old Twin Hills	52	47	26	Loader	YES
Twelve Mile Outstation	52	47	19	Loader	YES
Twin Hills	52	47	21	Loader	YES
Urella	52	47	18	Loader	YES

* A facade transmission loss of 7 dB(A) taken into consideration to evaluate the outdoor noise level based on indoors Acoustic Quality Objectives.

** Conservative L_{Amax} descriptor used instead of L_{A1} in the assessment.

Table 7-2 shows that under the worst-case noise propagation, the maximum noise levels are expected to comply with the noise criterion.

7.2 CUMULATIVE IMPACTS

During the excavation of the Borrow 7 Quarry, activities associated with Back Creek South, Disney, Moray, and North Creek quarries will also be occurring at the same time. The peak production months for the quarries are as follows:

- Borrow 7 Quarry – November 2015;
- Disney Quarry – May 2015;
- Moray Quarry – September 2014;
- North Creek – September 2014; and
- Back Creek South – August 2014.

The distances between the Borrow 7 Quarry and the other quarries are significant, except from Disney, as shown in Table 7-2. The nearest sensitive receptor is Old Twin Hills, approximately 6.6 km southwest of the Borrow 7 Quarry. The Disney Homestead is located approximately 7.1 km north east and Twin Hills is located approximately 10.9 km south west of the Borrow 7 Quarry.

Table 7-2: Other Quarry Distances from Borrow 7 Quarry

Quarry	Distance from Borrow 7 Quarry
Back Creek	22.1 km
Disney	4.11 km
Moray	39 km
North Creek	35.8 km

Given the production schedules, the distances between the extraction sites and the distance of noise sensitive receptors to haul roads, it is expected that cumulative noise impacts between quarries are not expected to occur, except from Disney.

To allow for the possibility that the peak production months of the Disney and Borrow 7 quarries may coincide, a worst-case calculation was conducted, which combines the peak production predictions for these two quarries. The results are shown in Table 7-3 for neutral weather conditions.

Table 7-3: Cumulative $L_{Aeq,Adj,1hr}$ Noise Impacts – Neutral Weather

Sensitive Receptor	Extraction Activities Only (All quarries)	Haul Roads Only (All quarries)	Extraction and Haul Road Noise Levels Combined (All quarries)
Disney	37	30	38
Old Twin Hills	30	19	31
Twin Hills	24	15	25

A marginal exceedance of the night-time $L_{Aeq,Adj,1hr}$ noise criteria at the Disney receptor may occur due to extraction activities from Borrow 7 and Disney. Noise levels at this receptor are dominated by the extraction activities of the Disney Quarry, however the Borrow 7 quarry does contribute to the exceedance.

A cumulative noise impact calculation was also made for adverse weather. Results are presented in Table 7-4.

Table 7-4: Cumulative $L_{Aeq,Adj,1hr}$ Noise Impacts – Adverse Weather

Sensitive Receptor	Extraction Activities Only (All quarries)	Haul Roads Only (All quarries)	Extraction and Haul Road Noise Levels Combined (All quarries)
Disney	40	33	41
Old Twin Hills	35	25	36
Twin Hills	31	21	31

The night-time $L_{Aeq,Adj,1hr}$ noise criteria is exceeded by 4 dB(A) at the Disney receptor. The highest contributor of noise causing the exceedance is the extraction activities from Disney. Borrow 7 noise emissions contribute only 1 dB(A) to this noise level.

7.3 BLASTING

Blasting must limit environmental impacts to acceptable levels. The environmental conditions require that 9 of 10 consecutive blasts comply with ground vibration of 5 mm/s and airblast overpressure of 115 dB. The statistical nature of this requirement can be considered practically equivalent to 95% of all blasts complying with limits of 5 mm/s and 115 dB.

The operational plan for the blasting was not known at the time of preparing this assessment. Vipac's assessment is based on the following assumptions:

1. The nearest sensitive receptor to the extraction area (planned blasting locations) will be Old Twin Hills, approximately 6.6 km southwest of the Borrow 7 Quarry. The Disney Homestead is located approximately 7.1 km northeast and Twin Hills is located approximately 10.9 km south west of the Borrow 7 Quarry. These three residential receivers are closest to the proposed Borrow 7 Quarry extraction area, and considered most likely to receive detectable impacts from the extraction zone.
2. Blasting will be conducted between 9 am and 3 pm on week days, and between 9 am and 1 pm on Saturdays, and not on Sundays and public holidays, in accordance with Ecoaccess 2006 Guidelines.
3. Blasting will be conducted by experienced personnel in compliance with all appropriate State Regulations.
4. Blasts will not be fired in conditions, which are likely to produce either vibration or overpressure impacts beyond the normal and expected range (e.g. high winds blowing towards sensitive receivers).
5. All blasts will be fired using modern accessories and that hole-by-hole initiation is achieved for all blasts.
6. The blasting will be conducted with a bench height of 15 metres or less and blast hole diameter of 175 mm or less. ANFO will be used as the pre preferred explosive type for dry hole conditions, with no more than 10% of blasts containing high density explosives.
7. All blasts will be monitored by experienced personnel using instrumentation and practises conforming to all appropriate Australian Standards, at locations acceptable to EPA, and that records of monitoring will be maintained on record by the quarry management.

