C. Aboriginal Cultural Heritage

The EIS should contain:

1. A description of the Aboriginal objects and declared Aboriginal places located within the area of the proposal.

2. A description of the cultural heritage values, including the significance of the Aboriginal objects and declared Aboriginal places, that exist across the whole area that will be affected by the proposal, and the significance of these values for the Aboriginal people who have a cultural association with the land.

3. A description of any consultation with Aboriginal people regarding the proposal and the significance of any Aboriginal cultural heritage values identified through that consultation. The OEH advises that the proponent may utilise the OEH's *Aboriginal Consultation Requirements for Proponents 2010* as best practice guidelines for such consultation (these OEH requirements for consultation must be followed if the proposal requires an Aboriginal Heritage Impact Permit or the Aboriginal heritage assessment requires archaeological testing).

4. The views of those Aboriginal people regarding the likely impact of the proposal on their cultural heritage. If any submissions have been received as a part of the consultation requirements, then the report must include a copy of each submission and your response.

5. A description of the actual or likely harm posed to the Aboriginal objects or declared Aboriginal places from the proposal, with reference to the cultural heritage values identified.

6. A description of any practical measures that may be taken to protect and conserve those Aboriginal objects or declared Aboriginal places.

7. A description of any practical measures that may be taken to avoid or mitigate any actual or likely harm, alternatives to harm or, if this is not possible, to manage (minimise) harm.

In addressing these requirements, the proponent must refer to the following documents:

a. *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (OEH, 2010) - www.environment.nsw.gov.au/resources/cultureheritage/ddcop/10798ddcop.pdf. These guidelines identify a process that could be used to prepare Aboriginal cultural heritage assessments for development proposals assessed under Part 4 of the *Environmental Planning and Assessment Act 1979*.

b. *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (OEH, 2010) - www.environment.nsw.gov.au/licences/consultation.htm. This document further explains the consultation requirements that are set out in clause 80C of the National Parks and Wildlife Regulation 2009. The process set out in this document must be followed and documented in the EIS if the proposal requires an Aboriginal Heritage Impact Permit or the Aboriginal heritage assessment requires archaeological testing.

c. *Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales* (OEH, 2010) - www.environment.nsw.gov.au/licences/archinvestigations.htm. The process described in this Code should be followed and documented where the assessment of Aboriginal cultural heritage requires archaeological testing to be undertaken.

Notes:

- An Aboriginal Site Impact Recording Form (http://www.environment.nsw.gov.au/licences/DECCAHIMSSiteRecordingForm.htm) must be completed and submitted to the Aboriginal Heritage Information Management System (AHIMS) Registrar, for each AHIMS site that is harmed through archaeological investigations required or permitted through these environmental assessment requirements.

- Under section 89A of the *National Parks and Wildlife Act* 1974, it is an offence for a person not to notify OEH of the location of any Aboriginal object the person becomes aware of, not already recorded on the Aboriginal Heritage Information Management System (AHIMS). An AHIMS Site Recording Form should be completed and submitted to the AHIMS Registrar (http://www.environment.nsw.gov.au/contact/AHIMSRegistrar.htm), for each Aboriginal site found during investigations.

NOTE:

The OEH acknowledges the existence of Aboriginal sites recorded in the regional locality and within 3 kilometres of the proposed quarry. These sites include culturally significant artefact scatters and potential archaeological deposits (PADs). We would expect an Aboriginal cultural heritage assessment would be prepared to reflect the requirements detailed in the SEARS and that all supporting evidence of consultation undertaken with Aboriginal knowledge holders is provided in the EIS. Consideration should be given to the sensitivity and significance of these areas to the Aboriginal Elders and knowledge holders and any relationship that may exist between these sites and any Aboriginal cultural heritage values of the quarry.

D. Biodiversity

Based on the biodiversity values known to be present across the New England Tableland (Armidale Plateau) Bioregion and following examination of aerial photographs, the OEH is of the view that the subject site contains a number of high conservation value biodiversity attributes, including:

- Ribbon gum/Mountain white gum/Snow gum Endangered Ecological Community (EEC) and/or White box/Yellow box/Blakely's red gum Woodland EEC.

- Scattered trees (possibly both living and dead) that contain hollows. The hollow resources present can provide habitat for hollow-dependent fauna species which could include threatened species of microbats, arboreal mammals and possibly birds.

Biodiversity impacts can be assessed using **either** the OEH BioBanking Scheme (Scenario 1) **or** a detailed biodiversity assessment (Scenario 2). The requirements for each of these approaches are detailed below.

The BioBanking Assessment Methodology can be used **either** to obtain a BioBanking statement under Scenario 1, **or** to assess impacts of a proposal and to determine required offsets without obtaining a statement under Scenario 2.

Under Scenario 2, if the required offset cannot be attained in its entirety, appropriate alternative options may be developed in consultation with OEH officers and in accordance with OEH policy to ensure that the final offset package adequately compensates biodiversity impacts.

I. Scenario 1 - Where a proposal is assessed under the OEH BioBanking Scheme:

The EIS should include a biodiversity assessment undertaken in accordance with the OEH BioBanking Scheme. This assessment should address the matters included in the following sections.

1. Where a BioBanking Statement is being sought under Part 7A of the *Threatened Species Conservation Act 1995* (TSC Act), the assessment must be undertaken by an accredited BioBanking assessor (as specified under Section 142B (1)(c) of the TSC Act 1995) and done in accordance with the *BioBanking Assessment Methodology and Credit Calculator Operational Manual* (DECCW, 2008). To qualify for a BioBanking Statement a proposal must meet the improve-or-maintain standard.

2. The EIS should include a specific Statement of Commitments that reflects all requirements of the BioBanking Statement including the number of credits required and any approved variations to impacts on Red Flags.

3. With regard to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, the EIS should identify and assess any relevant Matters of National Environmental Significance and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.

II. Scenario 2 - Where a proposal is assessed outside the OEH BioBanking Scheme:

The EIS should include a detailed biodiversity assessment, including assessment of impacts on threatened biodiversity, native vegetation and habitat. This assessment should address the matters included in the following sections.

1. A field survey of the site should be conducted and documented in accordance with relevant guidelines, including:

    a. the *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna -Amphibians* (DECCW, 2009)

    b. *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DEC, 2004),

    c. Threatened species survey and assessment guideline information on www.environment.nsw.gov.au/threatenedspecies/surveyassessmentgdlns.htm

    If a proposed survey methodology is likely to vary significantly from the above methods, the proponent should discuss the proposed methodology with OEH prior to undertaking the EIS, to determine whether OEH considers that it is appropriate.

    Recent (less than five years old) surveys and assessments may be used. However, previous surveys should not be used if they have:

    - been undertaken in seasons, weather conditions or following extensive disturbance events when the subject species are unlikely to be detected or present, or

    - utilised methodologies, survey sampling intensities, timeframes or baits that are not the most appropriate for detecting the target subject species,

    unless these differences can be clearly demonstrated to have had an insignificant impact upon the outcomes of the surveys. If a previous survey is used, surveys for any additional entities listed under the *Threatened Species Conservation Act 1995* since the previous survey took place, must be undertaken and documented.

    Determining the list of potential threatened species for the site should be done in accordance with the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DEC, 2004) and the *Guidelines for Threatened Species Assessment* (Department of Planning, July 2005). The OEH Threatened Species website http://www.environment.nsw.gov.au/threatenedspecies/ and the *Atlas of NSW Wildlife* database should be the primary information sources for the list of threatened species present. The BioBanking Threatened Species Database, the Vegetation Types databases (available on OEH website at http://www.environment.nsw.gov.au/biobanking/biobankingtspd.htm and http://www.environment.nsw.gov.au/biobanking/vegtypedatabase.htm, respectively) and other data sources (e.g. PlantNET, Online Zoological Collections of Australian Museums (http://www.ozcam.org/), previous or nearby surveys etc.) may also be used to compile the list.

2. The EIS should contain the following information as a minimum:

    a. The requirements set out in the *Guidelines for Threatened Species Assessment* (Department of Planning, July 2005

b. Description and geo-referenced mapping of study area (and spatial data files), e.g. overlays on topographic maps, satellite images and /or aerial photos, including details of map datum, projection and zone, all survey locations, vegetation communities (including classification and methodology used to classify), key habitat features and reported locations of threatened species, populations and ecological communities present in the subject site and study area.

c. Description of survey methodologies used, including timing, location and weather conditions.

d. Details, including qualifications and experience of all staff undertaking the surveys, mapping and assessment of impacts as part of the EIS.

e. Identification of national and state listed threatened biota known or likely to occur in the study area and their conservation status.

f. Description of the likely impacts of the proposal on biodiversity and wildlife corridors, including direct and indirect and construction and operation impacts. Wherever possible, quantify these impacts such as the amount of each vegetation community or species habitat to be cleared or impacted, or any fragmentation of a wildlife corridor.

g. Identification of the avoidance, mitigation and management measures that will be put in place as part of the proposal to avoid or minimise impacts, including details about alternative options considered and how long term management arrangements will be guaranteed.

h. Description of the residual impacts of the proposal. If the proposal cannot adequately avoid or mitigate impacts on biodiversity, then a biodiversity offset package is expected (see the requirements for this at point 4 below).

3. An assessment of the significance of direct and indirect impacts of the proposal must be undertaken for threatened biodiversity known or considered likely to occur in the study area based on the presence of suitable habitat. This assessment must take into account:

   a. the factors identified in s.5A of the *Environmental Planning & Assessment Act 1979*, and

   b. the guidance provided by *The Threatened Species Assessment Guideline – The Assessment of Significance* (DECCW, 2007) which is available at: http://www.environment.nsw.gov.au/resources/threatenedspecies/tsaguide07393.pdf

4. The proposal must be designed to avoid and minimise impacts on biodiversity and offset remaining direct and indirect biodiversity impacts. In determining an appropriate offset package it is recommended that the EIS should:

   a. Accord with the 13 OEH offsetting principles available at http://www.environment.nsw.gov.au/biodivoffsets/oehoffsetprincip.htm.

   b. Use the BioBanking Assessment Methodology to determine the quantum of offsets required to compensate for those remaining biodiversity impacts.

c. Identify the conservation mechanisms to be used to ensure the in-perpetuity protection and management of proposed offset sites.

d. Include a specific Statement of Commitments for the proposed offset package which is informed by a., b. and c. above and by any consultation with OEH.

5. With regard to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, the EIS should identify any relevant Matters of National Environmental Significance and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.

NOTE:

The OEH records indicate that the following threatened species have been identified either on site or in close proximity to the proposed quarry site:

- Spotted Harrier (*Circus assimilis);*
- Tusked frog (*Adelotus brevis)* and
- Austral Toadflax (*Thesium austral)*

In this regard, the EIS should provide an assessment to determine if such species are likely to use the subject site and any potential impacts (direct and indirect) of the development on these species.

The EIS should provide an assessment to determine if high conservation value biodiversity attributes are likely to exist on the subject site and any potential impacts (direct and indirect) of the development of the quarry on these species. These high conservation value biodiversity attributes could include, but not be limited to:

- Ribbon gum/Mountain white gum/Snow gum Endangered Ecological Community (EEC) and/or White box/Yellow box/Blakely's red gum Woodland EEC.

- Scattered trees (possibly both living and dead) that contain hollows.

E. OEH Estate

The EIS should address the following with respect to land reserved under the *National Parks and Wildlife Act 1974*.

1. Where appropriate, likely impacts (both direct and indirect) on any adjoining and/or nearby OEH estate reserved under the *National Parks and Wildlife Act 1974*. Refer to the *Guidelines for developments adjoining land and water managed by the Department of Environment, Climate Change and Water* (DECC, 2010). The guideline is available at: http://www.environment.nsw.gov.au/protectedareas/developmntadjoiningdecc.htm

Note: Proposals which may impact marine protected areas should be referred to the Department of Primary Industries to determine the assessment and approval requirements

F. Historic Heritage

The EIS should address the following:

1. The heritage significance of the site and any impacts the proposal may have upon this significance should be assessed. This assessment should include natural areas and places of Aboriginal, historic or archaeological significance. It should also include a consideration of wider heritage impacts in the area surrounding the site.

