

GR & AK Jones



Grants Road Sand Quarry
MP08_0099

Environmental Plan of Management

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Peter Andrews + Associates
Pty Ltd

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1.0 BACKGROUND

1.1 Description of the Project

Grants Road Sand Quarry is located at 270 Grants Road, Somersby. It is some 5km south west of the Peats Ridge turn off on the Sydney - Newcastle F3 Freeway and about 10km west of Gosford. The quarry commenced in September 2000.

The total area of extraction subject to this Environmental Management Plan is approximately 20 hectares as shown in Appendix 1. This is based on quarrying to a maximum depth of 33m in the east to RL 200 and to a maximum depth of 15m in the south-west corner to RL193. This will result in a quarry floor with an approximate gradient of 2%. This incorporates the area of the existing quarry.

Quarrying of the site will occur in two stages as outlined below. The area has been further divided into seven Precincts (also outlined below).

1.1.1 Stage 1

Stage 1 comprises Precinct A being the existing quarry site, and Precincts B and C and part of Precinct E. Quarrying operations are generally proposed as follows:

- The topsoil, which ranges in depth up to approximately 60cm is pushed towards the boundary of the quarry site, revegetated and used as sound mounds.
- The precincts are sectioned into approximately 60m² areas. Two sections within the Precinct are ripped concurrently. Each section is ripped to an approximate depth of 1 metre.
- The McLoskey Screen is relocated to the area that is being ripped. This will be used for screening of material only and then the sand is loaded straight onto the trucks for transportation.
- Material that is to be screened and washed will be transported to Precinct A and will utilise the existing infrastructure. The material will then be loaded onto trucks within Precinct A and then transported.
- Existing infrastructure including the access roads, weigh bridge, wheel wash and wash plant will be retained in its existing location in Precinct A.
- Additional access roads will be developed using the onsite materials to provide access to the precincts.
- The dozer will be used approximately 10% of the time in Precinct A and approximately 90% of the time in Precinct B/C. Once the softer sand material has been ripped within Precinct B (subject to requirements of the noise management plan) and Precinct C, the dozer will be used in the southern portion of Precinct E to commence the ripping of the soft sand product.
- Precinct E will be used for the management of clean water upon the completion of quarrying of the southern section of Precinct E.

1.1.2 Stage 2

Stage 2 comprises Precincts D, F and G and the northern part of Precinct E. The quarrying of Stage 2 will be similar to the operations described for Stage 1. Stage 2 Operations Plan and as follows:

- Silt dams will be located in Precincts A and C to allow quarrying of Precinct D.
- Relocation of the chicken sheds and existing dwelling will be undertaken prior to the quarrying of Precincts F and G.
- Existing infrastructure including the wash plant, weigh bridge and wheel wash may be relocated to land within Stage 2 to allow the remainder of Precinct A to be quarried.
- The topsoil will be pushed to the quarry boundary, revegetated and used as sound mounds as per Stage 1.
- The soft sand will be ripped in approximate 60m², screened and washed where required and transported similar to Stage 1.

1.1.3 Precincts

The following outlines the various Precincts.

Table 1.1 – Quarry Precincts

Precinct	Staging
A	<p>This is the current quarry site subject to DA 22952. The total resource has not been quarried to date, however the remaining product is dimension stone and therefore is required to be crushed to provide any soft sand product. The remainder of the material will be extracted as part of Stage 1.</p> <p>This area also includes the current auxiliary infrastructure for the operation of the quarry including the quarry access road, weighbridge, wheel wash facility and the screen and wash plant.</p>
B	<p>The quarrying of Precinct B will generally be undertaken at the same time as Precinct C in stage 1. However, extraction of material within exposed locations in Precinct B is to be undertaken in periods of high winds >5m/s (particularly east and south-east winds) and/or rain with elevated background noise levels in accordance with the Noise Management Plan. Further, quarrying in Precinct B is to maximise site shielding and minimise the number of plant and equipment on exposed locations.</p>
C	<p>Precinct C is included in the first stage. Precinct C contains a good source of coloured dimension stone and includes the soft sand product. Quarrying in Precinct C is to maximise site shielding and minimise the number of plant and equipment on exposed locations particularly towards the east.</p>
D	<p>Precinct D contains the existing water management and silt dams for the quarry operations. Precinct D will continue to provide water management and silt dams for Stage 1. The quarrying of this precinct will form part of Stage 2 once the silt dams and water management areas are relocated.</p>
E	<p>The lowest part of the site is located in the southern section of Precinct E. The southern portion of Precinct E will be quarried to its full depth and will be quarried as part of Stage 1. This area will then be managed for water and drainage for the whole of the quarry site.</p> <p>The northern section of Precinct E will be quarried as part of Stage 2.</p>
F	<p>Precinct F forms part of Stage 2. This will require the relocation of the chicken operations.</p> <p>Extraction of material within exposed locations in Precinct F is to be undertaken in periods of high winds >5m/s (particularly east and south-east winds) and/or rain with elevated background noise levels in accordance with the Noise Assessment. Further, quarrying in Precinct F is to maximise site shielding and minimise the number of plant and equipment on exposed locations.</p>
G	<p>Precinct G forms part of Stage 2. This will require the relocation of the dwelling on the site.</p> <p>Extraction of material within exposed locations in Precinct G is to be undertaken in periods of high winds >5m/s (particularly east and south-east winds) and/or rain with elevated background noise levels in accordance with the Noise Assessment. Further, quarrying in Precinct G is to maximise site shielding and minimise the number of plant and equipment on exposed locations.</p>

1.2 Extraction Period

The EA estimated the total resource as 9,433,435 tonnes. Based on the area of the precincts and the resource volumes the time to extract the material in the two stages based on 250,000 tonnes per annum is outlined in Table 1.2. The quarry life will extend to 38 years based on a total resource of 9,433,435 tonnes and quarrying of 250,000 tonnes per annum.

Table 1.2 – Estimated Time Period for Extraction

Stage	Tonnage (tonnes)	Years	Estimated Period (years)
1	4,885,602	0-20	19.5
2	4,547,833	20-30	> 10 years

In accordance with the Project Approval, Grants Road Sand Quarry may carry out quarrying operations on the site until 30 June 2044.

1.3 Hours of operation

The hours of operation for the quarry and for construction activities are:

- Monday to Friday 7.00am to 6.00pm; and
- Saturdays from 7.00am to 1.00pm.

Other activities, e.g. maintenance carried out on site may be conducted outside the above hours if conducted in a manner that is inaudible at all privately-owned residences.

The following activities may be carried out on the site outside the above hours:

- Delivery or dispatch of materials as requested by the Police or other authorities; and
- Emergency work to avoid the loss of lives, property and/or to prevent environmental harm.

In such circumstances, the Proponent shall notify the Secretary and affected residents prior to undertaking the activities, or as soon as is practical thereafter.

1.4 Statutory matters

Grants Road Sands was granted "Deferred Commencement" Consent on 11 May 1999 to operate the proposed 'Somersby Sand Quarry'. The "Deferred Commencement" Consent was modified from the original development application and Environmental Impact Statement (EIS) submitted to Gosford City Council (GCC) in January 1998; as amended by a Supplementary Report to the EIS in May 1998 and a Report responding to a GCC letter in December 1998. A Plan of Management was submitted to GCC within 12 months of the date of the "Deferred Commencement" Consent as required by Condition 1 and subsequently Grants Road Sands received an operative consent (DA 22592/1998) on 5 July 2000.

In September 2003, an application for an amendment to DA 22592/1998 under Section 96 of the Environmental Planning & Assessment Act was accompanied by a Statement of Environmental Effects for the installation of a washing plant and associated settling pond and water management infrastructure to allow the quarry to extend its market into washed sands. This amendment was approved by GCC on 14 April 2004.

A Preliminary Environmental Assessment was prepared in January 2008 for the extension of the Grants Road Sand Quarry to seek the then NSW Department of Planning's Director General's Requirements (DG's Requirements). The DG's Requirements were issued on 31 July 2008 for the proposed extension of the Grants

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Road Sand Quarry, including the extraction, processing and transporting by road of up to 250,000 tonnes of extractive materials a year for a period of 30 years.

Modified DG's Requirements were issued on 26 August 2010 for the proposed extension as outlined above, however excludes the requirement for the final void to be free draining.

The Environmental Assessment was prepared for the extension of Grants Road Sand Quarry. Project Approval under section 75J of the Environmental Planning & Assessment Act for the expansion of the quarry as shown in Appendix 1 was given on 25 July 2014.

Schedule 5 of the Project Approval requires that an Environmental Management Strategy be prepared and implemented for the project. This Environmental Management Strategy for the Grants Road Sand Quarry provides the following information in accordance with the Project Approval:

- Provide the strategic framework for environmental management of the project;
- Identify the statutory approvals that apply to the project;
- Describe the role, responsibility, authority and accountability of all key personnel involved in the environmental management of the project;
- Describe the procedures that would be implemented to:
 - Keep the local community and relevant agencies informed about the operation and environmental performance of the project;
 - Receive, record, handle, and respond to complaints;
 - Resolve any disputes that may arise during the course of the project;
 - Respond to any non-compliance;
 - Respond to emergencies; and
- Include:
 - Copies of any strategies, plans and programs approved under the conditions of this approval; and
 - A clear plan depicting all the monitoring to be carried out under the conditions of this approval.

1.5 Definitions

The following definitions apply for this Environmental Management Plan.

Annual Review	The review required by condition 3 of schedule 5 of the Project Approval and as outlined in this EMP
BCA	Building Code of Australia
Biodiversity Offset Strategy	The conservation and management of the offset sites on Lot 1 DP358717
CCC	Community Consultative Committee
Conditions of the Project approval	Conditions contained in Schedules 2 to 5 inclusive
Council	Gosford City Council
Department	Department of Planning and Environment
DRE	Division of Resources and Energy (within the Department of Trade and Investment, Regional Infrastructure and Services)
EA	Environmental Assessment of the project titled <i>Grants Road Sand Quarry Extension - Environmental Assessment Report</i> prepared by Peter Andrews and Associates, dated April 2013; and the Proponent's response to the issues raised in submissions, dated December 2013
Environmental Consequences	The environmental consequences of quarrying operations, including erosion, sedimentation and adverse impacts on water quality, water quantity and biodiversity
EPA	Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EP&A Regulation	<i>Environmental Planning and Assessment Regulation 2000</i>

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EPL	Environment Protection License issued under the POEO Act
Feasible	Feasible relates to engineering considerations and what is practical to build or carry out
GDEs	Groundwater Dependent Ecosystems
High Priority GDEs	GDEs listed in Schedule 5 of the <i>Water Sharing Plan for the Kulnura Mangrove Mountain Groundwater Sources 2003</i> , including <i>Hawkesbury Coastal Banksia Woodland</i> and <i>Sandstone Hanging Swamps</i>
Incident	A set of circumstances that: <ul style="list-style-type: none">• causes, or threatens to cause, material harm to the environment; and/or• breaches or exceeds the limits or performance measures/criteria in this approval
Land	As defined in the EP&A Act, except where the term is used in the noise and air quality conditions in Schedules 3 and 4 of this approval, where it is defined as the whole of a lot, or contiguous lots owned by the same landowner, in a current plan registered at the Land Titles Office at the date of this approval
Material harm to the environment	Actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial
Minister	Minister for Planning, or delegate
Minor	Not very large, important or serious
Mitigation	Activities associated with reducing the impacts of the project
Negligible	Small and unimportant, such as to be not worth considering
NOW	NSW Office of Water
OEH	Office of Environment and Heritage
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
Privately-owned land	Land that is not owned by a public agency or a mining or quarrying company (or its subsidiary)
Project	The project as described in the EA, including existing quarrying operations and disturbance
Proponent	GR and AK Jones or any person who seeks to carry out the approved project under this approval
Public Infrastructure	Linear and related infrastructure that provides services to the general public, such as roads, railways, water supply, drainage, sewerage, gas supply, electricity, telephone, telecommunications etc.
Quarrying operations	The extraction, processing and transportation of extractive materials on the site and the associated removal of vegetation, topsoil and overburden
Reasonable	Reasonable relates to the application of judgment in arriving at a decision, taking into account: mitigation benefits, cost of mitigation versus benefits provided, community views and the nature and extent of potential improvements
Rehabilitation	The restoration of land disturbed by the project to a good condition and for the purpose of establishing a safe, stable and non-polluting environment
Secretary	Secretary of the Department, or nominee
Site	The land described in Schedule 1
Statement of Commitments	The Proponent's commitments in Appendix 1
VENM	Virgin Excavated Natural Material and/or Excavated Natural Material

2.0 STRATEGIC FRAMEWORK

2.1 Environmental Management Responsibilities

All employees and contractors/suppliers have a responsibility for the effective and ongoing management of environmental impacts at the quarry. The Quarry Manager has specific duties and responsibilities including:

- Day to day implementation of the EMP.
- Ensuring site personnel have undertaken appropriate environmental awareness training and are observing all necessary management requirements.
- Ensure all required environmental auditing/monitoring is undertaken.
- Consultation with relevant stakeholders and complaints handling.

2.2 Training

The level of environmental awareness required of personnel and contractors/suppliers who enter and undertake work at the quarry should include:

- Familiarity with all legislation and guidelines relevant to the services being provided.
- Familiarity with the EMP.
- Emergency response preparedness.
- Waste management/minimisation practices.
- Dangerous goods handling (where applicable).
- Other environmental awareness training as relevant to specific quarry operations.

2.3 Communication

The quarry has consulted with the residents adjacent to the site throughout the course of the existing quarry operations and the quarry extension proposal. The Quarry Manager or its representative will continue to maintain close communications with the neighbouring residences. Procedures that have been developed for internal and external communications for the quarry site include:

- Carry out the reporting and monitoring requirements as set out in this EMP.
- All relevant information including current management plans, annual reviews, monitoring results, etc. are available on the Grants Road Quarry website and available at the Grants Road Quarry site office.
- Carrying out incident reporting and informing the Secretary and any other relevant agency or person on the incident.
- As soon as practicable after obtaining monitoring results showing:
 - An exceedance of any relevant criteria outlined in the EMP, the Quarry shall notify the affected landowners in writing of the exceedance, and provide regular monitoring results to each affected landowner until the project is again complying with the relevant criteria; and
 - An exceedance of any relevant air quality criteria, the quarry shall send a copy of the NSW Health fact sheet entitled "Mine Dust and You" to the affected landowners and current tenants of the land (including the tenants of land which is not privately-owned).
- The Annual review would record the monitoring results and complaints over the past calendar year as well as any non-compliances and a description of the actions undertaken to ensure compliance.
- The quarry will register all complaints received and act upon and record the relevant information including:
 - the date and time of the complaint received;
 - the date and time of the event or nuisance forming the subject matter of the complaint;
 - the detail of the subject matter of the complaint;
 - the identity and address of the complainant (if provided); and
 - any action taken in response to the complaint.

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- The up-to-date Complaints Register will be kept at the quarry and made available to relevant agencies and the community upon request.

Other mechanisms that the community can implement include:

If an owner of privately-owned land considers the project to be exceeding the relevant criteria in this EMP, then he/she may ask the Secretary in writing for an independent review of the impacts of the project on his/her land.

If the Secretary is satisfied that an independent review is warranted, then within 2 months of the Secretary's decision, the Quarry shall commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Secretary, to:

- consult with the landowner to determine his/her concerns;
- conduct monitoring to determine whether the project is complying with the relevant criteria in Schedule 3; and
- if the project is not complying with these criteria, then identify measures that could be implemented to ensure compliance with the relevant criteria; and
- give the Secretary and landowner a copy of the independent review.

Further, if directed by the Secretary, the Quarry shall establish and operate a Community Consultative Committee (CCC) for the project to the satisfaction of the Secretary. Any such CCC must be operated in general accordance with the *Guidelines for Establishing and Operating Community Consultative Committees for Mining Projects* (Department of Planning, 2007, or its latest version).

It should be noted that:

- The CCC would be an advisory committee. The Department and other relevant agencies are responsible for ensuring that the Quarry complies with the project approval.
- In accordance with the Department's guideline, the CCC should be comprised on an independent chair and appropriate representation from the Quarry, Council (if available) and the local community.
- This CCC can be combined with any other CCC established under conditions of consent or approval for State Significant quarry developments on the Somersby Plateau.

3.0 REPORTING AND REVIEW

Grants Road Sand Quarry will prepare the following reports for the project:

- Management Plans have been prepared for the following and are addressed and included as part of this EMP:
 - Groundwater
 - Surface water
 - Noise
 - Air Quality
 - Traffic
 - Heritage

- Other management plans / studies that have been completed and approved by the Department include:
 - Grants Road maintenance contributions study.
 - Landscape and Rehabilitation Management Plan.

A summary of the monitoring/audits to be undertaken include:

Table 3.1 – Report Summary

Report Summary	Timing / Frequency	Condition No
Independent Environmental Audit Within six weeks of the audit, the quarry shall submit a copy of the audit report to the Secretary together with its response to any recommendations contained in the audit report.	30 June 2015 and every three years thereafter	Schedule 5 Condition 9
Annual Review Undertake a review of the environmental performance of the project for the previous calendar year	March annually	Schedule 5 Condition 4
Incident Reporting Prepare a detailed report of the incident	Within 7 days of the date of the incident	Schedule 5 Condition 7
Management Plans / Strategies / Programs Review strategies, plans and programs after completion of the above and amend where required.	Within three months of submission of the above documents	Schedule 5 Condition 5

The overall reporting/monitoring for the Grants Road Sand Quarry project is outlined in Table 3.2 below. Further details are outlined in each of the relevant sections.

Table 3.2 – Reporting and Monitoring Requirements

Control Measure	Timing / Frequency	Condition and Consultation Requirements
Soil and Erosion Measures		
1. Erosion control and water management structures will remain in place until slopes and exposed areas are fully stabilised and revegetated. Dams will be retained as pollution control devices.	As required	Schedule 3 Condition 3

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Control Measure	Timing / Frequency	Condition and Consultation Requirements
2. Review of soil and erosion measures to be undertaken as part of the annual review or independent environmental audit.	Annually	Schedule 5 Condition 4
Groundwater Impact Monitoring		
1. Water level monitoring Automatic water level measurements in water level data loggers installed in monitoring bores. (Refer Figure 3, Appendix 2 for bore hole locations)	<ul style="list-style-type: none"> Initial 4-hourly (1 sample every 4 hours) Assess data after 12 months Depending on results and trends, decrease frequency to 8-hourly (1 sample every 8 hours) Downloaded initially at 1 month intervals 	Schedule 3 Condition 4
2. Water Quality Monitoring Groundwater sampling in representative monitoring bores.	<ul style="list-style-type: none"> Initial 3-monthly (1 sample per bore every 3 months) for 12 months Assess data after 12 months Depending on results and trends decrease frequency to 6-monthly (1 sample every 6 months) 	Schedule 3 Condition 4 DPI Water
3. Rainfall Monitoring Automatic rainfall measurements in tipping bucket rain gauge data logger on site.	Continuous logging at every 0.2 mm tip with time/date stamps	Schedule 3 Condition 4
4. Data Management The water level and water quality data acquired from the monitoring bores would be imported into an electronic database, collated and viewed by the hydrogeological consultant.	Following each round of monitoring.	Schedule 3 Condition 4
5. Ground Water Reporting <ul style="list-style-type: none"> A complete set of water level data and groundwater quality monitoring results will be recorded, collated and reported including a statistical analysis and a comparison of water level monitoring results. Report to be provided to NOW. 	Six-monthly basis for the first 12 months then on an annual basis. Annually	Schedule 3 Condition 4 DPI Water
6. Ground Water Management Plan Undertake an internal review of the Ground Water Management Plan. Changes to the Management Plan will only occur	As required	Schedule 5 Condition 5 Changes to the Plan will be forwarded to the Secretary of the

Control Measure	Timing / Frequency	Condition and Consultation Requirements
if improvements are identified or required as part of the annual review or instructed by the Department. Changes to the Plan will be forwarded to the Secretary of the Department for approval.		Department of Planning & Environment for approval.
7. Records The results of all ground water monitoring will be held onsite and maintained by the Quarry Manager or designate. A comprehensive summary of the monitoring results would be made available to the public and placed on the website.	As required	Schedule 5 Condition 8
Surface Water Impact Monitoring		
1. Surface Water Monitoring Undertake surface water sampling at the following monitoring sites. <ul style="list-style-type: none"> W1 – Process water dam W4 – Culvert on south-west waterway <ul style="list-style-type: none"> S1 – South-west waterway on western boundary of Lot 1. (Refer Figure 4, Appendix 3 for monitoring locations).	<ul style="list-style-type: none"> Monthly (1 sample per monitoring site every month) for 12 months Assess data after 12 months <i>Depending on results and trends decrease frequency to quarterly (1 sample every 3 months)</i> <ul style="list-style-type: none"> Monthly (1 sample per monitoring site every month) for 12 months Within 12 hours prior to any controlled discharge; and Weekly during any discharge. 	Schedule 3 Condition 4 Consult with EPA within 1 month of end of Year 1 to discuss decrease of monitoring frequency from monthly to quarterly (3 monthly). <i>Depending on results and trends, and approval from EPA, decrease frequency to quarterly (1 sample every 3 months)</i>
2. Rainfall Monitoring Automatic rainfall measurements in tipping bucket rain gauge data logger on site.	Continuous logging at every 0.2 mm tip with time/date stamps	Schedule 3 Condition 4
3. Surface Water Reporting <ul style="list-style-type: none"> Surface water quality monitoring results will be recorded, collated and duly reported in-house review of results and any exceedances Report sent to the New South Wales Office of Water.	Six-monthly for the first 12 months then on an annual basis. Annually	Schedule 5 Condition 4 DPI Water, EPA, Department Planning & Environment
4. Surface Water Management Plan Undertake an internal review of the Surface Water Management Plan. Changes to the Management Plan will only occur	As required	Schedule 5 Condition 5 Department of Planning

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Control Measure	Timing / Frequency	Condition and Consultation Requirements
if improvements are identified or required as part of the annual review or instructed by the Department. Changes to the Plan will be forwarded to the Secretary of the Department for approval.		& Environment
5. Records The results of all surface water monitoring will be held onsite and maintained by the Quarry Manager or designate. A comprehensive summary of the monitoring results would be made available to the public and placed on the website.	As required	Schedule 5 Condition 8
Noise Impact Monitoring		
1. Provision of site contact details for public / residents seeking information or to report noise incidents.	As required	Schedule 3 Condition 9
2. Noise Monitoring Report Monitoring of emitted noise levels during construction and operations will be undertaken to ensure noise levels due to operational activities do not exceed the criteria for all adjoining privately owned residences. Monitoring procedures will include: <ul style="list-style-type: none"> • Attended noise measurements over fifteen (15) minutes at each receiver noting aural observations, recording LA90 and LAeq noise levels and weather conditions (specifically wind speed and direction); • Determination of LAeq, 15min noise contribution from Grants Road Sand Quarry activities for each receiver location; • Review of Grants Road Sand Quarry contributions compared to noise criteria; • Inspection of site to confirm quarry operations at time of audit; • Attended nearfield or midfield measurements of individual site plant and equipment to confirm operating noise levels and sound power levels; • Conduct second round of attended noise measurements at the reference monitoring locations over fifteen (15) minutes at each receiver noting aural observations, recording LA90 and LAeq noise levels and weather conditions (specifically wind speed and direction) • Determination of LAeq, 15min noise contribution from Grants Road Quarry activities at receivers; 	Annually	Schedule 3 Condition 9

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Control Measure	Timing / Frequency	Condition and Consultation Requirements
<ul style="list-style-type: none"> • Consideration of any agreement with adjoining landowners (sensitive receivers) regarding noise and noise exceedances; • If noise exceedances of the noise limits are identified, investigate sources contributing to the exceedance and provide recommendations for ameliorative action or management for Quarry operator; and, • Preparation of Noise Monitoring Report. 		
3. The Quarry will undertake noise level testing of all plant or machinery to ensure acoustic performance compliance.	Annually	Schedule 3 Condition 9
4. If the noise levels of a plant or machinery item exceed the criteria levels and if noise levels at the nearby residences exceed the criteria, the Quarry will have the noise-producing plant or machinery serviced or modified, or will provide additional noise attenuation measures.	As required	Schedule 3 Condition 9
5. The quarry shall notify the affected landowners in writing of any exceedance, and provide regular monitoring results to each affected landowner until the project is again complying with the relevant criteria.	As soon as practicable after obtaining monitoring results	Schedule 4 Condition 1 Schedule 5 Condition 7 Department of Planning and Environment and effected residents
6. The Department of Planning and Environment and affected residences will be notified of any incident. Options for mitigation of identified trends or sustained noise exceedances will be assessed in consultation with affected residences and the Department. Where sustained non-compliance is identified noise reduction programs will be investigated and options to minimise any potential addressed.	Within 7 days of the incident	Schedule 4 Condition 1 Schedule 5 Condition 7 Department of Planning and Environment and effected residents
7. Incident generated noise monitoring Where noise incidents are reported, the source of the noise incident will be identified and ameliorative measures implemented, if required. Additional noise monitoring will be considered in response to receipt of noise incidents and noise audits conducted. Additional ameliorative measures would be considered if required. Quarry Manager or Designate who receive the reported incident will record where possible pertinent details at the time.	As required	Schedule 4 Condition 1 Schedule 5 Condition 7 Department of Planning and Environment and effected residents
8. Noise Management Plan Undertake an internal review of the Noise Management Plan. Changes to the Noise Management Plan will only	As required	Schedule 3 Condition 9 Changes to the Plan will be forwarded to the Secretary of the

Control Measure	Timing / Frequency	Condition and Consultation Requirements																																
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<p>9. Records</p> <p>The results of all noise monitoring will be held onsite and maintained by the Quarry Manager or designate. A comprehensive summary of the monitoring results would be made available to the public and placed on the website.</p>	As required	<p>Schedule 5 Condition 11</p> <p>A comprehensive summary of the monitoring results would be made available to the public and placed on the website.</p>																																
Air Quality Impact Monitoring																																		
<p>1. Meteorological Monitoring</p> <p>Parameters to be measured include:</p> <table border="1"> <thead> <tr> <th>Parameter</th> <th>Units</th> <th>Averaging Period</th> <th>Sampling Method</th> </tr> </thead> <tbody> <tr> <td>Rainfall</td> <td>mm</td> <td>1-hour</td> <td>AM-4</td> </tr> <tr> <td>Temperature @2m</td> <td>°C</td> <td>15 minute</td> <td>AM-4</td> </tr> <tr> <td>Temperature @10m</td> <td>°C</td> <td></td> <td>AM-2/AM-4</td> </tr> <tr> <td>Wind Speed @10m</td> <td>m/s</td> <td></td> <td>AM-2/AM-4</td> </tr> <tr> <td>Wind Direction @10m</td> <td>Degrees</td> <td></td> <td>AM-2/AM-4</td> </tr> <tr> <td>Sigma Theta</td> <td>Degrees</td> <td></td> <td>AM-2/AM-4</td> </tr> <tr> <td>Solar Radiation</td> <td>W/m2</td> <td></td> <td>AM-4</td> </tr> </tbody> </table>	Parameter	Units	Averaging Period	Sampling Method	Rainfall	mm	1-hour	AM-4	Temperature @2m	°C	15 minute	AM-4	Temperature @10m	°C		AM-2/AM-4	Wind Speed @10m	m/s		AM-2/AM-4	Wind Direction @10m	Degrees		AM-2/AM-4	Sigma Theta	Degrees		AM-2/AM-4	Solar Radiation	W/m2		AM-4	Continuous	Schedule 3 Condition 10
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<p>2. Air Quality Monitoring</p> <p>Monitoring PM₁₀ at the most affected off-site location. High Volume Air Sampler (HVAS) for long term compliance monitoring at the most affected receptor.</p> <p>The High Volume Air Sampler monitoring will be operated in accordance with AS/NZS 3580.9.6:2003 Methods for sampling and analysis of ambient air – Determination of suspended particulate Matter – PM₁₀ – high volume air sampler with size selective inlet – gravimetric method.</p> <p>Data from the HVAS monitoring station will be handled as follows:</p> <ul style="list-style-type: none"> • Samples retrieved from monitoring instrumentation on a six day cycle. • Samples sent to a laboratory for analysis. • Data entered into electronic database (or similar) for comparison with relevant air quality criteria. • Data compared with relevant criteria and any exceedances noted and investigated. 	As noted and reviewed on an as needs basis and for the annual review	Schedule 3 Condition 10																																

Control Measure	Timing / Frequency	Condition and Consultation Requirements
<p>Monitoring data will be reviewed annually as part of the annual reporting requirements. Depending on the findings of each annual review, and in consultation with the relevant authorities, monitoring requirements may be discontinued or augmented.</p>		
<p>3. Greenhouse Gas Monitoring Primarily monitoring the use of:</p> <ul style="list-style-type: none"> • Diesel • Oil • Grease • Electricity. <p>Monitoring will be undertaken in accordance with the requirements of the National Greenhouse and Energy Reporting Act 2007 and the National Greenhouse and Energy Reporting Regulations 2008.</p>	<p>Annually</p>	<p>Schedule 3 Condition 11</p>
<p>4. Air quality monitoring above the criteria Where air quality monitoring data are above the levels indicated for the Impact Assessment Criterion, the following additional analysis will be conducted to test non-compliance.</p> <ul style="list-style-type: none"> • Investigate the meteorological data for the period to determine dominant wind direction, average wind speeds, percentage calm conditions (< 0.5 m/s) and significant periods of strong winds (> 5.4 m/s). <p>Where the dominant wind direction is not blowing across the site and towards the monitoring location, the level above the Impact Assessment Criteria is unlikely to have resulted from site activities and does not represent non-compliance.</p> <p>Where the dominant wind direction is blowing across the site and towards the monitoring location, the following additional analysis is required to determine if dust from the site has contributed to the elevated levels and / or if wind-blown dust from other upwind sources are also contributing.</p> <ul style="list-style-type: none"> • Determine if the wind speeds are conducive to wind erosion from exposed surfaces (moderate winds > 5.4 m/s) or if calm conditions were prevalent (< 0.5 m/s). Calm conditions can result in poor dispersion of activity dependent emissions from the site, however, wind erosion from exposed 	<p>Within 7 days of the incident</p>	<p>Schedule 3 Condition 11</p> <p>The Department of Planning and Environment and affected residences will be notified of any incident. Options for mitigation of identified trends or sustained air quality exceedances will be assessed in consultation with affected residences and the Department.</p>

Control Measure	Timing / Frequency	Condition and Consultation Requirements
<p>surfaces would not be expected to occur under these conditions.</p> <ul style="list-style-type: none"> Obtain a site activity log for the elevated level day to determine what activities were occurring and characterise the activities based on being wind speed independent, wind speed dependent or wind erosion sources. Request additional microscopic analysis of the exposed filter paper to determine the likely dust source (i.e. is the dust similar or different to material handled at the site). <p>The Department of Planning and Environment and affected residences will be notified of any incident. Options for mitigation of identified trends or sustained air quality exceedances will be assessed in consultation with affected residences and the Department.</p>		
<p>5. Incident generated air quality monitoring Where air quality incidents are reported, the source of the incident will be identified and ameliorative measures implemented, if required. Additional air quality monitoring will be considered in response to receipt of these incidents and audits conducted. Additional ameliorative measures would be considered if required. Quarry Manager or Designate who receive the reported incident will record where possible pertinent details at the time.</p>	As required	Schedule 5 Condition 7 Department of Planning & Environment and affected landowners
<p>6. The quarry shall notify the affected landowners in writing of any exceedance, and provide regular monitoring results to each affected landowner until the project is again complying with the relevant criteria.</p>	As soon as practicable after obtaining monitoring results	Schedule 5 Condition 7 Department of Planning & Environment and affected landowners
<p>7. In the event of an exceedance of any relevant air quality criteria, the quarry shall send a copy of the NSW Health fact sheet entitled "Mine Dust and You" (as may be updated from time to time) to the affected landowners and current tenants of the land (including tenants of land which is not privately-owned).</p>	As soon as practicable after obtaining monitoring results	Schedule 5 Condition 7 Department of Planning & Environment and affected landowners
<p>8. Air quality monitoring report Monitoring of air quality during construction and operations will be undertaken to ensure levels due to operational activities do not exceed the criteria for all adjoining privately owned residences. Monitoring procedures will include:</p> <ul style="list-style-type: none"> Attended noise measurements over fifteen 	Annually	Schedule 5 Condition 4

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Control Measure	Timing / Frequency	Condition and Consultation Requirements
(15) minutes at each receiver noting aural observations, recording LA90 and LAeq noise levels and weather conditions (specifically wind speed and direction).		
9. Air quality management plan Undertake an internal review of the Air Quality Management Plan. Changes to the Air Quality Management Plan will only occur if improvements are identified or required as part of the annual review or instructed by the Department. Changes to the Plan will be forwarded to the Secretary of the Department for approval.	As required	Schedule 3 Condition 12
10. Records The results of all noise monitoring will be held onsite and maintained by the Quarry Manager or designate. A comprehensive summary of the monitoring results would be made available to the public and placed on the website.	As required	Schedule 5 Condition 11
Transport Impact Controls		
1. Minimising impact on surrounding road network <ul style="list-style-type: none"> Project related heavy vehicles trucks will enter and exit the site in a forward manner. All loads will be covered prior to leaving the site. All laden vehicles leaving the site are cleaned of and other material that may fall on the road, before leaving the site. 	At all times	Schedule 3 Condition 18
2. Monitoring of product transport The quarry will keep accurate records of the following and publish the records on its website: <ul style="list-style-type: none"> Amount of quarry products transported from the site (per calendar month and year) and Number of laden vehicle movements from the site (per hour, day, week, calendar month and year). 	Biannually	Schedule 3 Condition 14
3. Grants Road maintenance <ul style="list-style-type: none"> Payment of contributions to Gosford Council in accordance with the Maintenance requirements for Grants Road. 	Annually	Schedule 3 Condition 16
4. Traffic Management <ul style="list-style-type: none"> Ensure all visitors, customers and contractors are inducted in regards to the traffic management requirements. All hazards and incidents to be reported immediately and appropriate action implemented. 	At all times	Schedule 3 Condition 18