Control of ground vibration is strongly dependent on the charge mass per delay once the local ground propagation properties are known. Airblast overpressure from blasting can also vary significantly with the charge mass per delay, depending on other factors such as blast direction and burden, which can be used to control airblast when required.

Vipac expects the Maximum Instantaneous Charge (MIC) to remain below 120 kg of explosive in typical quarries, but has included values twice this size (i.e. 240 kg). The site and rock properties are not known nor have trial blasting measurements been conducted for Borrow 7 Quarry. Based on Vipac experience with quarries, a site exponent of 1.6 and a conservative maximum site constant K_{95} of 4400 were applied. With the abovementioned parameters, a single blast has approximately 95% probability of resulting ground vibration levels less than 0.3 mm/s at the nearest residential receiver (6.6 km). This is less than 10% of the acceptable level, even for the greatest predicted blast impacts.

Typically, overpressure regression can provide poor predictability, primarily due to the factors that affect the peak-measured levels, such as direction of pattern initiation, stemming, topographical barriers and direction of receiver relative to the free face. In any case, assuming very conservative regression parameters β of 24 and dB_{L95} of 174, the overpressure is expected to have approximately 95% probability of remaining below 102 dB. This is 13 dB less than the acceptable level, even for the greatest predicted blast impacts.

Vipac acknowledges that there is a slight possibility the abovementioned MIC may not be a limit for the quarry and notes that blasting vibration monitoring (during trials) is recommended in order to confirm the amount of limiting charge mass per delay and that the quarry can readily design blasts according to continually updated vibration and overpressure regressions trends to minimise impacts at all nearby sensitive receivers.

It is concluded that ground vibration and airblast overpressure from blasting can be controlled to acceptable levels at the currently identified residential receptor locations using standard blasting practices. Blast monitoring should be conducted in order to provide feedback to control environmental impacts and to know accurate amount of the limiting charge mass per delay. The specific blast design parameters are not known at this stage, however, very conservative calculations show that when practical amount explosives and control measures will be used, the ground vibration and airblast overpressure criteria would not be exceeded at the currently identified residences.

Environmental Protection Act 1994 and *Ecoaccess Noise Guideline* state clearly that the criteria conditions specify impact levels, which are significantly higher than the levels of human perception, for both ground vibration and overpressure. Therefore compliance does not imply blasting will not be detectable, or there will not be loss of amenity, but rather it defines what environmental protection agencies consider acceptable amenity impacts.

Vipac is unaware of any buried piping or other infrastructure located adjacent to the quarry (besides Borrow 7 site buildings, haul roads and public roads). In case any of these are located within 300m of typical blasting, damage must be avoided by limiting the MIC. A risk analysis is required to limit the blast vibration impact to values less than the material threshold of the infrastructure.

Fly rock may cause damage to infrastructure, which is adjacent to the quarry blasting. Damage can be avoided by limiting the MIC. A risk analysis may be required to avoid fly rock impact on the infrastructure.

7.4 SUMMARY OF RESULTS OF BORROW 7 QUARRY

This assessment has reviewed the maximum output of the Borrow 7 Quarry. Based on Vipac's noise predictions, the combined noise levels for extraction activities and haul road movements during maximum output of the Borrow 7 Quarry alone would comply with the outdoor $L_{Aeq,Adj,1hr}$ and $L_{A1,Adj,1hr}$ day-time and night-time noise criteria under neutral and adverse weather conditions.

A cumulative noise assessment indicated that when the Disney quarry is also under operation, the night-time $L_{Aeq,Adj,1hr}$ noise criteria may be marginally exceeded by 1 dB(A), under neutral weather conditions. The exceedance is caused by extraction activities at the Disney Quarry, not by the Borrow 7 Quarry, however the Borrow 7 Quarry does contribute to this exceedance.

Under adverse weather conditions, the night-time $L_{Aeq,Adj,1hr}$ noise criteria may be exceeded by up to 4 dB(A). The exceedance is caused by extraction activities at the Disney Quarry not by the Borrow 7 Quarry. Borrow 7 noise emissions contribute only 1 dB(A) to this noise level.

It is concluded that ground vibration and airblast overpressure from blasting can be controlled to acceptable levels at the currently identified residential receptor locations using standard blasting practices.

Damage to the infrastructure by blasting (vibration and fly rock) must be avoided by limiting the MIC. A risk analysis would be required to limit the blast impact on the infrastructure.

8. MITIGATION

This section outlines the potential mitigation options available to reduce noise at sensitive receptors.