2. The Heritage Council maintains the State Heritage Inventory which lists some items protected under the *Heritage Act 1977* and other statutory instruments. This register can be accessed through the Heritage Branch home page on the internet (http:www.heritage.nsw.gov.au). In addition, lists maintained by the National Trust, any heritage listed under the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* and the local council should be consulted in order to identify any known items of heritage significance in the area affected by the proposal. These lists are constantly evolving and items with potential heritage significance may not yet be listed

3. Non-Aboriginal heritage items within the area affected by the proposal should be identified by field survey. This should include any buildings, works, relics (including relics underwater), gardens, landscapes, views, trees or places of non-Aboriginal heritage significance. A statement of significance and an assessment of the impact of the proposal on the heritage significance of these items should be undertaken. Any policies/measures to conserve their heritage significance should be identified. This assessment should be undertaken in accordance with the guidelines in the NSW Heritage Manual. The field survey and assessment should be undertaken by a qualified practitioner/consultant with historic sites experience. The Manager, OEH Heritage Division Conservation Team, can be contacted on telephone (02) 9873 8599 for a list of suitable consultants.

G. Acid Sulfate Soils

The EIS should address the following:

1. The potential impacts of the proposal on acid sulfate soils must be assessed in accordance with the relevant guidelines in the Acid Sulfate Soils Manual (Stone et al. 1998) and the Acid Sulfate Soils Laboratory Methods Guidelines (Ahern et al. 2004).

2. Describe mitigation and management options that will be used to prevent, control, abate or minimise potential impacts from the disturbance of acid sulfate soils associated with the proposal and to reduce risks to human health and prevent the degradation of the environment. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.

H. Flooding, Stormwater and Coastal Erosion

The EIS should include an assessment of the following referring to the relevant guidelines in Attachment 2:

1. The potential effect of coastal processes and coastal hazards including potential impacts of sea level rise:

    a. on the proposal; and

    b. arising from the proposal.

2. Whether the proposal is consistent with any coastal zone management plans.

3. Whether the proposal is consistent with any floodplain risk management plans.

4. Whether the proposal is compatible with the flood hazard of the land.

5. Whether the proposal will significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties.

6. Whether the proposal will significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.

7. Whether the proposal incorporates appropriate measures to manage risk to life from flood.

8. Whether the proposal is likely to result in unsustainable social and economic costs to the community as a consequence of flooding.

9. The implications of flooding over the full range of potential flooding, including the probable maximum flood, should be considered as set out in the NSW Government Floodplain Development Manual. This should include the provision of:

    a. Full details of the flood assessment and modelling undertaken in determining any design flood levels (if applicable), including the 1 in 100 year flood levels.

    b. A sensitivity assessment of the potential impacts of an increase in rainfall intensity and runoff (10%, 20% and 30%) and sea level rise on the flood behaviour for the 1 in 100 year design flood if applicable.

10. All site drainage, stormwater quality devices and erosion / sedimentation control measures should be identified and the onsite treatment of stormwater and effluent runoff and predicted stormwater discharge quality from the proposal should be detailed.

I. Cumulative Impacts

The EIS should include an assessment of the following:

1. The cumulative impacts, including both construction and operational impacts, from all clearing activities and operations, associated edge effects and other indirect impacts on cultural heritage, biodiversity and OEH Estate in accordance with the *Environmental Planning and Assessment Act 1979*.

2. The cumulative impacts, including both construction and operational impacts, of the proponent's existing and proposed development and associated infrastructure (such as access tracks etc.) as well as the cumulative impact of the development in the context of other developments located in the vicinity.

Attachment 2 – EIS Guidance Material

Title	Web address
Relevant Legislation	
Coastal Protection Act 1979	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+13+1979+cd+0+N
Commonwealth Environment Protection and Biodiversity Conservation Act 1999	http://www.austlii.edu.au/au/legis/cth/consol_act/epabca1999588/
Floodplain Development Manual	http://www.environment.nsw.gov.au/floodplains/manual.htm
Environmental Planning and Assessment Act 1979	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+203+1979+cd+0+N
Fisheries Management Act 1994	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+38+1994+cd+0+N
Marine Parks Act 1997	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+64+1997+cd+0+N
National Parks and Wildlife Act 1974	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+80+1974+cd+0+N
Protection of the Environment Operations Act 1997	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+156+1997+cd+0+N
Threatened Species Conservation Act 1995	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+101+1995+cd+0+N
Water Management Act 2000	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+92+2000+cd+0+N
Aboriginal Cultural Heritage	
Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (2005)	Available from DPE.
Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010)	http://www.environment.nsw.gov.au/licences/consultation.htm
Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW, 2010)	http://www.environment.nsw.gov.au/licences/archinvestigations.htm
Aboriginal Site Impact Recording Form	http://www.environment.nsw.gov.au/licences/DECCAHIMSSiteRecordingForm.htm
Aboriginal Heritage Information Management System (AHIMS) Registrar	http://www.environment.nsw.gov.au/contact/AHIMSRegistrar.htm

Biodiversity

BioBanking Assessment Methodology (DECC, 2008)	http://www.environment.nsw.gov.au/resources/biobanking/08385bbassessmethod.pdf
BioBanking Assessment Methodology and Credit Calculator Operational Manual (DECCW, 2008)	http://www.environment.nsw.gov.au/biobanking/operationalmanual.htm
Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna -Amphibians (DECCW, 2009)	http://www.environment.nsw.gov.au/resources/threatenedspecies/09213amphibians.pdf
Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft (DEC, 2004)	http://www.environment.nsw.gov.au/resources/nature/TBSAGuidelinesDraft.pdf
Guidelines for Threatened Species Assessment (Department of Planning, July 2005)	Draft available from DPE
OEH Threatened Species website	http://www.environment.nsw.gov.au/threatenedspecies/
Atlas of NSW Wildlife	http://wildlifeatlas.nationalparks.nsw.gov.au/wildlifeatlas/watlas.jsp
BioBanking Threatened Species Database	http://www.environment.nsw.gov.au/biobanking/biobankingtspd.htm
Vegetation Types databases	http://www.environment.nsw.gov.au/biobanking/vegtypedatabase.htm
PlantNET	http://plantnet.rbgsyd.nsw.gov.au/
Online Zoological Collections of Australian Museums	http://www.ozcam.org/
Threatened Species Assessment Guideline - The Assessment of Significance (DECCW, 2007)	http://www.environment.nsw.gov.au/resources/threatenedspecies/tsaguide07393.pdf
Principles for the use of biodiversity offsets in NSW	http://www.environment.nsw.gov.au/biocertification/offsets.htm

OEH Estate

Land reserved or acquired under the NPW Act

List of national parks	http://www.environment.nsw.gov.au/NationalParks/parksearchatoz.aspx
OEH Revocation of Land Policy	http://www.environment.nsw.gov.au/policies/RevocationOfLandPolicy.htm
Guidelines for developments adjoining land and water managed by the Department of Environment, Climate Change and Water (DECCW, 2010)	http://www.environment.nsw.gov.au/resources/protectedareas/10509devadjdeccw.pdf

Water and Soils

Acid sulfate soils

Acid Sulfate Soils Planning Maps	http://canri.nsw.gov.au/download/
Acid Sulfate Soils Manual (Stone et al. 1998)	Manual available for purchase from: http://www.landcom.com.au/whats-new/the-blue-book.aspx Chapters 1 and 2 are on DPI's Guidelines Register at: Chapter 1 Acid Sulfate Soils Planning Guidelines: http://www.planning.nsw.gov.au/rdaguidelines/documents/NSW%20Acid%20Sulfate%20Soils%20Planning%20Guidelines.pdf Chapter 2 Acid Sulfate Soils Assessment Guidelines: http://www.planning.nsw.gov.au/rdaguidelines/documents/NSW%20Acid%20Sulfate%20Soils%20Assessment%20Guidelines.pdf
Acid Sulfate Soils Laboratory Methods Guidelines (Ahern et al. 2004)	http://www.derm.qld.gov.au/land/ass/pdfs/lmg.pdf This replaces Chapter 4 of the Acid Sulfate Soils Manual above.

Flooding and Coastal Erosion

Reforms to coastal erosion management	http://www.environment.nsw.gov.au/coasts/coastalerosionmgmt.htm
Floodplain development manual	http://www.dnr.nsw.gov.au/floodplains/manual.shtml
Coastline management manual	Note: To be replaced by the Guidelines for preparing coastal zone management plans, 2013. This document will be available on OEH's website – currently available at http://www.environment.nsw.gov.au/coasts/coastalmgtdocs.htm.

Water

Water Quality Objectives	http://www.environment.nsw.gov.au/ieo/index.htm
ANZECC (2000) Guidelines for Fresh and Marine Water Quality	http://www.mincos.gov.au/publications/australian_and_new_zealand_guidelines_for_fresh_and_marine_water_quality
Applying Goals for Ambient Water Quality Guidance for Operations Officers – Mixing Zones	http://deccnet/water/resources/AWQGuidance7.pdf
Approved Methods for the Sampling and Analysis of Water Pollutant in NSW (2004)	http://www.environment.nsw.gov.au/resources/legislation/approvedmethods-water.pdf

NSW RURAL FIRE SERVICE

The Secretary
Department of Planning & Environment
PO Box 39
SYDNEY NSW 2001

Your reference: EAR 1060
Our reference: D16/2098
D16070502700AB

Attention: Lauren Evans

8 July 2016

Dear Ms Evans,

Request for Secretary's Environmental Assessment Requirements: Wattle Vale Quarry Lots 249, 174, 175, 253, 101, 87 and 113 DP 753319; Gwydir Highway Glen Innes

I refer to NSW Planning and Environment correspondence dated 28 June 2016 seeking comment from the NSW Rural Fire Service on matters to be included in the Secretary's Environmental Assessment Requirements for the above proposal.

While the subject lots, are in part, mapped bush fire prone land by Glen Innes Severn Shire Council, the extraction sites and proposed vehicle access, are not mapped bush fire prone.

The NSW Rural Fire Service has no objection and no requirements for the proposed hard rock quarry.

For any enquiries regarding this correspondence, please contact Alan Bawden on 6691 0400.

Yours sincerely

John Ball
Manager – Planning and Environment Services Coffs Harbour

The RFS has made getting information easier. For general information on 'Planning for Bush Fire Protection, 2006', visit the RFS web page at www.rfs.nsw.gov.au and search under 'Planning for Bush Fire Protection, 2006'.

Postal address
NSW Rural Fire Service
Records Management
Locked Bag 17
GRANVILLE NSW 2142

Street address
NSW Rural Fire Service
Planning and Environment Services
Suite 1, 129 West High Street
COFFS HARBOUR NSW 2450

T (02) 6691 0400
F (02) 6691 0499
www.rfs.nsw.gov.au
Email: csc@rfs.nsw.gov.au

File No: NTH16/00067

Resource Assessments, Planning Services
Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2001

Attention: Lauren Evans

Dear Sir/Madam,

EAR 1060 – Wattle Vale Quarry, Glen Innes

I refer to your email of 28 June 2016 requesting input from Roads and Maritime Services in relation to the Secretary's Environmental Assessment Requirements for the abovementioned extractive industry proposal.

Roles and Responsibilities

The key interests for Roads and Maritime are the safety and efficiency of the road network, traffic management, the integrity of infrastructure assets and the integration of land use and transport.