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Control Measure	Timing / Frequency	Condition and Consultation Requirements
5. Traffic management plan Undertake an internal review of the Traffic management plan. Changes to the management plan will only occur if improvements are identified or required as part of the annual review or instructed by the Department.	As required	Schedule 3 Condition 18 Schedule 5 Condition 5 Changes to the plan will be forwarded to the Secretary of the Department for approval.
GDE Monitoring		
1. GDE monitoring surveys	Annually	Schedule 5 Condition 4
2. GDE Management Plan Undertake an internal review of the Management Plan. Changes to the Management Plan for GDEs will only occur if improvements are identified or required as part of the annual review or instructed by the Department. Changes to the Plan will be forwarded to the Secretary of the Department for approval.	As required	Schedule 3 Condition 21 DPI Water Changes to the Plan will be forwarded to the Secretary of the Department for approval.
3. Records The results of all monitoring of GDEs will be held onsite and maintained by the Quarry Manager or designate. A comprehensive summary of the monitoring results would be made available to the public and placed on the website.	As required	Schedule 5 Condition 11
Monitoring of Somersby Mintbush		
1. Somersby Mintbush monitoring surveys Areas of Somersby Mintbush are to be sampled by undertaking counts of the baseline populations identified. The outer extent of each population is to be mapped with the aid of a hand-held GPS device. Photographs of fixed locations are to be taken for each population during each monitoring event. Visual inspections and photographs are to be undertaken for the following: <ul style="list-style-type: none"> • Signs of surface erosion; • Signs of sedimentation; • Density of each stratum of surrounding vegetation; • Fire disturbance; • Herbivory; and • Trampling. 	Annually	Schedule 5 Condition 4

Control Measure	Timing / Frequency	Condition and Consultation Requirements
<p>2. Somersby Mintbush Management Plan Undertake an internal review of the Management Plan.</p> <p>Changes to the Management Plan for Somersby Mintbush will only occur if improvements are identified or required as part of the annual review or instructed by the Department. Changes to the Plan will be forwarded to the Secretary of the Department for approval.</p>	As required	<p>Schedule 3 Condition 22 OEH</p> <p>Changes to the Plan will be forwarded to the Secretary of the Department for approval.</p>
<p>3. Records The results of all monitoring of Somersby Mintbush will be held onsite and maintained by the Quarry Manager or designate. A comprehensive summary of the monitoring results would be made available to the public and placed on the website.</p>	As required	Schedule 5 Condition 11
Biodiversity Impact Monitoring		
<p>1. Biodiversity Offsets monitoring Monitoring of biodiversity offsets is to be undertaken initially prior to and then following vegetation clearing operations under the approval. Monitoring is required to assess the establishment and maintenance of at least 4 hectares of moderate – good quality Scribbly Gum Woodland vegetation and report on any nest box maintenance or replacement necessary over 10 years during stage 2 works.</p> <p>Biodiversity offset areas are to be monitored annually with fixed 400m² monitoring quadrats. The following is to be assessed for each quadrat:</p> <ul style="list-style-type: none"> • Floristics; • Native plant cover; • Exotic plant cover; • Plant regeneration (including percentage survival for plantings); • Condition of deer exclusion fencing; • Signs of surface erosion and sedimentation; • Presence of feral animals; • Natural Disturbance; • Fixed photo point observations; and • Nest box condition. <p>Results of the monitoring surveys are to be provided in annual monitoring reports.</p>	Annually	Schedule 5 Condition 4
<p>2. Biodiversity Offsets Management Plan Undertake an internal review of the Management Plan for Biodiversity Offsets will only occur if</p>	As required	<p>Schedule 3 Condition 10 and 20 OEH</p>

Control Measure	Timing / Frequency	Condition and Consultation Requirements
improvements are identified or required as part of the annual review or instructed by the Department. Changes to the Plan will be forwarded to the Secretary of the Department for approval.		Changes to the Plan will be forwarded to the Secretary of the Department for approval.
3. Records The results of all monitoring of the Biodiversity offsets will be held onsite and maintained by the Quarry Manager or designate. A comprehensive summary of the monitoring results would be made available to the public and placed on the website.	As required	Schedule 5 Condition 11
Landscape and Rehabilitation Monitoring		
1. Monitoring the effectiveness of the measures and progress against the performance and completion criteria.	To be determined	Schedule 3 Condition 27
2. Update of the Landscape and rehabilitation management Plan.	Every three years	Schedule 3 Condition 27
3. Conservation and rehabilitation bond Lodgement of a conservation and rehabilitation bond with the Department.	Within six months of approval of the Landscape and rehabilitation management plan.	Schedule 3 Condition 28
4. Review of conservation and rehabilitation bond.	Within 3 months of each independent environmental audit	Schedule 3 Condition 28
Heritage Impact Monitoring		
1. Inspection An inspection will be carried out one year post approval (25th July, 2015) or post fencing and at the time of inspection of the biodiversity area, which ever arises first.	As outlined.	Schedule 3 Condition 30
2. Biodiversity Offset Area The Biodiversity Offset Area will be inspected by an archaeologist and the RAPs prior to any revegetation or other works. Any sites located will be recorded, updated on AHIMS and within the CHMP. The CHMP prescribes the avoidance of sites by revegetation activities.	Prior to any works within the Biodiversity offset area	Schedule 3 Condition 30
3. Howes Aboriginal Monitoring Program The site 45-3-3343 will be incorporated into the Howes Reserve Aboriginal Monitoring program.	Five yearly	Schedule 3 Condition 30
4. Consultation with the RAPs The quarry will issue a newsletter or other relevant correspondence to the RAPS informing of the progress of the quarry site and of any relevant monitoring results.	Six monthly	Schedule 3 Condition 30

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Control Measure	Timing / Frequency	Condition and Consultation Requirements
<p>5. Heritage Management Plan Undertake an internal review of the Management Plan.</p> <p>Changes to the Heritage Management Plan will only occur if improvements are identified or required as part of the annual review or instructed by the Department. Changes to the Plan will be forwarded to the Secretary of the Department for approval.</p>	As required	Schedule 3 Condition 30 Changes to the Plan will be forwarded to the Secretary of the Department for approval.
<p>6. Records The results of all monitoring will be held onsite and maintained by the Quarry Manager or designate. A comprehensive summary of the monitoring results would be made available to the public and placed on the website.</p>	As required	Schedule 5 Condition 11
Visual Impact Monitoring		
Monitoring of the management measures to minimise the visual impact would be undertaken as part of the annual review.	Annually	Schedule 3 Condition 30 and 31 Schedule 5 Condition 4
Waste Management Impact Monitoring		
Monitoring of the management measures to minimise waste would be undertaken as part of the annual review.	Annually	Schedule 3 Condition 32 Schedule 5 Condition 4
Bushfire Impact Monitoring		
Monitoring of the management measures to manage bushfire would be undertaken as part of the annual review.	Annually	Schedule 3 Condition 35 Schedule 5 Condition 4

4.0 LICENSING

Groundwater

The Project Site is covered by the *Water Sharing Plan for the Kulnura Mangrove Mountain Groundwater Sources*. The proponent holds a Water Access License for the Property under the Water Management Act 2000.

The current water entitlement for the Property is 18 ML. This entitlement is attached to Water Access License 20WA100361, which presently covers two registered bores GW049244 and GW101915. It is noted that the annual water entitlement of 18 ML/year consists of 14 ML for industrial purposes and 4 ML for stock and domestic purposes.

The steady state numerical groundwater modelling predicts a total inflow of groundwater into the pit of 64 ML per annum. An additional amount of 50 ML in WALs will be required.

Surface water

The quarry owners will seek to modify their current Environment Protection License (EPL) to reflect the proposed discharge volumes and associated water qualities. Discharge from quarry operations are proposed to only occur via the Pollution Control Dam or Polishing Pond.

Surface water licence number 20SL056523 under the Water Act 1912 has been converted into Access Licences under the Water Management Act 2000. The Access Licences and their corresponding Water Access Licence numbers are listed in Table 4.1.

Table 4.1 – Register Surface Water Licences

Access Licence	Water Access Licence	Annual Entitlement	Purpose
20AL205915	WAL17440	6 ML	Stock / Domestic Specific Purpose
20AL205916	WAL17474	29 ML	Unregulated River
20CA205917	Permits for supply works such as construction of contour drain, diversion works, installation of pumps etc.		

The three licences listed above allow the abstraction and use of water in total from the Mooney Mooney Creek Water Source.

5.0 SOIL AND WATER

5.1 Introduction

A Groundwater Management Plan and Surface Water Management Plan have been prepared by Larry Cook Consulting Pty Ltd (November 2014 and February 2015) in accordance with Schedule 3 Part 4 of the Project Approval and are attached in appendices 2 and 3.

5.2 Objectives

The objectives for soil and water management are:

- Ensure that the project has sufficient water for all stages, and if necessary adjust the scale of operations to match the available water supply if required.
- Minimise the erosion and sedimentation of undisturbed areas, watercourses and water bodies.
- Minimise the loss of topsoil from areas disturbed by quarrying activities.
- Protect surface and ground water quality and comply with statutory requirements and conditions.
- Minimise the loss of topsoil through pre-stripping and reuse in the construction of bunding to control noise, visual amenity, surface water and public safety.
- Ensure an acceptable water supply is available to privately-owned groundwater bores.
- Minimise the impacts on local sandstone aquifers, privately-owned groundwater bores and high priority GDEs.
- Ensure an effective communication protocol with Central Coast Sands Quarry to minimise cumulative impacts.
- Maximise returns / natural flow of clean waters (undisturbed by the quarry operation) to the environment.
- Optimise the system for water security focussing upon surface / rainfall runoff.
- Minimise dependence on other water sources such as groundwater bores and creeks as permitted under existing Water Access Licences.

5.3 Soil

5.3.1 Management Measures

The mitigation measures include:

- Maintain topsoil for rehabilitation and minimise soil loss through erosion.
- Vegetate all mounds.
- Implement downslope sedimentation controls as required.

5.3.2 Monitoring Schedule

Table 5.1 – Soil and Erosion Measures

Control Measure	Timing / Frequency	Condition and Consultation requirement
1. Erosion control and water management structures will remain in place until slopes and exposed areas are fully stabilised and revegetated. Dams will be retained as pollution control devices.	As required	Schedule 3 Condition 3
2. Review of soil and erosion measures to be undertaken as part of the annual review or independent environmental audit.	Annually	Schedule 5 Condition 4

5.4 Groundwater

5.4.1 Groundwater Impact Assessment Criteria

It is recognised that any significant decrease in water level and/or changes on water quality in monitoring bores and monitoring sites may be a consequence of several factors including but not necessarily limited to pumping interference from neighbouring bores, interference from extraction operations or due partly to long-term environmental effects.

The development of a set of trigger levels is considered an important component of on-going long-term assessment of any potential impacts from quarrying on the local groundwater systems, other groundwater users and the environment.

Continuous 'real time' monitoring of water levels and regular monitoring of water quality is proposed to be continued in the monitoring bore network in order to establish *control ranges* that take into account, as best as possible, natural variation and fluctuations in climate and rainfall, and possible artificial changes induced by pumping from the network of existing district and neighbouring bores.

Analytical results will be compared against the Protection of Freshwater Aquatic Ecosystems (ANZECC 2000), and the 1999 NEPM 'Schedule B (1) Guideline on the Investigation Levels for Soil and Groundwater'. As prescribed in the Guidelines, statistical procedures will be used to determine whether there has been a significant (90% confidence level) change in the value of one or more of the indicator parameters specified in the water assessment plan (Appendix D of the Guideline). As documented, analysis of variance or other suitable statistical techniques can be used to perform this assessment.

In addition to comparing analytical results against the various guidelines to reveal any exceedances, it is proposed to establish control ranges for a set of indicator parameters. The control ranges and trigger levels would be developed using the progressively-collected monitoring data and a statistical analysis. The selected statistical analytical methods will be designed to provide warning and monitoring of any adverse trends associated with potential contamination of the groundwater system. The methods would provide warning of any imminent exceedances of the limits and establish, and monitor any impacts if they have already occurred.

5.4.2 Management Measures

The mitigation measures include:

- Ground water draw down will be regularly monitored to ensure the amenity of neighbours is maintained. If ground water draw down cause's the loss of yield on non-Quarry land, the Quarry will upgrade or replace the water supply.
- Undertake continuous 'real time' monitoring of water levels and regular monitoring of water quality be continued in the monitoring bore network in order to establish *control ranges* that take into account, as best as possible, natural variation and fluctuations in climate and rainfall, and possible artificial changes induced by pumping from the network of existing district and neighbouring bores.

5.4.3 Monitoring Schedule

Table 5.2 – Groundwater Impact Monitoring

Control Measure	Timing / Frequency	Condition / Consultation requirement
<p>1. Water level monitoring Automatic water level measurements in water level data loggers installed in monitoring bores.</p> <p>(Refer Figure 3, Appendix 2 for bore hole locations).</p>	<ul style="list-style-type: none"> Initial 4-hourly (1 sample every 4 hours) Assess data after 12 months Depending on results and trends, decrease frequency to 8-hourly (1 sample every 8 hours) Downloaded initially at 1 month intervals 	Schedule 3 Condition 4
<p>2. Water Quality Monitoring Groundwater sampling in representative monitoring bores.</p>	<ul style="list-style-type: none"> Initial 3-monthly (1 sample per bore every 3 months) for 12 months Assess data after 12 months Depending on results and trends decrease frequency to 6-monthly (1 sample every 6 months) 	Schedule 3 Condition 4 DPI Water
<p>3. Rainfall Monitoring Automatic rainfall measurements in tipping bucket rain gauge data logger on site.</p>	Continuous logging at every 0.2 mm tip with time/date stamps	Schedule 3 Condition 4
<p>4. Data Management The water level and water quality data acquired from the monitoring bores would be imported into an electronic database, collated and viewed by the hydrogeological consultant.</p>	Following each round of monitoring.	Schedule 3 Condition 4
<p>5. Ground Water Reporting A complete set of water level data and groundwater quality monitoring results will be recorded, collated and reported including a statistical analysis and a comparison of water level monitoring results.</p>	<p>Six-monthly basis for the first 12 months then on an annual basis.</p> <p>Annually</p>	Schedule 3 Condition 4 DPI Water
<p>6. Ground Water Management Plan Undertake an internal review of the Ground Water Management Plan. Changes to the Management Plan will only occur if improvements are identified or required as part of the annual review or instructed by the Department.</p>	As required	Schedule 5 Condition 5 Changes to the Plan will be forwarded to the Secretary of the Department of Planning & Environment for approval.

<p>7. Records The results of all ground water monitoring will be held onsite and maintained by the Quarry Manager or designate. A comprehensive summary of the monitoring results would be made available to the public and placed on the website.</p>	<p>As required</p>	<p>Schedule 5 Condition 8</p>
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5.5 Surface Water

5.5.1 Surface Water Impact Assessment Criteria

The NSW EPA has prescribed criteria for the maximum allowable discharge concentrations for several potential pollutants in surface water discharge into the south-west waterway. The recommended limits are listed in Table 5.3.

The maximum concentrations for nutrients (trigger levels) cannot be established at this stage until sufficient analytical data is collected and statistically analysed. It is therefore proposed that event-based sampling and testing be carried out in order to establish *control ranges* that take into account, as best as possible, natural variation and fluctuations in climate and rainfall.

Table 5.3 – Recommended Water Quality Discharge Limits

Analyte	Trigger Value
pH	> 6.0 and < 8.0
Electrical Conductivity (EC)	< 350 µS/cm
Total Suspended Solids (TSS)	40 mg/L
Total Nitrogen (TN)	< 1.8 mg/L
Total Phosphorus (TP)	< 0.54 mg/L

5.5.2 Management Measures

The management of surface water incorporates the continuation of the existing ‘in pit’ closed system approach for:

- Containment of in-pit flows;
- Sand washing;
- Bunding;
- Diversion drains;
- Silt and tailings dams;
- Decant / return water pond;
- Storage of ‘in pit’ rainfall runoff; and
- Pumps and transfer lines (wash plant, wash-down, dust suppression).

Additional ‘out of pit’ infrastructure is proposed comprising:

- A Pollution Control Dam to capture polluted runoff;
- Pump and transfer pipeline line into the quarry for operational water security;
- Polishing Pond; and
- Bunding and surface water diversion drains.

It is not expected that the expansion of the existing quarry will have any significant impact on downstream water quality. That is, minimal impacts on the Mooney Mooney Creek are expected as a consequence of the quarry expansion.

The existing water quality in the northern catchment will not be impacted by the quarry expansion as all clean runoff upstream of the quarry will be diverted around the quarry to the north-west waterway. The same process will be followed for the southern catchment where all runoff will be diverted around the quarry to the Pollution Control Pond and Polishing Pond prior to release to the south-west waterway and ultimately to the Mooney Mooney Creek system.

During the life of the quarry, surface water within the Project Site and in the Pollution Control Pond will be monitored and tested for quality.

The main contaminants of concern are acidity, salinity and suspended solids associated with the sand extraction operations and nutrients from the existing chicken growing operations. The potential contaminants are:

- pH
- Electrical Conductivity (EC)
- Total Suspended Solids (TSS)
- Total Nitrogen (TN)
- Total Phosphorus (TP).

Water quality from the Project Site will improve as runoff from the chicken growing operations is effectively treated in the 'out-of-pit' Pollution Control Dam and Polishing Pond. During Stage 2, when the quarry extends to the south to its maximum extent, the chicken growing operation will be decommissioned and sheds removed from Lot 1. This will potentially result in an improvement in nutrient levels (TN and TP) in downstream water quality.

During the sand extraction operations at the maximum quarry extent, water will be required to be pumped out of the quarry from the Decant Pond into the 'out-of-pit' Pollution Control Dam on the south-western corner of Lot 1. Pumped water will be stored in the Pollution Control Dam until water quality criteria is satisfied. When this occurs, the retained water in the Pollution Control Dam will be released to the Polishing Dam which then drains to the south-west waterway.

Total Suspended Solids (TSS) in runoff waters take approximately 6 to 7 days to settle. In order to satisfy discharge water quality criteria, typically up to 9 ML/week can be pumped from the Decant Dam into the Pollution Control Dam. Suitable settling will occur prior to any discharge through the Polishing Pond to the south-west waterway.

5.5.3 Monitoring Schedule

Table 5.4 – Surface Water Impact Monitoring

Control Measure	Timing / Frequency	Condition and Consultation requirement
1. Surface Water Monitoring Undertake surface water sampling at the following monitoring sites. <ul style="list-style-type: none"> • W1 – New monitoring point. • W4 – Culvert on south-west waterway. 	<ul style="list-style-type: none"> • Monthly (1 sample per monitoring site every month) for 12 months • Assess data after 12 months <p><i>Depending on results and trends decrease frequency to quarterly (1 sample every 3 months)</i></p>	Schedule 3 Condition 4 Consult with EPA within 1 month of end of Year 1 to discuss decrease of monitoring frequency from monthly to quarterly (3 monthly). <i>Depending on results and trends, and approval from EPA,</i>

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<ul style="list-style-type: none"> • S1 – South-west waterway on western boundary of Lot 1. <p>(Refer Figure 4, Appendix 3 for monitoring locations).</p>	<ul style="list-style-type: none"> • Monthly (1 sample per monitoring site every month) for 12 months • Within 12 hours prior to any controlled discharge; and • Weekly during any discharge. 	<p>decrease frequency to quarterly (1 sample every 3 months)</p>
<p>2. Rainfall Monitoring</p> <p>Automatic rainfall measurements in tipping bucket rain gauge data logger on site.</p>	<p>Continuous logging at every 0.2 mm tip with time/date stamps</p>	<p>Schedule 3 Condition 4</p>
<p>3. Surface Water Reporting</p> <ul style="list-style-type: none"> • Surface water quality monitoring results will be recorded, collated and duly reported in-house. • review of results and any exceedances. <p>Report sent to the New South Wales Office of Water.</p>	<p>Six-monthly for the first 12 months then on an annual basis.</p> <p>Annually</p>	<p>Schedule 5 Condition 4</p> <p>DPI Water, EPA, Department Planning & Environment</p>
<p>4. Surface Water Management Plan</p> <p>Undertake an internal review of the Surface Water Management Plan.</p> <p>Changes to the Management Plan will only occur if improvements are identified or required as part of the annual review or instructed by the Department.</p>	<p>As required</p>	<p>Schedule 5 Condition 5</p> <p>Changes to the Plan will be forwarded to the Secretary of the Department of Planning & Environment for approval.</p>
<p>5. Records</p> <p>The results of all surface water monitoring will be held onsite and maintained by the Quarry Manager or designate. A comprehensive summary of the monitoring results would be made available to the public and placed on the website.</p>	<p>As required</p>	<p>Schedule 5 Condition 8</p>

6.0 NOISE

6.1 Introduction

A Noise Management Plan has been prepared by Atkins Acoustics and Associates Pty Ltd to address Approval Conditions 5, 6, 7, 8 and 9 of Schedule 3 and is attached in Appendix 4.

6.2 Objectives

The objectives for noise are:

- To manage the operation so as to minimise noise and ensure that statutory requirements are met.
- To monitor operational and environmental noise to ensure compliance with regulatory requirements.
- To keep adjacent residents and regulators informed of any noise related issues or changes to operating processes.

6.3 Noise Impact Assessment Criteria

Potential noise sensitive areas identified in the vicinity of the quarry include isolated rural residential dwellings located in close proximity to the quarry including:

- North ('Sammut' 210 Grants Road (Lot 105 DP 738384) and 200 Grants Road (Lot 106 DP 738384),
- East ('McGregor' 239 Grants Road (Lot 1 DP 104750) and 251-255 Grants Road (Lot 12 DP 1075554)), and
- South ('Ibels' 380 Somersby Falls Road (Lot 2 DP 358717)).

In addition Brisbane Water National Park adjoins the site to the west.

Table 6.1 – Grants Road Sand Quarry Noise Criteria L_{Aeq1hr} dB(A)

Receiver Location	$L_{Aeq(15\ min)}$ dB(A)
All privately-owned residences	40

Noise generated by the project is to be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy.

The noise criteria in Table 5.1 is to apply under all meteorological conditions except the following:

- During periods of rain or hail; or
- Wind speeds greater than 3 m/s measured at 10 m above ground level.

The noise criteria outlined in Table 5.1 do not apply if Grants Road Sand Quarry has an agreement with the relevant landowner to exceed the noise criteria, and this has been advised to the Department of Planning in writing of the terms of the agreement.

Instrumentation for noise measurement shall be NATA or factory calibrated, and hold current Certificates of Calibration. The reference level of each instrument will be checked in the field prior to and after the measurements with a NATA or factory calibrated calibrator. Any variations with the reference field calibration level check will be noted. Statistical sound level meters will be set to A-weighting, fast response and fifteen (15) minute sampling periods.

6.4 Management Measures

To minimise noise impacts and maintain compliance with the approval assessment criteria the following measures / practices will be implemented, specifically:

- Engineered noise reduction measures (upgraded exhausts, enclosure / panels to engines, or localised plant specific shielding*) to achieve the following noise reductions and resultant Sound Power Levels (Lw):
 - Dozer 4dB Lw108dB(A);
 - Trenchor (or Excavator + diamond saw) 3dB Lw109dB(A);
 - McCloskey 3dB Lw106dB(A); and,
 - Sandwash plant - air cooled 6 cylinder engine* 8dB Lw 104dB(A) (*smaller 4 cylinder engine is now operating with a purpose design enclosure and exhaust resulting in an 8dB reduction and does not require further attenuation*)
- Site mobile plant fitted and operated with low level or broadband ‘quacker’ reversing alarms
- Plant and equipment maintained to ensure acoustic performance complies with the limits outlined above;
- Site Operational Management Plan (SOMP) developed to:
 - Manage the operation of Dozer, Trenchor (or Excavator + diamond saw) and McCloskey to ensure they operate simultaneously;
 - document procedures to maximise site shielding and minimise number of plant operating simultaneously at exposed locations, particularly eastern and southern portions of quarry (Areas B, C, F and G);
 - manage extraction and processing plant / equipment where practical and feasible to one (1) item of plant when working <8m below natural ground level. All extraction to occur against the working face where practical;
 - manage site activities in conjunction with prevailing weather conditions to:
 - cease operations within Precinct F and G during north-north-west to west wind conditions (up to 3m/s) with respect to the dozer, Trenchor (or Excavator + diamond saw) and McCloskey in exposed locations (<8m below natural ground level); and,
 - utilise periods during high winds >5m/s (particularly east to south-east winds) and / or rain and elevated background noise levels to work within exposed locations (Areas B, F and G)
- Construct acoustic earth mounds 3-4 metres above natural ground level along the southern and south-eastern quarry boundaries as shown in *Figure 1 (Figure 14 of the Environmental Assessment)* before commencing Precincts E, F and G (Stage 2 quarry development);
- Real time monitoring of prevailing weather conditions including wind speed and direction at a height of ten (10) metres above ground level;
- Noise Incident Management and Reporting Procedures; and,
- Attended Compliance Noise Monitoring.

6.5 Monitoring Schedule

Control measures for measurement and monitoring during the Quarry operations are outlined in Table 5.2. Noise monitoring is undertaken annually to ensure that all noise control measures are installed and maintained, and that environment noise criteria are satisfied.

Table 6.2 – Noise Impact Monitoring

Control Measure	Timing / Frequency	Condition and Consultation requirement
1. Provision of site contact details for public / residents seeking information or to report noise incidents.	As required	Schedule 3 Condition 9
2. Noise Monitoring Report Monitoring of emitted noise levels during	Annually	Schedule 3 Condition 9

<p>construction and operations will be undertaken to ensure noise levels due to operational activities do not exceed the criteria for all adjoining privately owned residences.</p> <p>Monitoring procedures will include:</p> <ul style="list-style-type: none"> • Attended noise measurements over fifteen (15) minutes at each receiver noting aural observations, recording LA90 and LAeq noise levels and weather conditions (specifically wind speed and direction); • Determination of LAeq,15min noise contribution from Grants Road Sand Quarry activities for each receiver location; • Review of Grants Road Sand Quarry contributions compared to noise criteria; • Inspection of site to confirm quarry operations at time of audit; • Attended nearfield or midfield measurements of individual site plant and equipment to confirm operating noise levels and sound power levels; • Conduct second round of attended noise measurements at the reference monitoring locations over fifteen (15) minutes at each receiver noting aural observations, recording LA90 and LAeq noise levels and weather conditions (specifically wind speed and direction); • Determination of LAeq,15min noise contribution from Grants Road Quarry activities at receivers; • Consideration of any agreement with adjoining landowners (sensitive receivers) regarding noise and noise exceedances; • If noise exceedances of the noise limits are identified, investigate sources contributing to the exceedance and provide recommendations for ameliorative action or management for Quarry operator; and, • Preparation of Noise Monitoring Report. 		
<p>3. The Quarry will undertake noise level testing of all plant or machinery to ensure acoustic performance compliance.</p>	<p>Annually</p>	<p>Schedule 3 Condition 9</p>
<p>4. If the noise levels of a plant or machinery item exceed the criteria levels and if noise levels at the nearby residences exceed the criteria, the Quarry will have the noise-producing plant or machinery serviced or modified, or will provide additional noise attenuation measures.</p>	<p>As required</p>	<p>Schedule 3 Condition 9</p>

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<p>5. The quarry shall notify the affected landowners in writing of any exceedance, and provide regular monitoring results to each affected landowner until the project is again complying with the relevant criteria.</p>	<p>As soon as practicable after obtaining monitoring results</p>	<p>Schedule 4 Condition 1 Schedule 5 Condition 7 Department of Planning and Environment and effected residents</p>
<p>6. The Department of Planning and Environment and affected residences will be notified of any incident. Options for mitigation of identified trends or sustained noise exceedances will be assessed in consultation with affected residences and the Department. Where sustained non-compliance is identified noise reduction programs will be investigated and options to minimise any potential addressed.</p>	<p>Within 7 days of the incident</p>	<p>Schedule 4 Condition 1 Schedule 5 Condition 7 Department of Planning and Environment and effected residents</p>
<p>7. Incident generated noise monitoring Where noise incidents are reported, the source of the noise incident will be identified and ameliorative measures implemented, if required. Additional noise monitoring will be considered in response to receipt of noise incidents and noise audits conducted. Additional ameliorative measures would be considered if required. Quarry Manager or Designate who receive the reported incident will record where possible pertinent details at the time.</p>	<p>As required</p>	<p>Schedule 4 Condition 1 Schedule 5 Condition 7 Department of Planning and Environment and effected residents</p>
<p>8. Noise Management Plan Undertake an internal review of the Noise Management Plan. Changes to the Noise Management Plan will only occur if improvements are identified or required as part of the annual review or instructed by the Department.</p>	<p>As required</p>	<p>Schedule 3 Condition 9 Changes to the Plan will be forwarded to the Secretary of the Department for approval.</p>
<p>9. Records The results of all noise monitoring will be held onsite and maintained by the Quarry Manager or designate.</p>	<p>As required</p>	<p>Schedule 5 Condition 11 A comprehensive summary of the monitoring results would be made available to the public and placed on the website.</p>

7.0 AIR QUALITY

7.1 Introduction

An Air Quality Management Plan has been prepared by Pacific Environment Limited (29 March 2016) to address Approval Condition 12 of Schedule 3. The Air Quality Management Plan (AQMP) describes strategies for minimising and managing air quality (AQ) emissions for the Project.

7.2 Objectives

The objectives of the Air Quality Management Plan are:

- To minimise air quality impacts on surrounding residents and to comply with all statutory requirements.
- To inform the adjacent residents and regulators of any operational changes which may impact upon air quality.
- To respond quickly and effectively to issues and complaints.
- Implement best management practice to minimise the dust emissions from the project.
- Regularly assess air quality monitoring data and relocate, modify and/or stop operations on site to ensure compliance with the air quality criteria in this approval.
- Minimise the air quality impacts of the project during adverse meteorological conditions and extraordinary events.
- Implement all reasonable and feasible measures to minimise the release of greenhouse gas emissions from the site.
- Minimise the area of surface disturbance and maximise progressive rehabilitation of the site.

7.3 Air Quality Impact Assessment Criteria

All reasonable and feasible avoidance and mitigation measures are employed to ensure that particulate matter emissions generated by the project do not exceed the criteria listed in the following tables at any residence on privately-owned land.

Table 7.1 – Long term criteria for particulate matter

Pollutant	Averaging Period	Criteria
Total suspended particulate (TSP) matter	Annual	90 µg/m ³
Particulate matter <10 µm (PM10)	Annual	30 µg/m ³

Table 7.2 – Short term criteria for particulate matter

Pollutant	Averaging Period	Criteria
Particulate matter <10 µm (PM10)	24 hour	50 µg/m ³

Table 7.3 – Long term criteria for deposited dust

Pollutant	Averaging period	Maximum increase in the deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m ² /month	4 g/m ² /month

Table 7.4 – Impact assessment criterion for crystalline silica

Pollutant	Averaging period	Criteria
Chronic Reference Exposure Level (REL) (PM4)	Annual	3 µg/m ³

7.4 Management Measures

Mitigation and management measures include:

- Watering of unsealed roads.
- Use of wheel-wash and operation of sealed road from wheel-wash to the front gate.
- Covering of loads during hauling.
- Watering of stockpiles when necessary.
- Limiting vehicle speed on-site.
- Limiting area of disturbed land and progressive rehabilitation of completed ones.
- Review opportunities to increase energy efficiency such as minimising haul distances, reducing trips by coordinating delivery and removal of materials etc.
- Consideration of the use of alternative fuels where economically and practically feasible.
- Regular maintenance of diesel powered equipment to ensure operation at peak efficiency.
- Consideration of energy efficiency for all electrical equipment, appliances, lighting and hot water system.