8.1 NOISE MANAGEMENT

Noise predictions indicated that exceedances could be expected at noise sensitive receptors for the combined operation of the quarries. As such, a noise management plan, which includes the following items, is recommended:

- Conduct trial blasts to determine the Maximum Instantaneous Charge (MIC) per delay, which would comply with the blast noise and ground vibration criteria at Elgin Downs;
- Liaise with property owners and explain the temporary nature of the Project, to minimise noise complaints; and
- Consider noise mitigation options at noise sensitive receptors, if noise exceedances are ongoing.

8.2 GENERAL NOISE CONTROL MEASURES

There are many general measures that can reduce noise levels at the source such as:

- Applying a 'buy quiet' policy when selecting quarry equipment;
- Avoiding unnecessary revving of engines and switch off equipment when not required;
- Keeping haul routes well maintained and avoid steep gradients;

- Ensure that all operators of plant and haul trucks do not drive aggressively and horn use is limited;
- Minimise the drop heights of materials;
- Start up plant and vehicles sequentially rather than all together;
- Audible reversing warning systems on mobile plant and vehicles should be of a type which, whilst ensuring that they give proper warning, have a minimum noise impact on persons outside sites. When reversing, mobile plant and vehicles should travel in a direction away from sensitive receptors whenever possible;
- As far as reasonably practicable, sources of significant noise should be enclosed. The extent to which this can be done depends on the nature of the machine or process to be enclosed and their ventilation requirements;
- Plant should always be used in accordance with manufacturers' instructions. Care should be taken to site equipment away from noise sensitive areas. Where possible, loading and unloading should also be carried out away from such areas;
- Machines such as cranes that might have intermittent use should be shut down between work periods or should be throttled down to a minimum. Machines should not be left running unnecessarily, as this can be noisy and wastes energy;
- Plant from which the noise generated is known to be particularly directional should, wherever practicable, be orientated so that the noise is directed away from noise-sensitive areas; and
- Acoustic covers to engines should be kept closed when the engines are in use and idling.

9. CONCLUSION

Vipac completed noise predictions to determine the potential noise impacts from the Borrow 7 Quarry activities based on the worst-case scenario of 209,906 tonnes of material being extracted in November 2015. The noise assessment has considered the extraction and hauling activities separately and in combination.

Predictions for the combined activities indicated that exceedance of the outdoor $L_{Aeq,Adj,1hr}$ and $L_{A1,Adj,1hr}$ day-time and night-time noise criteria would not be expected during maximum output of the Borrow 7 Quarry alone.

A cumulative noise assessment was conducted to include the operation of the Borrow 7 and Disney Quarry.

Exceedances of the day-time and night-time $L_{Aeq,Adj,1hr}$ noise criteria were found when Borrow 7 and Disney are operating. It is noted that the calculations are conservative to allow for the possibility that the peak production months of the Disney and Borrow 7 quarries may coincide. These exceedances are produced by the extraction activities of the Disney Quarry at its closest sensitive receptors and not by the extraction activities of the Borrow 7 Quarry. The noise levels are dominated by the Disney Quarry, however the Borrow 7 Quarry does contribute to the exceedance. Recommendations were provided in this report to mitigate the noise impacts.

Given the temporary nature of the operations, we expect that the equipment to be used will be second hand rather than new equipment. It is therefore unknown if any plant will include any noise control options, such as low-noise tyre tread designs for road trains, high performance silencers for machines or sound absorbing panels around the power house of excavators. Without this knowledge, the sound power level of machines and their location in the computer model were chosen conservatively to model a worst-case scenario.

It is also concluded that ground vibration and airblast overpressure from blasting can be controlled to acceptable levels at the currently identified residential receptor locations using standard blasting practices.

Damage to the infrastructure by blasting (vibration and fly rock) must be avoided by limiting the Maximum Instantaneous Charge (MIC). A risk analysis would be required to limit the blast impact on the infrastructure.

Overall, the Borrow 7 Quarry will have an intensive use for a limited period of time to produce materials for road upgrades and Carmichael Coal Mine and Rail, after which it will drop to nominal amounts required for road maintenance and use by Council. As such, noise impacts will be temporary.

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APPENDIX A: GLOSSARY

Ambient noise – the totally encompassing noise in a given situation at a given time; it is usually composed of noise from many sources, near and far.

Attenuation – a general term used to indicate the reduction of noise or vibration, by whatever method or for whatever reason, and the amount in decibels, by which it is reduced.

A-weighting – a frequency weighting devised to attempt to take into account the fact human response to sound not equally sensitive to all frequencies.

dB(A) – the A-weighted sound pressure level.

Decibel (dB) – the logarithmic-scaled unit used to report the level or magnitude of sound.

Hertz (Hz) - the unit of frequency.

L (Level) – the sound pressure level (SPL); it implies the use of decibels related to the ratio of powers or the power related quantities such as sound intensity or sound pressure.

L₁₀ – level that is equal to or exceeded for 10% of the time interval considered in the absence of the noise under investigation. The L₁₀ is considered to be representative of road traffic noise. The A-weighted background level is denoted as L_{A10}.

Loudness – the measure of the subjective impression of the magnitude or strength of a sound.