Gwydir Highway is a classified (state) road. In accordance with Section 7 of the *Roads Act 1993* (the Act) Glen Innes Severn Council is the Roads Authority for this road and all other public roads in the subject area. Roads and Maritime is the Roads Authority for freeways and has responsibilities for freeways and classified roads in accordance with the Act.

In accordance with Clause 16 of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*, Roads and Maritime is given the opportunity to review and provide comment on the subject development application as it involves the transport of materials on a public road.

It is emphasised that the following comments are based on the information included in your enquiry. They are not to be interpreted as binding upon Roads and Maritime and final comment will be subject to a formal assessment of any development application referred by the relevant consent authority.

Roads and Maritime Response

It is understood that a proposed new extractive industry is planned at the subject location and will likely result in traffic impacts on the Gwydir Highway. Roads and Maritime has had preliminary discussions with the applicant regarding the potential impacts this and other development in the area could have on the highway.

It is noted that a Traffic and Transport Impact Assessment (TIA) will be undertaken as part of the Environmental Impact Statement. The TIA will need to be prepared by a suitably qualified person in accordance with the Austroads Guide to Traffic Management Part 12, the complementary Roads and Maritime Supplement and the RTA Guide to Traffic Generating Developments and should address the following;

- The total impact of existing and proposed development on the road network with consideration for a 10 year horizon.

- The volume and distribution of traffic generated by the proposed development.
- Intersection sight distances at key intersections along the primary haulage route/s.
- Existing and proposed site access standards.
- Details of any proposed improvements to affected intersections.
- Details of servicing and parking arrangements.
- Impact on public transport (public and school bus routes) and consideration for alternative transport modes such as walking and cycling.
- Impacts of road traffic noise and dust generated along the primary haulage route/s.
- Consideration for Clause 16(1) of the Mining SEPP regarding;
  - Impact on school zones and residential areas.
  - Road safety assessment of key haulage route/s.
  - Code of Conduct for haulage operators.

  Any Code of Conduct could include, but not be limited to;

  - A map of the primary haulage route/s highlighting critical locations.
  - Safety initiatives for haulage through residential areas and/or school zones.
  - An induction process for vehicle operators and regular toolbox meetings.
  - A complaint resolution and disciplinary procedure.
  - Any community consultation measures for peak haulage periods.

Where road safety concerns are identified at a specific location along the identified haulage route/s, Roads and Maritime suggest that the TIA be supported by a targeted Road Safety Audit undertaken by suitably qualified persons.

The current Austroads Guidelines, Australian Standards and Roads and Maritime Supplements are to be adopted for any proposed works on the classified road network.

The Developer would be required to enter into a 'Works Authorisation Deed' (WAD) with Roads and Maritime for any works deemed necessary on the classified (state) road network. The developer would be responsible for all costs associated with the works and administration for the WAD

Further information on undertaking private developments adjacent to classified roads can be accessed at:

http://www.rms.nsw.gov.au/projects/planning-principles/index.html

If you have any further enquiries regarding the above comments please do not hesitate to contact Liz Smith, Manager Land Use Assessment on (02) 6640 1362 or via email at: development.northern@rms.nsw.gov.au

Yours faithfully

12 July 2016
for Monica Sirol
Network & Safety Manager, Northern Region

Appendix B Resource Assessment

Proposed Wattle Vale Quarry

Geotechnical Investigation Report and Resource Assessment

Prepared For: Glen Innes Shire Council

Date 22 December 2016

DOCUMENT/REPORT CONTROL FORM

Project Name:	Wattle Vale Quarry - Geotechnical Investigation
Project Number:	30012451
Revision Number:	Rev 1

Revision History

Revision #	Date	Prepared by	Reviewed by	Approved for Issue by
Rev 1	22/12/16	Ben Dalton	Patrick Kidd	Patrick Kidd

Issue Register

Distribution List	Date Issued	Number of Copies
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Office Library Gold Coast	22/12/16	1
SMEC Project File	22/12/16	1

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TABLE OF CONTENTS

1. INTRODUCTION

1.1. General

This report presents the results of the current and previous geotechnical investigations carried out by SMEC Australia Pty Ltd (SMEC) for Glen Innes Shire Council (Council) for the proposed Wattle Vale Quarry Site and collates all previous information from the previous site investigations carried out in April 2016.

The recent field investigation was conducted in November 2016. The investigation was undertaken in accordance with Australian Standard AS1726:1993 Geotechnical Site Investigations.

The site locality is shown in Figure 1.1 Locality Plan

Figure 1.1 Locality Plan

1.2. Background

The Wattle Vale property has been identified as a potential quarry site by Glen Innes Severn Council as a potential hard rock quarry site. The Wattle Vale property is approximately 200 hectares in size and straddles the Gwydir Highway. Council have previously identified five potential sites within the property to investigate as a potential quarry sites. Each site is approximately 2Ha in size. During the initial walk over carried out immediately prior to undertaking seismic survey it was decided that Site 2 (North West of Site 1) would not be investigated due to the steepness/undulation of the terrain.

Based on the results of the seismic survey intrusive investigation was commenced at selected sites.

The investigations comprised seismic survey, and borehole investigations both using a conventional drilling rig an Air Track Percussion Drilling Rig.

Site 5 identified materials which are more suitable for quarrying than other sites and three cored boreholes to approximately 25m were undertaken on the site.

An air track percussion drill and blast rig was utilised to undertake six boreholes to increase coverage of the site however drilling was unable to penetrate the weaker tuff and generally boreholes were terminated between 12m to 13m BGL.

The materials won from the quarry are likely to be used for aggregate and for road construction materials. Chemical and strength laboratory testing was completed separately by Council in April 2016. No additional laboratory testing has been undertaking on recovered materials.

Council has purchased the property and is undertaking the Environmental Impact Study to support their development application and has requested SMEC undertake further boreholes on Site 5. The purpose of the additional boreholes is to assess the potential extraction quantities/resource assessment and determine the rock condition at floor level at this site.

1.3. Report Contents

This report presents the results from all the geotechnical field investigations undertaken on the property by SMEC, together with plans showing the test locations. The results of the field investigations and laboratory testing are presented in the appendices.

The report aims to provide general commentary on the geological and geotechnical issues which will need consideration in the development of site 5 as a quarry and a resource assessment to provide input into the EIS.

2. GEOLOGICAL DESCRIPTION

2.1. Topography and Geomorphology

The topography and landform patterns within and surrounding the study area are dominated by undulating hills bounded by both perennial and ephemeral water courses and associated gullys. Typical slopes are up to 15 degrees with short steeper sections located adjacent to water courses and outside the subject site.

2.2. Soils and Geology

The Interactive Geological Map of NSW from the NSW Department of Industry - Resources and Energy indicates the site is underlain by Mafic volcanic rocks of the Cainozoic (Tertiary) era defined as volcanics deposited in the last 65 million years. The Grafton geological map of the area (1:250,000) further identifies these as Volcanics comprising of basalts and dolerites. Reference to previous investigation results carried out for the nearby proposed White Rock Wind Farm indicate that the subsurface conditions (rock strength, weathering profile and volcanic layering) is highly variable with evidence of multiple basalt flows and layering within the rock profile.

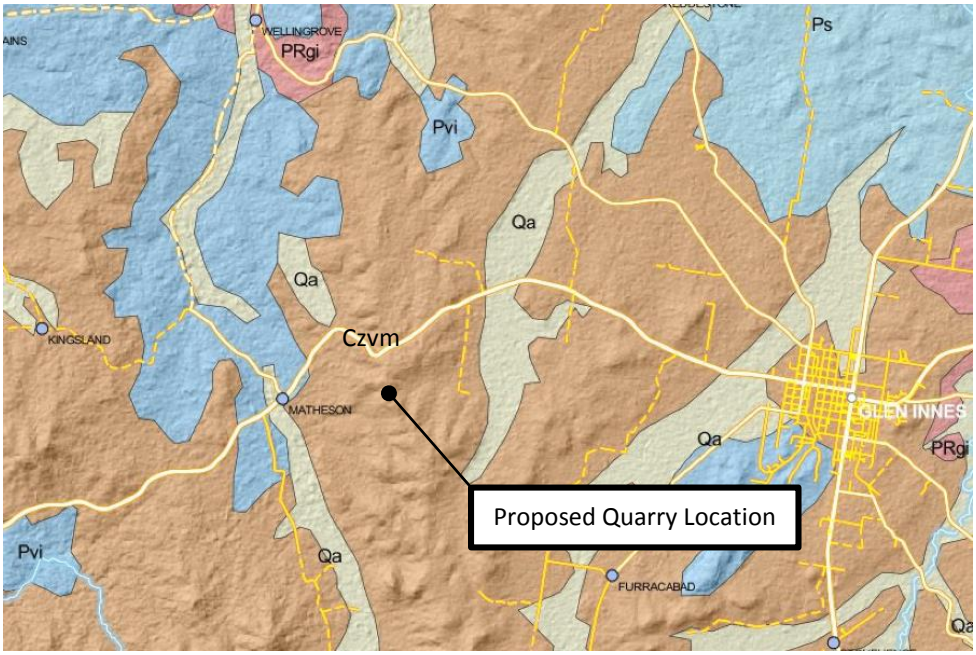

Figure 2.1 Extract from Interactive Geological Map of NSW from the NSW Department of Industry

Table 2.1 – Summary of Geological Units Present

Symbol	Unit	Age	Description
Qa	Alluvium	Quaternary	Current and recent mud, silt, sand and gravel deposited by river (alluvial) systems.
Pvi	I-type volcanics	Permian	Volcanic eruptive rocks such as lava flows, and pyroclastic deposits such as ignimbrites. Typically
Czvm	Mafic volcanics	Cainozoic	Mafic volcanic rocks are those that were erupted from widespread volcanic activity through the eastern part of the state over the last 65 million years. Basalt lava flows are typical examples.

2.3. Encountered Geology

2.3.1. Topsoil and Residual Soils

Surficial soils comprise of topsoil and soil derived by weathering of the parent rock below (residual soils). These typically consist of clays and silts to depths of 1.0 to 2.0m.

- Surficial topsoils were generally firm consistency, dark brown of medium to high plasticity and 0.5m thick.
- Residual soils were generally stiff to very stiff, grey-brown and of medium to high plasticity

2.3.2. Basalt

Basalt is a product of mafic volcanics, it most commonly forms as an extrusive rock, such as a lava flow, but can also form in small intrusive bodies. The basalts of Glen Inness are typically formed with alkali olivine and transitional basalt.

2.3.3. Volcaniclastics

Volcaniclastic rocks were encountered as part of the investigation, these consist primarily of Agglomerates and Tuff. These layers have been formed as part of the volcanic events between basaltic lava flows.

Agglomerates consists of large, coarse, rock fragments associated with volcanic activity and formed by the ejected and deposition of rock during volcanic eruptions. Sometimes referred to as pyroclastic breccia, they can be welded by heated deposition. Agglomerates are pyroclastic igneous rocks that consist almost wholly of angular or rounded lava fragments of varying size and shape. Fragments of rock are usually found in a tuffaceous matrix, or appear in lithified volcanic dust or ash.

Tuff consists of fine type of rock made of fine grained volcanic materials, such as ash, ejected during a volcanic eruption. The materials are deposited, occasionally superheated, and form hard rock layers, under both heat and pressure of overlying materials.

3. GEOTECHNICAL FIELD INVESTIGATION

3.1. Scope of Work

The geotechnical investigations were carried out in April 2016 and November 2016. The scope of work for the geotechnical field investigations comprised the following:

- Preparation of field documentation;
- Non-core borehole drilling, sampling and SPT's (standard penetration tests);
- Cored borehole drilling, core photography and point load testing;
- Seismic refraction survey;
- Laboratory testing of soil and rock samples for geotechnical purposes; and
- Co-ordinate survey of completed exploratory locations.

While SMEC were on site in April 2016 Council engaged a percussion drilling rig to undertake percussion holes at the site. These holes were observed by the SMEC Engineer.