7.5 Monitoring Schedule

Table 7.5 – Air Quality Impact Monitoring

Control Measure	Timing / Frequency	Condition and Consultation requirement																																
<p>1. Meteorological Monitoring</p> <p>Parameters to be measured include:</p> <table border="1"> <thead> <tr> <th>Parameter</th> <th>Units</th> <th>Averaging Period</th> <th>Sampling Method</th> </tr> </thead> <tbody> <tr> <td>Rainfall</td> <td>mm</td> <td>1-hour</td> <td>AM-4</td> </tr> <tr> <td>Temperature @2m</td> <td>°C</td> <td>15 minute</td> <td>AM-4</td> </tr> <tr> <td>Temperature @10m</td> <td>°C</td> <td></td> <td>AM-2/AM-4</td> </tr> <tr> <td>Wind Speed @10m</td> <td>m/s</td> <td></td> <td>AM-2/AM-4</td> </tr> <tr> <td>Wind Direction @10m</td> <td>Degrees</td> <td></td> <td>AM-2/AM-4</td> </tr> <tr> <td>Sigma Theta</td> <td>Degrees</td> <td></td> <td>AM-2/AM-4</td> </tr> <tr> <td>Solar Radiation</td> <td>W/m2</td> <td></td> <td>AM-4</td> </tr> </tbody> </table>	Parameter	Units	Averaging Period	Sampling Method	Rainfall	mm	1-hour	AM-4	Temperature @2m	°C	15 minute	AM-4	Temperature @10m	°C		AM-2/AM-4	Wind Speed @10m	m/s		AM-2/AM-4	Wind Direction @10m	Degrees		AM-2/AM-4	Sigma Theta	Degrees		AM-2/AM-4	Solar Radiation	W/m2		AM-4	Continuous	Schedule 3 Condition 10
Parameter	Units	Averaging Period	Sampling Method																															
Rainfall	mm	1-hour	AM-4																															
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Sigma Theta	Degrees		AM-2/AM-4																															
Solar Radiation	W/m2		AM-4																															
<p>2. Air Quality Monitoring</p> <p>Monitoring PM₁₀ at the most affected off-site location. High Volume Air Sampler (HVAS) for long term compliance monitoring at the most affected receptor.</p> <p>The High Volume Air Sampler monitoring will be operated in accordance with AS/NZS 3580.9.6:2003 Methods for sampling and analysis of ambient air – Determination of suspended particulate Matter – PM₁₀ – high volume air sampler with size selective inlet – gravimetric method.</p> <p>Data from the HVAS monitoring station will be handled as follows:</p> <ul style="list-style-type: none"> • Samples retrieved from monitoring instrumentation on a six day cycle. • Samples sent to a laboratory for analysis. • Data entered into electronic database (or similar) for comparison with relevant air quality 	As noted and reviewed on an as needs basis and for the annual review	Schedule 3 Condition 10																																

<p>criteria.</p> <ul style="list-style-type: none"> Data compared with relevant criteria and any exceedances noted and investigated. <p>Monitoring data will be reviewed annually as part of the annual reporting requirements. Depending on the findings of each annual review, and in consultation with the relevant authorities, monitoring requirements may be discontinued or augmented.</p>		
<p>3. Greenhouse Gas Monitoring Primarily monitoring the use of:</p> <ul style="list-style-type: none"> Diesel Oil Grease Electricity. <p>Monitoring will be undertaken in accordance with the requirements of the National Greenhouse and Energy Reporting Act 2007 and the National Greenhouse and Energy Reporting Regulations 2008.</p>	<p>Annually</p>	<p>Schedule 3 Condition 11</p>
<p>4. Air quality monitoring above the criteria Where air quality monitoring data are above the levels indicated for the Impact Assessment Criterion, the following additional analysis will be conducted to test non-compliance.</p> <p>Investigate the meteorological data for the period to determine dominant wind direction, average wind speeds, percentage calm conditions (< 0.5 m/s) and significant periods of strong winds (> 5.4 m/s).</p> <p>Where the dominant wind direction is not blowing across the site and towards the monitoring location, the level above the Impact Assessment Criteria is unlikely to have resulted from site activities and does not represent non-compliance.</p> <p>Where the dominant wind direction is blowing across the site and towards the monitoring location, the following additional analysis is required to determine if dust from the site has contributed to the elevated levels and / or if wind-blown dust from other upwind sources are also contributing.</p> <ul style="list-style-type: none"> Determine if the wind speeds are conducive to wind erosion from exposed surfaces (moderate winds > 5.4 m/s) or if calm conditions were prevalent (< 0.5 m/s). Calm conditions can result in poor dispersion of activity dependent emissions from the site, however, wind erosion from exposed surfaces would not be expected to occur under these conditions. 	<p>Within 7 days of the incident</p>	<p>Schedule 3 Condition 11</p> <p>The Department of Planning and Environment and affected residences will be notified of any incident. Options for mitigation of identified trends or sustained air quality exceedances will be assessed in consultation with affected residences and the Department.</p>

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<ul style="list-style-type: none"> Obtain a site activity log for the elevated level day to determine what activities were occurring and characterise the activities based on being wind speed independent, wind speed dependent or wind erosion sources. Request additional microscopic analysis of the exposed filter paper to determine the likely dust source (i.e. is the dust similar or different to material handled at the site). 		
<p>5. Incident generated air quality monitoring Where air quality incidents are reported, the source of the incident will be identified and ameliorative measures implemented, if required. Additional air quality monitoring will be considered in response to receipt of these incidents and audits conducted. Additional ameliorative measures would be considered if required. Quarry Manager or Designate who receive the reported incident will record where possible pertinent details at the time.</p>	As required	Schedule 5 Condition 7 Department of Planning & Environment and affected landowners
<p>6. The quarry shall notify the affected landowners in writing of any exceedance, and provide regular monitoring results to each affected landowner until the project is again complying with the relevant criteria.</p>	As soon as practicable after obtaining monitoring results	Schedule 5 Condition 7 Department of Planning & Environment and affected landowners
<p>7. In the event of an exceedance of any relevant air quality criteria, the quarry shall send a copy of the NSW Health fact sheet entitled "Mine Dust and You" (as may be updated from time to time) to the affected landowners and current tenants of the land (including tenants of land which is not privately-owned).</p>	As soon as practicable after obtaining monitoring results	Schedule 5 Condition 7 Department of Planning & Environment and affected landowners
<p>8. Air quality monitoring report Monitoring of air quality during construction and operations will be undertaken to ensure levels due to operational activities do not exceed the criteria for all adjoining privately owned residences. Monitoring procedures will include:</p> <ul style="list-style-type: none"> Attended noise measurements over fifteen (15) minutes at each receiver noting aural observations, recording LA90 and LAeq noise levels and weather conditions (specifically wind speed and direction). 		Schedule 5 Condition 4
<p>9. Air quality management plan Undertake an internal review of the Air Quality Management Plan. Changes to the Air Quality Management Plan will only occur if improvements are identified or required as part of the annual review or instructed by the Department. Changes to the Plan will be forwarded to the Secretary of the Department for approval.</p>	As required	Schedule 3 Condition 12

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<p>10. Records</p> <p>The results of all noise monitoring will be held onsite and maintained by the Quarry Manager or designate. A comprehensive summary of the monitoring results would be made available to the public and placed on the website.</p>	<p>As required</p>	<p>Schedule 5 Condition 11</p>
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8.0 TRANSPORT

8.1 Introduction

A traffic management plan has been prepared by Grants Road Sand Quarry to address Approval Condition 18 of Schedule 3 and is attached in Appendix 6.

Grants Road Sand Quarry will also record relevant data identifying production rates from its quarry operations.

8.2 Objectives

- Ensure minimal impact on the surrounding road network.
- Minimise the impacts of project-related trucks on local residences and road users.
- Prevent conflicts between equipment, vehicles and pedestrians.
- Comply with relevant legislation.

8.3 Management Measures

Traffic management measures for the quarry site incorporates the following key elements:

- All people entering the quarry, must make contact with the production manager or representative for directions as to where to proceed.
- Visitors must park in the Visitors Car Park and after contacting management, wait for a management representative to meet them. Visitors are not to walk off on their own into and around the quarry.
- Customer trucks are to keep strictly to the "Customer Truck Route". This route takes them on the left hand side of the office to the sand stockpiles where they are to wait to be loaded. Truck drivers are not to get out and walk around on their own.
- Where possible the operation of earth moving equipment will be used only in the quarry and will be kept separate from customer truck movement. Where this is not possible customer truck drivers are to be warned of any possible hazards over the two way radio.
- All visitors to the quarry including customer truck drivers are to be inducted in the Site Safety Rules and the Traffic Management Plan.
- The speed limit at the quarry is 20 km/hr.

8.4 Monitoring Schedule

Table 8.1 – Transport Impact Controls

Control Measure	Timing / Frequency	Condition and Consultation requirement
1. Minimising impact on surrounding road network <ul style="list-style-type: none">• Project related heavy vehicles trucks will enter and exit the site in a forward manner.• All loads will be covered prior to leaving the site.• All laden vehicles leaving the site are cleaned of and other material that may fall on the road, before leaving the site.	At all times	Schedule 3 Condition 18

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<p>2. Monitoring of product transport The quarry will keep accurate records of the following and publish the records on its website:</p> <ul style="list-style-type: none">• Amount of quarry products transported from the site (per calendar month and year) and• Number of laden vehicle movements from the site (per hour, day, week, calendar month and year).	Biannually	Schedule 3 Condition 14
<p>3. Grants Road maintenance</p> <ul style="list-style-type: none">• Payment of contributions to Gosford Council in accordance with the Maintenance requirements for Grants Road.	Annually	Schedule 3 Condition 16
<p>4. Traffic Management</p> <ul style="list-style-type: none">• Ensure all visitors, customers and contractors are inducted in regards to the traffic management requirements.• All hazards and incidents to be reported immediately and appropriate action implemented.	At all times	Schedule 3 Condition 18
<p>5. Traffic management plan Undertake an internal review of the Traffic management plan. Changes to the management plan will only occur if improvements are identified or required as part of the annual review or instructed by the Department.</p>	As required	Schedule 3 Condition 18 Schedule 5 Condition 5 Changes to the plan will be forwarded to the Secretary of the Department for approval.

9.0 BIODIVERSITY

9.1 Groundwater Dependent Ecosystem Monitoring and Management Program

9.1.1 Introduction

A Groundwater Dependent Ecosystem Management Plan has been prepared by Conacher Consulting Pty Ltd to address Approval Conditions 19 and 21 of Schedule 3.

9.1.2 Objective

The objective for the biodiversity performance measures for groundwater dependant ecosystems is that the proponent shall ensure that the project does not cause any exceedances of the identified performance measures.

The project conditions specify that the proponent shall undertake additional studies on the high priority GDEs located within 1 km of extraction operations under the approval and potentially impacted by the project. The studies shall be undertaken in consultation with NOW and include:

- a) A description of the nature and extent of groundwater reliance for each GDE;
- b) Long term monitoring for the condition of the GDEs;
- c) Performance indicators for project-related environmental consequences on GDEs and trigger levels to initiate mitigation/response measures; and
- d) Mitigation / response measures to ensure minor environmental consequences on the GDEs, to the satisfaction of the Secretary.

9.1.3 Groundwater Dependent Ecosystem Assessment Criteria

The following performance measures relate to minor environmental consequences for high priority GDEs located within 1 kilometre of extraction operations, including:

- Negligible erosion of the surface of the GDEs;
- Negligible sedimentation within the GDEs;
- Minor changes in the size of the GDEs;
- No significance change to the composition or distribution of species within the GDEs.

9.1.4 Groundwater Dependent Ecosystem Characteristics

Field inspection of the high priority GDE vegetation within 1 km of the extraction operations was undertaken and the mapping of high priority GDEs was refined accordingly. High priority groundwater dependent ecosystems, which occur within 1 km of the extraction operations under the approval with potential to be impacted upon are outlined below:

Hawkesbury Banksia Scrub-Woodland

Details for this GDE include:

- Structurally variable community, which consists of either tall dense scrub dominated by *Banksia ericifolia* or an open scrub or low heath with scattered emergent eucalypts.
- Not an obligate GDE, however may be a facultative GDE.
- Classification as a high priority GDE is not based on a NOW desktop assessment, advice from a local national parks officer and historical observations by a local farmer.
- Status as a high priority GDE within the Somersby region is not well documented in scientific literature.

Sandstone Hanging Swamps

Sandstone Hanging Swamps are widely recognised as a groundwater dependent ecosystem. The Sandstone Hanging Swamp vegetation type mapped by Bell (2009) is recognised by the NSW Scientific Committee (2012) as the endangered ecological community Coastal Upland Swamp in the Sydney Basin Bioregion. It is described by The NSW Scientific Committee (2012) as a typically treeless community, which occurs on periodically waterlogged soils on impermeable Hawkesbury sandstone plateaus in the headwater valleys of streams and on sandstone benches with abundant seepage moisture.

9.1.5 Management Measures

If the following performance indicators are breached as a result of actions associated with the approved extraction operations appropriate mitigation and response measures will be required:

- More than negligible erosion of the surface of the GDEs;
- More than negligible sedimentation within the GDEs;
- More than minor changes in the size of the GDEs;
- Significant change to the composition or distribution of species within the GDEs.

Management measures are to be implemented on an as-needs basis and are to be targeted and/or adapted as necessary to the specific management issue to ensure minor environmental consequences on the high priority GDEs. Specific management measures implemented are to be agreed by the project ecologist and the Quarry Manager and recorded for monitoring reporting.

If the performance measures for high priority GDEs are exceeded and the Secretary determines that:

- It is not reasonable or feasible to remediate the impact or environmental consequence; or
- Remediation measures implemented by the Quarry owners have failed to satisfactorily remediate the impact or environmental consequence, to high priority GDEs then the Quarry owner shall provide a suitable offset to compensate for the impact or environmental consequence.

9.1.6 Monitoring Schedule

Monitoring Program Sampling Design

Permanent monitoring quadrats are to be established at each of the monitoring locations identified in the GDE Monitoring and Management Program report.

Sampling Methods

Groundwater dependant ecosystem condition will be monitored through sampling of both qualitative and quantitative variables. Several of the quantitative variables are to be sampled generally in accordance with the vegetation condition assessment methods specified within the Biobanking Assessment Methodology (OEH 2014). The variables to be measured and the sampling techniques to be employed are outlined as follows.

i. Floristics

The floristic data specified in the Table below is to be collected during monitoring events within each permanent 20 x 20 metre monitoring plot.

Table 9.1 – Floristic sampling data to be collected

Variable	Data to be collected
Stratum (and layer)	Stratum and layer in which each species occurs
Growth Form	Growth form for each species recorded
Species Name	Scientific name
Cover	Estimate of cover from 1-5% then to the nearest 5%
Abundance Rating	Relative number of individuals or shoots (1-10, 20, 50, 100, 500, 1000 etc.)

ii. Native Plant Cover

An estimate of the cover of native vegetation within the upper-stratum, mid-stratum and lower stratum is to be recorded at 10 points along a 50 metre transect during monitoring events. The final value for each monitoring location is to be calculated as the average of the 10 values recorded.

iii. Exotic Plant Cover

An estimate of the cover of exotic vegetation within the combined mid-stratum and lower stratum (grasses, shrubs and other) is to be recorded separated at 10 points along each permanent 50 metre transect. The final value for each monitoring location is to be calculated as the average of the 10 values recorded.

iv. Plant Regeneration

Regeneration is to be measured as the proportion of upper stratum plant species that are regenerating within and surrounding each plot within the identified high priority GDEs.

v. GDE Extent

The extent of each high priority GDE surveyed is to be mapped by aerial photograph interpretation supplemented by field verification surveys.

vi. Visual Inspection

Photographs of fixed locations are to be taken for each monitoring location during each monitoring event.

Additional visual inspections are to be undertaken for each high priority GDE area identified downslope of the extraction area. Inspections are to be undertaken for signs of erosion of the surface of the high priority GDEs and sedimentation within the high priority GDEs resulting from the extraction operations.

Table 9.2 – GDE Monitoring

Control Measure	Timing / Frequency	Condition and Consultation requirement
1. GDE monitoring surveys	Annual	Schedule 5 Condition 4
2. GDE Management Plan Undertake an internal review of the Management Plan. Changes to the Management Plan for GDEs will only occur if improvements are identified or required as part of the annual review or instructed by the Department.	As required	Schedule 3 Condition 21 DPI Water Changes to the Plan will be forwarded to the Secretary of the Department for approval.

<p>3. Records</p> <p>The results of all monitoring of GDEs will be held onsite and maintained by the Quarry Manager or designate. A summary of the monitoring results would be made available to the public and placed on the website.</p>	<p>As required</p>	<p>Schedule 5 Condition 11</p>
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9.2 Somersby Mintbush

9.2.1 Introduction

A Somersby Mint bush Monitoring Program has been prepared by Conacher Consulting Pty Ltd to address Approval Condition 22 of Schedule 3.

9.2.2 Objective

The objective of the Somersby Mint bush Monitoring Program is to monitor the known populations of Somersby Mint bush within the vicinity of the extraction operations, which occur within the adjoining areas of Brisbane Water National Park.

The project conditions specify that the Proponent shall prepare and implement, in consultation with OEH and Council, a Somersby Mintbush (*Prostanthera junonis*) Monitoring Program within the vicinity of the site. This program must include:

- a) A baseline assessment of the extent and condition of the Somersby Mintbush populations before commencement of quarrying operations under the approval;
- b) Long-term monitoring of these populations;
- c) Establishment of performance indicators for project-related environmental consequences on Somersby Mintbush and trigger levels to initiate mitigation/response measures; and
- d) Mitigation / response measures to ensure negligible environmental consequences on the Somersby Mintbush, to the satisfaction of the Secretary.

9.2.3 Somersby Mint bush Monitoring Criteria

The required performance measures relating to Somersby Mint bush is to ensure negligible environmental consequences.

9.2.4 Somersby Mint bush Extent and Condition

Prior to the commencement of extraction operations details of a baseline survey of the Somersby Mintbush condition and extent within the vicinity of the site in areas of Brisbane Water National Park are to be provided in an initial monitoring report. Surveys are to be undertaken during 2-3 visits during the main flowering period between October to mid-December.

9.2.5 Management Measures

If the following performance indicators are breached as a result of actions associated with the approved extraction operations appropriate mitigation and response measures will be required:

- Erosion of the surface of the areas containing Somersby Mint bush;
- Sedimentation within areas containing Somersby Mint bush; and
- Reduction in the site of the areas containing Somersby Mint bush.

Management measures are to be implemented on an as-needs basis and are to be targeted and/or adapted as necessary to the specific management issue to ensure negligible environmental consequences on the Somersby Mintbush. Specific management measures implemented are to be agreed by the project ecologist and the Quarry Manager and recorded for monitoring reporting.

If the performance measures for Somersby Mintbush are exceeded and the Secretary determines that:

- It is not reasonable or feasible to remediate the impact or environmental consequence; or
- Remediation measures implemented by the Proponent have failed to satisfactorily remediate the impact or environmental consequence to Somersby Mintbush then the proponent shall provide a suitable offset to compensate for the impact or environmental consequence.

9.2.6 Monitoring Schedule

Table 9.3 – Monitoring of Somersby Mint bush

Control Measure	Timing / Frequency	Condition and Consultation requirement
<p>1. Somersby Mint bush monitoring surveys Areas of Somersby Mint bush are to be sampled by undertaking counts of the baseline populations identified. The outer extent of each population is to be mapped with the aid of a hand-held GPS device.</p> <p>Photographs of fixed locations are to be taken for each population during each monitoring event.</p> <p>Visual inspections and photographs are to be undertaken for the following:</p> <ul style="list-style-type: none"> • Signs of surface erosion; • Signs of sedimentation; • Density of each stratum of surrounding vegetation; • Fire disturbance; • Herbivory; and • Trampling. 	Annually	Schedule 5 Condition 4
<p>2. Somersby Mintbush Management Plan Undertake an internal review of the Management Plan.</p> <p>Changes to the Management Plan for Somersby Mintbush will only occur if improvements are identified or required as part of the annual review or instructed by the Department. Changes to the Plan will be forwarded to the Secretary of the Department for approval.</p>	As required	<p>Schedule 3 Condition 22 OEH</p> <p>Changes to the Plan will be forwarded to the Secretary of the Department for approval.</p>

<p>3. Records</p> <p>The results of all monitoring of Somersby Mintbush will be held onsite and maintained by the Quarry Manager or designate. A comprehensive summary of the monitoring results would be made available to the public and placed on the website.</p>	<p>As required</p>	<p>Schedule 5 Condition 11</p>
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9.3 Biodiversity Offsets

9.3.1 Introduction

Biodiversity Offsets are to be provided in accordance with the strategy described within the Environmental Assessment, Condition 22 of Schedule 3 and Appendix 3 of the Approval Conditions.

9.3.2 Objective

The objective of the Biodiversity Offset Strategy is to provide details on the retention, management and monitoring of a suitable biodiversity offset to compensate for the loss of 1.5 hectares of Cleared Land with Remnant Trees vegetation.

9.3.3 Biodiversity Offset Criteria

The Proponent is required to implement the biodiversity offset strategy described in the Environmental Assessment, as summarised and revised and shown conceptually in the Approval Conditions, to the satisfaction of the Secretary.

The areas within the site proposed for biodiversity offsetting are located in the north eastern section of the site and along the western section of the site. The offsetting strategy proposed is to result in the improvement and maintenance of biodiversity values on the site for the medium to long term. A total of 6.37 hectares of land will be retained and managed as a biodiversity offset and is to consist of the following:

Table 9.4 – Summary of biodiversity offset strategy

Area	Offset criteria
<p>On-site offset area</p>	<p>Existing vegetation to be enhanced to establish:</p> <ul style="list-style-type: none"> • At least 4 hectares of moderate – good quality Scribbly Gum Woodland and/or another native vegetation community commensurate with the local surroundings; and • Suitable habitat for threatened fauna species including the provision of at least 36 nest boxes.

Additional biodiversity offsets proportionate with the significance of the impact or environmental consequence will be required if the project exceeds the specified performance measures for high priority groundwater dependent ecosystems and/or Somersby Mint Bush where the Secretary determines that:

- It is not reasonable or feasible to remediate the impact or environmental consequence; or
- Remediation measures implemented by the Proponent have failed to satisfactorily remediate the impact or environmental consequence.

9.3.4 Biodiversity Offset Management Measures

Offset areas will be protected in perpetuity and subject to a 10 year rehabilitation and maintenance period during stage 2 works. The biodiversity offset management measures include:

- Retention and management of 6.37 hectares of land including enhancement of existing cleared areas to establish at least 4 ha of moderate – good quality Scribbly Gum Woodland and/or another native vegetation community commensurate with the local surroundings;
- Enhancement of existing vegetation to establish suitable habitat for threatened fauna species including the provision of at least 36 nest boxes;
- Protective fencing around offset areas to exclude livestock and feral Rusa Deer; and
- Intensive replanting of endemic tree and shrub species within cleared areas and weed management of noxious and environmental weeds.

Biodiversity offset management measures are further outlined in the Biodiversity Offset Management and Habitat Rehabilitation Plan.

9.3.5 Long Term Security Measures

Biodiversity offsets for the proposal are to be retained in perpetuity. Retention, management and monitoring is to be undertaken in accordance with the project Approval Conditions. Following the initial 10 year management period additional formal security measures may be required.

9.3.6 Monitoring Schedule

Table 9.5 – Biodiversity Impact Monitoring

Control Measure	Timing / Frequency	Condition and Consultation requirement
<p>1. Biodiversity Offsets monitoring Monitoring of biodiversity offsets is to be undertaken initially prior to and then following vegetation clearing operations under the approval. Monitoring is required to assess the establishment and maintenance of at least 4 hectares of moderate – good quality Scribbly Gum Woodland vegetation and report on any nest box maintenance or replacement necessary over 10 years during stage 2 works.</p> <p>Biodiversity offset areas are to be monitored annually with fixed 400m² monitoring quadrats. The following is to be assessed for each quadrat:</p> <ul style="list-style-type: none"> • Floristics; • Native plant cover; • Exotic plant cover; • Plant regeneration (including percentage survival for plantings); • Condition of deer exclusion fencing; • Signs of surface erosion and sedimentation; • Presence of feral animals; • Natural Disturbance; • Fixed photo point observations; and 	Annually	Schedule 5 Condition 4

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Grants Road Sand Quarry

<ul style="list-style-type: none">• Nest box condition. <p>Results of the monitoring surveys are to be provided in annual monitoring reports.</p>		
<p>2. Biodiversity Offsets Management Plan</p> <p>Undertake an internal review of the Management Plan for Biodiversity Offsets will only occur if improvements are identified or required as part of the annual review or instructed by the Department.</p>	<p>As required</p>	<p>Schedule 3 Condition 10 and 20</p> <p>OEH</p> <p>Changes to the Plan will be forwarded to the Secretary of the Department for approval.</p>
<p>3. Records</p> <p>The results of all monitoring of the Biodiversity offsets will be held onsite and maintained by the Quarry Manager or designate. A summary of the monitoring results would be made available to the public and placed on the website.</p>	<p>As required</p>	<p>Schedule 5 Condition 11</p>

10.0 LANDSCAPE

10.1 Introduction

The site will be rehabilitated to the satisfaction of the Secretary upon completion of the quarrying activities. A landscape and rehabilitation management plan has been prepared and approved for the site.

10.2 Objectives

The objectives for rehabilitation of the site include:

Table 10.1 – Rehabilitation Objectives

Features	Objective
Site (as a whole)	<ul style="list-style-type: none"> • Safe, stable and non-polluting • Minimise the visual impact of the final landforms as far as is reasonable and feasible.
Surface infrastructure	<ul style="list-style-type: none"> • To be decommissioned and removed, unless the Secretary agrees otherwise.
Quarry benches	<ul style="list-style-type: none"> • Suitably landscaped and revegetated using native species.
Quarry pit floor	<ul style="list-style-type: none"> • Establish land with a level of at least Class 4 agricultural suitability over 80% of the quarry floor.
Community	<ul style="list-style-type: none"> • Ensure public safety. • Minimise the adverse socio-economic effects associated with quarry closure.

10.3 Landscape Impact Assessment Criteria

The Landscape and rehabilitation management plan details performance and completion criteria for evaluating the performance of the biodiversity offset strategy and the rehabilitation of the site, including triggers for any necessary remedial action.

10.4 Management Measures

The site shall be rehabilitated progressively, that is, as soon as reasonably practicable following disturbance. All reasonable and feasible measures must be taken to minimise the total area exposed for dust generation at any time. Interim stabilisation measures must be implemented where reasonable and feasible to control dust emissions in disturbed areas that are not active and which are not ready for final rehabilitation. It is noted that parts of the site that are progressively rehabilitated may be subject to further disturbance in the future.

10.5 Monitoring Schedule

Table 10.2 – Landscape and Rehabilitation Monitoring

Control Measure	Timing / Frequency	Condition and Consultation requirement
1. Monitoring the effectiveness of the measures and progress against the performance and completion criteria.	Annually	Schedule 3 Condition 27
2. Update of the Landscape and rehabilitation management plan.	Every three years	Schedule 3 Condition 27

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3. Conservation and rehabilitation bond Lodgement of a conservation and rehabilitation bond with the Department.	Within six months of approval of the Landscape and rehabilitation management plan.	Schedule 3 Condition 28
4. Review of conservation and rehabilitation bond.	Within 3 months of each independent environmental audit	Schedule 3 Condition 28

11.0 HERITAGE

11.1 Introduction

An Aboriginal Cultural Heritage Management Plan (ACHMP) was prepared by Insite Heritage Pty Ltd (October 2015) and attached in Appendix 7. The ACHMP is the tool for the management of Aboriginal cultural heritage during the operation, rehabilitation and post extraction of the Grants Road Sand Quarry Expansion project.

11.2 Objectives

Objectives for the quarry site for heritage management include:

- Protecting existing and future Aboriginal sites.
- Maintaining and managing reasonable access for Aboriginal stakeholders to cultural heritage items on site.
- Ensuring ongoing consultation with the local Aboriginal stakeholders in the conservation and management of Aboriginal cultural heritage on-site.
- Ensuring the long term management of the Aboriginal cultural heritage values of the site post extraction operations and rehabilitation of the site.

11.3 Heritage Impact Assessment Criteria

Protecting, monitoring and managing Aboriginal sites within the site.

11.4 Management Measures

Management measures for heritage incorporates:

- An Aboriginal Cultural Heritage Assessment of the Biodiversity Offset Area will be undertaken with the registered Aboriginal stakeholders for the project. The assessment will be undertaken prior to any vegetation planting, maintenance or clearance works proposed to be undertaken in the offset area.
- Site 45-3-3343 Grants Rd RE 1 will be fenced. The fencing will be offset from the margins of the sandstone exposure by 8 metres in all directions. The bund wall between the top of the quarry cut and 45-3-3343 will be constructed of block rather than the earth bund wall to be constructed around the remainder of the quarry.
- Site 45-3-3344 Grants Rd RE 2 is a small mound and will be adequately protected by the track diversion put in place upon its recording.
- Managing the discovery of any human remains or previously unidentified Aboriginal objects on site, including (in the case of human remains) stop work provisions and notification protocols.
- Undertake ongoing consultation with the local Aboriginal stakeholders in the conservation and management of Aboriginal cultural heritage on-site.
- Ensuring any workers on site receive suitable heritage inductions prior to carrying out any activities, which may disturb Aboriginal sites, and that suitable records are kept of these inductions.
- Ensuring the long term management of the Aboriginal cultural heritage values of the site post extraction operations and rehabilitation of the site.

11.5 Monitoring Schedule

Table 11.1 – Heritage Impact Monitoring

Control Measure	Timing / Frequency	Condition and Consultation requirement
1. Inspection An inspection will be carried out one year post	Completed.	Schedule 3 Condition 30

Environmental Plan of Management

Grants Road Sand Quarry

<p>approval (25th July, 2015) or post fencing and at the time of inspection of the biodiversity area, which ever arises first.</p>		
<p>2. Biodiversity Offset Area The Biodiversity Offset Area will be inspected by an archaeologist and the RAPs prior to any revegetation or other works. Any sites located will be recorded, updated on AHIMS and within the CHMP. The CHMP prescribes the avoidance of sites by revegetation activities.</p>	<p>Prior to any works within the Biodiversity offset area</p>	<p>Schedule 3 Condition 30</p>
<p>3. Howes Aboriginal Monitoring Program The site 45-3-3343 will be incorporated into the Howes Reserve Aboriginal Monitoring program.</p>	<p>Five yearly</p>	<p>Schedule 3 Condition 30</p>
<p>4. Consultation with the RAPs The quarry will issue a newsletter or other relevant correspondence to the RAPS informing of the progress of the quarry site and of any relevant monitoring results.</p>	<p>Six monthly</p>	<p>Schedule 3 Condition 30</p>
<p>5. Heritage Management Plan Undertake an internal review of the Management Plan. Changes to the Heritage Management Plan will only occur if improvements are identified or required as part of the annual review or instructed by the Department.</p>	<p>As required</p>	<p>Schedule 3 Condition 30 Changes to the Plan will be forwarded to the Secretary of the Department for approval.</p>
<p>6. Records The results of all monitoring will be held onsite and maintained by the Quarry Manager or designate. A summary of the monitoring results would be made available to the public and placed on the website.</p>	<p>As required</p>	<p>Schedule 5 Condition11</p>

12.0 VISUAL

12.1 Introduction

The quarry owner shall implement all reasonable and feasible measures to minimise the visual and off site light impacts of the project.

12.2 Management Measures

The quarry shall:

- vegetate any earthen perimeter bund at the project within 3 months of establishing the bund, using appropriate flora species to minimise the visual and off-site sedimentation impacts of the project;
- maintain this vegetation in a good condition throughout the remainder of the project;
- maintain the site;
- keep the site clean and tidy where possible; and
- Progressively revegetate all areas where quarrying is completed.

12.3 Monitoring Schedule

Table 12.1 – Visual Impact Monitoring

Control Measure	Timing / Frequency	Condition and Consultation requirement
Monitoring of the management measures to minimise the visual impact would be undertaken as part of the annual review.	Annually	Schedule 3 Condition 30 and 31 Schedule 5 Condition 4

13.0 WASTE MANAGEMENT

13.1 Introduction

The quarry owner shall implement all reasonable and feasible measures to minimise waste from the project.

13.2 Management Measures

The quarry shall:

- minimise and monitor the waste generated by the project;
- ensure that the waste generated by the project is appropriately stored, handled and disposed of;
- manage on-site sewage treatment and disposal in accordance with the requirements of Council.

13.3 Monitoring Schedule

Table 13.1 – Waste Management Impact Monitoring

Control Measure	Timing / Frequency	Condition and Consultation requirement
Monitoring of the management measures to minimise waste would be undertaken as part of the annual review.	Annually	Schedule 3 Condition 32 Schedule 5 Condition 4

14.0 BUSHFIRE

14.1 Introduction

The quarry owner shall implement all reasonable and feasible measures to minimise the risk from bushfire.

14.2 Management Measures

The quarry shall:

- ensure that the project is suitably equipped to respond to any fires on site; and
- assist the Rural Fire Service and emergency services as much as possible if there is a fire in the vicinity of the site.

14.3 Monitoring Schedule

Table 14.1 – Bushfire Impact Monitoring

Control Measure	Timing / Frequency	Condition and Consultation requirement
Monitoring of the management measures to manage bushfire would be undertaken as part of the annual review.	Annually	Schedule 3 Condition 35 Schedule 5 Condition 4



Appendix 1

Plan of Approved Limits of Extraction

Stephen Thorne and Associates
Pty Ltd





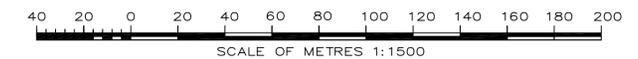
M.G.A. ORIGIN : PM 129108
 EASTING: 339151.581
 NORTHING: 6304688.124

NOTE:
 A SCALE FACTOR OF 0.999880 HAS
 BEEN APPLIED TO ALL DISTANCES
 TO CONFORM WITH M.G.A.

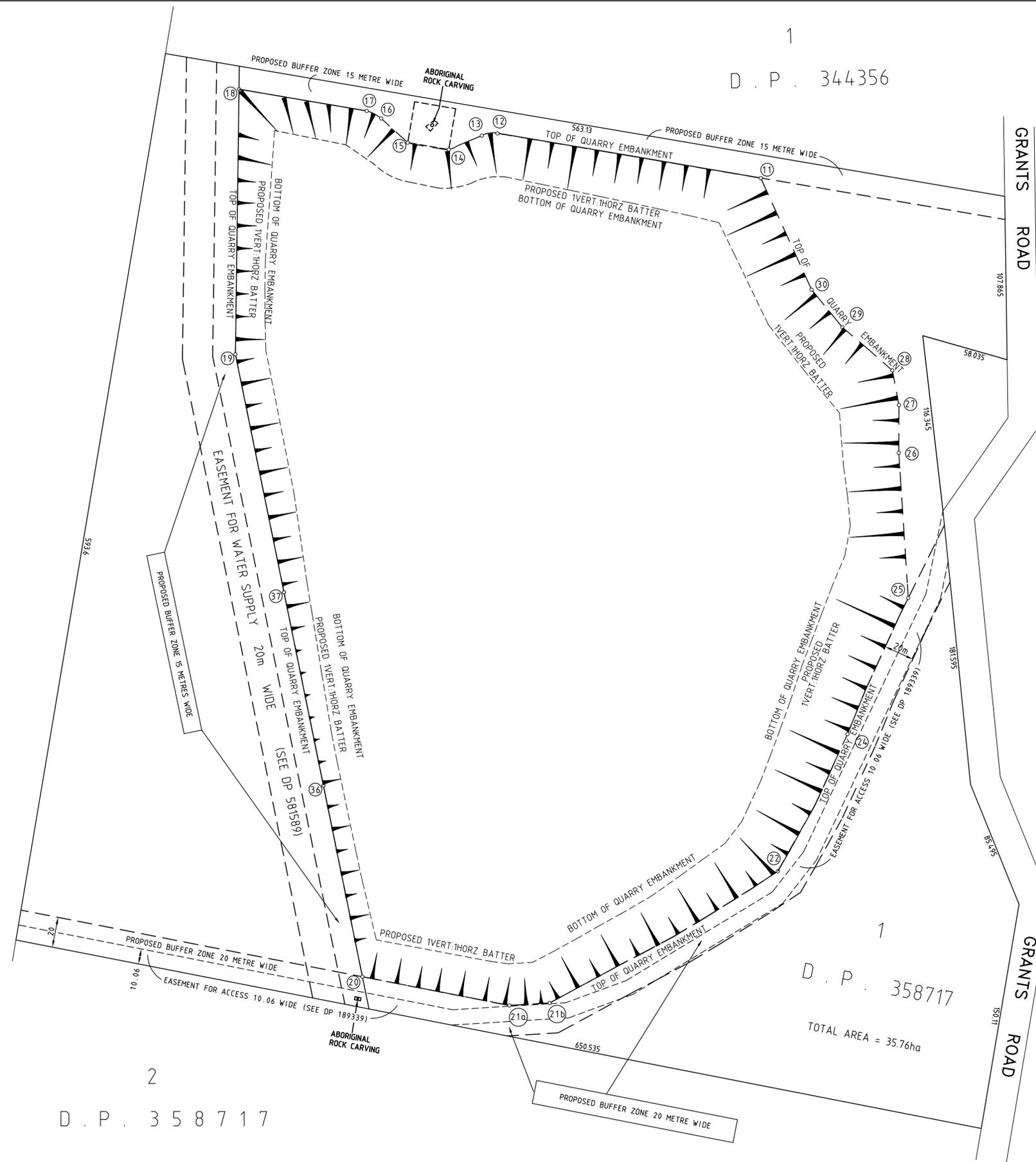
1
 D.P. 104750

SCHEDULE OF QUARRY CO-ORDINATES (M.G.A.)