Noise descriptors – A noise descriptor is a measure of noise used to define a specific characteristic of noise, e.g. average energy, variation (maximum and minimum) and annoyance. Noise descriptors are based on measurements of the sound pressure level. Common noise descriptors are provided below:

L _{Aeq,T}	Time-average A-weighted sound pressure level
L _{A90,T}	Background A-weighted sound pressure level
Max L _{pA,T}	A-weighted maximum instantaneous sound pressure level, obtained using time weighting F
Min L _{pA,T}	A-weighted minimum instantaneous sound pressure level, obtained using time weighting F
L _{Amax,T}	Maximum A-weighted sound pressure level, obtained by arithmetically averaging of the maximum levels of the noise under investigation -
L _{Amax,adj,T}	A-weighted sound pressure level, obtained using time-weighting F, and arithmetically averaging the maximum levels of the noise under investigation, during time interval 'T' and adding adjustments for tonality and impulsiveness
L _{Amin,T}	Minimum A-weighted sound pressure level, obtained by arithmetic averaging of the minimum levels of the noise under investigation
L _{Abg,T}	A-weighted sound pressure level, obtained using time weighting F and arithmetically averaging the lowest levels of the ambient sound pressure level, during time interval T

Noise limit – a maximum or minimum value imposed on a noise index e.g. a legal purpose.

Sound power – the sound energy radiated per unit time by a sound source, measured in watts.

Vibration – oscillating motion of matter about a fixed equilibrium position.

APPENDIX B: NOISE MONITORING DATA

B.1 OLD TWIN HILLS NOISE MONITORING DATA

Descriptor	Date								
	27/3/13	28/3/13	29/3/13	30/3/13	31/3/13	1/4/13	2/4/13	3/4/13	4/4/13
LA10, 18hr (6am to 12am)	41.7	40.5	41.9	43.0	42.1	42.6	42.8	42.6	45.1
LA90, 8hr (10pm to 6am)	23.2	23.4	22.6	24.7	24.5	27.0	27.1	23.3	24.3
LAmx (24hr)	69.3	75.3	71.4	76.7	84.8	82.6	73.6	67.1	79.1
LAeq,Avg(7am to 6pm)	42.5	42.3	41.9	43.3	45.7	42.9	43.3	42.7	46.0
LAeq,Avg (6pm to 10pm)	39.1	36.7	40.5	41.2	39.9	52.8	40.2	41.6	62.5
LAeq,Avg (10pm to 7am)	34.0	30.8	32.3	34.0	31.2	33.1	36.7	32.4	28.3
LAeq,Max 1hr (7am to 6pm)	46.1	45.4	45.9	46.8	52.2	48.4	45.8	45.5	49.5
LAeq,Max 1hr (6pm to 10pm)	42.4	40.2	42.6	42.5	41.1	58.3	43.6	44.7	68.5
LAeq,Max 1hr(10pm to 7am)	41.5	37.3	38.4	38.3	35.7	39.7	43.1	38.7	32.7
LA90,Avg,1hr (7am to 6 pm)	36.0	32.2	30.3	31.9	32.0	30.6	35.3	34.6	35.5
LA90,Avg , 1hr(6 pm to 10pm)	32.6	30.9	33.3	36.1	32.8	31.5	33.7	36.4	34.6
LA90,Avg, 1hr(10pm to 7am)	23.3	23.6	22.7	25.4	25.1	26.9	26.8	23.3	23.7

B.2 DISNEY NOISE MONITORING DATA

Descriptor	Date								
	27/3/13	28/3/13	29/3/13	30/3/13	31/3/13	1/4/13	2/4/13	3/4/13	4/4/13
LA10, 18hr (6am to 12am)	43.8	42.1	43.7	42.3	38.9	37.9	38.6	38.3	40.8
LA90, 8hr (10pm to 6am)	29.4	30.0	30.9	27.9	29.2	28.3	25.3	25.5	23.6
LAmx (24hr)	79.5	72.5	69.3	65.8	95.8	67.3	75.2	70.4	94.3
LAeq,Avg(7am to 6pm)	46.0	38.3	38.1	39.2	49.9	36.1	37.5	38.2	54.4
LAeq,Avg (6pm to 10pm)	38.6	48.0	50.6	54.3	37.1	38.5	38.7	36.6	38.1
LAeq,Avg (10pm to 7am)	35.9	42.9	45.7	37.1	35.5	35.9	33.8	36.9	31.7
LAeq,Max 1hr (7am to 6pm)	41.9	42.6	41.8	42.0	60.1	40.0	41.0	43.8	64.7
LAeq,Max 1hr (6pm to 10pm)	40.0	51.9	53.4	59.9	37.9	41.1	41.6	40.6	40.6
LAeq,Max 1hr(10pm to 7am)	41.4	48.6	53.3	43.6	38.1	42.8	40.6	44.3	36.4
LA90,Avg,1hr (7am to 6 pm)	31.1	30.1	28.4	30.4	28.6	26.3	29.1	28.5	32.1
LA90,Avg , 1hr(6 pm to 10pm)	35.1	40.5	42.4	40.8	34.0	30.8	34.1	31.7	32.1
LA90,Avg, 1hr(10pm to 7am)	29.6	30.3	30.7	28.5	29.4	28.7	25.8	26.2	24.2