A discussion of each component of the geotechnical investigation is provided in the subsequent sections of this report.

3.2. Geotechnical Investigation

3.2.1. Geotechnical Boreholes

Boreholes were drilled using a track and truck mounted site investigation drilling rigs. An experienced Geotechnical Engineer from SMEC was present full time during the drilling investigation.

Boreholes were drilled using auger drilling techniques with a 'V' shaped bit or tungsten carbide (TC) bit through soils and into extremely weathered rock. Standard penetration tests were carried out at a nominal 1.0 to 1.5m interval.

Coring of the rock was carried out using diamond coring (NMLC or HQ3 wireline) techniques. Rock core from boreholes was boxed, photographed and point load tested. Point load tests were conducted approximately every 1.0m where rock core was suitable for testing, and selected samples were wrapped for later UCS testing.

Appendix A contains the following:

- Explanatory notes;
- Borehole logs; and
- Core photography.

3.2.2. Percussion Holes

A total of six percussion drill holes were carried out at the site at locations nominated by Council. The holes were drilled using a tracked Atlas Copco Roc D9C Silenced Smart Rig. Initially nine holes had been scheduled however the sub-contractor engaged by Council left site before completing all nine.

The location of the six holes undertaken is presented on the site plan in Appendix E

Observations were made by the SMEC Geotechnical Engineer as drilling works were undertaken. Records of the observations made are presented in Appendix C.

3.2.3. Seismic Refraction Survey

As discussed in Section 1.2 seismic refraction survey was undertaken at 4 sites on the property. The location of the seismic traverses carried out for each site are shown on Figure 3.1.

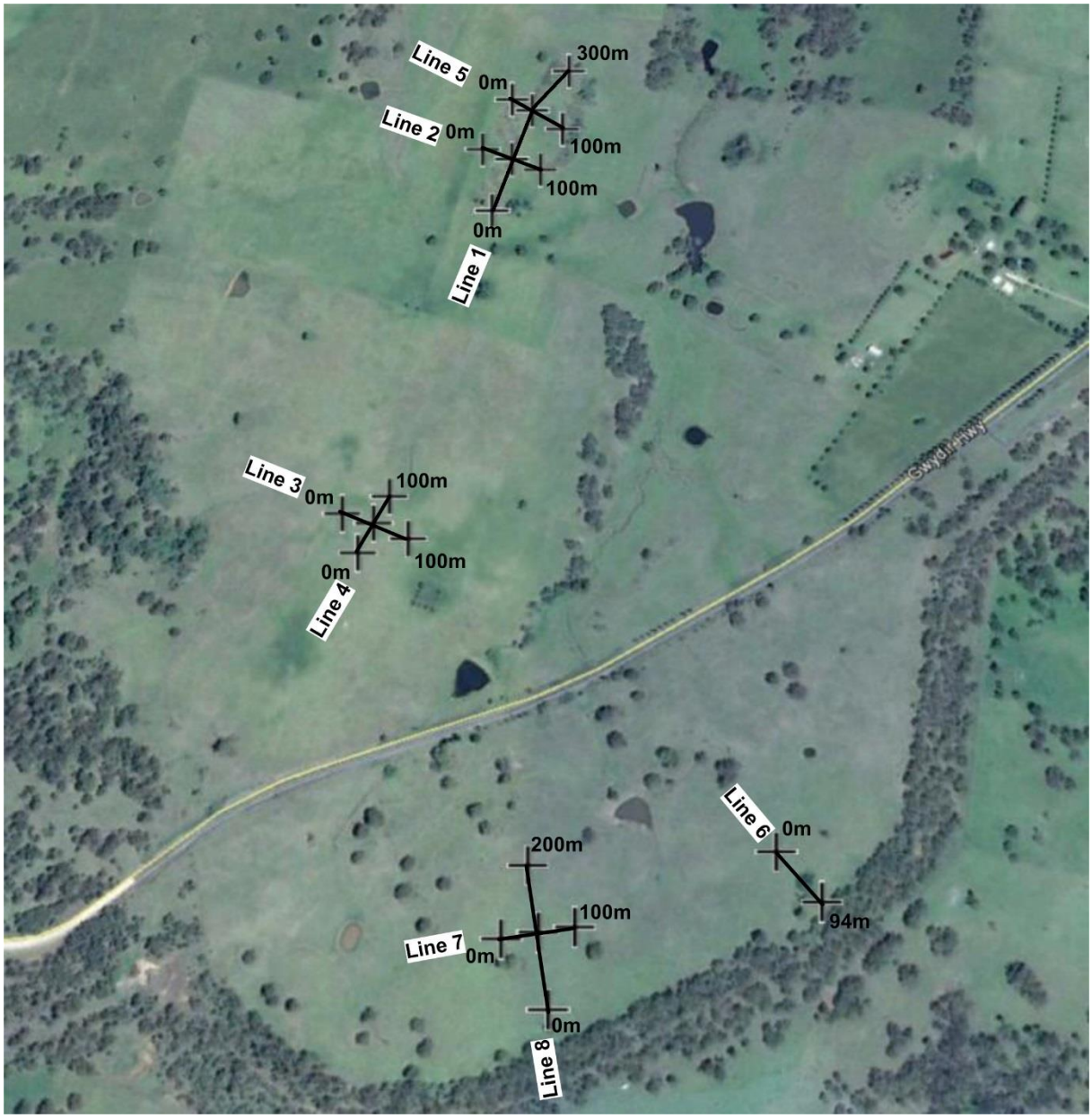

Figure 3.1 Location of Seismic Transverses

For each traverse a series of geophones were positioned along a line and detonators or low powered explosives used to generate a seismic wave through the soil/rock and the data recorded.

The results of the survey are presented as 2-dimensional profiles of the ground with variations in the wave velocity shown with respect to depth and position along the traverse. The results of the seismic refraction survey are presented in Appendix F.

3.2.4. Geotechnical Laboratory Testing

A programme of laboratory testing was carried out on samples obtained during the first round of investigation in April 2016. Samples were labelled, stored and subsequently scheduled laboratory

geotechnical testing at a NATA accredited laboratory. Geotechnical laboratory test results are presented in Appendix G.

3.2.5. Investigation locations

The location of all geotechnical intrusive geotechnical investigation sites are outlined below in Table 3.1, this included a series of Boreholes and percussion drill holes. Locations are shown on appended layout plan (Ref:161129-300112451-PLAN-001-DR) and summarised in the table below.

Site investigation locations were set out by SMEC using site location plans and GPS co-ordinates entered into a hand held GPS unit. Upon completion of the investigations a Registered NSW surveyor carried out a survey of the completed investigation locations and refraction lines.

Table 3.1 – Investigation Locations

Borrow Site	Location ID	Approx. Easting	Approx. Northing	Approx. Elevation (m AHD)	Final Depth (m)
3	BH01	365264.5	6711922.5	1125.1	18.16
3	BH02	365276.8	6711984.1	1163.1	14.80
3	BH03	365289.4	6712024.3	1162.3	20.00
3	BH05	365304.6	6711968.9	1162.7	17.35
	BH06	NOT DRILLED			
3	BH07	365338.4	6711994.3	1162.3	9.65
	BH08	NOT DRILLED			
5	BH09	365315.1	6710729.9	1215.0	18.00
5	BH10	365367.9	6710665.6	1218.6	18.00
5	BH11	365316.4	6710604.5	1218.6	25.35
5	BH12	365270.9	6710626.6	1216.9	25.24
5	BH13	365244.2	6710668.2	1213.5	20.00
5	BH14	365286.6	6710750.1	1212.5	20.10
5	BH15	365351.5	6710694.6	1217.6	25.00
5	BH16	365358.7	6710782.0	1212.3	20.20
5	BH17	365428.2	6710740.2	1214.1	20.00
5	BH18	365469.0	6710667.8	1218.0	25.00
5	BH19	365236.1	6710549.8	1217.0	25.00
5	BH20	365186.1	6710585.5	1211.9	20.00
5	PH04	365224.0	6710627.2	1213.0	13.90
5	PH05	365313.4	6710681.4	1217.2	11.50
5	PH06	365410.1	6710720.0	1216.1	14.80
5	PH07	365436.0	6710670.6	1218.2	14.00
5	PH08	365458.1	6710636.2	1219.6	14.70
5	PH09	365372.1	6710619.5	1219.4	11.10

3.3. Subsurface Profile

A summary of the subsurface profile encountered at different test locations for the current investigation is tabulated in Table 3.2 and presented in three cross sections in the drawings in Appendix B.

Table 3.2 – Sub Surface Summary

Borehole	Approximate Depth (m)							
	Topsoil/ Residual Soil	Basalt				Volcaniclastics		Termination Depth
		Extremely to Highly Weathered	Highly to Moderately Weathered	Moderately to Slightly Weathered	Slightly Weathered to Fresh	Lapilli Tuff	Agglomerate	
BH01	0 – 1.0	9.7 – 14.8			1.0 – 9.7 14.8 – TD			18.16
BH02	0 – 0.6	2.0 – 3.3 14.4 - TD			0.6 – 2.0 3.3 – 6.3	6.3 - 14.4		14.8
BH03	0 – 0.6				0.6 – 6.0 12.6 – 14.5 16.27 - TD	6.0 – 8.7 11.5 – 12.6	8.7 – 11.5 14.5 – 16.27	20.0
BH05	0 – 0.95				0.95 – 10.85 12.65 - TD	10.85 – 12.65		17.35
BH07	0 – 0.6	0.6 -8.7				8.7 - TD		9.65
BH09	0 – 1.7	1.7 – 2.0	14.0 – 15.65	2.0 – 6.8	6.8 – 14.0 15.65 - TD			18.0
BH10	0 – 1.0	1.0 –2.2 13.23 – 14.25	2.2 -3.72	3.72 – 11.25	11.25 – 13.23 14.25 – TD			18.0
BH11	0 – 1.0	1.0 – 3.2		3.2 – 7.6	7.6 – 12.8 14.05 – 21.2 23.2 - TD	22.5 – 23.2	12.8 – 14.05 21.2 – 22.5	23.35
BH12	0 – 1.2	1.2 - 3.2	3.2 – 8.3		8.3 – 10.94 13.4 – 18.4 20.4 - TD	10.94 – 13.4	18.4 – 20.4	25.24
BH13	0 – 1.7	1.7 – 2.0 15.86 – 17.07	7.5 – 12.85		2.0 – 7.5 17.07 – TD		12.85 – 15.86	20.0
BH14	0 – 1.0			1.0 – 6.75 8.52 -13.89 16.48 - TD		6.75 – 8.52 13.9 -16.48		20.1
BH15	0 – 2.0	2.0– 4.3		4.3 – 12.01 14.23 – 20.4	22.85 - TD	12.01 – 14.23 20.4 – 22.85		25.0
BH16	0 – 1.0	1.0 – 1.6		8.26 – 16.0 18.2 - TD	1.6 – 7.0	7.0 – 8.26 16.0 – 18.2		20.2
BH17	0 – 1.1	1.1 – 2.5	9.25 – 13.1 19.0 – TD	2.5 – 9.25 13.1 – 15.3		16.8 – 19.0	15.3 – 16.8	20.0
BH18	0 – 0.8		0.8 -7.15	12.25 – 13.9 14.5 – 16.0	7.15 – 12.2 16.0 – 19.12 22.5 - TD	13.9 – 14.5	19.12 – 22.5	25.0
BH19	0 – 1.0	1.0 – 3.45			3.45 – 10.5 12.64 – 18.1 21.53 - TD	18.1 – 21.53	10.5 – 12.64	25.0
BH20	0 – 1.0	1.0 –1.95	5.35 – 11.6 18 – 19.3	1.95 – 5.35 19.3 - TD	15.1 – 18.0		11.6 – 15.1	20.0

TD = Termination Depth (m)

3.4. Groundwater

Whilst undertaking drilling of the boreholes during the current investigations two standpipes were installed at site 5 in BH14 and BH19 and ground water levels in the boreholes were measured by leaving holes open during the investigations, and standing water levels were periodically dipped. All boreholes except where instrumentation was installed were plugged and backfilled after last measurement was taken.