PT. No.	EASTING	NORTHING	MARK PLACED
11	338658.80	6304272.66	PEG
12	338484.65	6304302.23	STAKE
13	338474.27	6304300.76	STAKE
14	338452.42	6304291.52	PEG
15	338425.30	6304296.10	PEG
16	338407.71	6304312.05	PEG
17	338398.14	6304317.05	PEG
18	338313.73	6304331.38	PEG
19	338311.34	6304156.35	PEG
20	338395.33	6303745.41	PEG
21a	338492.51	6303726.40	PEG
21b	338519.18	6303728.04	PEG
22	338670.04	6303815.03	PEG
24	338716.14	6303905.61	PEG
25	338756.32	6303995.43	PEG
26	338750.08	6304091.28	PEG
27	338750.18	6304122.82	NAIL IN ROCK
28	338745.80	6304145.67	PEG
29	338712.77	6304174.12	NAIL IN ROCK
30	338692.37	6304199.03	NOT MARKED
36	338369.55	6303871.52	PEG
37	338343.45	6303999.23	PEG



118
 D.P. 755246



2
 D.P. 358717

SCALE: 1:1500

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PLAN OF APPROVED LIMITS OF EXTRACTION
 GRANTS ROAD QUARRY EXTENSION
 LOT 1 IN D.P. 358717
 270 GRANTS ROAD, SOMERSBY

amendments

PLAN NUMBER
3164
 ISSUE
A

SHEET 1 OF 1 SHEETS

DATUM: Australian Height Datum

DATE
 18/09/2014

CAD FILE: 3164_QUARRY_BODY_MGA.dwg
 THIS PLOT: 22-09-2014 09:56
 REFERENCE: 3164.000



Appendix 2

Ground Water Management Plan

Larry Cook Consulting Pty Ltd



Larry Cook Consulting Pty Ltd

GROUNDWATER MANAGEMENT PLAN

Grants Road Sand Quarry Extension Project

Lot 1 in DP358717 270 Grants Road Somersby

Prepared for: **Peter Andrews & Associates Pty Ltd**
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REPORT NO. **11017-E GMP**

DATE: **June 2016**

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1.0 INTRODUCTION

1.1 INTRODUCTION AND PROJECT APPROVAL

Larry Cook Consulting Pty Ltd was commissioned by Peter Andrews & Associates Pty Ltd on behalf of G.R. & A.K. Jones (the Proponent) to prepare a Groundwater Management Plan (GMP) for the Grants Road Sand Quarry Extension.

The Grants Road Sand Quarry Extension project was approved by the NSW Minister for Planning on 23rd July 2014 (Application No. 08_0099).

1.2 PURPOSE AND OBJECTIVES

The GMP has been prepared in accordance with Schedule 3 Part 4 (c) (iii & iv) of the Project Approval. The purpose and objectives documented in Schedule 3 are reproduced as follows:

- *detailed baseline data on groundwater levels, yield and quality in local sandstone aquifers, privately-owned groundwater bores and in areas of high priority GDEs that could be affected by the project;*
- *groundwater impact assessment criteria for local sandstone aquifers, privately-owned bores and high priority GDEs;*
- *a program to monitor and report on:*
 - *groundwater inflows to the quarrying operations;*
 - *the impacts of the project on:*
 - *local sandstone aquifers;*
 - *privately-owned groundwater bores; and*
 - *high priority GDEs,**including provision for continuous groundwater monitoring; and*
- *a program to validate the groundwater model for the project, and comparison of monitoring results with modelled predictions;*
- *a protocol, developed in consultation with Central Coast Sands Quarry, to appropriately apportion responsibility for any potential impacts to privately-owned groundwater bores and/or high priority GDEs that may be affected cumulatively by the project and operations at Central Coast Sands Quarry;*
- *an investigation of opportunities to maintain ecosystem function in high priority GDEs to the west and northwest of the project through facilitating run-on of clean surface waters;*
- *a protocol for the investigation, notification and mitigation of identified exceedances of the surface water and groundwater impact assessment criteria;*
- *measures to mitigate and/or compensate potentially affected landowners of privately-owned land, including provision of alternative long-term supply of water to the affected landowner that is equivalent to the loss attributed to the project; and*
- *the procedures that would be followed if any unforeseen impacts are detected during the project.*

1.3 SCOPE OF WORK

The tasks that have been undertaken as part of the preparation of this GMP are:

- Review of the conditions of project approval including the requirements for ongoing and additional groundwater monitoring, sampling and water quality testing;
- Register of monitoring bores;

- Summary of baseline water level and water quality data;
- Identification of new strategic monitoring sites to satisfy the requirements of the conditions;
- Assessment of monitoring data and comparison with model predictions;
- Development of protocol to assess any cumulative impacts with Central Coast Sands;
- Water licensing requirements;
- Development of mitigation measures for any affected groundwater users; and
- Data management and reporting protocols.

1.4 RELEVANT GUIDELINES AND STANDARDS

The legislation, plans, policies and guidelines relevant to this approval are listed in **Table 1**.

Table 1 Relevant Legislation, Plans, Policies and Guidelines
NSW Water Management Act 2000
NSW Water Act 1912
Water Sharing Plan for the Kulnura Mangrove Mountain Groundwater Sources (2003)
NSW State Groundwater Policy Framework Document (NSW Government 1997)
NSW State Groundwater Dependent Ecosystems Policy (NSW Government 2002)
Environment Australia: Environmental Flows Initiative technical report No.2 (2001)
NSW State Groundwater Quality Protection Policy (NSW Government 1998)
Draft NSW Groundwater Quantity Management Policy (DLWC, 2001)
NSW Aquifer Interference Policy – (NSW Office of Water, 2012)
NSW Policy for Managing Access to Buried Groundwater Sources (NSW Office of Water, 2011)
ANZECC 2000 Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Agriculture and Resource Management Council of Australia and New Zealand and the Australian and New Zealand Environment and Conservation Council, 2000)

2.0 SITE DETAILS

2.1 LOCATION AND SITE IDENTIFICATION

The existing sand quarry and proposed quarry extension are located on Grants Road in Lot 1 in DP358717 on the Somersby Plateau.

The location of the Property and proposed sand extraction area is shown in **Figure 1**. The topographic map sheet covering the Property is the 1:25,000-scale Gosford topographic map sheet (9131-2S.) The approximate MGA coordinates of the centre of the proposed Project Site are Easting 338500 m and Northing 6304250 m.

The key features required to identify the Site are summarised in **Table 2**.

Table 2 Site Identification Details	
Site	Description
Site Name	Grants Road Sands
Site Owner	G.R. & A.K. Jones
Address	270 Grants Road Somersby NSW 2250
Title Plan	Lot 1 in DP358717
LGA	Gosford City Council

2.2 REGIONAL SETTING AND SURROUNDING LAND USE

2.2.1 Geology

The Project Site is underlain by approximately 160 m of relatively flat-lying Triassic Hawkesbury Sandstone which overlies Triassic sedimentary rocks belonging to the Terrigal Formation, the uppermost part of the Narrabeen Group.

In summary, the Hawkesbury Sandstone beneath the property within the proposed extraction depth range comprises interbedded massive and cross-bedded medium to coarse grained quartz sandstone with occasional interbeds and lenses of shale. Interbeds of very fine to medium-grained sandstone, pebbly sandstone and conglomeratic sandstone also occur.

2.2.2 Hydrogeology

Dual porosity water-bearing zones (aquifers) are commonly developed within the Hawkesbury Sandstone in the Mangrove Mountain area at different elevations down to its base. Aquifers are found in:

- Sub-horizontal relatively porous and stacked layers (beds) of sheeted sandstone with increased primary permeability which provides the main aquifer storage.

- Pervasive sub-vertical, semi-continuous to continuous, rock defects such as fractures and joints with secondary ‘enhanced’ permeabilities. These aquifers constitute a major component of the aquifers transmissivity but only a minor component of the aquifers storage.

In addition, several high priority Groundwater Dependent Ecosystems (GDEs) have been identified by state government mapping in the Water Sharing Plan (WSP) for the Kulnura Mangrove Mountain Groundwater Sources. These GDEs are listed in Schedule 5 of the WSP and include wetlands, heath scrub and woodland areas. The locations of the GDEs are shown in **Figure 2**.

2.2.3 Surrounding Land Use

The Site is surrounded by rural properties to the north, east and south and the Brisbane Water National Park to the west.

3.0 SITE RESPONSIBILITY

The details of the person responsible for the site are summarised in **Table 3**

Table 3 Site Responsibility Details	
Site	Description
Site Owner	G.R. & A.K. Jones
Name of Person Responsible for the Site and Position	Steven Jones (Manager)
Postal Address of Person Responsible for the Site	270 Grants Road Somersby NSW 2250
24 hour Contact Telephone Number for Person Responsible for the Site	0418 116 861

4.0 MONITORING PROGRAM

4.1 INTRODUCTION

A network of eight (8) monitoring bores exists on Lot 1. A ninth monitoring bore (BH1 (G1)) located in the north-eastern corner of the Site has been destroyed due to quarry operations in this area. Details of the network are documented in Section 4.2. Six (6) of these monitoring bores are located within the proposed quarry precinct, five (5) of which are dedicated monitoring bores drilled to at least the elevation of the base of the final quarry. The monitoring bores within the quarry precinct will be progressively destroyed by the expanding quarry over 12 to 20 years. Water level and water quality data will continue to be collected from the diminishing monitoring network.

The three (3) new monitoring bores proposed on the western boundary of Lot 1 will be drilled to the elevation of the final base of the quarry and designed to monitor the amount of drawdown of the piezometric surface (water table) along the western perimeter of the quarry. The monitoring data will enable an assessment of the

impact of quarrying on the groundwater system in the vicinity of the Groundwater Dependent Ecosystems (GDEs) immediately west of Lot 1. The monitoring data will be collated with monitoring data collected from the surviving monitoring bores within the quarry precinct, and a production bore outside, and immediately south-east of, the quarry. The results of water level monitoring will provide information on the drawdown of the water table beneath the quarry precinct, which will be compared with predictions from the groundwater model as documented in Section 4.2.

The predicted drawdowns in neighbouring bores, the details of which are documented in Section 6, were initially calculated using a Steady State Computer Groundwater Model developed by Coffey Geotechnics in 2011 (Coffey, 2011 – Report No. GEOTLCOV24003AA-AC). The parameters used in the model (including specific yield estimates) were obtained from the results of numerous groundwater investigations and multiple aquifer tests in the sandstone hosted aquifer system in this region and other parts of the Sydney Basin. Specific yield is discussed and estimated in Section 2.6.2.2 of the Coffey report (Coffey, 2011). The reader is referred to Section 18 of the Groundwater Impact Assessment (Larry Cook & Associates, 2012) in which a detailed description of the Steady State Computer Groundwater Model, parameters used, calibration, sensitivity analysis and predictions are provided. In addition, specific yield is discussed and estimated in Section 18.7.2. A steady state groundwater model is conservative (not staged and not transient) and usually overestimates drawdown.

Additional groundwater modelling was undertaken by Umwelt in late 2014. Umwelt developed a computer transient groundwater model based on data from the steady state model. The transient model showed similar impacts to those predicted by the steady state model.

The monitoring bores are considered to be representative of the local sandstone-hosted aquifer system. It is noted that the principle sandstone-hosted aquifers are a set of stacked, relatively 'flat lying' water bearing zones. Five (5) of the seven (7) dedicated bores within the quarry precinct were drilled to the approximate elevation of the proposed final quarry base. The depths of neighbouring bores exceed the depths of monitoring bores over the Project Site, therefore, the project monitoring bores are considered representative.

The GDEs west of the project site are in the Brisbane Water National Park and in relatively inaccessible terrain. In this regard, we have proposed the installation of new monitoring bores on the western side of the Project Site between the final western extent of the quarry extension and the western boundary of Site which is relatively close to the identified GDEs. Installation of monitoring bores within the GDEs is considered impractical due to the physical access to the GDEs, virtually impossible due to the steep topography (tiered 'step-down' sandstone landform on southern side of deeply dissected Mooney Creek valley). In addition, it is considered highly unlikely that permission would be forthcoming from the relevant agencies to mobilise any equipment/machinery into the Brisbane Water National Park and any GDEs.

Therefore, in our view, the installation of three (3) new monitoring bores to depths commensurate with the final depth of the quarry on the western boundary of Lot 1 provides the best available strategy to monitor drawdown associated with the expanding quarry.

4.2 MONITORING NETWORK

As documented in Section 4.1, a network of nine monitoring bores was originally located on the Site. However, one of the monitoring bores (BH 1 (G1)) is no longer operational which reduces the network to eight monitoring bores. Three proximal neighbouring registered bores are also listed. The locations of the monitoring bores are shown in **Figure 3** and a bore register provided in **Table 4**. The locations of two of the monitoring bores designated by NSW EPA for routine sampling (BH 3 (G3) and BH 4 (G4)) are shown in a survey plan prepared by licensed surveyors Stephen Thorne and Associates presented in **Figure 4**.

The existing network of eight on-site monitoring bores requires supplementation in the longer term as the existing monitoring bores are removed as the staged extraction proceeds. In this regard, a total of three additional monitoring bores are proposed within Lot 1 close to the western boundary. Existing bore GW049244 can be used as a control monitoring bore. The suggested locations of the additional monitoring bores are shown in **Figure 3**. A register of the three additional monitoring bores with specifications is provided in **Table 5**. Proposed construction details are provided in **Appendix 1**.

In accordance with the DGRs, contact was made with the Newcastle and Parramatta offices of then NSW Office of Water (NOW) in 2013 to arrange a meeting in their Newcastle office to discuss existing surface water and groundwater licenses (and entitlements) on Lot 1 (the Site), and increases in groundwater entitlement. Contacts were also made to discuss existing and proposed groundwater and surface water monitoring (level and quality) associated with the existing quarry and the proposed quarry extension.

The meeting was also suggested to discuss monitoring of groundwater levels and quality in the proximal groundwater dependent ecosystems (GDEs), in particular identified Hawkesbury Banksia Scrub Woodland and Sandstone Hanging Swamps west of the Project Site. We were particularly interested in exploring the direction from NOW to 'undertake appropriate studies' in regard to the assessment of any adverse impacts from the proposed quarry extension on the GDEs. Notes documenting these discussions with NOW contacts are provided in **Appendix 2**.

Table 4 Grants Road Sand Quarry Extension - Inventory of Monitoring Bores

Bore	Coordinates (MGA Grid)		Type	Authorised Purpose	License	Notes	Depth (m)	SWL (m BGL) July 2010	Elevation Collar Bore (m AHD)	Elevation Base Bore (m AHD)	Elevation Water Table (m AHD)
	Easting (m)	Northing (m)									
BH1 (G1)	0338663	6304246	Resource Destroyed		No	Monitoring bore in NE corner of Property Bore non operational (destroyed)	17.80	5.57	235.20	217.40	229.63
BH3 (G3)	0338348	6304311	Resource		No	Monitoring bore in NW corner of Property	20.46	5.56	218.10	197.64	212.54
BH4 (G4)	0338344	6304151	Resource		No	Monitoring bore in central west of Property	18.00	5.16	216.80	198.80	211.64
Test	0338505	6303994	Test		No	Test bore immediately north of chicken sheds	42.30	2.78	220.40	178.10	217.62
GW101915	0338324	6303784	Production	Dom, Ind, Stock	20WA100361	Production bore in SW corner of Property	61.00	9.60	202.80	141.80	193.20
Test	0338655	6303963	Test		No	Murray's bore	unknown	19.15	227.30	unknown	208.15
GW049244	0338674	6303778	Production	Dom, Stock	20WA100361	Production bore in SE corner of Property	38.10	19.15	227.30	189.20	208.15
DDH 1	0338466	6304187	Resource		No	2010 Resource Diamond Drill Hole in N	42.37	5.36	225.95	183.58	220.59
DDH 2	0338496	6303881	Resource		No	2010 Resource Diamond Drill Hole in S	41.00	3.18	218.5	177.5	215.32
GW056451	0338624	6303632	Production	Stock	20WA100737	Brenda's production bore	66.00	6.49	220.00	154.00	213.51
GW047695	0338943	6304237	Production	Dom, Irr, Stock	20WA100781	McGregors production bore	61.00	9.80	230.00	169.00	220.20
GW063850	0338933	6304538	Production	Dom	20WA100763	Zammit production bore	55.00	8.70	235.00	180.00	226.30

Notes:

Dom. Domestic
Stock Stock
Ind. Industrial
Irr. Irrigation

Table 5 Register Proposed Additional Monitoring Bores						
Monitoring Bore	Collar Elevation (m AHD)	Proposed Depth (m)	Construction			
			Class 18 PVC Casing		Class 18 PVC Screen	
			From (m)	To (m)	From (m)	To (m)
BH 5	211.0	30.00	0.00	24.00	24.00	30.00
BH 6	201.0	20.00	0.00	14.00	14.00	20.00
BH 7	200.0	20.00	0.00	14.00	14.00	20.00

AHD: Australian Height Datum

4.3 WATER LEVEL MONITORING

4.3.1 Baseline Water Level Monitoring

Manual baseline measurements of water levels recorded in the network of monitoring bores up to May 2012 are listed in **Table 6**. The table also includes baseline measurements collected in 2010 in the three closest neighbouring licensed bores (GW047695, GW056451 and GW063850).

A composite set of hydrographs for the nine on-site monitoring bores are provided in **Figure 5**. Automated water level measurements were collected in four of the monitoring bores between October 2013 and February 2016 (BH1 (G1), BH3, BH4 (G4) and DDH2). These hydrographs are presented in **Figure 6**. Rainfall data from the official nearby BOM weather station at Mangrove Mountain (Mangrove Mountain BOM Station No. 061375) is also charted.

The following observations and comments are provided:

- The character of the hydrograph for Monitoring Bore DDH2 is consistent with predictions that the relative deeper sub-horizontal sandstone aquifers that can be effectively separated and semi-confined (and sometimes confined) by interbedded relatively massive sandstone units that possess lower hydraulic conductivities. Although this relatively deeper set of aquifers in DDH 2 show a direct response to rainfall events, they do not usually respond as rapidly or in magnitude (amount of water level fluctuations) to the shallower aquifers intersected in the relatively shallow monitoring bores (BH1(G1), BH3 and BH4 (G4)).

Table 6 Measurements of Water Level

Bore	Depth (m)	Bore ID	Standing Water Level (m Below Ground Level)																			
			17/07/2008	12/09/2008	10/11/2008	21/01/2009	13/03/2009	14/05/2009	4/07/2009	20/09/2009	6/11/2009	23/02/2010	20/05/2010	29/07/2010	3/10/2010	16/12/2010	26/02/2011	10/06/2011	15/09/2011	18/11/2011	23/03/2012	17/06/2012
	17.80	BH1	4.49	4.76	5.12	5.82	6.12	6.33	6.45	6.38	6.50	6.78	6.84	5.57	6.63	6.58	6.66	6.42	6.48	6.53	4.27	4.71
BH3 (G3)	20.46	BH3	4.96	5.12	5.23	5.16	5.42	5.65	5.72	5.70	5.84	5.88	6.64	5.56	5.58	5.91	6.68	6.58	6.52	6.59	2.87	3.08
BH4 (G4)	18.00	BH4	5.22	4.84	5.02	4.97	5.07	5.28	5.32	5.28	5.34	5.54	5.68	5.16	5.23	5.45	5.97	5.53	5.42	5.56	4.41	4.80
DDH 1	42.37	DDH1											6.29	5.36	5.56	5.93	6.21	5.87	5.73	5.89	4.20	4.58
DDH 2	41.00	DDH2											4.17	3.18	3.40	4.26	4.70	4.14	4.24	4.43	2.08	2.42
OldTest Bore	42.30	Test		2.42	2.63	2.54	3.01	3.03	3.16	3.12	3.21	3.35	3.45	2.78	3.06	3.54	3.74	3.23	3.36	3.40	2.42	2.83
GW101915	61.00	GW101915	9.31	8.92	8.87	8.82	8.85	9.05	9.12	9.10	9.36	9.52	9.56	9.60	9.37	9.84	10.00	9.79	9.82	9.86	7.30	7.77
Murrays	38.10	Murrays	19.74	18.78	19.04	19.46	19.01	19.06	20.36	19.79	19.56	19.18	19.71	19.15	21.78	21.55	20.92	19.65	19.84	19.90	17.97	18.11
GW049244	66.00	GW049244	5.66	6.52	6.87	7.57	7.62	7.96	8.23	8.17	8.66	8.67	8.42	6.49	7.44	8.12	8.28	7.87	7.98	8.12	6.01	6.36
GW047695	61.00	Magregor												9.80								
GW056451	66.00	Brenda												2.41								
GW063850	55.00	Zammit												8.70								

- The close correlation between several rain events recorded at nearby Mangrove Mountain and water level rise recorded in shallow monitoring bores (BH1 (G1), BH3 and BH4 (G4)) suggests relative rapid recharge of the shallow aquifer system. This is particularly noticeable in the hydrograph for Control Monitoring Bore BH3 which has the longest recording history (2013-2016). This observation is consistent with the conclusions of extensive groundwater investigations over the Site and surrounding district by *Larry Cook Consulting Pty Ltd* who note that the shallow aquifers will be characterised by a predictably rapid response to any significant rainfall events (direct and immediate recharge).

4.3.2 New Monitoring Sites

Subsequent to the baseline water level monitoring, Monitoring Bore BH1 (G1) was destroyed as part of the quarry extension. In this regard, one of the existing groundwater monitoring sites (BH3 (G3)) replaces Monitoring Site BH1 (G1) (**Figure 4**).

New state-of-the-art automated water level data loggers (pressure transducer type) with telemetry were installed in four of the monitoring bores ((BH3, BH4 (G4), DDH1 and DDH2) in May 2016 and programmed to take (and record) measurements of water level once every 4 hours.

4.3.3 Proposed Water Level Monitoring

The recommended monitoring program is summarised in **Table 7** and incorporated in a master GMP in **Appendix 2**.

Table 7 Recommended Water Level Monitoring Program		
Activity	Sample Frequency	Comment
Automatic water level measurements in water level data loggers (with telemetry) installed in four monitoring bores	<ul style="list-style-type: none"> • <i>Initial</i> 4-hourly (1 sample every 4 hours) • Assess data after 12 months • <i>Depending</i> on results and trends, decrease frequency to 8-hourly (1 sample every 8 hours) • Downloaded via telemetry (cloud) weekly. 	This sample frequency is designed to provide adequate, real time good quality water level data, optimise the logger battery life and optimise logger memory.

Measurements of water level should be continued in the monitoring network in order to build on the existing baseline hydrogeological database. Measurements will be collected using automated water level data loggers and recorders with a telemetry

function. The water level data loggers will be programmed to take and record measurements of water level at an initial sample frequency of one measurement every 4 hours. The data will be downloaded on a weekly basis. In this way, real time water level data can be collected and regularly analysed, the integrity and performance of the data loggers checked and hydrographs constructed for each monitoring bore.

Manual measurements of water level will be taken in each on-site monitoring bore when either logger maintenance is scheduled or during groundwater sampling campaigns. Dependant on access, manual water level measurements will be collected on a regular basis in selected neighbouring bores listed in **Table 4**.

These monitoring data will be statistically analysed to establish any natural variation in water levels in the monitoring bores and neighbouring production bores within the outwardly migrating cone of depression surrounding the expanding quarry predicted in the computer groundwater model. A set of 'trigger levels' will be developed to alert any imminent or occurring impact/s from the proposed quarrying activities. The development of trigger levels is discussed in Section 5.

4.4 WATER QUALITY MONITORING

4.4.1 Baseline Water Quality Monitoring

Baseline water quality testing was carried out in the on-site monitoring bores to establish a set of representative water quality data for the sandstone aquifer system. Baseline analytical results are summarised in **Table 8**.

In summary,

- The pH measurements of the groundwater samples measured in the laboratory are all similar. The pH ranges from 3.9 in Bore GW049244 to 4.9 in the abandoned test bore.
- Laboratory measurements of EC reveal that the groundwater in all bores has low salinity with measurements ranging from 80 $\mu\text{S}/\text{cm}$ in Murrays Bore to 145 $\mu\text{S}/\text{cm}$ in GW049244.
- Concentrations of ammonia were generally less than the limit of detection.
- Concentrations of other cations (Ca, K and Mg) were unremarkable and indicate that the groundwater is 'soft'.
- Sulphate concentrations were generally low.
- Low levels of bicarbonate were recorded in all bores.
- Low concentrations of nitrate were recorded in the majority of monitoring bores.
- Concentrations of phosphate were generally less than the limit of detection.
- Concentrations of total phosphorus were generally less than the limit of detection.
- Dissolved iron was detected at trace levels in the majority of samples.
- Trace concentrations of copper, lead and zinc were recorded in the majority of samples.

Table 8 Summary of Baseline Water Quality Analytical Results - Monitoring Bores

SAMPLE	Guidelines		Method Detection Limit	Murrays Bore	GW049244	GW101915 (30 m)	GW101915 (50 m)	BH1 (G1)	BH3 (G3)	BH4 (G4)	Test Bore	Test Bore
	Drinking Water - Health Guidelines ¹	Irrigation ¹										
DATE												
ANALYTE	UNIT											
pH (lab)	pH Units	6.5 - 8.5	0.1	4.5	3.9	4.4	4.1	4.3	5.1	4.3	4.9	4.8
Electrical Conductivity (lab)	µS/cm		0.1	80	145	105	115	105	120	115	120	94
Total Dissolved Solids	mg/L	1000	1	50	88	59	67	62	75	72	64	55
Total Phosphorus	mg/L		0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.3	0.01	0.04	1.9
Cations												
Sodium Na+	mg/L	300	0.1	9.2	18	15	17	15	18	19	16	14
Potassium K+	mg/L		0.1	0.9	1.0	0.8	0.8	0.6	3.6	0.5	2.6	1.2
Calcium Ca++	mg/L		0.1	4.1	0.8	1.1	1.4	1.3	2.9	0.3	1.8	2.9
Magnesium Mg++	mg/L		0.1	2.4	5.9	3.6	3.7	2.8	1.9	3.5	1.5	1.4
Ammonia NH4-N	mg/L	0.01	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.6	0.1
Anions												
Chloride Cl-	mg/L	400	1	24	28	26	28	27	22	29	24	24
Bicarbonate HCO3-	mg/L		1	<1	<1	<1	<1	<1	13	<1	6	3
Sulphate SO4--	mg/L	400	2	6	6	13	14	7	13	5	10	7
Nitrate NO3-N	mg/L	10	0.1	0.75	25	0.4	0.35	4.2	2.5	10	1.2	0.89
Phosphate PO4-P	mg/L		0.1	<0.01	<0.01	<0.01	<0.01	<0.01	0.07	<0.01	<0.01	0.03
Metals												
Copper (Cu)	mg/L	0.0014	0.001	0.008	0.003	0.003	<0.001	0.006	<0.001	0.006	0.001	0.003

Lead (Pb)	mg/L	0.0034		0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.002	0.001	0.002	0.002
Zinc (Zn)	mg/L	0.008		0.001	0.025	0.010	0.017	0.019	0.018	0.006	0.015	0.026	0.28	0.28
Cadmium (Cd)	mg/L	0.0002		0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Chromium (Cr)	mg/L	0.05		0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel (Ni)	mg/L	0.011		0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron (Dissolved Fe)	mg/L	0.3		0.01	0.03	<0.01	0.04	0.02	<0.01	0.28	0.02	<0.01	0.02	0.02
Manganese (Mn)	mg/L	0.05		0.01	0.01	0.03	0.24	0.25	<0.01	<0.01	<0.01	0.03	0.08	0.08
Aluminium (Al)	mg/L	0.055		<0.1	<0.1	0.8	<0.1	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic (As)	mg/L	0.007		0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury (Hg)	mg/L	0.001		0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

¹ **Drinking Water Guidelines:** National Water Quality Management Strategy 2004

² **Irrigation Water Guidelines:** National Water Quality Management Strategy 2004

4.4.2 Follow-Up Water Quality Monitoring

Groundwater sampling was undertaken in the nominated groundwater monitoring bores (BH1 (G1) and BH4 (G4)) during the period 1.1.15 through 31.12.15.

The samples were submitted to NATA accredited laboratories for a suite of prescribed tests and determinations listed in **Table 9** in order to reveal any trends in the results and any potential contamination from quarrying and sand washing activities.

Table 9 List of Analytes and Tests
Total Suspended Solids (TSS)

Laboratory results are summarised in **Table 10**.

Table 10 Summary of Follow-up Water Quality Analytical Results - Monitoring Bores								
Analyte	Unit	Guidelines		Method Detection Limit	BH1 (G1)		BH4 (G4)	
		A	B		17/6/15	4/8/15	17/6/15	4/8/15
Total Suspended Solids (TSS)	mg/L	nil	nil	10	<10	<10	<10	<10

- A. Drinking Water Guidelines: National Water Quality Management Strategy 2011 Version 3.1 updated March 2015
- B. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. National Water Quality Management Strategy (ANZECC 2000)

In summary:

- The concentration of Total Suspended Solids (TSS) recorded in the two groundwater monitoring bores were less than the Method Detection Limit.

4.4.3 Proposed Water Quality Monitoring

The recommended monitoring program is summarised in **Table 11** and the detail provided in the master GMP in **Appendix 2**.

Table 11 Recommended Water Quality Monitoring Program		
Activity	Sample Frequency	Comment
Groundwater sampling in representative monitoring bores	<ul style="list-style-type: none"> • <i>Initial</i> 3-monthly (1 sample per bore every 3 months) for 12 months • Assess data after 12 months • <i>Depending</i> on results and trends, and DPI Water approval, decrease frequency to 6-monthly (1 sample every 6 months) 	This sample frequency is designed to provide adequate and representative water quality data to assess any significant changes (and evolution) in groundwater chemistry that may be due to the proposed quarry expansion operations.

Careful analysis and progressive assessment of the results may lead to the reduction of the number of analytes determined and the frequency of sampling. DPI Water will be consulted with any proposal to reduce the number of analytes or reduce the frequency of sampling and testing. A set of indicator analytes can be developed which will alert the Quarry Manager of any significant changes in water quality that may require action. The recommended list of analytes and tests for quarterly sampling is provided in **Table 12**.

Table 12 Recommended List of Analytes and Tests	
pH	Copper (Cu)
Electrical Conductivity (EC)	Lead (Pb)
Total Dissolved Solids (TDS)	Carbonate Alkalinity (as CaCO ₃)
Sodium (Na)	Total Alkalinity (as CaCO ₃)
Calcium (Ca)	Total Phosphorus (Total P)
Potassium (K)	Nitrate (NO ₃ -N)
Magnesium (Mg)	Nitrite (NO ₂ -N)
Ammonia (NH ₄ -N)	Phosphate (PO ₄)
Chloride (Cl)	Zinc (Zn)
Sulphate (SO ₄)	Total Iron (Fe)
Bicarbonate Alkalinity (as CaCO ₃)	Dissolved Iron (Fe)
Total Suspended Solids (TSS)	
Total Oils and Grease	

Groundwater sampling in monitoring bores will be conducted using nitrile disposable gloves and samples stored in laboratory-supplied plastic bottles and chilled in an esky. The samples will be submitted to the NATA accredited project laboratory for the suite of tests and determinations listed in **Table 12** in order to characterise the chemistry of the groundwater and reveal any potential changes. The samples will be transported under our Chain of Custody (COC) protocol. For this number of primary samples, a total of two duplicate samples will be prepared and a field blank sample prepared.

Field measurements of pH, Electrical Conductivity (EC), Dissolved Oxygen (DO), Redox Potential (Eh) and temperature will be undertaken on all samples. This field testing regime provides a method of establishing representative groundwater conditions.

These monitoring data will be statistically analysed to establish any natural variation in water quality in monitoring bores and neighbouring production bores within the outwardly migrating cone of depression surrounding the expanding quarry predicted in the computer groundwater model.

4.5 RAINFALL MONITORING

Rainfall data will be collected and recorded for the Project Site using the existing on-site Bureau of Meteorology approved automated tipping bucket rain gauge. The data will be downloaded on a monthly basis and collated in an electronic database or spreadsheet.

The recommended monitoring program is summarised in **Table 13** and the detail provided in the master GMP in **Appendix 2**.

Table 13 Recommended Rainfall Monitoring Program		
Activity	Sample Frequency	Comment
Automatic rainfall measurements in <i>tipping bucket rain gauge</i> data logger on site	<ul style="list-style-type: none"> <i>Continuous</i> logging at every 0.2 mm tip with time/date stamps 	This sample frequency is designed to provide adequate, real time good quality rainfall data, optimise the logger battery life and optimise logger memory.

4.6 PIT INFLOW MONITORING

The conclusion from the steady state numerical groundwater flow model is that the predicted groundwater inflows into the final pit void are always less than the evaporation potential. That is, the water balance presented in the groundwater modelling study indicates that any groundwater inflow into the pit will be effectively evaporated. No groundwater inflow can be monitored and any water retained in the void will be dependent on rainfall.

5.0 ASSESSMENT OF WATER LEVEL AND WATER QUALITY MONITORING RESULTS AND DEVELOPMENT OF TRIGGER LEVELS

At this stage, with limited available monitoring data, it is considered inappropriate to establish a set of absolute water levels, bore yield or water quality guidelines that if 'exceeded' may indicate that an impact or impacts associated with sand extraction operations are occurring.

It is recognised that any significant decrease in water level and/or changes on water quality in monitoring bores and monitoring sites may be a consequence of several factors including but not necessarily limited to pumping interference from neighbouring bores, interference from extraction operations or due partly to long-term environmental effects.

The development of a set of trigger levels is considered an important component of on-going long-term assessment of any potential impacts from quarrying on the local groundwater systems, other groundwater users and the environment.

It is therefore proposed that continuous 'real time' monitoring of water levels and regular monitoring of water quality be continued in the monitoring bore network (as proposed in Sections 4.2 and 4.3) in order to establish *control ranges* that take into account, as best as possible, natural variation and fluctuations in climate and rainfall, and possible artificial changes induced by pumping from the network of existing district and neighbouring bores.

Analytical results will be compared against the Protection of Freshwater Aquatic Ecosystems (ANZECC 2000), and the 1999 NEPM 'Schedule B(1) Guideline on the Investigation Levels for Soil and Groundwater'.

As prescribed in the Guidelines, statistical procedures will be used to determine whether there has been a significant (90% confidence level) change in the value of one or more of the indicator parameters specified in the water assessment plan (Appendix D of the Guideline). As documented, analysis of variance or other suitable statistical techniques can be used to perform this assessment.