B.3 TIME HISTORY GRAPHS

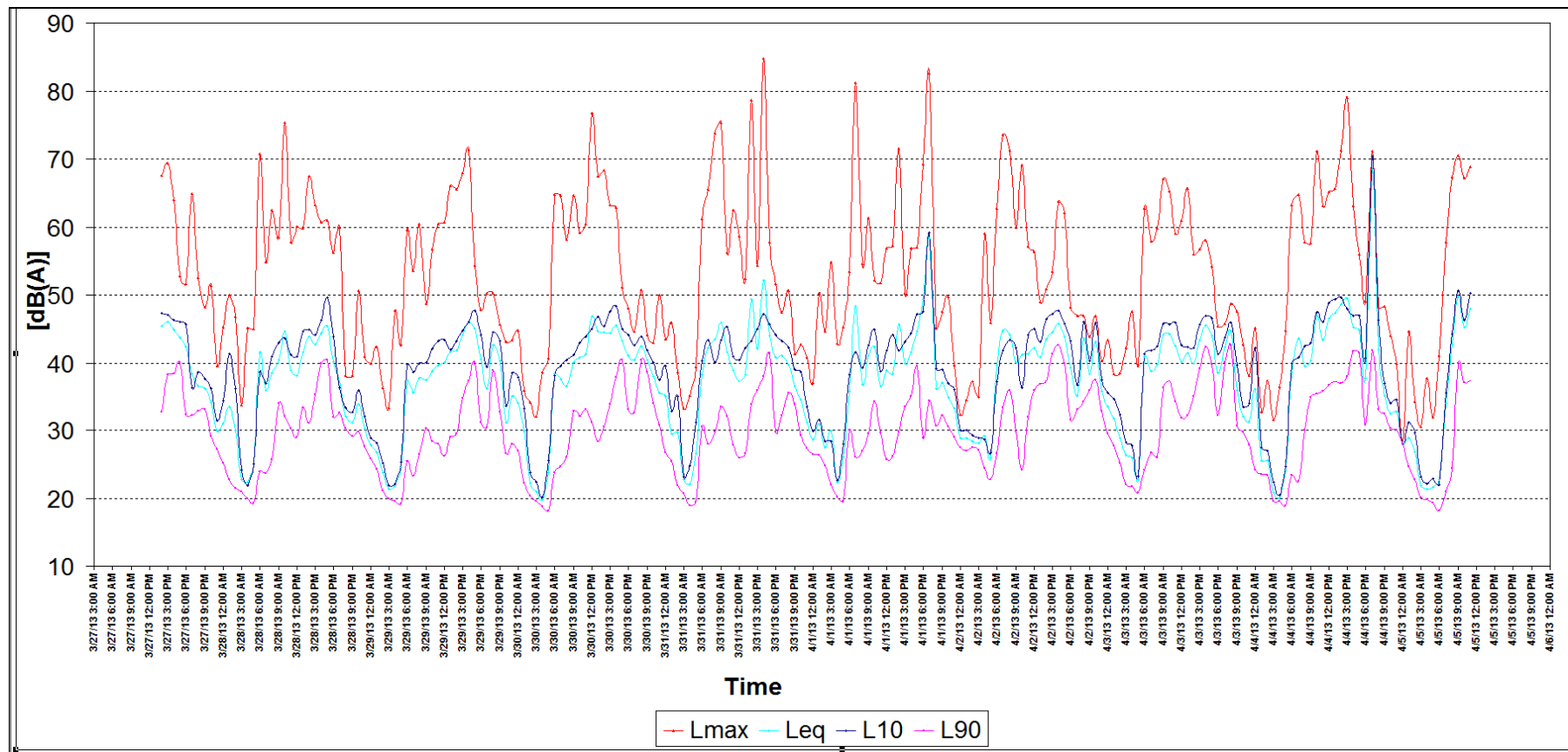


Figure B-1: Old Twin Hills Noise Monitoring Data