. Provides a summary of the standing water levels in the open boreholes and or stand pipe ground water levels recorded during and after the investigation. Generally the standing water levels were at higher elevations to the south of the site in comparison to that in the northern portion of the site.

Table 3.3 – Summary of Measured Ground Water Levels

BHID	Measured Water Level (m BGL)								
	10/10	14/10	17/10	20/10	21/10	24/10	25/10	26/10	21/11
BH12	-	-	-	7.3	7.9	-	7.9	8	-
BH13	-	-	-	-		16	16.1	-	-
BH14*	-	-	-	-	-	-		12.2	12.2
BH15	7.5	7.2	-	-	-	-	-	-	-
BH16	-	-	-	16.9	17.4	15.1	15.3	15.9	-
BH17	-	-	-	-	-	-	-	-	-
BH18	-	-	9.4	9.6	9.7	9.9	10	10.3	-
BH19*	-	-	-	-	-	-	-	16.08	17.52
BH20	-	-		-	-		7	6.9	-

* Stand Pipe Piezometer Installed.

It was noted that following a period of wet weather during this investigation water was observed to be seeping out of hill sides to the south the site.

4. Resource Assesment - Site 5

4.1. General

Council has identified an area on the site which is the proposed quarry extents see site plan in Appendix C. Using the 1m Contours provided by Council cross sections through the proposed quarry have been developed to calculate estimated quantities of materials which could be extracted from the site see Appendix D. A potential pit layout has been considered with the stripping of the overburden material and the extraction of slightly weathered to Fresh rock to RL 1160m across the potential pit. The RL 1160m was selected to allow natural water drainage from the potential pit.

4.2. Estimated Quantities

Based on the existing geological information, and the geological model interpreted by SMEC, estimated volumes of rock have been obtained. The estimated volumes of each rock type were extrapolated from the geological model. These quantities are for reference only, due to the complex geology of the area it is expected that these volumes may differ from the volumes existing in the borrow pit area.

The geological interpretation of the potential pit area shows a series of volcanoclastic layering are likely to increase significantly the volumes of overburden or unsuitable materials. The nature of this layering is clearly depicted on attached cross sections, refer Appendix B. It has been assumed that batters will be approximately 8-10m in height with average angles of 60° and benches approximately 5-8m wide. Access roads will be need to be constructed to allow excavations to reach the proposed floor level.

The volumes presented below in table 4.1 relates to a total volume of rock in situ and it does not considers bulking factors and waste of material during processing.

Table 4.1 – Estimate Volumes of Materials

Material	Volume to RL1160(m^3)
Overburden	67,500
Extremely Weathered Basalt	218,000
Moderately to Slightly Weathered Basalt	280,750
Slightly Weathered to Fresh Rock	276,750
Tuff/Agglomerate	99,500
Total Volume	**942,500**

5. GEOTECHNICAL ISSUES

5.1. Potential Geotechnical Issues

5.1.1. Trafficability

At the time of the recent field investigations, trafficking problems were encountered due to recent heavy rainfall. Access via the gate from Gwydir Highway was not possible for the drill rig and support vehicles, an alternative access was available via the old highway which traverses the ridge to the south of the property, however when trying to access the site via the top gate the water logged soils became boggy and un-trafficable without assistance of bog mats and creation of temporary access.

During the April investigation the generally dry conditions existing on the site and trafficking problems were not experienced. It is recommended that in these potential problem areas after stripping, clearing and grubbing, the exposed surface should be proof rolled to improve trafficability. If the exposed surface is too soft to be successfully proof rolled, the soft material could be excavated and replaced provided the existing earthworks and structures where present are not destabilised by undercutting. Alternatively consideration could be given to the placement of a geotextile then a gravel layer of at least 250mm over the soft areas to form a trafficable surface.

5.1.2. Preliminary Excavatability Assessment

It is understood that excavations up to approximately 20m in depth are proposed during the construction of the quarry pit. It is anticipated that excavations on the project will consist of the following:

- Bulk Excavations – for site stripping and material extraction.
- Cuts up to approx. 8m in height
- Construction of access roads and drainage.

The preliminary excavatability of the proposed quarry site was determined based on the results of the seismic refraction survey, and the results of the laboratory rock strength tests combined with the visual classification and weathering of the rock material.

The results of the seismic refraction survey at Site 5 (Line 8 Aligned South to North) showed that rock with seismic velocities below 2500m/second depths ranging from 5m below the ground at the southern end to 15m below the existing ground surface at the northern end of the seismic line. In general seismic velocities beyond 2500m/s are considered to be marginally rippable, subject to discontinuity, frequency pattern and spacings. Where seismic velocities exceed 2500m/s it is considered likely that the rock will require either hydraulic hammering and or drill and blast techniques to facilitate its excavation. The results from the seismic refraction survey have been included in Appendix F for reference.

The point load index of rock material can be used to estimate the potential excavatability of material when plotted with observed fracture spacings from the borehole logs. Figure 5.1 shows the point load index results plotted verses the averaged fracture spacing at the depth the tests were performed. The plot has been divided into zones showing the potential type of equipment required for excavation. Beyond a certain Is_{50} point load index and defect spacing, the material becomes unrippable and blasting may be required.

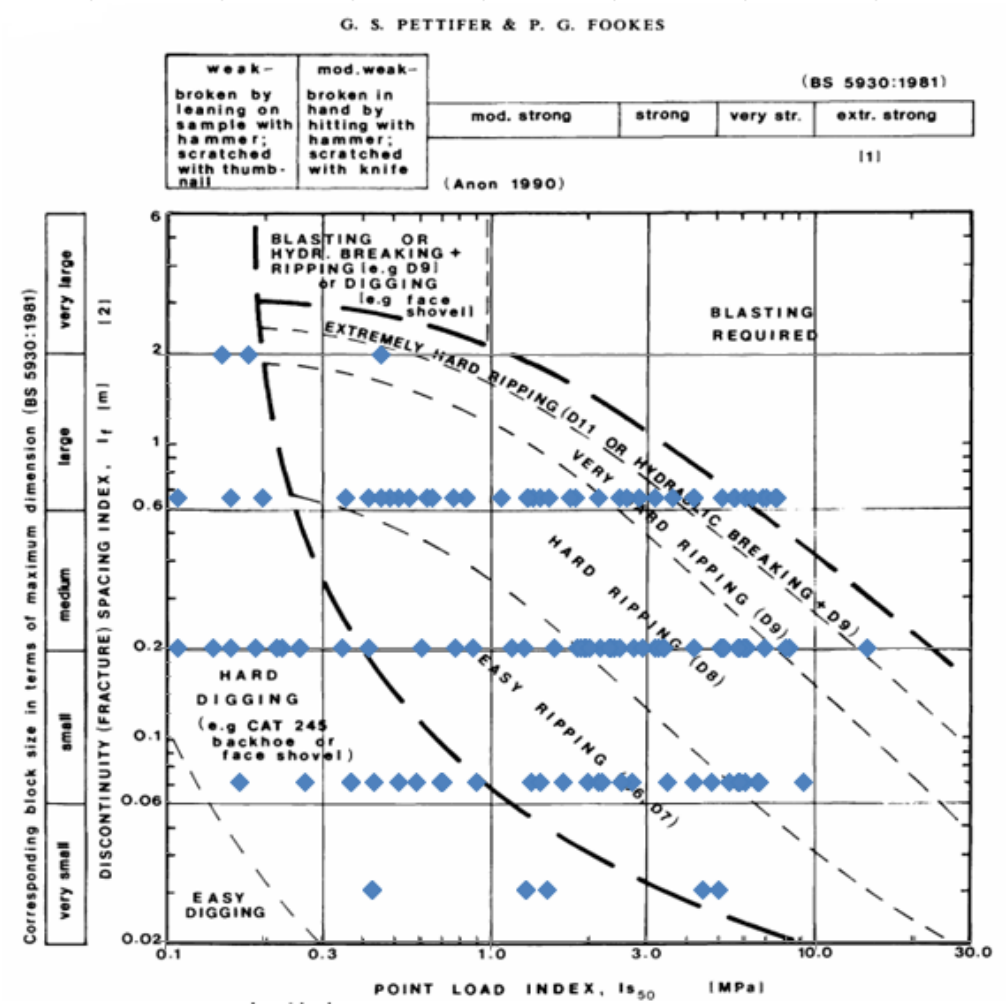

Figure 5.1 Rippability Chart (Modified from Pettifer and Fookes 1994.)

Is_{50} Values calculated from laboratory testing of rock samples have been plotted on Figure 5.1 above. The analysis indicates the excavatability may range from hard digging to extremely hard ripping, with a small percentage possibly requiring blasting. In general, the majority of results indicate fall within the Hard to Extremely hard ripping range.

5.1.3. Soils

5.1.3.1. Erosion Potential

The soils on the site are typical of Ferrosols. Soils derived from Basalt and show little change in A and B horizons.

According to the available information in the Australian Soil Resource Information System ASRIS (Atlas ASC Soil Order, Refer Appendix H for screenshot of the Map) the soil profile is:

1. 0m-0.3m, A Horizon, (Clay 30%), PFF1 Map Reference Rh6
2. 0.3m-0.9m B Horizon (Clay 70%), PFF1 Map Reference Rh6

Due to the cohesive nature of the soils and the high clay contents, the erodibility is assessed to be low to moderate. The A Horizon soils are likely to have higher erosion potential than the B Horizon.

Potential for erosion will possibly occur when the highly weathered Tuff is exposed after removal of upper Basalt layers excavation

5.1.3.2. Erosion Risk

Potential soil erosion impacts have been considered for earthworks areas and spoil disposal sites for the project area. Proposed construction activities that are likely to result in soil erosion impacts include:

- Vegetation clearing
- Site preparation activities
- Construction of laydown, material stockpile and equipment storage areas
- Construction of worksites, haul routes and vehicular access tracks
- Site remediation/reinstatement works

5.1.3.3. Stormwater Runoff Potential

Stormwater runoff quality will be slightly affected by the uncovering of earthworks on the site due to the low to moderate dispersive nature of the soils, check dams in drainage design will limit the amount of sedimentation flowing into the dam. Due the topography of the site and the shallow slopes at the top of the plateau significant seepage of rainfall occurs. Towards the crest of the slopes around the plateau drainage conditions are good due to the steep grass covered slopes. Once grasses are stripped and clays are exposed degradation of stormwater quality can be expected.

5.1.3.4. Soil Stability

Precautions should be taken to ensure that exposed batters of the potential pit where potentially erosive materials are exposed are suitably protected and appropriate drainage works are undertaken to prevent undermining which could possibly lead to instability of cut slopes.

5.1.4. Preliminary Batter Slopes

It is understood that excavations are proposed during the site development.

Maximum batter angles for the existing site materials and any potential fill materials are outlined in Table 5.1 for unsurcharged cut and fill batters less than 3m high on the site. Where surcharges are located within H (height of batter) of the top of the batter, then some reduction in design angle will be required. Steeper batters are possible with the use of retaining structures (temporary or permanent).

Table 5.1 Preliminary Batter Angles for Cuts and Fills

Material	Short Term	Long Term
Uncontrolled Fill / Alluvial Soils	1V to 2H (26°)	1V to 3H (18°)
Engineered Cohesive Fill / Residual Soils	1V to 1H (45°)	1V to 2.0H (22°)
Residual Gravelly Clays and Extremely Weathered Rock	1V to 1H (45°)	1V to 2H (26°)
Highly to Slightly Weathered Rock	1V to 0.6H (60°)[1]	1V to 0.6H (60°)[1]

Note:

1. The use of these batter slopes is subject to inspection by an experienced geotechnical professional as batter slopes in rock are dependent on the rock joint structure including the presence of clay seams and orientation of joints with respect to the cutting.
2. All batters should be protected to prevent scour and erosion.
3. Steeper Batters may be batter slopes maybe be possible with engineer design cuts.