In addition to comparing analytical results against the various guidelines to reveal any exceedances, it is proposed to establish control ranges for a set of indicator parameters. The control ranges and trigger levels would be developed using the progressively-collected monitoring data and a statistical analysis. The selected statistical analytical methods will be designed to provide warning and monitoring of any adverse trends associated with potential contamination of the groundwater system. The methods would provide warning of any imminent exceedances of the limits and establish, and monitor any impacts if they have already occurred.

There are a range of statistical control chart methods that are used in the processing industry. Two well documented methods are the *Exponentially Weighted Moving Average* (EWMA) method and the *Cumulative Sum* (Cusum) methods which are considered to be relevant to the assessment of any potential impacts associated with sand extraction. It is recommended that the two methods be integrated into one statistical analysis and implemented. The methods are described as follows.

The EWMA control chart is a data analysis technique for determining if a measurement process has got out of control. The EWMA chart plots a weighted average of the current data and the previously plotted point and uses statistical control limits. The chart is sensitive to drift and therefore in the context of the potential impacts from the composting facility would effectively detect any geochemical changes in groundwater due to the operations.

The Cusum chart is similar to the EWMA method. The chart is sensitive to drift and will detect small changes in the mean. The chart does not use fixed or parallel statistical control limits but plots the cumulative sum of the deviations between each plotted value (sample average) and a background value. The interpretation of the chart is more concerned with the slope of the plotted line, not just the distance between the plotted values and the centreline.

If the newly developed control ranges and trigger levels reveal exceedances, DPI Water will be notified and any exceedances reported within 1 month of receiving the water quality results.

6.0 LOCAL GROUNDWATER USERS

The results of the steady state numerical groundwater modelling indicate that the cone of depression associated with the proposed final pit will impact on a small number of neighbouring bores. Maximum drawdown of between approximately 8 and 9 m are predicted to occur in two proximal neighbouring bores (GW056451 and GW047695).

A summary of potential maximum impacts and the estimated percentage of available drawdown at the end of quarrying activities in Year 30 are provided in **Table 14**.

Water level monitoring of on-site and proximal neighbouring bores documented in Section 4.2 will provide the basis to compare actual water levels with model drawdown predictions. This comparison and analysis will be reported in annual reports to DPI Water.

Table 14 Summary of Maximum Predicted Drawdowns Neighbouring Bores		
Bore	Predicted Maximum Drawdown	Predicted Available Drawdown at End of Quarrying
GW056451	8 m	44.0 m
GW047695	9 m	44.7 m
GW049304	6 m	27.5 m
GW063850	6 m	42.0 m
GW100238	3 m	unknown
GW065458	3 m	36.0 m
GW047267	3 m	20.7 m
GW080166	2 m	19.5 m
GW066918	0.5 m	16.5 m
GW104097	0.5 m	unknown

7.0 ASSESSMENT AGAINST MODEL PREDICTIONS

Comparison of modelled water level predictions with actual water levels from monitoring will be undertaken in-house and reported to DPI Water on a six (6) monthly basis for the first 12 months then on an annual basis.

Manual water level data will be recorded on an in-house form (electronic database). Automated water level data acquired from Monitoring Bores BH3 (G3), BH4 (G4), DDH1 and DDH2 will be in electronic form (cloud based database) and regularly downloaded and collated by the hydrogeological consultant for the progressive construction of hydrographs. A copy of the data will be kept onsite, maintained by the Project Manager and an off-site backup maintained.

Groundwater model performance and predictions will require a review following the collection of additional data. This may take the form of model recalibration, verification, or both. Predictions from the current model and any future updated versions will be compared with monitoring results and further assessment carried out where monitoring data show trends significantly departing from model predictions.

Comparison of water level monitoring results with model drawdown predictions will be reported to DPI Water on a six (6) monthly basis for the first 12 months then on an annual basis.

8.0 CUMULATIVE IMPACTS

The conditions of approval stipulate the development of a protocol in consultation with Central Coast Sands Quarry, to appropriately apportion responsibility for any potential impacts to privately-owned groundwater bores and/or high priority GDEs that may be affected cumulatively by the proposed extension of Grants Road Sand Quarry and sand extraction operations at Central Coast Sands Quarry.

The proposed protocol to determine any cumulative impacts, and quantify them if they are detected, is listed as follows:

- Continue to measure, record and compile 'real time' water level measurements in the network of monitoring bores within the Project Site including progressive construction of hydrographs to establish any trends.
- Collect further baseline and follow-up measurements of water level in accessible neighbouring bores to establish existing water levels including collation of data.
- Review the constructed hydrographs from all available monitoring bores on a quarterly basis. Correlate water level data with daily rainfall data collected from the Project Site to establish any trends and reveal any exceedances to the criteria listed in Section 6 that may be attributable to impacts from the proposed extension of the existing quarry at Grants Road.
- Report results of water level and water quality monitoring (including hydrographs) to DPI Water as prescribed in the GMP.
- Assess whether any trends in water level fluctuations in the monitoring bores is interpreted to be associated with impacts from local extractive industry whether it be associated with the extension of the Grants Road Sand quarry or Central Coast Sands Quarry. If required, discuss interpretation of results with DPI Water.
- If an impact is indicated from the monitoring, approach Central Coast Sands Quarry to discuss possible collaboration regarding assessment of actual water level measurements in both developments and comparison with predicted drawdowns estimated from the two groundwater models and extent of drawdown (cone of depression) predicted around each quarry.

Explore any additional protocol that may help in assessing water level fluctuations that may be attributed to impacts from the quarry extensions and, if possible, apportion responsibility. The timing of this collaboration can be triggered by the identification of any adverse trends interpreted in the water level data (hydrographs) and determination of any exceedances to the criteria listed in Section 6.

9.0 PROTOCOL – INVESTIGATE/NOTIFY/MITIGATE ANY IDENTIFIED EXCEEDANCES

If there is a scientifically and independently demonstrated significant impact on any neighbouring water users surrounding the Project Site, for example, a fall in bore water level and subsequent bore performance (bore yield) or water quality that can, with the available scientific data, be linked to this project's extraction activities, the following options are presented for consideration subject to any agreement/s between the property owner and the proponent.

- Supply groundwater supplies to the property/s with a minimum flow equivalent to the measured and documented losses with water quality commensurate with the present bore supply, or better;
- Deepen the affected bore, if feasible;
- Drill a new test bore for the owner in order to replace or improve the bore yield of the existing registered bore. The water quality must be similar to the existing bore water quality or suitable for the intended purpose; or
- Agree to another arrangement mutually acceptable to the property owner and the proponent.

In regard to procedures required for any unforeseen impacts, it is considered that the potential impacts have been identified for example:

- Significant drawdown (as defined and agreed to between the proponent and DPI Water) in the water level in neighbouring bores.
- water quality exceedances in monitoring bores.
- water quality exceedances in surface water discharge.

In the event that Detection Monitoring identifies quality parameters that exceed the agreed trigger levels in this water management plan, the exceedance/s will be reported to DPI Water in writing within 1 week of receipt of the results and a program of Investigation Monitoring which consists of re-sampling and retesting the affected groundwater bore within 30 days to confirm the anomalous results.

If the follow-up test results confirm an exceedance/s, consultation with DPI Water will be arranged within one day regarding a suitable and agreed process of mitigation.

If the water level in a neighbouring bore is significantly impacted (significant drawdown as defined and agreed to between the proponent and DPI Water) and the drawdown is not due to that bore being pumped at the time, or within a day prior to measurement, the water level should be remeasured within two days and the level recorded in the in-house database. If the follow-up water level measurement confirms an impact, consultation with DPI Water will be arranged within one day regarding a suitable and agreed process of mitigation.

10.0 INVESTIGATION OF OPPORTUNITIES TO MAINTAIN ECOSYSTEM FUNCTION IN GDES

NSW Planning requested an investigation of opportunities to maintain ecosystem function in GDEs to the west and north-west of the Project Site in accordance with the DGRs. Identification and assessment of GDEs proximal to the Project Site, and the investigation of opportunities to maintain ecosystem function are documented in the ecological management plan prepared by the project's ecological consultant, in accordance with the DGRs.

Ecosystem function is also maintained by elements of the surface water management plan, in particular the diversion drains located on the eastern perimeters of the site which divert any 'clean water' runoff water around the northern and southern sides of the operational areas and offsite to the west. In this regard, the surface water consultant JP Environmental state that, in addition to any existing structures, new 'clean water' catchment diversion structures will be constructed down the north, east and south lease boundary and directed off-site.

Clean surface water diverted across the northern section of the site (northern catchment) will not be impacted by the quarry operation. JP Environmental add that this water can be directed off site to maximise 'normal' environmental flows using the existing offsite drainage paths on the western boundary of Lot 1 or directed into the Pollution Control Dam.

Surface water originating from the southern catchment not impacted by quarrying operations is classed as 'clean'. This water will report directly offsite via existing 'natural' flow paths to maximise 'normal' environmental flows along the western boundary.

The Pollution Control Dam will provide environmental protection of Brisbane Water National Park from waters containing elevated nutrient levels.

It is noted that offsite drainage/flow paths down the western boundary of Lot 1 were modified when Council constructed a town water supply pipeline trench and bund system within the water supply pipeline easement many years ago. The pipeline easement (with a 20 m buffer) forms the western-most extent of the proposed quarry extraction limit. JP Environmental states that the quarry development will not alter the existing surface water flow path configuration leaving the property boundary.

11.0 LICENSING

The Project Site is covered by the *Water Sharing Plan for the Kulnura Mangrove Mountain Groundwater Sources*. The proponent holds a Water Access License for the Property under the Water Management Act 2000.

The current water entitlement for the Property is 18 ML. This entitlement is attached to Water Access License 20WA100361 which presently covers two registered bores GW049244 and GW101915. It is noted that the annual water entitlement of 18 ML/year consists of 14 ML for industrial purposes and 4 ML for stock and domestic purposes.

The steady state numerical groundwater modelling predicts a total inflow of groundwater into the pit of 64 ML per annum. An additional amount of 51 ML in WALs is required. It is understood that the additional water entitlement has been acquired through water dealing.

12.0 DATA MANAGEMENT

Data management protocol is summarised as follows:

- The water level and water quality data acquired from the monitoring bores should be imported into an electronic database or spreadsheet, collated and viewed by the hydrogeological consultant following each round of monitoring. This process will ensure that a progressive record of the data is stored and maintained, and the integrity/quality of the data can be checked on a regular basis.
- Email a copy of the water level data to the hydrogeological consultant for assessment and keep a backup copy of the water level database or spreadsheet in a secure off-site place.
- Develop and maintain an electronic water quality database or spreadsheet. This database can also be part of the electronic water level monitoring database. A suitable database and progressive charting can be developed.
- Develop and maintain an electronic rainfall database or spreadsheet.

13.0 REPORTING

The protocol for reporting is summarised as follows.

- A complete set of water level data and any groundwater quality monitoring results will be recorded, collated and duly reported in-house on at least a six-monthly basis for the first 12 months then on an annual basis. The data will be reviewed by the consulting hydrogeologist. The aim is to assess any changes in water levels or groundwater chemistry and identify reasons for the changes if they occur. The monitoring schedule should be reviewed annually and changed if deemed appropriate by the hydrogeological consultant.
- Annual review of the results of the statistical analysis of monitoring data in order to detect any imminent or occurring impacts.
- Comparison of water level monitoring results with model drawdown predictions.
- A complete set of results of the production and monitoring program including a review and assessment of the statistical analysis should be formally reported to the *Senior Hydrogeologist DPI Water* and the Quarry Manager on an annual basis.

The report will include but not necessarily limited to the following.

- A progressive record of the water level measurements in the monitoring bores.
- A figure showing the locations of the monitoring bore network.
- A set of hydrographs.
- Rainfall data correlations.
- Progressive assessment of any trends in water level fluctuations.
- Analytical results and progressive assessment of any trends in groundwater geochemistry.
- Progressive assessment of any statistical trends (impacts).

- Comparison of water level monitoring results with model drawdown predictions and analysis of significance.
- Notification and assessment of any exceedances.
- Conclusions and recommendations.

The report should be submitted in hard copy and electronic format to the *Senior Hydrogeologist*, DPI Water and to the Quarry Manager. The raw water level and water quality data will be appended to the report in electronic form.

14.0 LIMITATIONS

This Groundwater Management Plan (GMP) has been prepared by Larry Cook Consulting Pty Ltd for the sole use of Grants Road Sands.

This GMP should only be presented in full and should be kept by Grants Road Sands. The GMP should not be used for any use other than the project specific requirements. Larry Cook Consulting Pty Ltd accepts no liability for any loss and/or damage incurred as a result of unauthorised changes to the GMP.

It is imperative to note that the GMP only considers the site conditions current at the time of investigation (March 2016), and to be aware that conditions may have subsequently changed. Any decisions based on the GMP must take into account any changes in site conditions and/or developments in legislative and regulatory requirements. Larry Cook Consulting Pty Ltd accepts no liability for any loss and/or damage incurred as a result of a change in the site conditions and/or regulatory/legislative framework since the date of the GMP.

Any reliance on this GMP by a third party shall be entirely at such party's own risk. Larry Cook Consulting Pty Ltd provides no warranty or guarantee to any third party, express or implied, as to the information and/or professional advice indicated in the GMP, and accepts no liability for or in respect of any use or reliance upon the GMP by a third party.

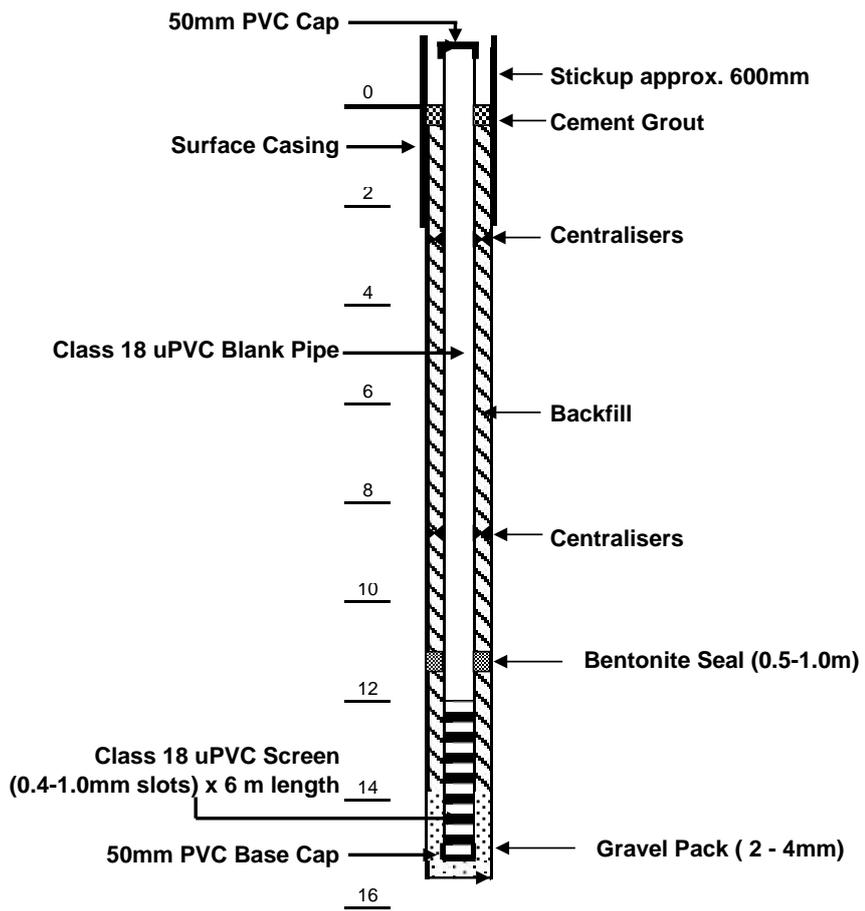
APPENDICES

Appendix 1

Design and General Specifications of the New Monitoring Bores

Monitoring sites would consist of a single 50 mm-diameter blank Class 18 PVC pipes installed at designated depths in a single bore of minimum 150 mm-diameter size. The final depths of the bores would be determined by the results of the drilling, geology encountered, any aquifers penetrated and the specifications provided in this GMP.

In summary, monitoring bore construction should be achieved using 50 mm-diameter blank Class 18 machine-slotted uPVC, screen and rubber ringed screw fittings, base caps, acid washed commercial 8/16 gravel pack (1.2-2.0mm), bentonite pellets (eg. *pel plug*), cement grout and a lockable steel monument. Profiles of typical piezometer construction is provided below.



Appendix 2

Communications and Discussions with NOW

Information

Agency Contacts: Bruce Westbrook – NSW Office of Water Newcastle
Stephanie Lynch – NSW Office of Water Newcastle
Hemantha De Silva - NSW Office of Water Newcastle
Mitchell Isaacs – NSW Office of Water Parramatta

Commentary

We consulted with the then NSW Office of Water (NOW) on several occasions by phone commencing 1st October 2013 to arrange a meeting in their Newcastle office. The contacts were with senior officer Bruce Westbrook to discuss existing surface water and groundwater licenses (and entitlements) on Lot 1 (the Site), and increases in groundwater entitlement. Contacts were also made with senior officers Stephanie Lynch and Hemantha De Silva to discuss existing and proposed groundwater and surface water monitoring (level and quality) associated with the existing quarry and the proposed quarry extension.

The meeting was also suggested to discuss monitoring of groundwater levels and quality in the proximal groundwater dependent ecosystems (GDEs), in particular identified Hawkesbury Banksia Scrub Woodland and Sandstone Hanging Swamps west of the Project Site. We were particularly interested in exploring the direction from NOW to 'undertake appropriate studies' in regard to the assessment of any adverse impacts from the proposed quarry extension on the GDEs. We were seeking, at this stage of assessment, options for 'appropriate studies' that may have been revealed from historic discussions between NOW and other proponents in similar extractive industry developments where GDEs were present, for example the Rocla Quarry Extension proposed at Calga, the Somersby Fields Sand quarry proposal at Somersby and the Hansen Quarry Extension also located at Somersby.

At this stage, we had proposed the installation of monitoring bores on the western side of the Project Site between the final western extent of the quarry extension and the western boundary of Site which is relatively close to the identified GDEs. It was also pointed out that physical access to the GDEs was virtually impossible due to the steep topography (tiered 'step-down' sandstone landform on southern side of deeply dissected Mooney Creek valley). It was understood that apart from physical access restrictions, it was considered highly unlikely that permission would be forthcoming from the relevant agencies to mobilise any equipment/machinery into the Brisbane Water National Park and any GDEs.

We further explained that in the past (mid 2000s), during the drought, we had manually installed 'shallow' piezometers in a small GDE north of the Site between the Project Site and Gosford Council's Balance Tanks to monitor any impacts on water level from a newly-constructed production bore located at the Balance Tanks.. We also noted the existing extensive network of monitoring bores across the Project Site which included two additional new drill holes sunk to the depth of the proposed quarry base in 2010.

We also discussed the methodology/process to assess cumulative impacts (water level drawdown) between Grants Road Quarry Extension and the Hansen Quarry Extension to the north. It was noted that impacts were likely already occurring around each extraction and it may be difficult to assess cumulative impacts associated with the two quarry extensions.

Stephanie indicated that a meeting was not considered necessary and we should contact Mitchell Isaacs in the Parramatta Office of NOW for further advice/thoughts on monitoring the GDEs, discuss what may constitute 'undertake appropriate studies' and to email points of discussion to her. Mitchell expressed the same view as Stephanie particularly in regard to 'appropriate studies'. Stephanie and Mitchell pointed out that this wording was in the Aquifer Interference Policy (Draft then) and did not reflect any particular methodology. We again noted our intended approach to eventually install monitoring bores between the Project Site and GDEs. In addition to water level and water quality monitoring proximal to the GDE, seasonal floristic surveys and assessments may be appropriate.

We cannot be sure that these 'points' were emailed to NOW because it became apparent from the phone discussions that 'undertake appropriate studies' referred to the text in the Draft Aquifer Interference Policy and not any specific methodology. There was, however, a general concurrence that the extensive monitoring network across the Site was consistent with industry-accepted approaches and proposed additional monitoring between the final western extent of the extended quarry and the GDEs was a plausible proposal. Our email account with provider CCI collapsed in early 2014 and we no longer have any email records prior to this time.

We add that general discussions were also made around this time with NOW regarding several other extractive industry projects and the design of monitoring networks, such as the Project Site, has been a consistent approach based on many years of experience. The Project Site has a monitoring network presently comprising 9 monitoring bores, 6 of which are dedicated piezometers and 3 are production bores. This is an extensive monitoring network and considered suitable for the purpose.

Appendix 3

Master Groundwater Management Plan

Groundwater Management Plan

Project: Grants Road Sand Quarry Extension

Water Level Monitoring

Bore Description	Licence Number	Location Description	Property Id Lot/DP	Coordinates	Monitoring Target/s	Monitoring Effect of	Monitoring Depth/s	Sampling Frequency	Sampling Parameters	Frequency of Data Download	Trigger Value or level indicating potential impact	Action Required	Any follow up actions	Reporting to DPI Water
BH 1 (G1)	Resource Hole	NE part of Project Site. Destroyed.	Lot 1 DP358717	E0338663 N6304246	Water Level Fluctuations	Artificial drawdown in the Watertable due Potentially to Sand Extraction Operations	17.80	Dedicated pressure transducers and data loggers for monitoring bores BH 3 (G3), BH4 (G4), DDH1 DDH2, BH5, BH6 and BH7 measuring and recording water level measurements at 4-hourly intervals. Review and assess data after 12 months. Depending on results, reduce frequency to 8 hourly.	SWL in single aquifers.	Weekly downloads using telemetry.	Gradual fall in water level in time or dramatic decline. Continuous 'real time' monitoring of water levels be continued in the monitoring bore for approximately 12 months in order to establish control ranges	Assess data, establish trends, compare against control ranges, determine any exceedances.	Progressive assessment of trends with prediction of any potential impacts. Determine whether the changes due to impacts from Grants Road Sands extraction operations or Central Coast Sands operations and, if so, report and notify DPI Water	If agreed trigger parameters exceed, further reporting on parameters @ month 1, 3, & 6.
BH 3 (G3)	Resource Hole	NW part of Project Site	Lot 1 DP358717	E0338348 N6304311			20.46							
BH 4 (G4)	Resource Hole	Central W part of Project Site	Lot 1 DP358717	E0338344 N6304151			18.00							
BH 5 Proposed New Bore	TBA	NW part of Project Site	Lot 1 DP358717	TBA			30.00							
BH 6 Proposed New Bore	TBA	SW part of Project Site	Lot 1 DP358717	TBA			20.00							
BH 7 Proposed New Bore	TBA	SW Corner of Project Site	Lot 1 DP358717	TBA			20.00							
DDH 1	Resource Hole	N Central part of Project Site	Lot 1 DP358717	E0338466 N6304187			42.37							
DDH 2	Resource Hole	S Central part of Project Site	Lot 1 DP358717	E0338496 N6303881			41.00							
Old Test	Test Hole	Central part of Project Site	Lot 1 DP358717	E0338505 N6303994			42.30							
Murrays	Test Hole	Central E part of Project Site	Lot 1 DP358717	E0338655 N6303963			?							
GW101915	20WA100361	SW part of Project Site	Lot 1 DP358717	E0338324 N6303784			61.00							
GW049244	20WA100361	SE part of Project Site	Lot 1 DP358717	E00338674 N6303778			38.10							
GW056451	20WA100737	Brenda's Bore S of Project Site	Lot 2 DP358717	E0338624 N6303632			66.00							
GW047695	20WA100781	McGregor's Bore NE of Project Site	Lot 1 DP104750	E0338943 N6304237			61.00							
GW063850	20WA100763	Zammit's Bore N-NE of Project Site	Lot 105 DP738384	E0338933 N6304538	55.00									

Water Quality Monitoring (Monitoring / Production Bores)

Bore Description	Licence Number	Location Description	Property Id Lot/DP	Coordinates	Monitoring Target/s	Monitoring Effect of	Monitoring Depth/s	Sampling Frequency	Sampling Parameters	Frequency of Data Download	Trigger Value or level indicating potential impact	Action Required	Any follow up actions	Reporting to DPI Water
BH 1 (G1)	Resource Hole	NE part of Project Site	Lot 1 DP358717	E0338663 N6304246	Groundwater Chemistry and Quality	Potential Deterioration of Groundwater Quality due to Drawdown of Water Table Surrounding Sand Extraction Operations	17.80	Groundwater sampling and water quality testing every 3 months for 12 months then, depending on results, reduce frequency to 6 monthly.	Field testing Temp, EC, pH, DO & Eh. Laboratory testing of pH, EC, TDS, TSS, Total Oil and Grease and analysis of major anions and cations plus suite of metals	Groundwater sampling and water quality testing every 3 months for 12 months then, depending on results, 6 monthly.	Gradual deterioration in water quality as a statistical trend. Continuous 'real time' monitoring of water quality be continued in the monitoring bore for approximately 12 months in order to establish control ranges. Review any exceedances.	Confirm any exceedances and or significant statistical trends of results. Assess data, establish trends, compare against control ranges, determine any exceedances.	Progressive assessment of trends with prediction of any potential impacts. Determine whether the changes possibly due to impacts from Grants Road Sands extraction operations and, if so, report and notify DPI Water.	If agreed trigger parameters exceed, further reporting on parameters @ month 1, 3, & 6.
BH 3 (G3)	Resource Hole	NW part of Project Site	Lot 1 DP358717	E0338348 N6304311			20.46							
BH 4 (G4)	Resource Hole	Central W part of Project Site	Lot 1 DP358717	E0338344 N6304151			18.00							
BH 5 Proposed New Bore	TBA	NW part of Project Site	Lot 1 DP358717	TBA			30.00							
BH 6 Proposed New Bore	TBA	SW part of Project Site	Lot 1 DP358717	TBA			20.00							
BH 7 Proposed New Bore	TBA	SW Corner of Project Site	Lot 1 DP358717	TBA			20.00							
DDH 1	Resource Hole	N Central part of Project Site	Lot 1 DP358717	E0338466 N6304187			42.37							
DDH 2	Resource Hole	S Central part of Project Site	Lot 1 DP358717	E0338496 N6303881			41.00							
Old Test	Test Hole	Central part of Project Site	Lot 1 DP358717	E0338505 N6303994			42.30							
Murrays	Test Hole	Central E part of Project Site	Lot 1 DP358717	E0338655 N6303963			?							
GW101915	20WA100361	SW part of Project Site	Lot 1 DP358717	E0338324 N6303784			61.00							
GW049244	20WA100361	SE part of Project Site	Lot 1 DP358717	E00338674 N6303778			38.10							
GW056451	20WA100737	Brenda's Bore S of Project Site	Lot 2 DP358717	E0338624 N6303632			66.00							
GW047695	20WA100781	McGregor's Bore NE of Project Site	Lot 1 DP104750	E0338943 N6304237			61.00							
GW063850	20WA100763	Zammit's Bore N-NE of Project Site	Lot 105 DP738384	E0338933 N6304538	55.00									

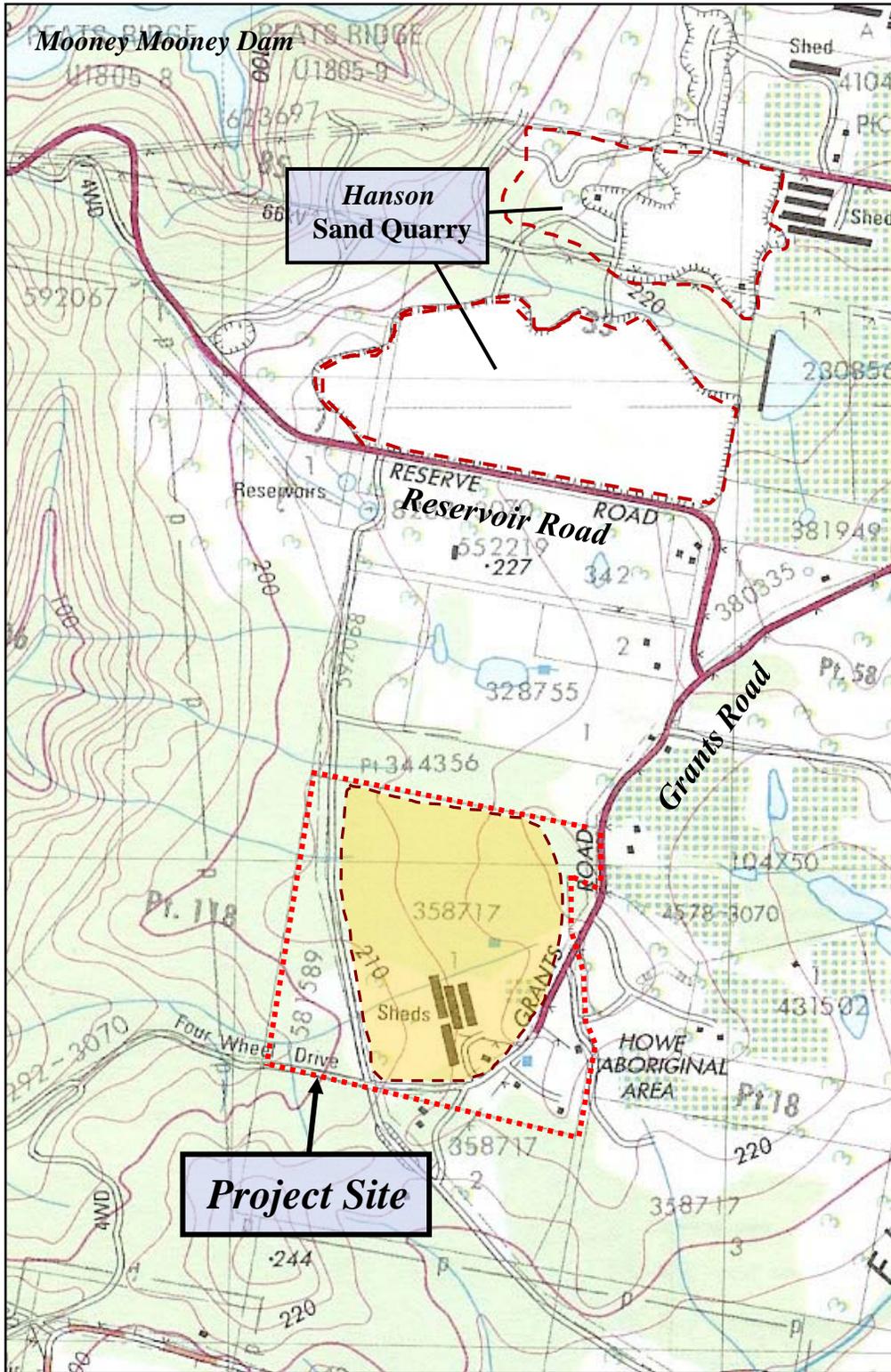
Rainfall Monitoring

Monitoring Device	Licence Number	Location Description	Property Id Lot/DP	Coordinates	Monitoring Target/s	Monitoring Effect of	Monitoring Depth/s	Sampling Frequency	Sampling Parameters	Frequency of Data Download	Trigger Value or level indicating potential impact	Action Required	Any follow up actions	Reporting to DPI Water
Tipping Bucket Gauge		On-site weather station	Lot 1 DP358717	TBA	Rainfall Intensity and Fluctuations			0.2 mm bucket tips	Rainfall Depth	1 monthly				With water level and water quality data

Mar-16

SWL: Standing Water Level from a Surveyed Reference Mark
 EC: Electrical Conductivity
 pH: Measure of Acidity
 DO: Dissolved Oxygen
 TDS: Total Dissolved Solids
 Eh: Oxidation Potential

Figures



 Proposed Extent of Sand Extraction Operations



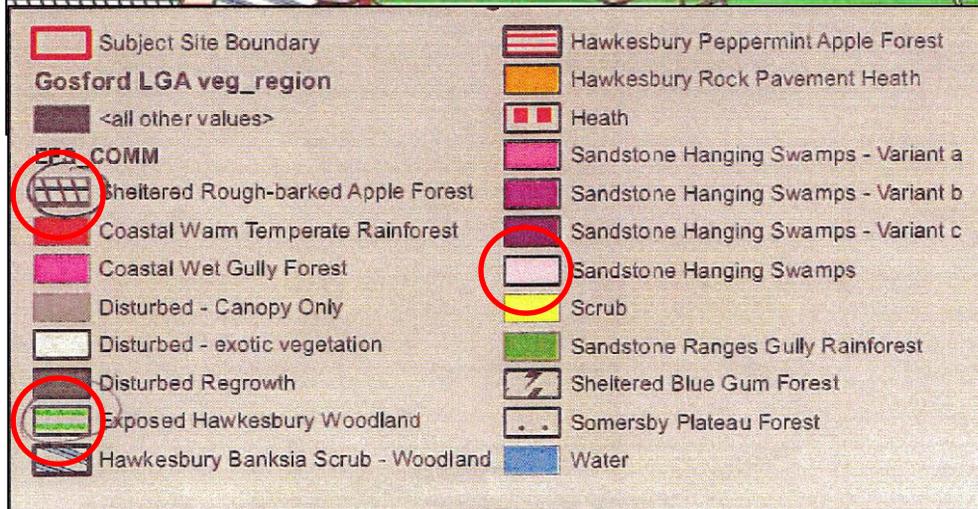
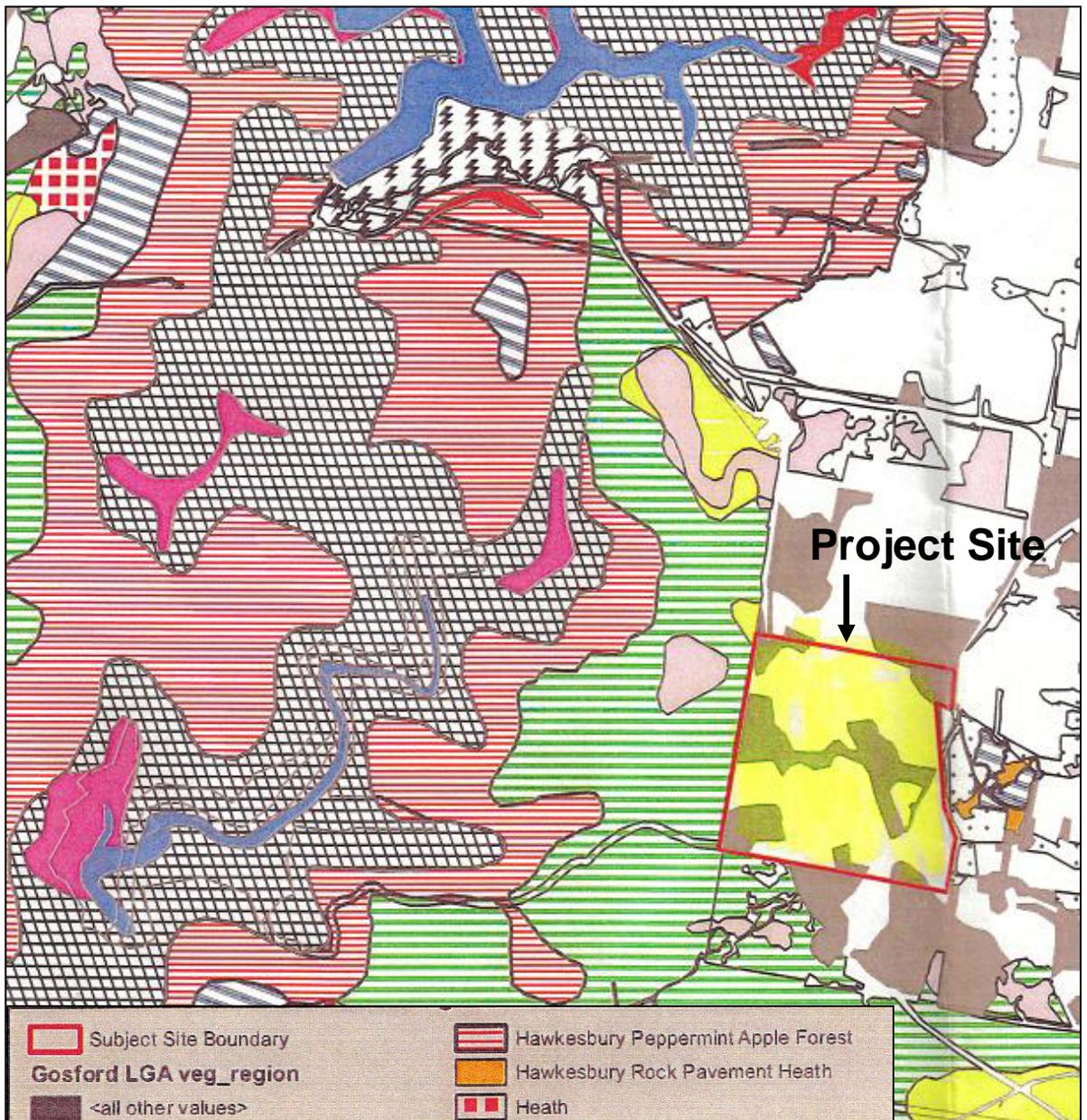
Larry Cook Consulting
 PO Box 8146
 Tumby Umbi NSW 2261
 Ph: 02 4340 0193