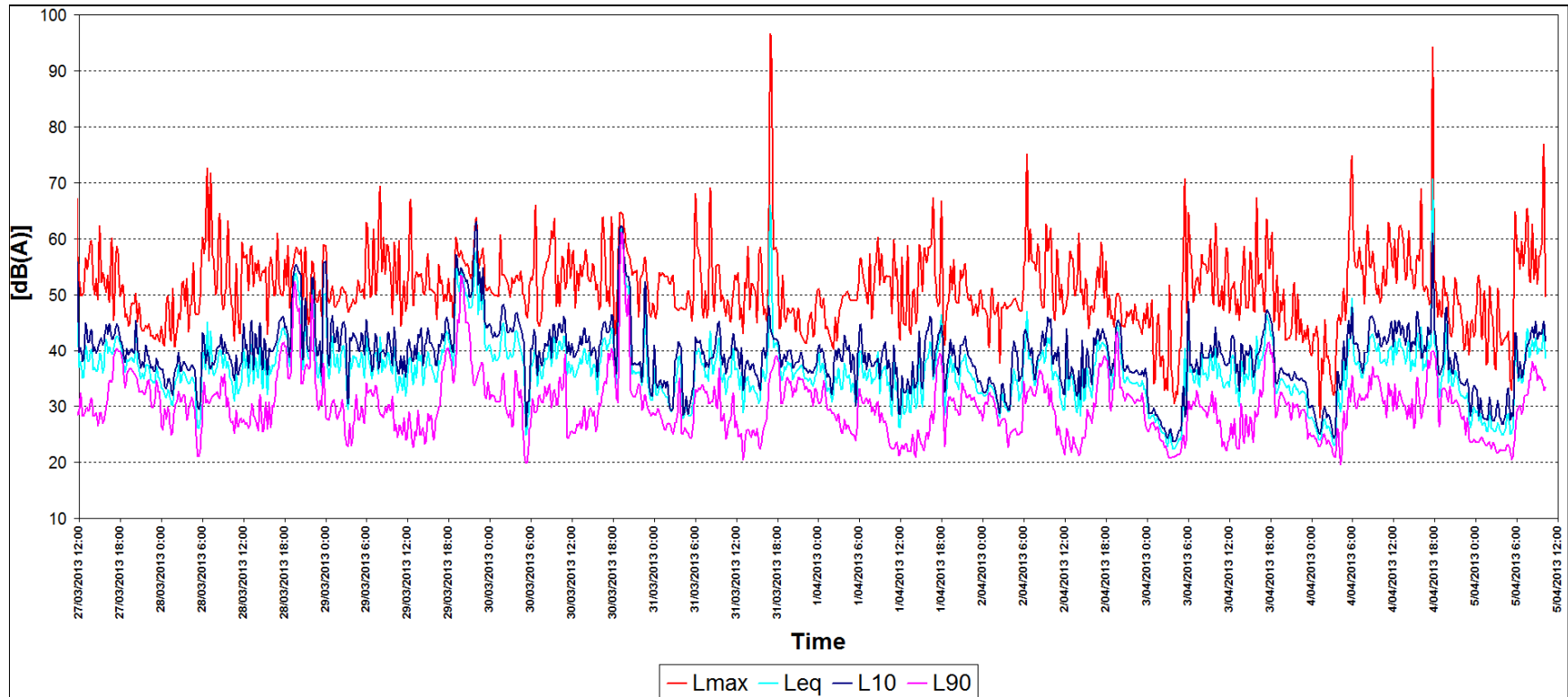


Figure B-2: Disney Noise Monitoring Data

APPENDIX C: NOISE CONTOURS