5.1.5. Additional Investigations

Due to the preliminary nature of this investigation and the uncertainty of the extents proposed earthworks. This data contained in this report is likely not sufficient for undertaking preliminary earthworks design including but not limited to design of:

- Stability of bench/batter slopes higher than 3m;
- Detailed rippability assessments and or blasting requirements;
- Hydrogeological modelling; and
- Erosion potential and sediment and runoff strategies.

Assessment of the requirements for further investigation to facilitate earthworks design should be undertaken.

6. LIMITATIONS

SMEC have prepared this report in accordance with our proposal submitted to Council. The contents of the report are for the sole use of the Council. No responsibility or liability will be accepted to any third party. Data or opinions contained within the report may not be used in other contexts or for any other purposes without prior review and agreement.

Site exploration identifies specific subsurface conditions only at those points from which samples have been taken and thus only a finite amount of information has been collected to meet the specific financial and technical requirements of the brief. This report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it must be appreciated that actual conditions could vary from the adopted geotechnical models.

It is possible that the subsurface soil and/or rock conditions encountered during construction or excavation may vary from those identified by this report. Should such variations or differences become apparent we recommend that SMEC should be immediately contacted for further geotechnical advice.

APPENDIX A BOREHOLE LOGS AND CORE PHOTOGRAPHS

NOTES RELATING TO GEOTECHNICAL REPORTS

Introduction

These notes have been provided to outline the methodology and limitations inherent in geotechnical reporting. The issues discussed are not relevant to all reports and further advice should be sought if there are any queries regarding any advice or report.

Geotechnical Reports

Geotechnical reports are prepared by qualified personnel on the information supplied or obtained and are based on current engineering standards of interpretation and analysis.

Information may be gained from limited subsurface testing, surface observations, previous work, and is supplemented by knowledge of the local geology and experience of the range of properties that may exhibited by the materials present. For this reason geotechnical reports should be regarded as interpretative rather than factual documents, limited to some extent by the scope of information on which they rely.

Where the report has been prepared for a specific purpose (e.g. design of a three storey building), the information and interpretation may not be appropriate if the design is changed (e.g. a twenty storey building). In such cases, the report and the sufficiency of the existing work should be reviewed by SMEC in the light of the new proposal.

Every care is taken with the report content, however, it is not always possible to anticipate or assume responsibility for the following conditions:

- Unexpected variations in ground conditions. The potential for this depends on the amount of investigative work undertaken.
- Changes in policy or interpretation by statutory authorities
- The actions of contractors responding to commercial pressures

If these occur, SMEC would be pleased to resolve the matter through further investigation, analysis or advice.

Unforseen Conditions

Should conditions encountered on site differ markedly from those anticipated from the information contained in the report, SMEC should be notified immediately. Early identification of site anomalies generally results in any problems being more readily resolved and allows re-interpretation and assessment of the implications for future work.

Subsurface Information

Logs of a borehole, recovered core, test pit, excavated face, or cone penetration test are an engineering and/or geological interpretation of the subsurface conditions. The reliability of the logged information depends on the drilling/testing method, sampling/observation spacing's and the ground conditions. It is not always possible or economic to obtain continuous high quality data. It should also be recognised that the volume of material observed or tested is only a fraction of the total subsurface profile.

Interpretation of subsurface information and application to design and construction must take into consideration the spacing of the test locations, the frequency of observations and testing, and the possibility that geological boundaries may vary between observation points.

Groundwater observations and measurements outside of specially designed and constructed piezometers should be treated with care for the following reasons:

- In low permeability soils groundwater may not seep into an excavation or bore in the short time it is left open.
- A localised perched water table may not represent the true watertable.
- Groundwater levels vary according to rainfall events or season.
- Some drilling and testing procedures mask or prevent groundwater inflow.

The installation of piezometers and long term monitoring of groundwater levels may be required to adequately identify groundwater conditions.

Supply of Geotechnical Information for Tendering Purposes

It is recommended tenderers are provided with as much geological and geotechnical information that is available, and that where there are uncertainties regarding the ground conditions, prospective tenderers should be provided with comments discussing the range of likely conditions in addition to the investigation data.

| GENERAL

Information obtained from excavation and drilling investigations is recorded on log sheets. The "Geotechnical Log of Non-core Drill Hole" presents data from drilling operations where a core barrel has not been used to recover material and information is based on a combination of regular sampling and insitu testing. The "Geotechnical Log of Excavation" presents data obtained on the subsurface profile from observations of excavations, either natural or man-made.

The heading of the log sheets contains information on client and project identification, hole identification, location, ground surface elevation, details of the drilling contractor, equipment, drilling dates and the personnel responsible for the preparation of log. The main section of the log contains information on drilling or excavation methods and conditions, material substance description, details of insitu tests and additional observations, presented as a series of columns plotted with reference to length in metres below the ground surface. The "Geotechnical Log of Excavation" contains a squared section for a scaled, graphical presentation of the typical excavation profile.

As far as is practicable the data contained on the log sheets is factual. Some interpretation is inevitable in the assessment of conditions between samples and of the origin of the materials. Material description and classification is generally based on Geotechnical Site Investigation Code AS1726-1993.

| DRILLING& EXCAVATION

Drilling & Casing

HA	Hand auger
AS	Auger screwing
ADV	Auger drilling with V bit
ADT	Auger drilling with TC bit
WB	Wash-bore drilling
RR	Rock Roller
NQ	NQ core barrel (47mm diameter)
NMLC	NMLC core barrel (52mm diameter)
HQ	HQ Core Barrel (63mm diameter)

Drilling Penetration / Excavation Penetration

VE	Very Easy
E	Easy
F	Firm
H	Hard
VH	Very Hard
R	Refusal

Groundwater Levels

▼	Groundwater level with date observed
►	Groundwater inflow at the level marked
◄	Loss of drilling fluid at the level marked

Samples & Field Tests

Sections sampled bounded by lines across column.

D	Disturbed sample
B	Bulk disturbed sample
E	Environmental sample
W	Water Sample
SPT	Standard penetration test sample
U50	Undisturbed tube sample (50 mm diameter)

N	Standard Penetration Test result
VS	Vane Shear (kPa)
PP	Pocket Penetrometer (kPa)
P	Pressuremeter
W	Permeability
MC	Field moisture content
DCP	Dynamic Cone Penetrometer (Blows/150mm)

Elevation / Depth

Elevation is vertical height in metres above datum.
Depth is length in metres below the ground surface.

| MATERIAL

Graphic Log

Material types are indicated by standard symbols based on visual examination, field tests and available laboratory tests.

Classification Symbol

Standard classification symbols are based on the Unified Soil Classification System (USCS), AS1726-1993, Appendix A, Table A1.

Material Description

Materials are described in accordance with AS1726- 1993: Soil Type, Plasticity (cohesive soils) or Particle Characteristics (cohesionless soils), Colour, Secondary and Minor Components. Soils types are described according to their predominate particle/grain size:

Cohesive Soils		Cohesionless Soils	
Silt	0.002 – 0.075 mm	**Boulder**	>200 mm
Clay	< 0.002 mm	**Cobble**	63 – 200 mm
		Gravel	2.36 – 63 mm
		Sand	0.075 – 2.36 mm

Plasticity – Cohesive Soils

Description	LL (%)
Low	< 35 %
Medium	35 – 50 %
High	> 50 %

Particle Characteristics – Cohesionless Soils

Sands and gravels can be subdivided by their grain size:

Name	Grading	Particle Size (mm)
Gravel	Fine	2.36 – 6.0
	Medium	6.0 – 20
	Coarse	20 – 63
Sand	Fine	0.075 – 0.20
	Medium	0.20 – 0.6
	Coarse	0.63 – 2.36

Moisture

D	Dry
M	Moist – no free water on remoulding
W	Wet – free water on remoulding

Consistency / Relative Density

Consistency – Cohesive Soils

Symbol	Term	Unconfined Compressive Strength, q_u (kPa)
VS	Very Soft	< 25
S	Soft	25 – 50
F	Firm	50 – 100
St	Stiff	100 – 200
VSt	Very Stuff	200 – 400
H	Hard	> 400
Fr	Friable	

Relative Density – Cohesionless Soils

Symbol	Term	SPT N- Value (Blows/0.3m)	Density
VL	Very Loose	0 – 3	< 15 %
L	Loose	3 – 8	15 – 35 %
MD	Medium Dense	8 – 25	25 – 65 %
D	Dense	25 – 52	65 – 85 %
VD	Very Dense	> 42	> 85 %

Structure & Other Observations

Fissuring and other structural defects are described in accordance with AS1726-1993, Appendix 2.6, using the terminology for rock defects.
Where practicable, an assessment is provided of probable origin of the soil, e.g. fill, topsoil, alluvium, colluvium, or residual soil.

| GENERAL

Information obtained from excavation and drilling investigations is recorded on log sheets. The "Geotechnical Log of Cored Drill Hole" presents data from operations where a core barrel has been used to recover material – commonly rock.

The heading of the log sheets contains information on client and project identification, hole identification, location, ground surface elevation, details of the drilling contractor, equipment, drilling dates and the personnel responsible for the preparation of log. The main section of the log contains information on drilling methods and conditions, rock substance description and rock mass defects, presented as a series of columns plotted with reference to length in metres below the ground surface.

As far as is practicable the data contained on the log sheets is factual. Some interpretation (such as description of weathering, estimation of strength and identification of drilling induced defects) is inevitable in areas where no core was recovered. Material description and classification is generally based on Geotechnical Site Investigation Code AS 1726-1993.

| DRILLING

Drilling & Casing

Refer to **Explanatory Notes for Non-Core Drill Hole and Excavation.**

Water Return

Indication of water loss during coring, e.g. water loss through rock fractures or voids.

Core Loss & Run %

Length of core recovered as a percentage of total length drilled.

RQD %

The Rock Quality Designation (RQD) is the sum of lengths of unfractured core pieces greater than 100mm, over the total length of the core run, expressed as a percentage.

Samples & Field Tests

Sections sampled bounded by lines across column.

C	Core sample
P	Pressuremeter Test
O	Core Orientation
I	Impression Device
H	Hydraulic Fracturing
U	Unconfined Compressive Strength
D	Point Load Strength (Index) (Diametral)
A	Point Load Strength Index (Axial)
W	Water Pressure Test
Is(50)	Point Load Strength Index

| MATERIAL

Material Description

Materials are described in accordance with AS1726-1993, Appendix A3.1 to A3.3, and tables A6a and A7. Rock types are described by colour, grain size, and structure (texture, fabric, mineral composition, hardness alteration, cementation, etc.).

Grain Size

Grading	Grain Size (mm)
Very Coarse	> 60
Coarse	2 – 60
Medium	0.06 – 2
Fine	0.002 – 0.06
Very Fine	< 0.002
Glassy	

Bedding

Description	Separation (mm)
Very thickly bedded	> 2000
Thickly bedded	600 – 2000
Medium bedded	200 – 600
Thinly bedded	60 – 200
Very thinly bedded	20 – 60
Laminated	6 – 20
Thinly laminated	< 6

Weathering

F	Fresh; rock substance unaffected.
SW	Slightly weathered; partial staining or discolouration of rock substance
MW	Moderately weathered; staining or discolouration extends throughout the whole rock substance
HW	Highly weathered; rock substance partly decomposed
EW	Extremely weathered; rock substance entirely decomposed.
RS	Residual soil; mass structure and fabric are no longer evident

Strength

Symbol	Strength	Is50 (MPa)
EL	Extremely Low	< 0.03
VL	very Low	0.03 – 0.1
L	Low	0.1 – 0.3
M	Medium	0.3 – 1
H	High	1 – 3
VH	Very High	3 – 10
EH	Extremely High	> 10

Strengths are estimated where possible by Point Load Index Testing of representative samples. Test results are plotted on the graphical estimated strength by using:

○	Diametral Test
●	Axial Test

Natural Fracture

The average distance between fractures is measured parallel to the core axis, in mm.