Grants Road Sand Quarry Extension

Scale: As shown

Location of Property and Proposed Sand
 Proposed Extraction Area

FIGURE 1



Modified after Connacher Environmental Group, 2011

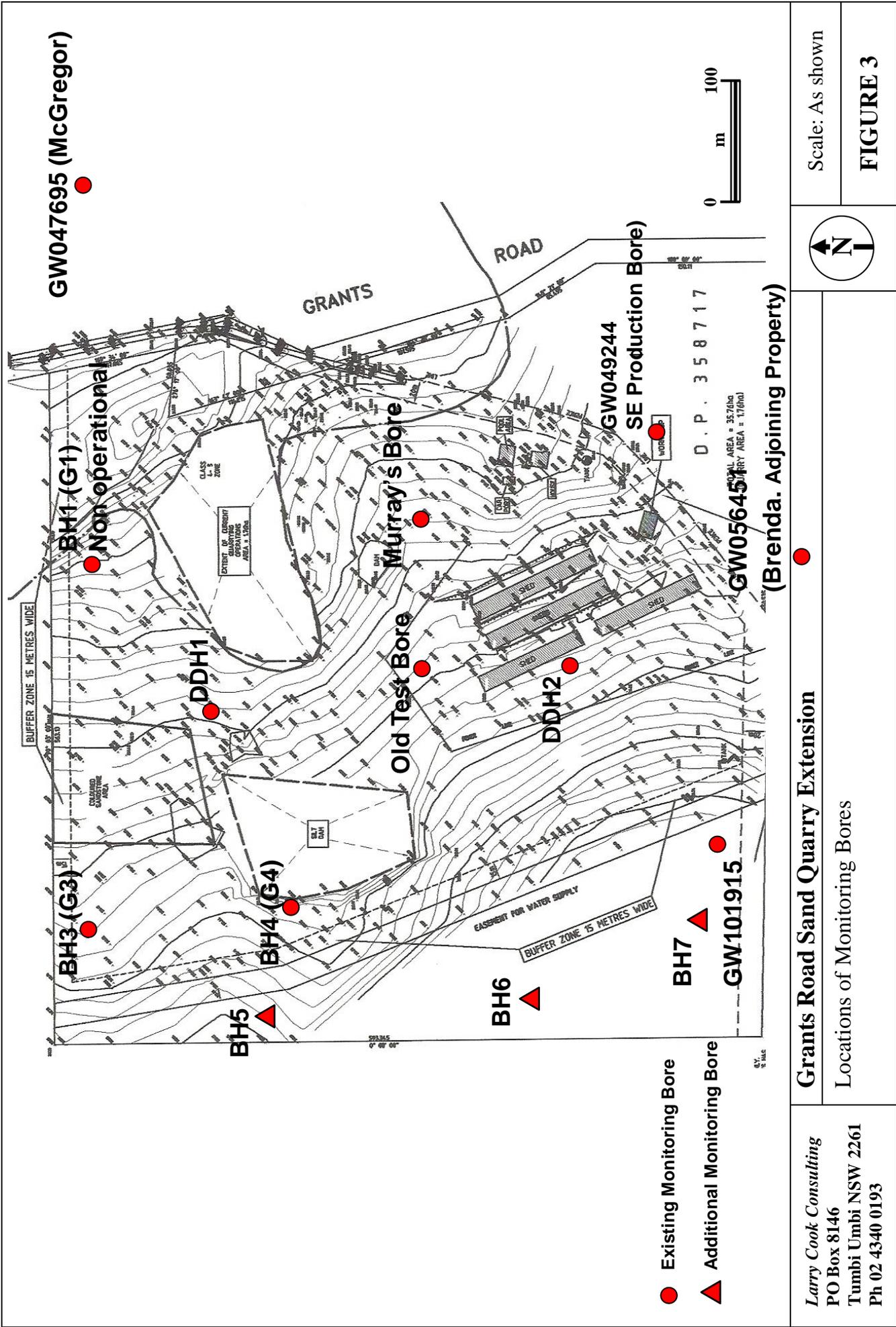
Larry Cook Consulting
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 Tumbi Umbi NSW 2261
 Ph: 02 4340 0193

Grants Road Sand Quarry Extension

Groundwater Dependent Ecosystems

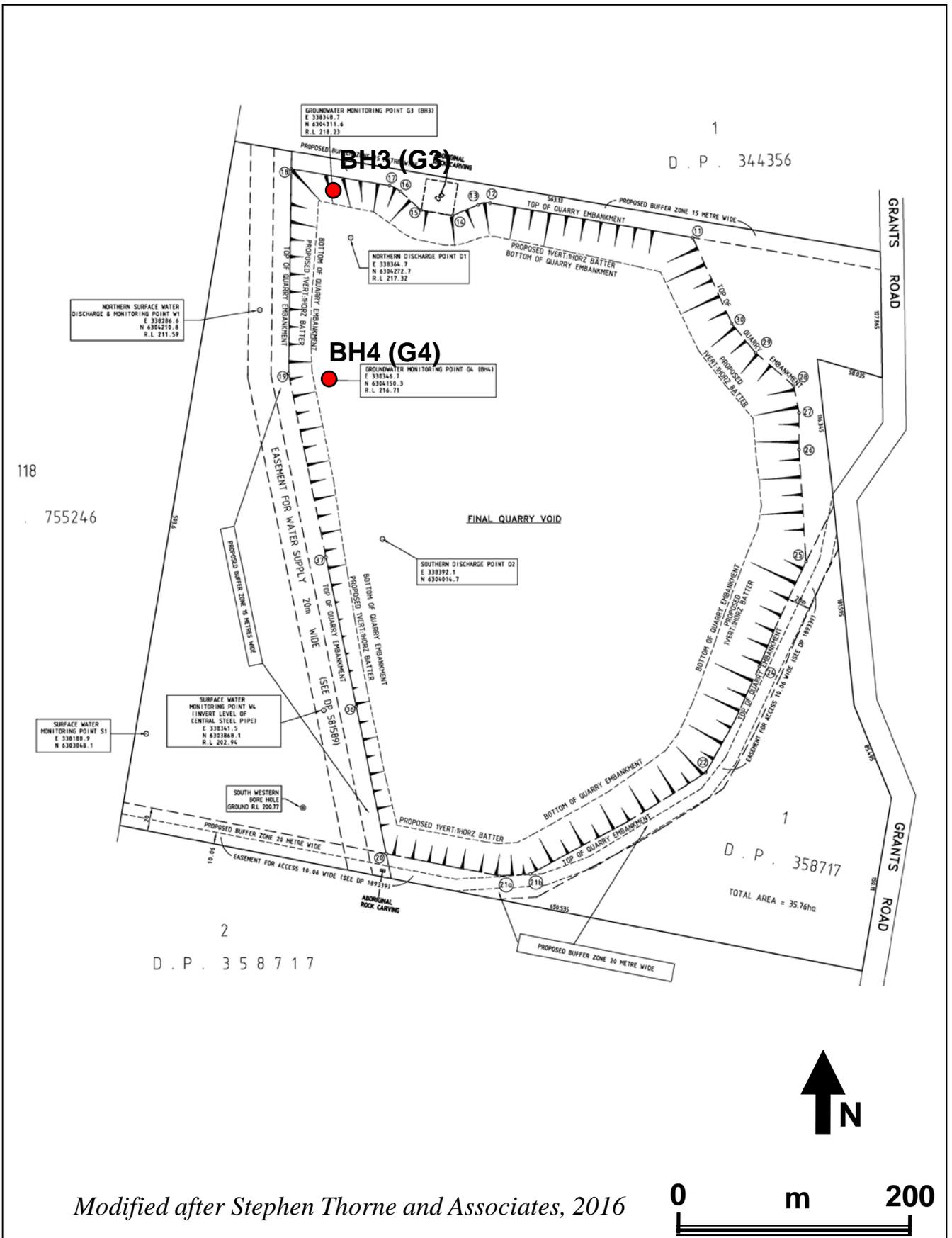
Scale: As shown

FIGURE 2

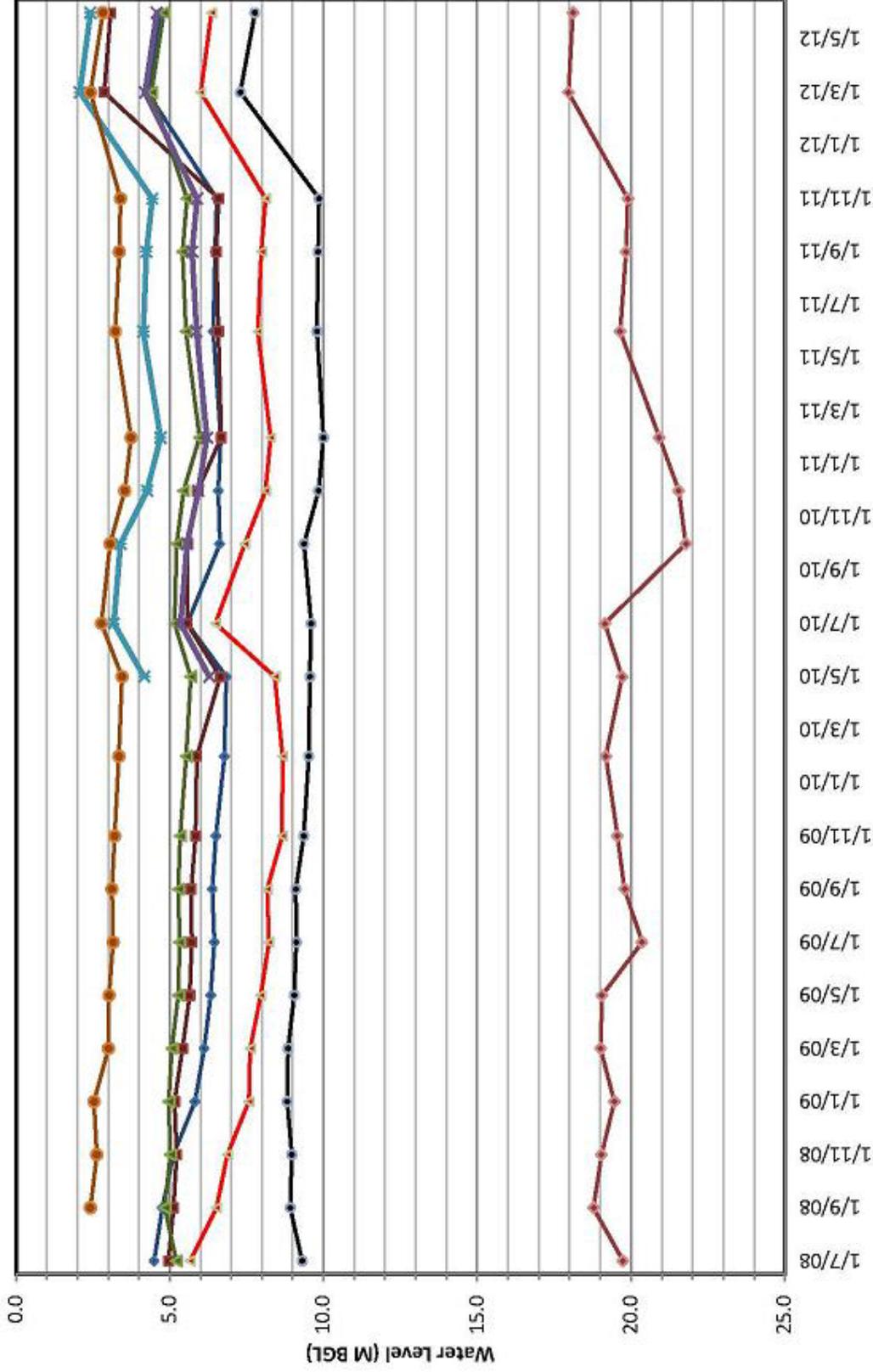


- Existing Monitoring Bore
- ▲ Additional Monitoring Bore

<p><i>Larry Cook Consulting</i> PO Box 8146 Tumbi Umbi NSW 2261 Ph 02 4340 0193</p>	<p>Grants Road Sand Quarry Extension Locations of Monitoring Bores</p> <p style="text-align: right;">(Brenda. Adjoining Property)</p>		<p>Scale: As shown</p> <p style="text-align: center;">FIGURE 3</p>
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Larry Cook Consulting PO Box 8146 Tumby Umbi NSW 2261 Ph: 02 4340 0193	Grants Road Sand Quarry Extension	Scale: As shown
	Locations of Designated Monitoring Bores	FIGURE 4



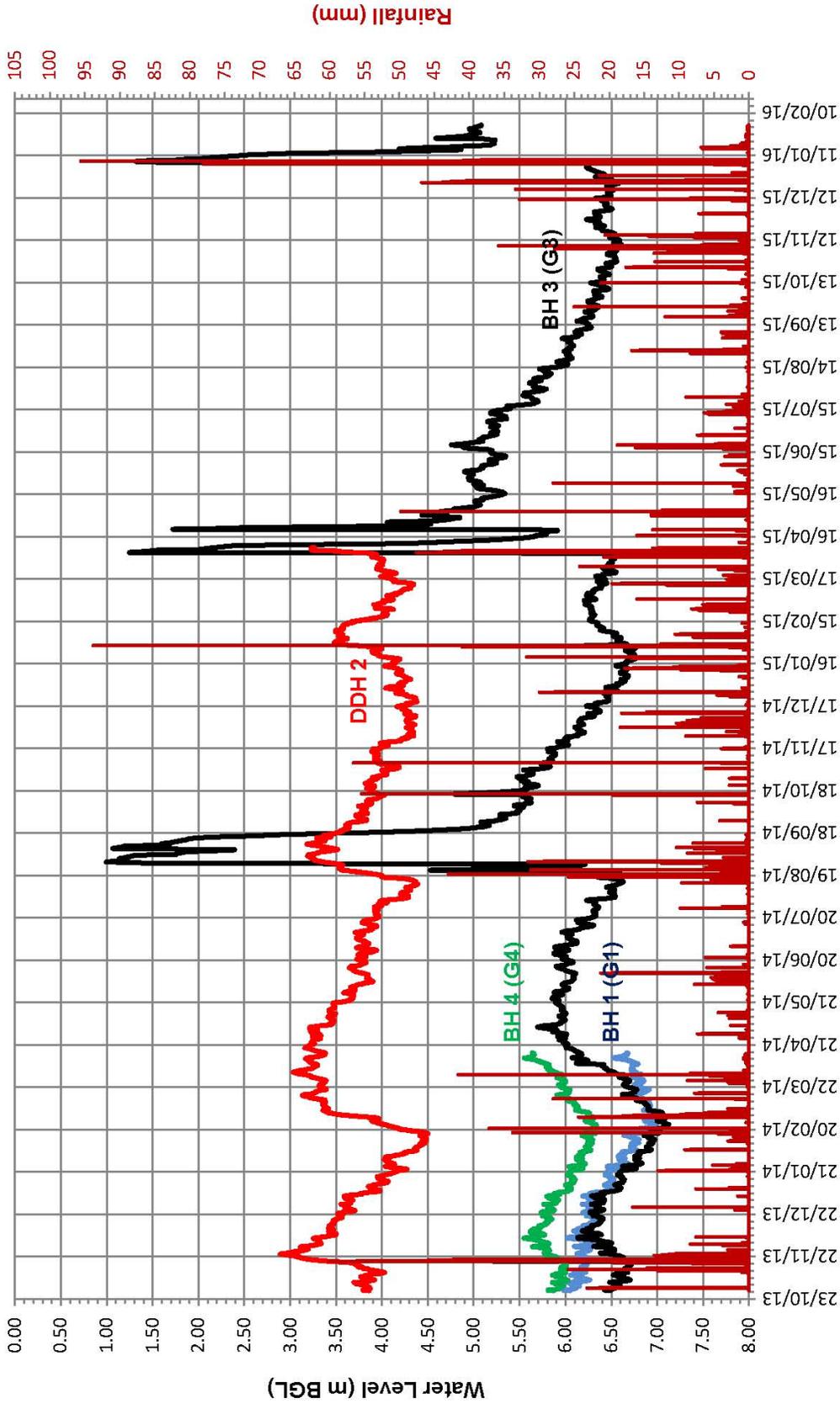
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Grants Road Sand Quarry Extension
 Hydrographs – Monitoring Bores



Scale: As shown

FIGURE 5



Composite Hydrographs

Period 28.10.13 - 1.2.16

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Grants Road Sand Quarry Extension
 Hydrographs – Automated Monitoring Bores

Scale: As shown

FIGURE 6



Appendix 3

Surface Water Management Plan

Larry Cook Consulting Pty Ltd



Larry Cook Consulting Pty Ltd

SURFACE WATER MANAGEMENT PLAN

Grants Road Sand Quarry Extension Project

Lot 1 in DP358717 270 Grants Road Somersby

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REPORT NO. **11017-G WMP**

DATE: **June 2016**

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1.0 INTRODUCTION

1.1 INTRODUCTION AND PROJECT APPROVAL

Larry Cook Consulting Pty Ltd was commissioned by Peter Andrews & Associates Pty Ltd on behalf of G.R. & A.K. Jones (the Proponent) to prepare a Surface Water Management Plan (WMP) for the Grants Road Sand Quarry Extension.

The Grants Road Sand Quarry Extension project was approved by the NSW Minister for Planning on 23rd July 2014 (Application No. 08_0099).

1.2 PURPOSE AND OBJECTIVES

The WMP has been prepared in accordance with Schedule 3 Part 4 (c) (i, ii & iv) of the Project Approval. The purpose and objectives of the WMP are to set out how any potential environmental impacts associated with surface water will be managed as part of the expansion of the existing Grants Road Sand Quarry.

The requirements documented in Schedule 3 Part 4 (c) (i, ii & iv) of the Project Approval are reproduced as follows:

- *details of:*
 - *sources and security of water supply;*
 - *water use and management on site;*
 - *any off-site water transfers;*
 - *reporting procedures; and*
- *measures that would be implemented to minimise clean water use on site;*
- *detailed baseline data on surface water flows and quality in water bodies that could potentially be affected by the project;*
- *a detailed description of the water management system on site, including the:*
 - *clean water diversion system;*
 - *erosion and sediment controls;*
 - *dirty water management system; and*
 - *water storages;*
- *a program to monitor and report on surface water flows and quality in water bodies that could potentially be affected by the project; and NSW Government 9 Department of Planning and Environment*
- *a comparison of monitoring results with modelled predictions;*
- *a protocol for the investigation, notification and mitigation of identified exceedances of the surface water and groundwater impact assessment criteria;*
- *measures to mitigate and/or compensate potentially affected landowners of privately-owned land, including provision of alternative long-term supply of water to the affected landowner that is equivalent to the loss attributed to the project; and*
- *the procedures that would be followed if any unforeseen impacts are detected during the project.*

1.3 TERM OF THIS PLAN

The WMP will be valid for the life of the approved expansion of the Grants Road Sand Quarry. Reviews of this plan can be undertaken annually or when conditions change, or in response to incidents or investigations.

1.4 PROJECT DESCRIPTION

Grants Road Sand Quarry has been in operation since 2002 and has consent from Gosford City Council (Council) for the extraction of sand products down to a depth of 20 m within an approved two hectare footprint. The proponent has approval from the NSW Minister for Planning to expand the existing operations and carry out quarrying of the site in two stages over a 30 year quarry life at the rate of approximately 250,000 tpa.

1.5 SCOPE OF WORK

The tasks that have been undertaken as part of the preparation of this WMP are:

- Review of the conditions of project approval including the requirements for ongoing and additional surface water monitoring, sampling and water quality testing;
- Describe site conditions and regional setting;
- Describe the surface water catchment and water management system;
- Detail the management of surface water;
- Prepare a register of existing and proposed surface water monitoring sites and describe the monitoring program;
- Summarise baseline and follow-up surface water quality data;
- Prescribe the frequency of monitoring and suite of analytes;
- Develop mitigation measures for any affected surface water users; and
- Develop data management and reporting protocols.

1.6 RELEVANT GUIDELINES AND STANDARDS

The legislation, plans, policies and guidelines relevant to this approval are listed in **Table 1**.

Table 1 Relevant Legislation, Plans, Policies and Guidelines
NSW Water Management Act, 2000
ANZECC 2000 Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Agriculture and Resource Management Council of Australia and New Zealand and the Australian and New Zealand Environment and Conservation Council, 2000)
Protection of the Environment Operations Act, 1997

2.0 SITE DETAILS

2.1 LOCATION AND SITE IDENTIFICATION

The existing sand quarry and proposed quarry extension are located on Grants Road in Lot 1 in DP358717 on the Somersby Plateau.

The location of the Project Site is shown in **Figure 1**. The topographic map sheet covering the Property is the 1:25,000-scale Gosford topographic map sheet (9131-2S.) The approximate MGA coordinates of the centre of the proposed Project Site are Easting 338500 m and Northing 6304250 m.

The key features required to identify the Site are summarised in **Table 2**.

Table 2 Site Identification Details	
Site	Description
Site Name	Grants Road Sands
Site Owner	G.R. & A.K. Jones
Address	270 Grants Road Somersby NSW 2250
Title Plan	Lot 1 in DP358717
LGA	Gosford City Council

2.2 REGIONAL SETTING AND SURROUNDING LAND USE

2.2.1 Geology

The Project Site is underlain by approximately 160 m of relatively flat-lying Triassic Hawkesbury Sandstone which overlies Triassic sedimentary rocks belonging to the Terrigal Formation, the uppermost part of the Narrabeen Group.

2.2.2 Hydrogeology

Dual porosity water-bearing zones (aquifers) are commonly developed within the Hawkesbury Sandstone in the Mangrove Mountain area at different elevations down to its base. Aquifers are found in:

- Sub-horizontal relatively porous and stacked layers (beds) of sheeted sandstone with increased primary permeability which provides the main aquifer storage; and
- Pervasive sub-vertical, semi-continuous to continuous, rock defects such as fractures and joints with secondary 'enhanced' permeabilities. These aquifers constitute a major component of the aquifers transmissivity but only a minor component of the aquifers storage.

In addition, several high priority Groundwater Dependent Ecosystems (GDEs) have been identified by state government mapping in the Water Sharing Plan (WSP) for the Kulnura Mangrove Mountain Groundwater Sources.

2.2.3 Surrounding Land Use

The Site is surrounded by rural properties to the north, east and south and the Brisbane Water National Park to the west.

3.0 SITE RESPONSIBILITY

The details of the person responsible for the site are summarised in **Table 3**.

Table 3 Site Responsibility Details	
Site	Description
Site Owner	G.R. & A.K. Jones
Name of Person Responsible for the Site and Position	Steven Jones (Manager)
Postal Address of Person Responsible for the Site	270 Grants Road Somersby NSW 2250
24 hour Contact Telephone Number for Person Responsible for the Site	0418 116 861

4.0 CLIMATE

The regional climate is described as temperate. Average monthly rainfall, temperature and evaporation data for Station 061351 Waratah Road Peats Ridge is provided in **Table 4**. Rainfall is summer dominated and averages approximately 1,250 mm per annum. John Pola Environmental Pty Ltd (herein referred to as JPE) report average daily evaporative losses typically ranging from 4.8 mm/day in December to 1.6 mm/day in June (JPE, 2012).

Table 4
Summary Climate Statistics – Peats Ridge (Station 061351)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years	
Temperature															
Mean maximum temperature (°C)	26.9	26.5	24.5	22.2	19.0	16.5	15.9	17.6	20.4	22.9	24.0	26.0	21.9	26	1981 2011
Mean minimum temperature (°C)	16.1	16.2	14.5	12.0	9.6	7.1	6.0	6.5	8.5	10.8	12.7	14.8	11.2	25	1981 2011
Rainfall															
Mean rainfall (mm)	116.4	162.3	137.2	125.3	97.9	98.6	64.6	79.8	73.1	93.3	104.8	95.3	1245.9	28	1981 2011
Decile 5 (median) rainfall (mm)	103.6	129.4	115.6	107.0	85.2	68.6	46.0	44.4	57.2	58.6	97.0	81.2	1226.6	28	1981 2011
Mean number of days of rain ≥ 1 mm	10.6	10.8	11.1	8.7	9.2	7.5	7.0	6.4	6.5	8.0	10.0	9.5	105.3	28	1981 2011
Evaporation															
Mean Evaporation (mm)	146	123	112	81	56	48	56	78	109	130	141	152	1232	28	1981 2011

5.0 SURFACE WATER CATCHMENT

The Project Site is located to the south of the Mooney Mooney Dam which is used as a source of drinking water by Gosford City Council. The catchment context for the existing and proposed Grants Road Sand Quarry is shown in **Figure 2** (after JPE, 2012 and Umwelt, 2013). This figure shows that the existing and proposed extended quarry footprint is downstream of the Mooney Mooney Dam drinking water catchment, and that runoff from the Project Site drains through ephemeral waterways into the Mooney Mooney Creek system, downstream of the Mooney Mooney Dam. The Project Site is located within the catchment of the Lower Mooney Dam which is not used as a drinking water catchment.

Runoff from the Project Site flows into two ephemeral waterways that convey water to Mooney Mooney Creek. The north-west waterway has a catchment of approximately 140 hectares, of which approximately 24 hectares of the upstream catchment near the quarry has been mostly cleared and is used for grazing. The south-west waterway has a catchment of approximately 95 hectares. Approximately 16 hectares of the upstream catchment for the south-west waterway has been cleared and is predominantly used for grazing and chicken growing, and also includes private residences.

It is understood that there are no water users downstream of the location where runoff from the Project Site enters the Mooney Mooney Creek system.

6.0 WATER MANAGEMENT SYSTEM

6.1 INTRODUCTION

The Project Site is located within the catchment of Mooney Mooney Creek, nearby to the Brisbane Waters National Park. Water management practices have been implemented at the Quarry to mitigate potential impacts on Mooney Mooney Creek, the National Park and on other surrounding surface water and groundwater resources.

6.2 OBJECTIVES

The objectives of the surface water management system are to:

- Minimise erosion and sedimentation of undisturbed areas, watercourses and water bodies;
- Maximise returns / natural flow of clean waters (undisturbed by the quarry operation) to the environment;
- Optimise the system for water security focussing upon surface / rainfall runoff;
- Minimise dependence on other water sources such as groundwater bores and creeks as permitted under existing Water Access Licences;
- Minimise the loss of topsoil through pre-stripping and reuse in the construction of bunding to control noise, visual amenity, surface water and public safety; and
- Protect surface water and groundwater quality and comply with statutory requirements and conditions.

6.3 WATER USE

Water is mainly required for sand washing and dust suppression.

JPE (2012) report that approximately 44 kL/day will be required for sand washing (sand processing) and about 14 kL/day used for dust suppression (JPE, 2012). This water will be solely sourced from the decant pond.

6.4 WATER MANAGEMENT INFRASTRUCTURE

The management of surface water is documented by JPE (2012). The management plan incorporates the continuation of the existing 'in pit' closed system approach for:

- Containment of in-pit flows;
- Sand washing;
- Bunding;
- Diversion drains;
- Silt and tailings dams;
- Decant / return water pond;
- Storage of 'in pit' rainfall runoff; and
- Pumps and transfer lines (wash plant, wash-down, dust suppression).

The locations of water management infrastructure are shown on a recent Google Earth image in **Figure 3**.

Additional 'out of pit' infrastructure is proposed comprising:

- A Pollution Control Dam to capture polluted runoff;
- Pump and transfer pipeline line into the quarry for operational water security;
- Polishing Pond; and
- Bunding and surface water diversion drains.

Water accumulating in the quarry excavation is pumped into a sediment dam and then taken from the decant pond for use in the washing process and dust suppression. Fines extracted in the washing process are pumped to a series of primary silt ponds / tailings dams which cascade to a final tailings dam. Sediment free water is recovered from the final tailings dam and decant pond and re-used in the wash plant.

Under 'normal' operating conditions all supply water comes from existing 'in pit' water management infrastructure. Environment Protection Licence (EPL) and development consent conditions generally prevent the release of 'process' waters 'offsite' due to degraded or reduce water quality. All disturbed area / quarry pit runoff and process water is retained onsite and no contaminated runoff is released from the site.

The decant or return water pond (decant pond) is sized such that it can contain a 1:100ARI24hr storm event. Only under periods of prolonged, heavy rainfall it is possible that discharge could occur, however, as quarrying progresses and pit deepens, discharge will be back into the quarry pit. This system ensures that no contaminated runoff can leave site without adequate retention or treatment if required. Environmental protection is currently achieved through 'in pit' retention design to accommodate run-off from a 1:10ARI1hr storm followed by a 1:100ARI1hr storm all within a 24 hour period.

Diversion drains located on the eastern perimeters of the site divert any clean runoff water around the northern and southern sides of the operational areas and offsite towards to the West. The same system for 'in pit' water management is proposed to be carried forward into the expanded operation.

Offsite drainage / flow paths down the western boundary of the property were changed when council installed a pipeline trench and bund many years ago. The pipeline easement with a 20 metre buffer, form the western most extent of the proposed quarry extraction limit. The quarry development will not alter the existing surface water flow path configuration leaving the property boundary.

New 'clean' water catchment diversion structures are required down the north, east and south of the lease boundary and directly off site. Drop structures may be required to control the water velocity at key locations to prevent erosion and minimise sedimentation downstream.

Surface water management structures are tailored to site requirements involving a combination techniques depending whether the area is disturbed, undisturbed, roads, tracks and hardstands, regular vehicular movements, vehicle type etc. Specific and suitable structures for the control of surface water may include;

- Pipes and culverts.
- Drains and channels.
- Rock lining, geotextiles, rip rap and gabion baskets.
- Erosion control including filter fences and check dams etc.
- Curtains and aprons.

North Catchment

Clean surface water diverted across the northern section of the site will not be impacted by the quarry operation. As such, this water can be directed offsite to maximise 'normal' environmental flows using the existing offsite drainage paths on the western property boundary (**Figure 2**) or directed into the Pollution Control Dam. This catchment including zones A to C shown in **Figure 4** is entirely consumed by mining during the first 7 years of operation. The only surface flow to occur from the northern catchment will originate from zones B and C until they are progressively pre-stripped and mined.

South Catchment

The south catchment surface water runoff is broken up into 2 classes, 'contaminated' and 'clean'. Runoff originating from zones F and G on which residences, chicken growing operations and sheds are located is classed 'contaminated' and characterised by elevated nitrogen and phosphorus levels. This runoff is to be intercepted by drains and channels etc. and directed into the Pollution Control Dam and Polishing Ponds. Drainage structures between unmined areas of zones F and G and the rest of the quarry are required to direct runoff and prevent pit flooding. Drain configurations will be re-aligned as pre-stripping and mining progress however the destination of the surface runoff remains unchanged, as shown in **Figure 2**.

Drainage within zones F and G only need to be clay lined earthen drains, however, where runoff moves down past the southern pit flank past Zone E and the boundary line, the topography gets relatively steep and narrow. Contaminated runoff reporting to the Pollution Control Dam will may require velocity control as it will have a 10% grade. Additionally, vehicular access will be maintained. Drainage structures alongside Zone E will consist of a concrete drain or similar structure with large rocks semi-regularly embedded for velocity control and is broad and strong enough to facilitate vehicular crossing. Finally, this runoff will flow directly into the Pollution Control Dam and as such, no additional drop structures will be required.

All other runoff from the remainder of the South Catchment will not be impacted by quarrying is classed 'clean'. This water will report directly offsite via existing 'natural' flow paths to maximise 'normal' environmental flows along the western property boundary.

Contaminated water diversion drain/s are to be installed in Year 1 between zones E and F to capture surface water runoff mostly derived from zones F and G. Surface water originating from this sub catchment contains nutrients from existing chicken farming infrastructure, the location of which is shown in **Figure 2**. An 'out of pit' Pollution Control Dam (PC Dam) with a capacity of 10 Megalitres (ML) will be constructed in the south-western corner of the property to capture this surface runoff from the chicken farming operations, sheds and residences (**Figure 4**).

The PC Dam will provide environmental protection of Brisbane Water National Park from waters containing elevated nutrient levels. The PC Dam will provide additional 'water security' and any makeup required by the sand washing plant in addition to backup supply for asset protection from bushfires.