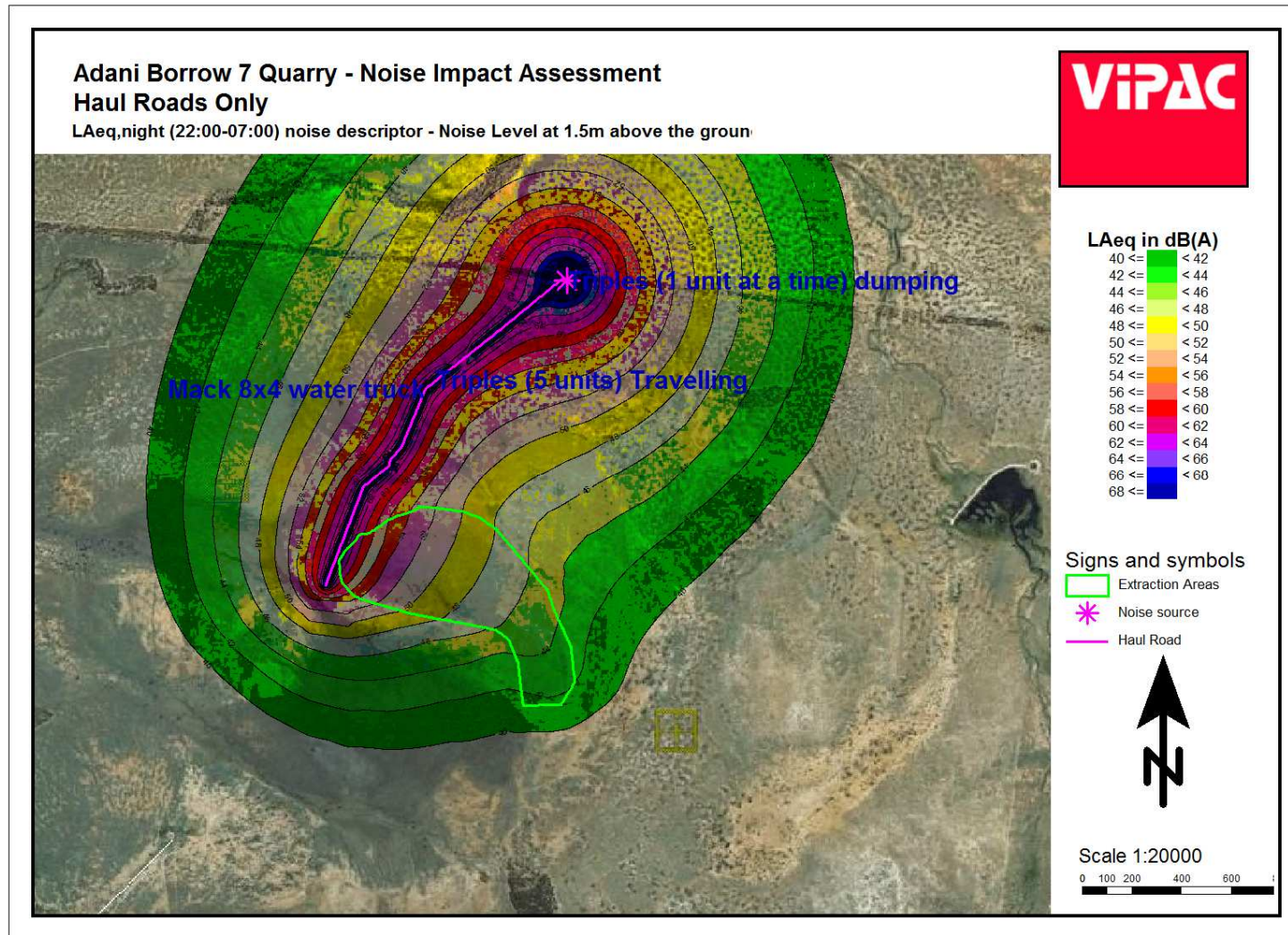


Figure C-1: Borrow 7 – Haul Roads Only

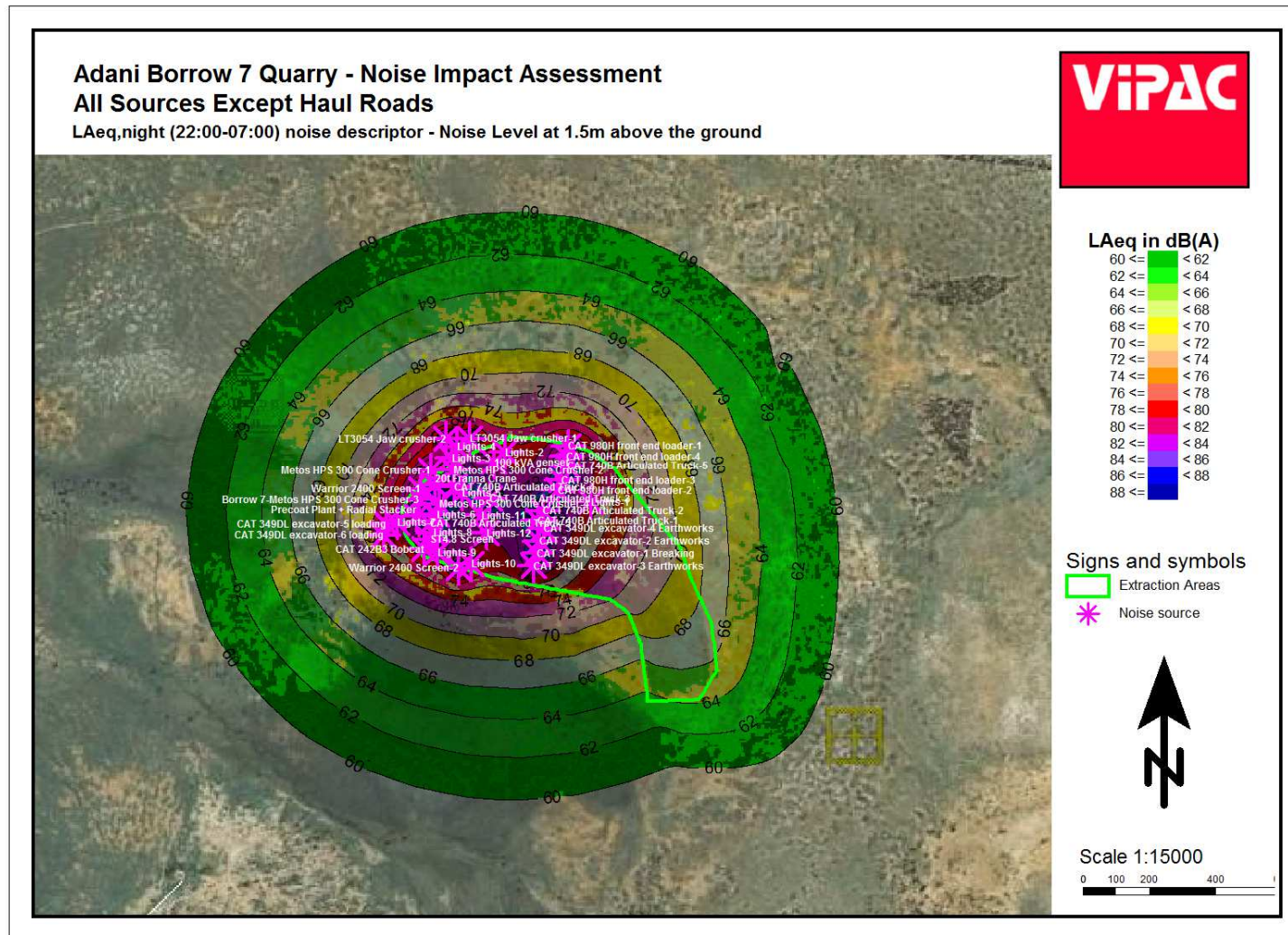