Defects

Description of individual defects by type, orientation, in-filling, shape and roughness in accordance with AS1726-1993, Appendix A Table A10, notes and Figure A2.

Type

BP	Bedding Parting
JT	Joint
SM	Seam
FZ	Fracture Zone
SZ	Shear Zone
VN	Vein
FL	Foliation
CL	Cleavage
DL	Drill Lift
HB	Handling Break
DB	Drilling Break
DS	Decomposed Seam
DZ	Decomposed Zone

Roughness

RF	Rough
VR	Very Rough
S	Smooth
SL	Slickensided
POL	Polished

Infilling

Cn	Clean
VR	Veneer (< 1mm)
X	Carbonaceous
CY	Clay
KT	Chlorite
CA	Calcite
Fe	Iron Oxide
QZ	Quartz
G	Gypsum
UM	Unidentified Materials

Shape

PL	Planar
IR	Irregular
CU	Curved
UN	Undulating
ST	Stepped
DIS	Discontinuous

NON-CORE DRILL HOLE - GEOLOGICAL LOG

HOLE NO : BH01

PROJECT : WATTLE VALE QUARRY
LOCATION : MATHESON NSW
CLIENT : GLEN INNES SEVERN COUNCIL
FEATURE : PROPOSED QUARRY SITE 3
FILE / JOB NO : 30012451
SHEET : 1 OF 5

POSITION : E: 365264.000, N: 6711927.000 (56 MGA94) SURFACE ELEVATION : 1125.124 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : P160 MOUNTING : Track CONTRACTOR : NCD DRILLER : DALE

DATE STARTED : 29/3/16 DATE COMPLETED : 30/3/16 DATE LOGGED : 30/3/16 LOGGED BY : BD CHECKED BY : SB

DRILLING						MATERIAL					
DRILLING & CASING	SAMPLES	DRILLING PENETRATION	GROUND WATER LEVELS	FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	STRUCTURE & Other Observations
AD/T					0.0 1125.0		CI-CH	Silty CLAY red brown, with boulders, with cobbles	D to M		TOPSOIL
					0.50m						
HQ Casing					1124.5		CI	Silty CLAY orange brown, with basalt boulders			RESIDUAL SOIL 0.60: Auger refusal
WR					1.00m 1.0 1124.0			BASALT fine, dark grey *high to very high strength, slightly weathered, with yellow-brown clay seams*			ROCK
			GNE		1.50m			Continued as Cored Drill Hole			
					1123.5 2.0 1123.0						
					1122.5 3.0 1122.0						
					1121.5 4.0 1121.0						
					1120.5 5.0						

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

CORED DRILL HOLE LOG

HOLE NO : BH01

PROJECT : WATTLE VALE QUARRY
LOCATION : MATHESON NSW
CLIENT : GLEN INNES SEVERN COUNCIL
FEATURE : PROPOSED QUARRY SITE 3
FILE / JOB NO : 30012451
SHEET : 2 OF 5

POSITION : E: 365264.000, N: 6711927.000 (56 MGA94) SURFACE ELEVATION : 1125.124 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : P160 MOUNTING : Track CONTRACTOR : NCD HOLE DIA : 96mm

DATE STARTED : 29/3/16 DATE COMPLETED : 30/3/16 DATE LOGGED : 30/3/16 LOGGED BY : BD CHECKED BY : SB

CASING DIAMETER : HQ BARREL (Length) : 3.00 m BIT : Diamond Impreg S10-12 BIT CONDITION : Good

DRILLING

PROGRESS: DRILLING & CASING; (WATER RETURN %); (CORE LOSS RUN %) DRILL DEPTH

SAMPLES & FIELD TESTS

ELEVATION (RL) DEPTH (m)

MATERIAL

GRAPHIC LOG

DESCRIPTION
ROCK TYPE : Colour, Grain size, Structure
(texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)

Weathering

ESTIMATED STRENGTH Is(50) ● - Axial ○ - Diametral
EL 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH

ROCK MASS

RQD (%)

DEFECT SPACING (mm) 20 40 100 300 1000

DEFECTS
(joints, partings, seams, zones, etc)
Description, orientation, infilling or coating, shape, roughness, thickness, other

Depth (m)	RL	Description	Weathering	RQD (%)	Defects
0.0	1125.0				
0.5	1124.5				
1.0	1124.0				
1.50m		START CORING AT 1.50m			
1.5	1123.5	BASALT fine grained, dark grey, occasional amygdales up to 10mm, some clay seams	SW to FR		1.55-1.60: SM, 15-25°, Clay FILLED; 1.74-1.75: SM, Clay FILLED, 10 mm; 1.75-1.87: JT, 80-90°, Un, S, FE SN
1.90m		some iron stained fractures 20-40mm spacing		70	
2.0	1123.0				2.26: JT, 5-10°, IR, RF, FE SN
2.60m		no healed fractures			2.60: JT, 5-25°, IR, RF, FE SN; 2.66: JT, 10°, IR, RF, FE SN
2.5	1122.5				
3.0	1122.0				2.97: JT, 50°, PR, RF, FE SN
3.5	1121.5			92	3.32: JT, 15°, IR, RF, FE SN
3.80m		occasional sub vertical joints with calcite veneers and iron staining			3.82: JT, 75°, PR, S, FE SN
4.0	1121.0				4.05: JT, 10°, PR, S, FE SN
4.5	1120.5				4.42: JT, 75°, PR, S, CA VR; 4.50-4.80: JT, 80°, PR, S, CA VR; 4.80-4.89: SM, S, Clay FILLED; 4.94: JT, 50°, IR, RF, Clay CN
5.0					

NMLC; 0%LOSS 2.10; 100 %RETURN; 0%LOSS; 4.50 4.50; 90 %RETURN 0%LOSS

2.20m Is(50) d=3.86 MPa
3.30m Is(50) d=5.91 MPa
4.00m Is(50) d=3.93 MPa

DRILLING

AD/T	Auger Drilling with TC Bit
AD/V	Auger Drilling with V Bit
AS	Auger Screwing
DB	Washbore with Drag Bit
DT	Diatube
HMLC	HMLC Core Barrel
HQ3	HQ3 Core Barrel
NMLC	NMLC Core Barrel
NQ3	NQ3 Core Barrel
PQ3	PQ3 Core Barrel
R	Rock Roller

WATER

▽	10 Oct., 73 Water Level on Date shown
▶	water inflow
◀	water outflow

WEATHERING

FR	Fresh
SW	Slightly Weathered
MW	Moderately Weathered
HW	Highly Weathered
EW	Extremely Weathered

STRENGTH

EH	Extremely High
VH	Very High
H	High
M	Medium
L	Low
VL	Very Low
EL	Extremely Low

ROUGHNESS

POL	Polished
RF	Rough
S	Smooth
SL	Slickensided
VR	Very Rough

DEFECT TYPE

BP	Bedding Plane
CL	Cleavage
CS	Crushed Seam
CZ	Crushed Zone
DB	Drilling Break
FC	Fracture
HB	Handling Break
IS	Infilled Seam
JT	Joint
SM	Seam
SS	Shear Seam
SZ	Shear Zone
VN	Vein
VO	Void
FA	Fault

COATING

CN	Clean
CT	Coating (>= 1.0m)
FILLED	Filled
SN	Stained
VR	Veneer (< 1.0mm)

PLANARITY

CU	Curved
DIS	Discontinuous
IR	Irregular
PR	Planar
ST	Stepped
UN	Undulose

INFILL

CA	Calcite
CLAY	Clay
FE	Iron Oxide
FE	Iron Oxide Clay
CLAY	
KT	Chlorite
MS	Secondary Mineral
MU	Unidentified Mineral
QZ	Quartz
X	Carbonaceous

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

CORED DRILL HOLE LOG

HOLE NO : BH01

PROJECT : WATTLE VALE QUARRY
LOCATION : MATHESON NSW
CLIENT : GLEN INNES SEVERN COUNCIL
FEATURE : PROPOSED QUARRY SITE 3
FILE / JOB NO : 30012451
SHEET : 3 OF 5

POSITION : E: 365264.000, N: 6711927.000 (56 MGA94) SURFACE ELEVATION : 1125.124 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : P160 MOUNTING : Track CONTRACTOR : NCD HOLE DIA : 96mm

DATE STARTED : 29/3/16 DATE COMPLETED : 30/3/16 DATE LOGGED : 30/3/16 LOGGED BY : BD CHECKED BY : SB

CASING DIAMETER : HQ BARREL (Length) : 3.00 m BIT : Diamond Impreg S10-12 BIT CONDITION : Good

DRILLING

PROGRESS: DRILLING & CASING; (WATER RETURN %); (CORE LOSS RUN %) DRILL DEPTH

SAMPLES & FIELD TESTS

ELEVATION (RL) DEPTH (m)

MATERIAL

GRAPHIC LOG

DESCRIPTION
ROCK TYPE : Colour, Grain size, Structure
(texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)

Weathering

ESTIMATED STRENGTH Is(50) ● - Axial ○ - Diametral
EL 0.03 | VL 0.1 | L 0.3 | M 1 | H 3 | VH 10 | EH

ROCK MASS

RQD (%)

DEFECT SPACING (mm) 20 40 100 300 1000

DEFECTS
(joints, partings, seams, zones, etc)
Description, orientation, infilling or coating, shape, roughness, thickness, other

Depth	RL	Description	Weathering	RQD	Defects
5.0	1120.0	BASALT fine grained, dark grey, occasional amygdales up to 10mm, some clay seams *(continued)*	SW to FR	51	5.05: JT, 70°, PR, S, CN 5.21: JT, 10°, PR, RF, CN 5.30-5.44: JT, 20-70°, SN, partly open x 5
5.50m		some calcite veneer on closed micro fractures			5.60: JT, 25°, PR, RF, FE SN 5.77: JT, 25°, PR, RF, FE SN 5.92: JT, 75°, PR, S, FE SN
6.00m	1119.5	BASALT fine grained, dark grey some red-brown clay in fractures, very fine grained, fractures generally 10° - 40°	SW	0	
			EW		6.34-6.45: SM, EW
			SW		6.61: CS, 15-25°, Clay CT, 20 mm
7.10m	1118.5			0	6.69-7.10: FZ, 40-100°, Clay CT
7.20m	1118.0	CORE LOSS 0.10m (7.10-7.20)			
		BASALT fine grained, dark grey occasional clay seams up to 10mm thick	SW	0	7.20-7.40: FZ, Fe Clay CT, 40-100mm 7.33: JT, 15-40°, FE/CLAY FILLED, 10 mm 7.53: SM, 15-40°, Fe FILLED, 10 mm 7.40-8.10: JT, 70°, FE/CLAY FILLED, 40-60mm
			HW to EW		8.10-8.30: FZ, CLAY FILLED, 20-40mm
			SW	0	8.51: JT, 30°, PR, FE/CLAY FILLED, 10 mm
				0	
				0	8.30-10.00: JT, 15-30°, PR, RF, FE/CLAY VR, 40-100mm spacing 9.20: JT, 70°, RF, FE SN
9.70m	1115.5	dark grey to black, fractures coated with grey-brown clay	MW	0	
10.00m					