The PC Dam will be constructed to maximise sediment settling, retaining a deep sump to allow pumping back to the wash plant. A spillway in the PC Dam will direct any overflow to a small shallow 'polishing pond' containing suitable wetland species that will remove residual nitrogen. The location of the Polishing Pond/Wetland is shown in **Figure 4**. Passive treatment by wetland species has been shown to improve water quality to a standard that allows water to report offsite without any further treatment with the exception of velocity control if required.

Umwelt provided a review of the surface water management plan in 2013 (Umwelt, 2013). Umwelt iterate that the maximum impact to surface water due to the proposed quarry extension will occur during Stage 2 when the quarry reaches its maximum footprint of approximately 20 hectares. At this stage, predicted groundwater inflows to the pit will exceed maximum quarry production water demands and in-pit water losses due to infiltration and evaporation. Excess groundwater and rainfall collected in the quarry will be pumped into the Decant Pond, located within the quarry.

During extraction at the maximum quarry extent, water will be required to be pumped out of the quarry from the Decant Pond into the Control Pollution Dam. Water in the Control Pollution Dam will be stored until water quality criteria is satisfied, upon which water in the Control Pollution Dam will be released to the Polishing Pond which then drains to the south-west waterway. Umwelt indicate that to satisfy discharge quality criteria, based on 6 to 7 days settlement time, up to approximately 9 ML/week can be pumped from the Decant Ponds to the Pollution Control Dam where it will settle prior to any discharge through the Polishing Pond into the south-west waterway.

6.5 SOURCES OF WATER SECURITY

The existing quarry operation operates under a closed system approach for water management (JPE, 2012). The approved quarry expansion will continue to operate under a similar closed water management system with silt ponds, tailing ponds and a decant water pond remaining within the quarry pit catchment. A new 'out of pit' dam (pollution control dam) is proposed to provide water supply security and nutrient control as its core functions in the south-west corner of Lot 1 (JPE, 2012).

JPE report that for 90% of the time there is no extraction required from licenced sources. Abstraction events will, according to JPE, be rare and when required it is restricted to the first 7 years of sand extraction. Any make-up water will be sourced from appropriately licensed groundwater bores on Lot 1.

The computer surface water modelling undertaken by JPE (2012) results in an optimal surface water management configuration that includes a Pollution Control Dam. The model indicates that the sand quarry is never without sufficient water to sustain day to day operational demand.

6.6 WATER BALANCE

6.6.1 Introduction and Water Budget Elements

A total site water balance model is detailed in Section 7 (JP Environmental, 2012). Usage requirements and water budget elements are listed in tables 3 and 8, and the sources of water are clearly identified. The SWIA clearly documents the strategy for recycling and transfer of water using the Decant Pond and Pollution Control Dam which, by their design minimises the use of clean water.

The surface water modelling document in the SWIA was prepared in 2011 and 2012 and utilised the then up-to-date climate data (design rainfall). Water usage volumes including calculated transfers between the Decant Pond and Pollution Control Dam are also tabled (tables 3 and 8) (JP Environmental, 2012).

The water balance model was developed by JP Environmental such that it incorporated all reasonable contributions and losses from the quarry on a day to day basis including the following points;

- Contributions to the site water inventory arising from incidental rainfall.
- Contributions based upon water access / harvest licences including bores
- Evaporation losses per day
- Surface wetting by rain
- Seepage losses through dams and silt ponds
- Groundwater pit inflow
- Surface water runoff
- Losses through dust suppression
- Losses through product moisture retention approximately

The elements of the water budget developed by JP Environmental are summarised in **Table 5**.

Table 5 Water Budget Elements	
Parameter	Detail
Rainfall	1251.6 mm/yr
Water Access / Harvest	15.66 ML/yr
Evaporation	3.3 mm/day
Seepage Losses	1.0 to 2.5 mm/day
Groundwater Inflows	34 m ³ /day
Surface water Runoff	18 to 58 m ³ /day
Dust Suppression	10 kL/day
Product Moisture Retention	6 to 10% (8% average.)

The 'mine plan' shown in **Figure 4** proposes to extract 250,000 tonnes of product per year for 30 years as described by L.Cook et al (2011) in the resources assessment. Based upon the area of each zone and the estimated resource contained therein, it is estimated that the stage duration is as follows in **Table 6**.

Table 6 Two Stage Mine Plan		
Mine Plan Area	(ha)	Duration
Stage 1	10.46	20 Years
Stage 2	9.72	10 Years
Total	20.18	30 Years

The OPSIM surface water model has been built on each of the original subsections or 'Zones' A through G for enhanced model resolution with the modelled time within each zone **Table 7**.

Table 7 Modelled Quarry Sub-Sections		
Subsection	Area (ha)	Duration
Zone A	4.2	Existing
Zone A + B	4.7	1 Year
Zone C part E	5.9	6 Years
Zone D part E	3.1	5 Years
Zone F	4.2	9 Years
Zone G	2.2	9 Years
Total	20.1	30 Years

6.6.2 Modelled Parameters – Staged Supply

Bunding

JP Environmental recommended that bunding be developed progressively surrounding the quarry as the highwall will exceed 30 metres in some areas.

Diversion Drains

As documented in Section 6.4, new ‘clean’ water catchment diversion bunds are required down the north, east and south of the lease boundary and directly off site. Drop structures will be required to control the water velocity at key locations to prevent erosion and minimise sedimentation downstream.

Clean surface water diverted across the northern section of the site will not be impacted by the quarry operation. As such, this water is to be directed off site to maximise ‘normal’ environmental flows using the existing offsite drainage paths on the western property boundary.

Within the quarry perimeter boundary diversions drains are required between zones E and F to divert water with elevated nutrient levels into the pollution control dam. Diversion drains between zone C and the rest of the quarry are required to prevent pit flooding. This drain configuration will be re-aligned as mining progresses down through zone C however the destination of the surface runoff remains unchanged.

Pollution Control Dam

JP Environmental recommended that contaminated water diversion drain/s be installed in year 1 between zones E and F to capture surface water runoff mostly derived from zones F and G. Surface water originating from this sub catchment contains nutrients from existing chicken farming infrastructure . An ‘out of pit’ pollution control dam (PC Dam) with a capacity of 10 Megalitres (ML) is required in the south-western corner of the property to capture this surface runoff from the chicken farming operations, sheds and residences (**Figure 4**).

The PC Dam will provide environmental protection of Brisbane Water National Park from waters containing potentially elevated nutrient levels. The PC Dam will provide additional ‘water security’ and any makeup required by the wash plant in addition to backup supply for asset protection from bushfires.

The PC Dam would ideally be constructed to maximise sediment settling, retaining a deep sump to allow pumping back to the wash plant. A spillway in the PC Dam will direct any overflow to a small shallow ‘polishing pond’ containing suitable wetland species that will remove residual nitrogen.

In order to maintain sufficient free board / maximum operating level, an outlet structure is required that automatically commences operation when dam levels exceed 5 ML. The outlet should operate at about 1 l/s (86.4 kL/day) to transfer water to the polishing ponds to sustain the wetland plants during dry periods with no rain.

Below 5 ML the outlet would cease transfer water out of the PC Dam. An ideal outlet would be a “floating suction”. Under ‘normal’ climatic conditions, the PC Dam should not overflow and contains sufficient capacity to capture a 1:20 ARI storm event where the runoff has been calculated to be 10 ML. The proposed location for the PC Dam and polishing pond is at one of the lower points on the south - westward draining property.

Pumps and Pipelines

The PC Dam will require a pump to be installed during the first year of operation with a pipeline to transfer water to the decant pond which in turn feeds the wash plant and dust suppression activities. The transfer rate has been optimised and modelled at an average rate of 10 l/s (864 KL/day). The modelled pumps and transfer rates are summarised in **Table 8**.

Table 8 Modelled Pumps and Transfer Rates			
Pump Location	Model - Average Daily Demand	Unit	Notes
Wash Plant	44	kL/day	Solely demanded from the Decant Pond
Decant Pond	1500	kL/day	Transfer to PC Dam. Asset protection from pit inundation or bushfire
Pollution Control Dam	864	kL/day	Transfer to Decant Pond
Bores	28	kL/day	Pump direct to Decant Pond. Allows for sustained pumping within WAL constraints of 14 ML/yr

Rainfall

The Australian Government Bureau of Meteorology (BOM) records for the Grants Road area only goes back approximately 30 years, which is approximately equivalent to the life of the proposed quarry.

Long term daily rainfall data (data drill) was obtained from the SILO web page for use in the Grants Road surface water model (OPSIM). The SILO website is operated by the hosted by the Queensland Climate Change Centre of Excellence (QCCCE). SILO is a daily meteorological data set which provides historical daily weather records from 1889 to the present. The data drill is a subset of this data which provides climatic data at any one point in Australia on an approximate 5km by 5km grid, interpolated from analysis of daily rainfall data from the Australia wide network of 4,700 Bureau of Meteorology weather stations.

Catchment Yield

Catchment yield within the surface water model (OPSIM) was estimated using the Australian Water Balance Yield Model (AWBM). AWBM parameters for 221 catchments across Australia were developed by Boughton et al (1996) to define relationships between soil storage characteristics, runoff and rainfall at each analogue catchment site. Grants Road lies within one of these catchments.

6.6.3 Water Budget

A water budget from the “Grants Road Sands Revised Environmental Plan of Management” indicated a current annual water make-up requirement of approximately 18 ML. Approximately 50% of this make-up requirement for normal operations is met mainly from site runoff, which is consistent with estimates made. Harvestable rights for Lot 1 DP 358717 were estimated to be 0.099 ML/ha. Using current undisturbed areas, the maximum current dam size for harvesting water should be no more than 3.6ML.

Average annual runoff is estimated at about 0.99 ML/ha. Based on the current disturbed area, within which all water must be contained, on average, about 6.7 ML per annum can be harvested from the quarrying area for processing and dust suppression. Future water make-up requirements are estimated at about 39 ML per annum.

Approaching the end of the quarry life, in a 10% dry year (Decile 9), the quarry may need to source up to 29 ML from licences, conversely, in a 10% wet year (Decile 1), up to 10 ML of excess water may need to be stored until it can be reused or otherwise disposed of. There are two licensed groundwater sources on the premises, totalling 18ML per annum. via works approval 20WA100746. Up to 14 ML of groundwater from these two bores can be used to meet quarry make-up requirements if required, however this is considered good quality water and is to be sourced from the PC Dam in the first instance prior to utilising existing water access licences.

- The current surface water licence (20SL056525 35 ML per annum in nearby Floods Creek),
- Runoff water collected on site – ranging from 6.7 ML to 21.4 ML in an average year over the varying phases of the development, and,
- Up to 14 ML of groundwater from the licensed water bores on the site.

6.6.4 Model Results

The key questions asked of the model are summarised as follows;

- Will there be sufficient water to sustain day to day operations,
- How frequent will deficits / surplus occur?,
- What infrastructure is required to address the deficit / surplus?

Decant Pond

This dam has a capacity of 43ML and is modeled on the existing Decant Pond and pump with the addition of a transfer pipeline to the Pollution Control Dam.

The model assumes pit dewatering to the tailings and decant pond. Upon expansion, this dam will be positioned above the pit floor enabling spill into the pit in an extreme rainfall event. The transfer capacity of the pump will be exceeded in a 1:100 ARI storm and the dam is designed to spill to the quarry.

Model results are summarised as follows:

- In 'normal' climatic conditions, (50th percentile) the Decant Pond contains 26 ML of water.
- Under wetter conditions (90th percentile) the dam contains 28 ML and shows transfer to the Pollution Control Dam.
- Under dryer conditions (10th percentile) the dam contains 18 ML of water and shows demand events from the Pollution Control Dam.

The model concluded that the primary operational water supply, the Decant Pond, will never run out of water.

Pollution Control Dam

This dam is to be constructed upon approval for the quarry expansion and has a capacity of 10 ML. Water is pumped to the Decant Pond as required. Above 10 ML this dam spills to a small wetland to 'polish' the water of any remaining sediment and nutrients prior to flowing offsite to the environment. The dam configuration has been optimised for size and pump capacity to ensure operational water security, prevention of pollution and asset protection from bushfire.

Model results are summarised as follows:

- In 'normal' climatic conditions, (50th percentile) the Pollution Control Dam contains less than 4.06 ML of water.
- Under wetter conditions (90th percentile) the dam contains less than 9.57 ML.
- Under dryer conditions (10th percent of the time) the dam contains less than 1 ML.

The model concluded that the Pollution Control Dam is rarely without water optimising the balance between water security, environmental and asset protection and minimising demand on bores and Water Access Licences.

Decant Demand from the Pollution Control Dam

The Pollution Control Dam is modelled to pump transfer water to the Decant Pond as required. The modelled pump capacity has been optimised as by balancing cost with anticipated work load including asset protection from bushfires. The modelled transfer from the Pollution Control Dam to the Decant Pond is 17 Lt/s (1500 kL/d)

Model results are summarised as follows:

- Pumping is necessary less than 10% of the time.
- Under dry climatic conditions, pumping volumes are less than 158.4 kL/day.
- Only the 5th & 10th percentiles show consistent annual usage of the transfer capability.

The model concluded that the pump rate is never running at maximum capacity for extended durations. Regular transfers are required less than 10% of the time. The pump will have sufficient standby capacity for asset protection from bushfire without having to draw from the operational water supply in the Decant Pond.

Bore Pumping

On-site bores are licensed to supply 14 ML per year for industrial use. The Decant Pond will demand backup water from bores only as a last resort when the Pollution Control Dam has insufficient supply to sustain quarry operations. The model allows for a maximum daily bore extraction of 28.5 kL/day (10.4 ML / year).

Model results are summarised as follows:

- Pumping is necessary less than 10% of the time.
- No bore pumping is necessary after 2019 which correlates with the progression of extraction from zone C and into zone D. At this point in the mine life year 7, the catchment area for the pit and any incidental rainfall increases significantly.

The model concluded that for 90% of the time there is no extraction required from licensed groundwater bores. Groundwater extraction events will be rare and when required it is restricted to the first 7 years of quarrying.

Quarry Flood

The Decant Pond is modeled to spill to the quarry pit which may occur in extreme prolonged rainfall events. Transfer of excess Pond water to the Pollution Control Dam commences when the level reach 29 ML to maintain a safety buffer well before maximum capacity, for asset protection from flooding. Dewatering of the quarry eventually returns spilled water via the series of silt ponds or directly in to the Decant Pond. Spill to the quarry pit occurs when volume reaches 43 ML

Model results are summarised as follows:

- 98% of the time, the Decant Pond will not spill to the pit.
- 1% of the time, spill of 3.4 ML of water may collect in the pit may occur over the mine life.
- The risk of pit inundation increases as the pit catchment area increases.

The model concluded that for 98% of the time there will not be any significant spill of Decant Pond waters into the pit.

Pollution Control Dam Spill to Polishing Ponds

The Pollution Control Dam is modeled to spill to a polishing pond / wetland before flowing offsite.

- Spill from the Pollution Control Dam occurs when volume reaches 10 ML (RL 2.8).
- Floating siphon at 1 Lt/s (86.4 KL/day) operates from full capacity down to 5 ML (RL 1.0)

Model results are summarised as follows:

- 90% of the time the Pollution Control Dam will not spill.
- 10% of the time spill of up to 3,406 kL/d on average may occur over the life of the quarry.

The model concluded that for 90% of the time there will not to be any significant spill from the Pollution Control Dam. The dam size, spillway design and supply / transfer configuration has been optimised for ensure operational water security, provide environmental protection, provide asset protection whilst minimising demand on water access licenses (WALs). These factors in conjunction with size constraints for the proposed dam location and cost of construction has resulted in current design capacity of 10 ML.

7.0 SURFACE WATER MANAGEMENT

7.1 POTENTIAL CONTAMINANTS AND IMPACTS

It is not expected that the expansion of the existing quarry will have any significant impact on downstream water quality. That is, minimal impacts on the Mooney Mooney Creek are expected as a consequence of the quarry expansion.

Umwelt (2014) and JPE (2012) consider that the existing water quality in the northern catchment will not be impacted by the quarry expansion as all clean runoff upstream of the quarry will be diverted around the quarry to the north-west waterway. Umwelt and JPE note that the same process will be followed for the southern catchment where all runoff will be diverted around the quarry to the Pollution Control Pond and :Polishing Pond prior to release to the south-west waterway and ultimately to the Mooney Mooney Creek system.

During the life of the quarry, surface water within the Project Site and in the Pollution Control Pond will be monitored and tested for quality.

The main contaminants of concern are acidity, salinity and suspended solids associated with the sand extraction operations and nutrients from the existing chicken growing operations. The potential contaminants are:

- pH
- Electrical Conductivity (EC)
- Total Suspended Solids (TSS)
- Total Nitrogen (TN)
- Total Phosphorus (TP).

Water quality from the Project Site will improve as runoff from the chicken growing operations is effectively treated in the 'out-of-pit' Pollution Control Dam and Polishing Pond.

During Stage 2, when the quarry extends to the south to its maximum extent, the chicken growing operation will be decommissioned and sheds removed from Lot 1. This will potentially result in an improvement in nutrient levels (TN and TP) in downstream water quality.

7.2 DISCHARGE

The risk of any impacts from the quarry expansion to the Mooney Mooney Creek system will be effectively mitigated by directing any runoff waters from the sand extraction operations to the 'out-of-pit' Pollution Control Dam and Polishing Pond.

Umwelt (2014) and JPE (2012) document that during the sand extraction operations at the maximum quarry extent, water will be required to be pumped out of the quarry from the Decant Pond into the 'out-of-pit' Pollution Control Dam on the south-western corner of Lot 1. Pumped water will be stored in the Pollution Control Dam until water quality criteria is satisfied. When this occurs, the retained water in the Pollution Control Dam will be released to the Polishing Dam which then drains to the south-west waterway.

Umwelt (2014) and JPE (2012) further document that previous investigations have found that Total Suspended Solids (TSS) in runoff waters take approximately 6 to 7 days to settle. In order to satisfy discharge water quality criteria, typically up to 9 ML/week can be pumped from the Decant Dam into the Pollution Control Dam. Suitable settling will occur prior to any discharge through the Polishing Pond to the south-west waterway.

8.0 MONITORING PROGRAM

8.1 MONITORING NETWORK

8.1.1 Existing Monitoring Sites

A network of three existing surface water monitoring sites was established on the Site. These are identified as W1, W4 and S1. These monitoring sites are referred to as points 1, 2 and 3 by the NSW EPA. Umwelt (2013) and JPE (2012) proposed that following construction of the Pollution Control Dam and Polishing Pond, the quality of the treated quarry discharge released to the south-west waterway is monitored at Monitoring Site S1. However, it is noted that Monitoring Site S1 has been included in the current monitoring network.

The locations of the monitoring bores are shown in **Figure 5**. A site register of surface monitoring bores is provided in **Table 9**.

Table 9			
Register of Surface Water Monitoring Sites			
Monitoring Site	NSW EPA Reference	Location	Monitoring
W1	Point 1	Process water dam	Water quality
W4	Point 2	Culvert on south-west waterway	Water quality
S1	Point 3	South-west waterway on western boundary of Lot 1	Water quality

The rationale for monitoring S1 is that any discharge from the quarry operations will only occur via the Pollution Control Dam / Polishing Pond system. According to JPE (2012) and Umwelt (2013), initially the Pollution Control Dam and the Polishing Pond will be utilised mainly to treat runoff from the chicken growing operations, the existing dwelling and a small area of pasture and will only be used to treat any water captured within the quarry during large rainfall events until the commencement of Stage 2. As the quarry extends to its maximum footprint in Stage 2, pumping out of the quarry may occur as regularly as weekly (Umwelt, 2013) and all remaining upstream catchment consisting of cleared pasture will be captured in the existing easement and conveyed to the south-west waterway.

8.1.2 New Monitoring Sites

Surface water Monitoring Point W1 located in the central part of the Site is in a 'clear water' dam that is not part of the sand processing pond system (**Figure 5**). That is, the dam is a small farm dam that is not associated with quarrying and does not receive any process water.

In this regard, a more meaningful environmentally significant surface water monitoring site in the north-western part of the quarry precinct has been chosen to replace Monitoring Point W1. The monitoring site is newly labelled W1, the location of which is shown in **Figure 5**.

8.2 SURFACE WATER FLOW MONITORING

As documented in Section 6.5, the existing quarry operation operates under a closed 'in pit' system approach for water management. JPE (2012) document that the quarry development will not alter the existing surface water flow path configuration leaving the property boundary.

Upon expansion of the quarry, the operators will maintain a similar closed water management system approach with silt ponds, tailings ponds and decant water pond all located within the quarry pit catchment. As documented in JPE (2012) and described in this WMP, a new 'out of pit' dam (Pollution Control Dam) will be constructed to provide water security and nutrient control.

The results of surface water modelling by JPE (2012) indicates that for 90% of the time, the Pollution Control Dam will not spill and for 10% of the time over the life of the quarry, spills of up to 3,402 kL/day on average may occur.

8.3 WATER QUALITY MONITORING

8.3.1 Baseline Water Quality Monitoring

Baseline surface water quality testing and monitoring has been carried out at two monitoring sites W1 and W4 since 2000. The locations of former monitoring site W1 and monitoring site W4 are shown in **Figure 5**. Monitoring site W1 is located at an existing process water dam and monitors runoff from the access driveway pasture used for grazing. Monitoring site W4 is located at a pipe culvert on the south-west waterway prior to entering Brisbane Waters National Park and the Mooney Mooney Creek system. The culvert presently channels runoff from the existing chicken shed operations on Lot 1 and pasture presently used for grazing.

All samples are analysed for pH, Total Dissolved Solids (TDS), Total Suspended Solids (TSS) and nutrients; Total Kjeldahl Nitrogen (TKN), Total Nitrogen (TN) and Total Phosphorus (TP). Baseline analytical results obtained from JPE (2012) are summarised in **Table 10**.

Table 10 Water Quality Results (after JPE, 2012)					
Analyte	Sample Date	Unit	Guidelines ¹	W1 'Process Water Dam'	W4 Culvert 'SW Waterway'
pH	2008	pH unit	6.5 – 8.1	5.36	5.43
	2009			6.70	No flow
	2010			6.32	6.80
	Long Term Average 2000-2008			6.32	6.36
	Long Term Average 2000-2010			6.31	6.58
Total Kjeldahl Nitrogen (TKN)	2008	mg/L	N/A	0.9	0.6
	2009			0.8	No flow
	2010			0.2	1.9
	Long Term Average 2000-2008			1.53	1.56
	Long Term Average 2000-2010			0.84	1.73
Total Oxidised Nitrogen (TN) (nitrate + nitrite)	2008	mg/L	0.04	0.01	0.01
	2009			0.10	No flow
	2010			0.005	0.10
	Long Term Average 2000-2008			0.07	0.07
	Long Term Average 2000-2010			0.06	0.09
Total Nitrogen (TN)	2008	mg/L	0.35	0.90	0.60
	2009			No flow	No flow
	2010			No flow	No flow
	Long Term Average 2000-2008			1.57	1.61
	Long Term Average 2000-2010			1.57	1.61
Total Phosphorus (TP)	2008	mg/L	0.025	0.08	0.01
	2009			0.05	No flow
	2010			0.05	1.30
	Long Term Average 2000-2008			0.25	0.29
	Long Term Average 2000-2010			0.12	0.80
Total Dissolved Solids (TDS)	2008	mg/L	1000	45	43
	2009			83	No flow
	2010			46	150
	Long Term Average 2000-2008			92	118
	Long Term Average 2000-2010			76.67	134.00
Total	2008	mg/L	50	24	No flow

Suspended Solids (TSS)	2009			No flow	No flow
	2010			6	13
	Long Term Average 2000-2008			32.62	7.92
	Long Term Average 2000-2010			19.31	10.46

[†] Values from the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000)* at 95% protection level.

In summary,

- Surface water used in the present operations for sand washing is mildly acidic. Average pH values are close to the lower limit documented in the guidelines documented in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000). It is noted however that relatively low pH values are typical for groundwater hosted by the Hawkesbury Sandstone.
- Concentrations of Total Nitrogen (TN) for W1 (upstream of the quarry) have significantly decreased from 2000 to 2001. From the beginning of 2002, TN levels have averaged 0.8 mg/L with a range of 0.05 mg/L to 1.8 mg/L.
- Concentrations of Total Nitrogen (TN) for W4 in the ephemeral drainage line in the south-west of the Project Site (when flowing) is 1.6 mg/L on average but exceeds 1.8 mg/L in 20% of the samples recorded.
- Concentrations of Total Phosphorus (TP) for W1 have significantly decreased from 2000 to 2001 levels, and from the beginning of 2002 have averaged 0.08 mg/L with a range of 0.01 mg/L to 0.654 mg/L.
- Concentrations of Total Phosphorus (TP) for W4 is 0.3 mg/L on average but is reported to exceed 0.54 mg/L in approximately 18% of the samples recorded.
- Umwelt (2013) report that the levels of TN and TP typically exceed the default water quality triggers for NSW upland river ecosystems. It is noted that the results for Monitoring Site W4 are typically higher than local upstream monitoring results for up to 20% of samples collected.
- The elevated TN and TP levels in the downstream surface water results (W4) are considered by Umwelt to be predominantly influenced by chicken growing operations, cattle grazing in the local catchment and existence of the unbunded chicken litter stockpiles on the south-west drainage path that dissects this part of the Project Site.
- However, it is noted that any chicken litter will be removed from Lot 1 and no longer stored on site. This strategy will result in an improvement in water quality results at W4 and associated runoff to the south-west waterway.
- Concentrations of TDS and TSS are always less than the guideline levels documented in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000).

8.3.2 Follow-Up Water Quality Monitoring

Surface water sampling was undertaken at the designated surface water monitoring sites (New W1, W4 and S1) during the period 1.1.15 through 31.12.15.

The samples were submitted to NATA accredited laboratories for a suite of prescribed tests and determinations listed in **Table 11** in order to reveal any trends in the results and any potential contamination from quarrying and sand washing activities.

Table 11 List of Analytes and Tests
pH
Total Suspended Solids (TSS)
Total Oils and Grease

Laboratory results are summarised in **Table 12**.

In summary:

- Monitoring Site S1 on the south-western boundary of the Site (set of three discharge pipes) is noted to be dry at different times.
- The **pH** of the surface water (W1 W4 and S1) is slightly acidic to near neutral that reflects rainwater recharge and temporary retention of water within Hawkesbury Sandstone.
- The levels of **oils and grease** tested in surface water samples (W1, W4 and S1) were less than the Limit Of Reporting (LOR) for the various NATA accredited laboratories used in 2015. Measurement of Total Oils and Grease does not specify the hydrocarbon species. The Guidelines for Assessing Service Station Sites. EPA, 1994 was used to compare the results. Because the information needed to establish threshold values is incomplete, a threshold criterion of 10 mg/L was used, as suggested by NSW EPA.
- The concentration of **Total Suspended Solids (TSS)** recorded in the surface water monitoring sites W4 and S1 were less than the LOR. The exception is surface water monitoring site W1 which returned levels either less than the LOR or at low concentrations (7 mg/L in August 2015 and 6 mg/L in October 2015).

Table 12
Summary of Follow-Up Water Quality Analytical Results – Surface Water Monitoring

SAMPLE DESCRIPTION	Guidelines		Method Detection Limit	W1				W4				S1			
	Drinking Water - Health Guidelines ¹	Trigger Value for the Protection of Freshwater Aquatic Ecosystems ²		Surface Water Monitoring Site				Surface Water Monitoring Site				Surface Water Monitoring Site			
DATE	UNIT			17/6/15	4/8/15	14/8/15	19/10/15	17/6/15	4/8/15	14/8/15	19/10/15	17/6/15	4/8/15	14/8/15	19/10/15
pH		pH Units	0.1		7.1	6.1	6.4			6.7	6.5				
Total Suspended Solids		mg/L	10.0	<10	<10	7	6	<10	<10	<5	<5	<10	<5	<5	<5
Total Oils and Grease ³		mg/L	5.0		<5	<10	<5		<5	<10	<10				<5

¹ **Drinking Water Guidelines:** National Water Quality Management Strategy 2011 Version 3.1 updated March 2015

² **Australian and New Zealand Guidelines for Fresh and Marine Water Quality.** National Water Quality Management Strategy (ANZECC 2000)

³ **Guidelines for Assessing Service Station Sites.** EPA, 1994. Information needed to establish threshold values is incomplete. A threshold criterion of 10 mg/L is suggested by EPA.

Note: ISD denotes insufficient data to set a guideline value based on health considerations

8.4 SURFACE WATER QUALITY MONITORING

8.4.1 Water Quality Monitoring

The water quality monitoring program was developed by JPE (2012) and reviewed by Umwelt (2013). The program was refined by NSW EPA specific for monitoring sites W1 and W4, and separately for S1. New Monitoring Site W1 in the north-western part of the quarry precinct is shown in **Figure 5**. The details are summarised in **Table 13**.

Table 13 Recommended Water Quality Monitoring Program		
Monitoring Site	Sample Frequency	Comment
W1 and W4	<ul style="list-style-type: none"> Monthly (1 sample per monitoring site every month) for 12 months Consult with EPA within 1 month of end of Year 1 to discuss decrease of monitoring frequency from monthly to quarterly (3 monthly). <i>Depending</i> on results and trends, and approval from EPA, decrease frequency to quarterly (1 sample every 3 months) 	This sample frequency is designed to provide adequate and representative water quality data to assess any significant changes in surface water chemistry (contaminants of concern) that may be due to the quarry operations.
S1	<ul style="list-style-type: none"> Monthly (1 sample per monitoring site every month) for 12 months Consult with EPA within 1 month of end of Year 1 to discuss decrease of monitoring frequency from monthly to quarterly (3 monthly). <i>Depending</i> on results and trends, and approval from EPA, decrease frequency to quarterly (1 sample every 3 months) Within 12 hours prior to any controlled discharge; and Weekly during any discharge 	This sample regime is designed to provide adequate and representative water quality data to assess water chemistry (contaminants of concern) prior to any controlled discharge and chemistry during any discharge.

Careful analysis and progressive assessment of the results may lead to the reduction of the frequency of scheduled sampling for monitoring sites W1 and W4. The NSW EPA will be consulted with any proposal to reduce the frequency of sampling and testing. The selected set of indicator analytes will alert the Quarry Manager of any significant changes in water quality that may require action. The prescribed list of analytes and tests for each monitoring site is provided in **Table 14**.

Table 14 List of Analytes and Tests			
Analytes	Unit of Measure	Monitoring Site	
		W1 & W4	S1
Total Suspended Solids (TSS)	mg/L	X	X
Oil & Grease	mg/L		X
pH	pH units		X
Oil & Grease	visible		X
Total Nitrogen (TN)	mg/L	X	X
Total Phosphorus (TP)	mg/L	X	X

Grab sampling at monitoring sites will be conducted using nitrile disposable gloves and samples stored in laboratory-supplied plastic bottles and chilled in an esky. The samples will be submitted to the NATA-accredited project laboratory for the suite of tests and determinations listed in **Table 10** in order to establish the concentrations of the potential contaminants of the surface water, reveal any potential changes and establish any trends. The samples will be transported under our Chain of Custody (COC) protocol. For this number of primary samples, a total of one duplicate sample will be prepared and a field blank sample prepared.

8.4.2 Event Based Water Quality Monitoring

In accordance with the NSW EPA, event based sampling of the Pollution Control Dam (S1) will be required within 12 hours prior to any controlled discharge and weekly during any discharge. The suite of analytes and tests is listed in **Table 8**.

8.5 RAINFALL MONITORING

Rainfall data will be collected and recorded for the Project Site using an on-site Bureau of Meteorology-approved automated tipping bucket rain gauge. The data will be downloaded on a monthly basis and collated in an electronic database or spreadsheet.

The recommended monitoring program is summarised in **Table 15**.

Table 15 Recommended Rainfall Monitoring Program		
Activity	Sample Frequency	Comment
Automatic rainfall measurements in <i>tipping bucket rain gauge</i> data logger on site	<ul style="list-style-type: none"> <i>Continuous</i> logging at every 0.2 mm tip with time/date stamps 	This sample frequency is designed to provide adequate, real time good quality rainfall data, optimise the logger battery life and optimise logger memory.

9.0 ASSESSMENT OF SURFACE WATER QUALITY MONITORING RESULTS AND DEVELOPMENT OF TRIGGER LEVELS

The NSW EPA has prescribed criteria for the maximum allowable discharge concentrations for several potential pollutants in surface water discharge into the south-west waterway. The recommended limits are listed in **Table 16**.

Table 16 Recommended Water quality Discharge Limits	
Analyte	Trigger Value
Total Suspended Solids (TSS)	40 mg/L
Oil & Grease	5 mg/L or none visible
pH	< 6.0 and > 8.0 pH units
Total Nitrogen (TN)	<1.8 mg/L
Total Phosphorus (TP)	< 0.54 mg/L

In summary, the recommended discharge criteria for Total Suspended Solids (TSS) for water to be discharged from the Pollution Control Pond is less than 40 mg/L. Oil and grease must be less than 5 mg/L or none visible and pH must fall within the range 6.0 to 8.0. The maximum concentrations for nutrients (trigger levels) cannot be established at this stage until sufficient analytical data is collected and statistically analysed. This is discussed below.

It is noted that Umwelt (2013) propose that the water discharge limits for nutrients for water discharged from the Pollution Control Dam are less than 1.8 mg/L for Total Nitrogen (TN) and less than 0.54 mg/L Total Phosphorus (TP). Umwelt also propose a discharge limit of less than 350 μ S/cm for Electrical Conductivity (EC). These limits are incorporated in **Table 12**.

As discussed earlier in this section, at this stage, with limited available monitoring data, it is considered inappropriate to establish a set of water quality guidelines for Total Nitrogen (TN) and Total Phosphorus (TP) that if 'exceeded' may indicate that an impact or impacts on the environment associated with sand extraction operations are occurring.

The development of a set of trigger levels for TN and TP is considered an important component of on-going long-term assessment of any potential impacts from quarrying on the downstream catchment.

It is therefore proposed that event-based sampling and testing be carried out in order to establish *control ranges* that take into account, as best as possible, natural variation and fluctuations in climate and rainfall.

Analytical results will be compared against the Protection of Freshwater Aquatic Ecosystems (ANZECC 2000), and the 1999 NEPM 'Schedule B(1) Guideline on the Investigation Levels for Soil and Groundwater'.

As prescribed in the Guidelines, statistical procedures will be used to determine whether there has been a significant (90% confidence level) change in the value of one or more of the indicator parameters specified in the water assessment plan (Appendix D of the Guideline). As documented, analysis of variance or other suitable statistical techniques can be used to perform this assessment.