Figure C-2: Borrow 7 – All Activities Except Haul Roads

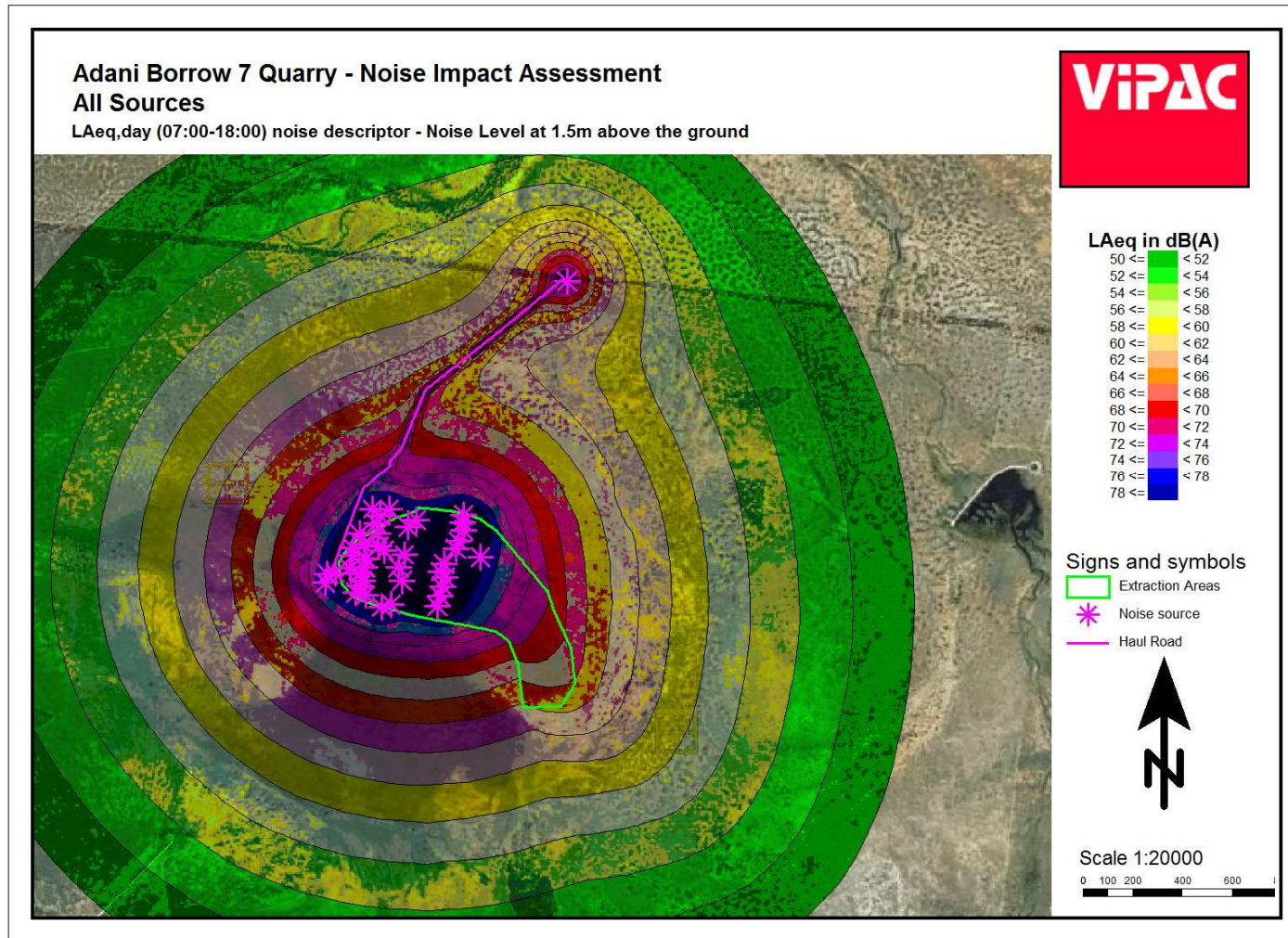


Figure C-3: Borrow 7 – All Quarry Activities