5.50m Is(50) d=2.16 MPa
7.45m Is(50) d=7.68 MPa
8.84m Is(50) d=9.01 MPa

NMLC 90 %RETURN

0%LOSS 6.00 | 0%LOSS 6.50 | 14%LOSS 7.20 | 0%LOSS 8.30 | 0%LOSS 8.70 | 0%LOSS 9.00 | 0%LOSS 9.30 | 0%LOSS 9.70 | 0%LOSS

DRILLING

AD/T	Auger Drilling with TC Bit
AD/V	Auger Drilling with V Bit
AS	Auger Screwing
DB	Washbore with Drag Bit
DT	Diatube
HMLC	HMLC Core Barrel
HQ3	HQ3 Core Barrel
NMLC	NMLC Core Barrel
NQ3	NQ3 Core Barrel
PQ3	PQ3 Core Barrel
R	Rock Roller

WATER

	10 Oct., 73 Water Level on Date shown
	water inflow
	water outflow

WEATHERING

FR	Fresh
SW	Slightly Weathered
MW	Moderately Weathered
HW	Highly Weathered
EW	Extremely Weathered

STRENGTH

EH	Extremely High
VH	Very High
H	High
M	Medium
L	Low
VL	Very Low
EL	Extremely Low

ROUGHNESS

POL	Polished
RF	Rough
S	Smooth
SL	Slickensided
VR	Very Rough

DEFECT TYPE

BP	Bedding Plane
CL	Cleavage
CS	Crushed Seam
CZ	Crushed Zone
DB	Drilling Break
FC	Fracture
HB	Handling Break
IS	Infilled Seam
JT	Joint
SM	Seam
SS	Shear Seam
SZ	Shear Zone
VN	Vein
VO	Void
FA	Fault

COATING

CN	Clean
CT	Coating (>= 1.0m)
FILLED	Filled
SN	Stained
VR	Veneer (< 1.0mm)

PLANARITY

CU	Curved
DIS	Discontinuous
IR	Irregular
PR	Planar
ST	Stepped
UN	Undulose

INFILL

CA	Calcite
CLAY	Clay
FE	Iron Oxide
FE	Iron Oxide Clay
CLAY	
KT	Chlorite
MS	Secondary Mineral
MU	Unidentified Mineral
QZ	Quartz
X	Carbonaceous

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

CORED DRILL HOLE LOG

HOLE NO : BH01

PROJECT : WATTLE VALE QUARRY
LOCATION : MATHESON NSW
CLIENT : GLEN INNES SEVERN COUNCIL
FEATURE : PROPOSED QUARRY SITE 3
FILE / JOB NO : 30012451
SHEET : 4 OF 5

POSITION : E: 365264.000, N: 6711927.000 (56 MGA94) SURFACE ELEVATION : 1125.124 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : P160 MOUNTING : Track CONTRACTOR : NCD HOLE DIA : 96mm

DATE STARTED : 29/3/16 DATE COMPLETED : 30/3/16 DATE LOGGED : 30/3/16 LOGGED BY : BD CHECKED BY : SB

CASING DIAMETER : HQ BARREL (Length) : 3.00 m BIT : Diamond Impreg S10-12 BIT CONDITION : Good

DRILLING | MATERIAL | ROCK MASS

PROGRESS: DRILLING & CASING; (WATER RETURN %); (CORE LOSS RUN %) DRILL DEPTH; SAMPLES & FIELD TESTS; ELEVATION (RL) DEPTH (m); GRAPHIC LOG; DESCRIPTION — ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable); Weathering; ESTIMATED STRENGTH Is(50) ● - Axial ○ - Diametral (EL 0.03, VL 0.1, L 0.3, M 1, H 3, VH 10, EH); RQD (%); DEFECT SPACING (mm) 20 40 100 300 1000; DEFECTS (joints, partings, seams, zones, etc) Description, orientation, infilling or coating, shape, roughness, thickness, other

Depth	RL	Description	Weathering	RQD	Defects
10.0	1115.0	BASALT fine grained, dark grey *(continued)* weathered to silty clay with MW basalt gravel	HW to EW	0	10.00-10.22: FZ, CLAY CT, 0-20mm
10.25m		very fine grained, dark grey	SW		10.30-10.44: FZ, FE SN, 0-20mm
10.40		0%LOSS		0	
10.50		0%LOSS			10.44-10.75: SM, 20-40°, PR, RF, FE SN, 20-40mm spacing
10.5	1114.5	10.54m Is(50) d=9.55 MPa		0	
10.80m		brown-grey weathered to clay in parts, some slightly weathered fragments	HW to EW		
10.80		0%LOSS			
11.0	1114.0			0	10.75-11.67: SM, XW
11.40		0%LOSS			
11.5					
11.67m	1113.5	CORE LOSS 0.86m (11.67-12.53)			
12.0		76%LOSS		0	
12.53					
12.5	1113.0	90 %RETURN			
12.53m		BASALT fine grained, grey brown to brown	RS		
		hard, high plasticity, purple-grey silty clay 12.53m to 12.67m some white, remoulds to silty clay	EW	0	
13.00		0%LOSS			
13.00m	1112.5	fine-grained, dark grey-black, dark iron stained, closed fractures, some extremely weathered zones	HW		13.00-13.11: XW
13.0					13.20: JT, 20°, PR, RF, FE SN
	1112.0	13.25m Is(50) d=0.07 MPa		15	13.30: JT, 15-20°, PR, RF, FE SN
13.5					13.44-13.48: XW
13.65		0%LOSS			
	1111.5		HW		13.65-14.00: FZ, CLAY CT, 10-20mm
14.0		0%LOSS		0	14.00-14.10: SM, CLAY FILLED
14.15m		dark grey, frequent sub-horizontal fractures	SW to MW		14.10: JT, 0-10°, PR, RF, FE SN, 10-40mm
14.15m Is(50) d=0.07 MPa					
14.40		0%LOSS			
14.40m		frequent iron stained healed fractures			
14.5	1111.0		HW		
	1110.5				
14.80m		dark grey with calcite and green mineral in fractures, occasional laths and amygdales	FR	20	14.80: JT, 20°, PR, RF, FE SN 14.86: JT, 20°, PR, RF, FE SN 14.90: CS, 15-20°
15.0					

NMLC

DRILLING

AD/T	Auger Drilling with TC Bit
AD/V	Auger Drilling with V Bit
AS	Auger Screwing
DB	Washbore with Drag Bit
DT	Diatube
HMLC	HMLC Core Barrel
HQ3	HQ3 Core Barrel
NMLC	NMLC Core Barrel
NQ3	NQ3 Core Barrel
PQ3	PQ3 Core Barrel
R	Rock Roller

WATER

- 10 Oct., 73 Water Level on Date shown
- water inflow
- water outflow

WEATHERING

FR	Fresh
SW	Slightly Weathered
MW	Moderately Weathered
HW	Highly Weathered
EW	Extremely Weathered

STRENGTH

EH	Extremely High
VH	Very High
H	High
M	Medium
L	Low
VL	Very Low
EL	Extremely Low

ROUGHNESS

POL	Polished
RF	Rough
S	Smooth
SL	Slickensided
VR	Very Rough

DEFECT TYPE

BP	Bedding Plane
CL	Cleavage
CS	Crushed Seam
CZ	Crushed Zone
DB	Drilling Break
FC	Fracture
HB	Handling Break
IS	Infilled Seam
JT	Joint
SM	Seam
SS	Shear Seam
SZ	Shear Zone
VN	Vein
VO	Void
FA	Fault

COATING

CN	Clean
CT	Coating (>= 1.0m)
FILLED	Filled
SN	Stained
VR	Veneer (< 1.0mm)

PLANARITY

CU	Curved
DIS	Discontinuous
IR	Irregular
PR	Planar
ST	Stepped
UN	Undulose

INFILL

CA	Calcite
CLAY	Clay
FE	Iron Oxide
FE	Iron Oxide Clay
CLAY	
KT	Chlorite
MS	Secondary Mineral
MU	Unidentified Mineral
QZ	Quartz
X	Carbonaceous

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

CORED DRILL HOLE LOG

HOLE NO : BH01

PROJECT : WATTLE VALE QUARRY
LOCATION : MATHESON NSW
CLIENT : GLEN INNES SEVERN COUNCIL
FEATURE : PROPOSED QUARRY SITE 3
FILE / JOB NO : 30012451
SHEET : 5 OF 5

POSITION : E: 365264.000, N: 6711927.000 (56 MGA94) SURFACE ELEVATION : 1125.124 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : P160 MOUNTING : Track CONTRACTOR : NCD HOLE DIA : 96mm

DATE STARTED : 29/3/16 DATE COMPLETED : 30/3/16 DATE LOGGED : 30/3/16 LOGGED BY : BD CHECKED BY : SB

CASING DIAMETER : HQ BARREL (Length) : 3.00 m BIT : Diamond Impreg S10-12 BIT CONDITION : Good

DRILLING | MATERIAL | ROCK MASS

DRILLING & CASING	PROGRESS (WATER RETURN %)	(CORE LOSS RUN %) DRILL DEPTH	SAMPLES & FIELD TESTS	ELEVATION (RL)	DEPTH (m)	GRAPHIC LOG	DESCRIPTION ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)	Weathering	ESTIMATED STRENGTH Is(50) ● - Axial ○ - Diametral EL VL L M H VH EH (0.03 0.1 0.3 1 3 10)	RQD (%)	DEFECT SPACING (mm) (20 40 100 300 1000)	DEFECTS (joints, partings, seams, zones, etc) Description, orientation, infilling or coating, shape, roughness, thickness, other
NMLC	90 %RETURN	0%LOSS 15.30	15.21m Is(50) d=6.08 MPa	1110.0	15.0		BASALT fine grained, grey brown to brown *(continued)*	FR		20		14.99: FC, 30-40°, CA VR
					15.5							15.43: JT, 5°, PR, RF, CN 15.49: JT, 45°, PR, RF, MU CT 15.60: JT, 30°, RF, MU VR 15.70: JT, 20°, IR, RF, MU CT
		0%LOSS		1109.5	16.0					82		15.95-16.02: JT, 30-35°, PR, RF, CT, x 3 16.15: JT, 10°, PR, RF, CN
				1109.0								16.40: JT, 20°, PR, RF, CN
			16.70m Is(50) d=4.19 MPa	1108.5	16.5							16.62: JT, 0-20°, UN, RF, CN
		16.80										16.80: JT, 55°, PR, RF, MU VR
		0%LOSS		1108.0	17.0							17.07: JT, 10°, IR, RF, MU VR
			17.60m Is(50) d=9.01 MPa	1107.5	17.5					84		17.50: JT, 10°, IR, RF, MU VR 17.70: JT, 20-30°, PR, RF, MU VR 17.76: JT, 70°, PR, S, MU VR 17.88: JT, 20°, PR, RF, CN
		18.16	18.16	1107.0	18.0		18.16m					
							BOREHOLE BH01 TERMINATED AT 18.16 m Target depth					
				1106.5	18.5							
				1106.0	19.0							
				1105.5	19.5							
					20.0							

DRILLING

AD/T	Auger Drilling with TC Bit
AD/V	Auger Drilling with V Bit
AS	Auger Screwing
DB	Washbore with Drag Bit
DT	Diatube
HMLC	HMLC Core Barrel
HQ3	HQ3 Core Barrel
NMLC	NMLC Core Barrel
NQ3	NQ3 Core Barrel
PQ3	PQ3 Core Barrel
R	Rock Roller

WATER

▽	10 Oct., 73 Water Level on Date shown
▶	water inflow
◀	water outflow

WEATHERING

FR	Fresh
SW	Slightly Weathered
MW	Moderately Weathered
HW	Highly Weathered
EW	Extremely Weathered

STRENGTH

EH	Extremely High
VH	Very High
H	High
M	Medium
L	Low
VL	Very Low
EL	Extremely Low

ROUGHNESS

POL	Polished
RF	Rough
S	Smooth
SL	Slickensided
VR	Very Rough

DEFECT TYPE

BP	Bedding Plane
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