In addition to comparing analytical results against the various guidelines to reveal any exceedances, it is proposed to establish control ranges for TN and TP. The control ranges and trigger levels would be developed using the progressively-collected monitoring data and a statistical analysis. The selected statistical analytical methods will be designed to provide warning and monitoring of any adverse trends associated with potential pollution of the surface water system. The methods would provide warning of any imminent exceedances of the limits and establish, and monitor any impacts if they have already occurred.

There are a range of statistical control chart methods that are used in the processing industry. Two well documented methods are the *Exponentially Weighted Moving Average* (EWMA) method and the *Cumulative Sum* (Cusum) methods which are considered to be relevant to the assessment of any potential impacts associated with sand extraction. It is recommended that the two methods be integrated into one statistical analysis and implemented. The methods are described as follows.

The EWMA control chart is a data analysis technique for determining if a measurement process has got out of control. The EWMA chart plots a weighted average of the current data and the previously plotted point and uses statistical control limits. The chart is sensitive to drift and therefore in the context of the potential impacts from the sand extraction operations would effectively detect any geochemical changes in surface water due to the operations.

The Cusum chart is similar to the EWMA method. The chart is sensitive to drift and will detect small changes in the mean. The chart does not use fixed or parallel statistical control limits but plots the cumulative sum of the deviations between each plotted value (sample average) and a background value. The interpretation of the chart is more concerned with the slope of the plotted line, not just the distance between the plotted values and the centreline.

If the newly developed control ranges and trigger levels reveal exceedances, NOW and the NSW EPA will be notified and any exceedances reported within 1 week of receiving the water quality results.

10.0 ASSESSMENT AGAINST MODELLED PREDICTIONS

Comparison of modelled water flow predictions with actual surface flows and water quality from monitoring will be undertaken in-house and reported to DPI Water on a six (6) monthly basis for the first 12 months then on an annual basis.

Water flow and water quality data will be recorded on a form (electronic database) which will also be used to record actual water usage (including bores) and transfers. The data and information will be kept onsite, maintained by the Project Manager and an off-site backup maintained.

11.0 PROTOCOL – INVESTIGATE/NOTIFY/MITIGATE ANY IDENTIFIED EXCEEDANCES

The water quality results will be compared against the default trigger levels (concentrations) tabled in the *Australian and New Zealand Environment and Conservation Council Guidelines for Fresh and Marine Quality 2000* (ANZECC). These guidelines values are considered conservative and represent a 95 % protection of species for slight to moderately disturbed ecosystems. The comparison of site water quality data can be undertaken to determine if the ANZECC guideline values are appropriate. It is noted that no additional water quality data was able to be sourced. However, *Umwelt* suggest that one of the surface water monitoring sites is considered to be minimally impacted by quarry operations and may be used as a guide to local variance in surface water quality.

In regard to procedures required for any unforeseen impacts, it is considered that the potential impacts have been identified for example:

- water quality exceedances in surface water discharge at Monitoring Sites W1 and/or W4 and/or S1.

In the event that Detection Monitoring identifies quality parameters that exceed the agreed trigger levels in this water management plan, the exceedance/s will be reported to DPI Water in writing within 1 week of receipt of the results and a program of Investigation Monitoring which consists of re-sampling and retesting the affected surface water monitoring site within 30 days to confirm the anomalous results.

If the follow-up test results confirm an exceedance/s, consultation with DPI Water will be arranged regarding a suitable and agreed process of mitigation.

In the event that the Control Pollution Dam overflows during 'above design' storm events or prolonged wet period, the incident will be reported to DPI Water in writing within three days of the spill and 'event based' water sampling will be undertaken immediately following the cessation of the event and water samples analysed as per the analysis suite and duly reported. Consultation with DPI Water will be arranged within one day regarding a suitable and agreed process of mitigation if required

12.0 MITIGATION MEASURES

JPE (2012) report that current management controls designed to manage uncontrolled water overflows are considered adequate. As part of the sand processing operations, water management infrastructure will be located inside the quarry void as it expands as a means of eliminating the risk of uncontrolled discharge off the Project Site.

In regard to potential impacts on local water users, JPE (2012) and Umwelt (2013) report that there are no water users downstream of the location where runoff from the Project Site enters the Mooney Mooney Creek system (south-west waterway).

13.0 LICENSING

The quarry owners will seek to modify their current Environment Protection License (EPL) to reflect the proposed discharge volumes and associated water qualities. Discharge from quarry operations are proposed to only occur via the Pollution Control Dam or Polishing Pond.

Surface water licence number 20SL056523 under the Water Act 1912 has been converted into Access Licences under the Water Management Act 2000. The Access Licences and their corresponding Water Access Licence numbers are listed in **Table 17**.

Table 17 Register Surface Water Licences			
Access License	Water Access License	Annual Entitlement	Purpose
20AL205915	WAL17440	6 ML	Stock / Domestic Specific Purpose
20AL205916	WAL17474	29 ML	Unregulated River
20CA205917	Permits for supply works such as construction of contour drain, diversion works, installation of pumps etc		

The three licences listed above allow the abstraction and use of water in total from the Mooney Mooney Creek Water Source.

14.0 DATA MANAGEMENT

Data management protocol is summarised as follows:

- The water quality data acquired from the surface water monitoring sites should be imported into an electronic database or spreadsheet, collated and viewed by the quarry manager (and possibly the hydrological consultant) following each round of monitoring. This process will ensure that a progressive record of the data is stored and maintained, and the integrity/quality of the data can be checked on a regular basis.
- Email a copy of the water level data to the hydrological consultant for assessment and keep a backup copy of the water level database or spreadsheet in a secure off-site place.
- Develop and maintain an electronic water quality database or spreadsheet. A suitable database and progressive charting can be developed.
- Develop and maintain an electronic rainfall database or spreadsheet.

15.0 REPORTING

The protocol for reporting is summarised as follows.

- A complete set of surface water quality monitoring results will be recorded, collated and duly reported in-house on at least a six-monthly basis for the first 12 months then on an annual basis. The data will be reviewed by the hydrological consultant. The aim is to assess any changes in surface water chemistry and identify reasons for the changes if they occur. The monitoring schedule should be reviewed annually and changed if deemed appropriate by the hydrological consultant.
- A complete set of results of the production and surface water monitoring program including a review of results and any exceedances should be formally reported to DPI Water, EPA and the Quarry Manager on an annual basis.
- The report will include but not necessarily limited to the following.
 - A progressive record of the surface water quality results for the monitoring sites.
 - A figure showing the locations of the surface water monitoring network.
 - Rainfall data correlations.
 - Analytical results and progressive assessment of any trends in surface water chemistry.
 - Notification and assessment of any exceedances.
 - Conclusions and recommendations.

The report should be submitted in hard copy and electronic format to DPI Water, EPA and to the Quarry Manager. The raw water quality data will be appended to the report in electronic form.

- If uncontrolled discharge of runoff from the Polishing Pond occurs as a consequence of unpredicted events such as a storm event or prolonged wet period and an exceedance of criteria listed in **Table 12** is revealed from 'event based' sampling and testing, the incident will be reported to the EPA within 1 week of the incident occurring.

16.0 LIMITATIONS

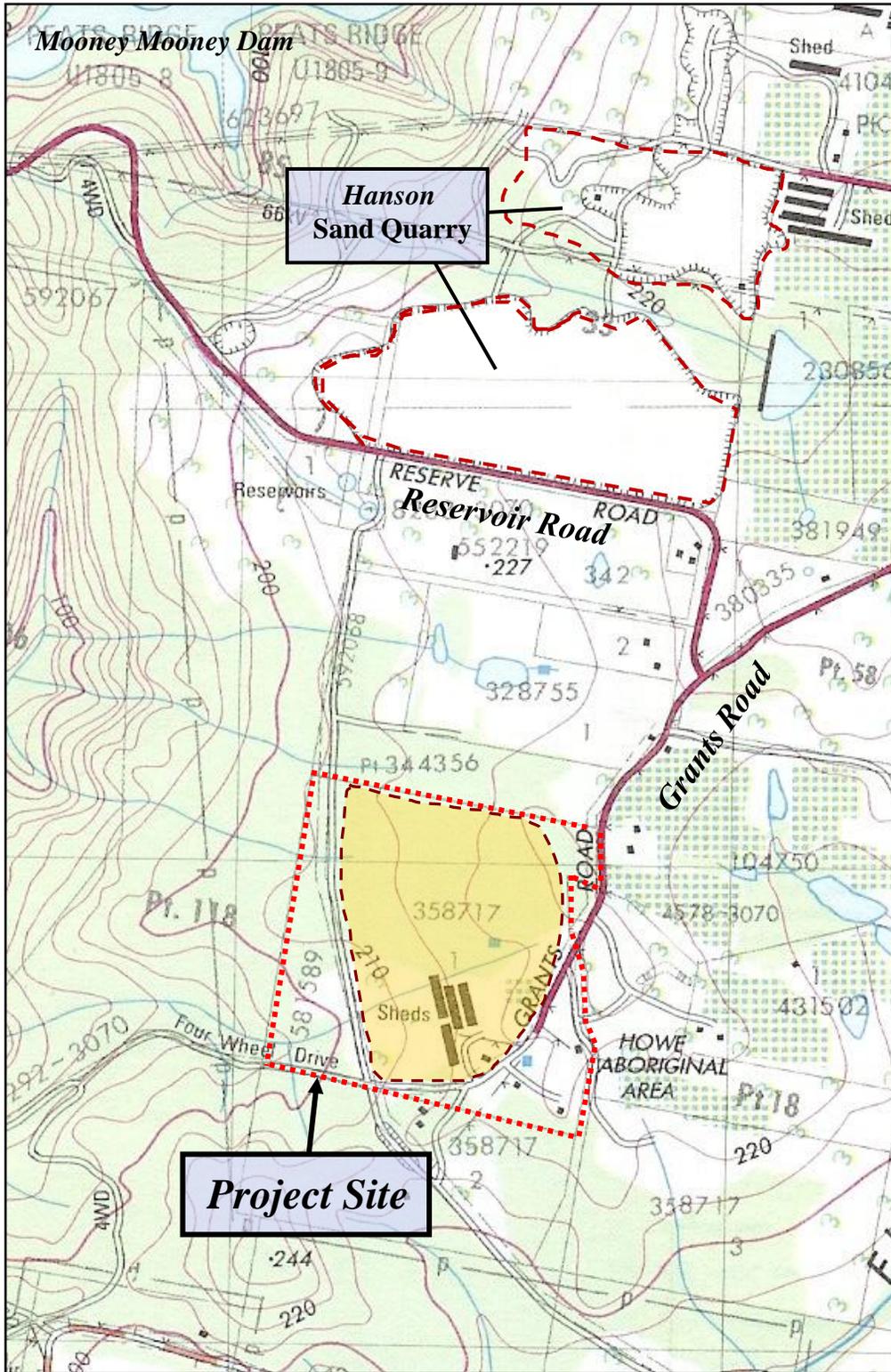
This Surface Water Management Plan (WMP) has been prepared by Larry Cook Consulting Pty Ltd for the sole use of Grants Road Sands.

This WMP should only be presented in full and should be kept by Grants Road Sands. The WMP should not be used for any use other than the project specific requirements. Larry Cook Consulting Pty Ltd accepts no liability for any loss and/or damage incurred as a result of unauthorised changes to the WMP.

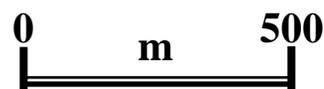
It is imperative to note that the WMP only considers the site conditions current at the time of investigation (March 2016), and to be aware that conditions may have subsequently changed. Any decisions based on the WMP must take into account any changes in site conditions and/or developments in legislative and regulatory requirements. Larry Cook Consulting Pty Ltd accepts no liability for any loss and/or damage incurred as a result of a change in the site conditions and/or regulatory/legislative framework since the date of the WMP.

Any reliance on this WMP by a third party shall be entirely at such party's own risk. Larry Cook Consulting Pty Ltd provides no warranty or guarantee to any third party, express or implied, as to the information and/or professional advice indicated in the GMP, and accepts no liability for or in respect of any use or reliance upon the WMP by a third party.

Figures



 Approved Extent of Sand Extraction Operations



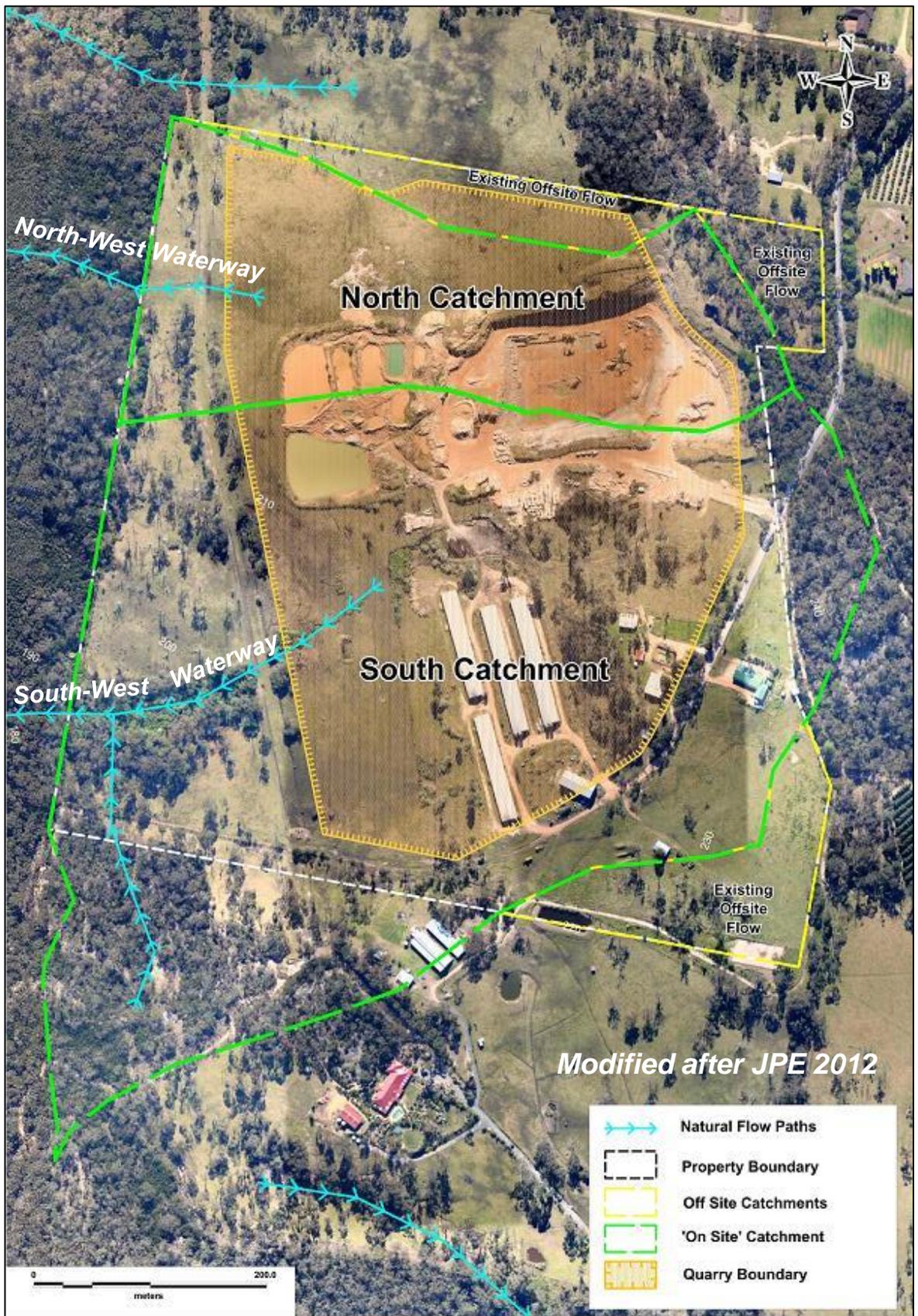
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Grants Road Sand Quarry Extension

Scale: As shown

Location of Project Site

FIGURE 1



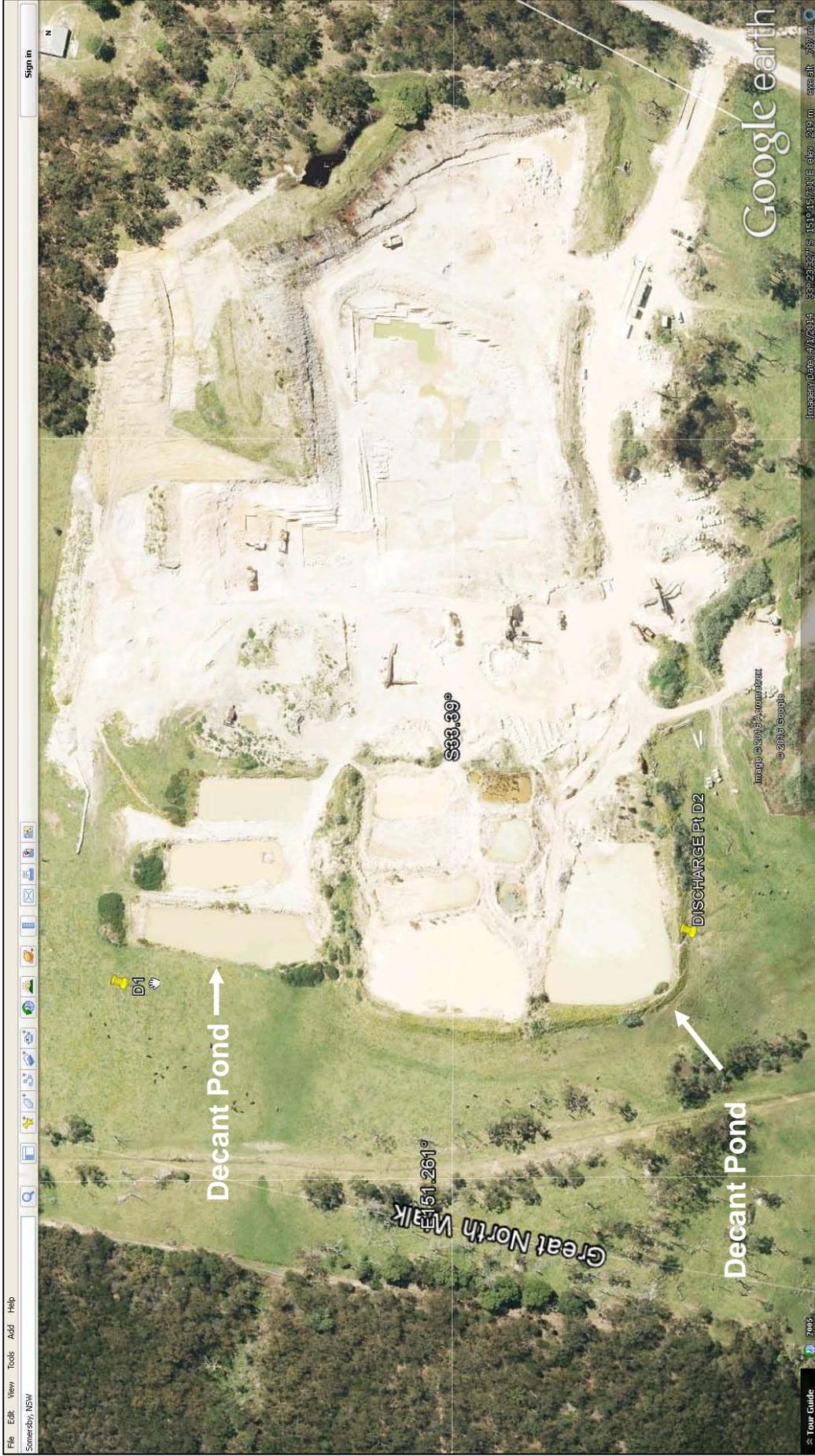
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Grants Road Sand Quarry Extension

North and South Catchments

Scale: As shown

FIGURE 2



Google Earth, 2016

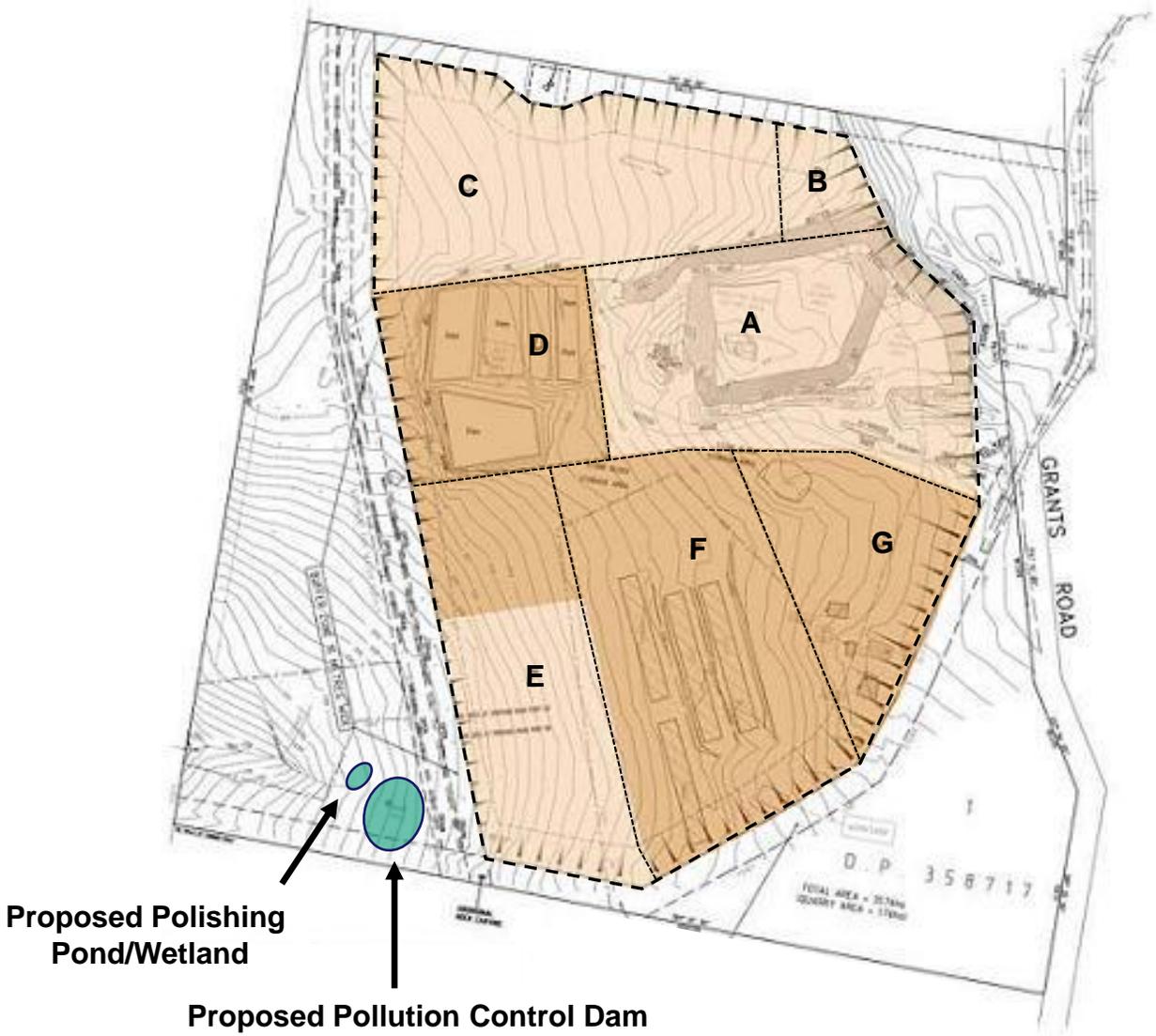
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**Grants Road Sand Quarry Extension
 Water Management Infrastructure**



Scale:

FIGURE 3

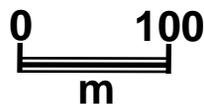


Proposed Polishing Pond/Wetland

Proposed Pollution Control Dam

Legend

- Stage 1
- Stage 2



Plan Modified after Stephen Thorne & Associates (2011)

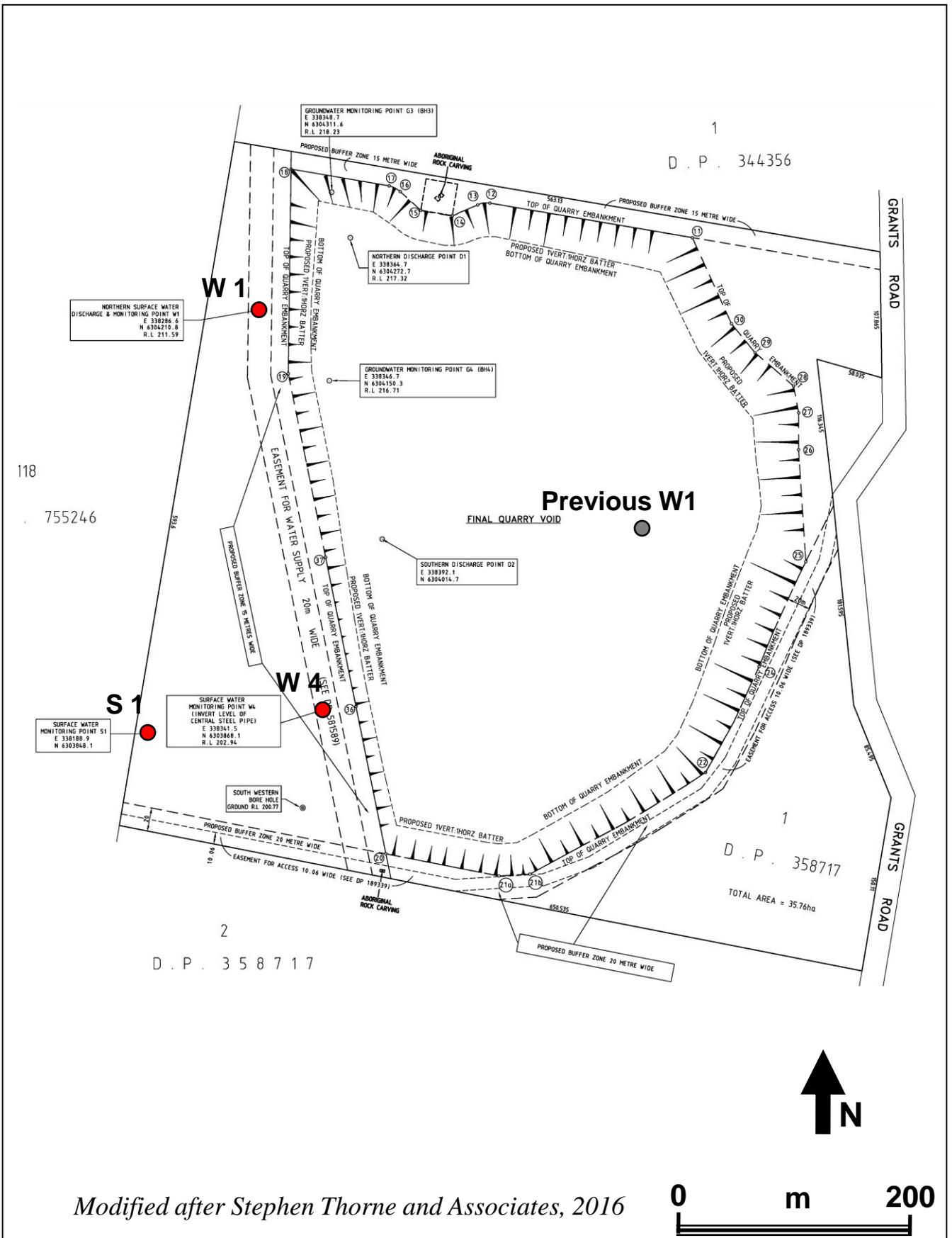
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Grants Road Sand Quarry Extension

Proposed Quarry Stages

Scale: As shown

FIGURE 4



Modified after Stephen Thorne and Associates, 2016



Larry Cook Consulting PO Box 8146 Tumby Umbi NSW 2261 Ph: 02 4340 0193	Grants Road Sand Quarry Extension	Scale: As shown
	Locations of Designated Monitoring Sites	FIGURE 5



Appendix 4

Noise Management Plan

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Consulting Acoustical & Vibration Engineers

**NOISE MANAGEMENT PLAN
GRANTS ROAD SAND QUARRY
GRANTS ROAD, SOMERSBY**

46.6920.R1.NMP:GA/CF/DT
Rev 03

Prepared for: Grants Road Sand Pty Ltd
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June 2016

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LIST OF ATTACHMENTS

ATTACHMENT 1: TERMS & DEFINITIONS
ATTACHMENT 2: EPA CORRESPONDENCE

DOCUMENT REGISTER

File Name	Revision	Date	Author	Review
44.6920.R1.NMP:CFCD7	Rev00	27/8/14	Carl Fokkema	Graham Atkins
44.6920.R1.NMP:CFCD7	Rev01	24/10/14	Carl Fokkema	Graham Atkins
44.6920.R1.NMP:CFCD7	Rev02	1/9/15	Carl Fokkema	Graham Atkins
46.6920.R1.NMP:GA/CF/DT	Rev03	216/16	Graham Atkins	Graham Atkins

1.0 INTRODUCTION

Atkins Acoustics were engaged by Grants Road Sand Pty Ltd (*GRS*) to prepare a Noise Management Plan (*NMP*) for the Grants Road Quarry at Somersby. *GRS* sought to expand the existing quarry at Lot 1 DP 358717, 270 Grants Road, Somersby. The approval included extraction, processing and transportation of up to 250,000 tonnes per annum of various quarry products until 30 June 2044.

The development was approved by DoPE on 25 July 2014 (08_0099). Specific noise conditions (Schedule 3 - Conditions 5, 6, 7, 8 & 9) contained within the consent include the requirement for preparation of a *NMP* (*Schedule 3 - Condition 9*) to the satisfaction of the Secretary. The *NMP* is to provide procedures to address *Schedule 3 - Condition 9* of the consent (08_0099) and provide a strategy for managing noise impacts from the quarry.

The approval conditions require the *NMP* to:

Table 1: Noise Management Plan Requirements

Requirement - Noise Management Plan	Section / Comment
Be prepared in consultation with the EPA, and submitted to the Secretary for approval by the end of November 2014.	<i>Appendix 2</i>
Describe the measures that would be implemented to ensure: <ul style="list-style-type: none"> ○ compliance with the relevant conditions of this approval; ○ best management practice is being employed; and ○ the noise impacts of the project are minimised during meteorological conditions under which the noise criteria in this approval do not apply. 	<i>Section 1.2</i> <i>Section 1.3</i> <i>Section 3</i>
Describe the proposed noise management system.	<i>Section 5</i>
Include a monitoring program that: <ul style="list-style-type: none"> ○ uses attended monitoring to evaluate the compliance of the project against the noise criteria in this approval; ○ evaluates and reports on the effectiveness of the noise management system and the best practice noise management measures; and ○ defines what constitutes a noise incident at the project, and includes a protocol for identifying and notifying the Department and relevant stakeholders of any noise incidents. 	<i>Section 4</i>

Whilst *Schedule 5 – Condition 2* requires that all management plans:

Table 2: Management Plan Requirements

Requirement - Management Plans	Section / Comment
Detailed baseline data;	<i>Section 2, Section 3</i>
A description of: <ul style="list-style-type: none"> ○ the relevant statutory requirements (including any relevant approval, licence or lease conditions); ○ any relevant limits or performance measures/criteria; ○ the specific performance indicators that are proposed to be used to judge the performance of, or ○ guide the implementation of, the project or any management measures; 	<p style="text-align: center;"><i>Section 1.2</i></p> <p style="text-align: center;"><i>Section 3</i></p> <p style="text-align: center;"><i>Section 4</i></p>
A description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	<i>Section 3</i>
A program to monitor and report on the: <ul style="list-style-type: none"> ○ impacts and environmental performance of the project; ○ effectiveness of any management measures (see c above); 	<i>Section 4</i>
A contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	<i>Section 4</i>
A program to investigate and implement ways to improve the environmental performance of the project over time;	<i>Section 4.7, Section 5</i>
A protocol for managing and reporting any: <ul style="list-style-type: none"> ○ incidents; ○ complaints; ○ non-compliances with statutory requirements; and ○ exceedances of the impact assessment criteria and/or performance criteria; and 	<i>Section 4</i>
A protocol for periodic review of the plan.	<i>Section 6</i>

Note: The Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans

1.1 Purpose of NMP

The purpose of the *NMP* is to implement all practical and feasible measures to minimise noise exposure for sensitive receivers, and ensure that all statutory requirements outlined in the Consent 08_0099 are satisfied.

1.2 Statutory Requirements

In the operation and management of noise for the Grants Road Quarry, the following documents are to be considered:

NSW Industrial Noise Policy (EPA 2000)

NSW Road Noise Policy (EPA 2011)

AS 1055.1, 1055.2, 1055.3 – *Acoustics – Description and measurement of environmental noise*

AS 2659.1, 2659.2 – *Guide to use of sound-measuring equipment*

Project construction and quarry operational noise conditions imposed by the DoPE (*Approval 08_0099*) dated 25 July 2014 – Schedule 3 are presented below:

NOISE

Hours of Operation

5. The Proponent shall only conduct construction activities and quarrying operations on the site:
- (a) between 7.00 am and 6.00 pm, Monday to Friday;
 - (b) between 7.00 am and 1.00 pm, Saturday; and
 - (c) at no time on Sunday or public holidays.

Note: The Proponent may carry out other activities e.g. maintenance, on the site provided that these activities are conducted in a manner that is inaudible at all privately-owned residences.

6. The following activities may be carried out on the site outside the hours specified in condition 5:
- (a) delivery or dispatch of materials as requested by Police or other authorities; and
 - (b) emergency work to avoid the loss of lives, property and/or to prevent environmental harm.

In such circumstances the Proponent shall notify the Secretary and affected residents prior to undertaking the activities, or as soon as is practical thereafter.

Noise Impact Assessment Criteria

7. The Proponent shall ensure that the construction and operational noise generated by the project does not exceed the criteria in Table 1 at any residence on privately-owned land.

Table 1: Noise criteria

Receiver Location	$L_{Aeq(15 min)}$ dB(A)
All privately-owned residences	40

Noise generated by the project is to be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the *NSW Industrial Noise Policy*. Appendix 2 sets out the meteorological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.

However, the noise criteria in Table 1 do not apply if the Proponent has an agreement with the relevant landowner to exceed the noise criteria, and the Proponent has advised the Department in writing of the terms of the agreement.

It is noted that *Schedule 3 – Condition 7* does not provide noise limits for the National Park. In accordance with the EA Noise Assessment and procedures of the *NSW, INP* a level of $L_{Aeq,15min}$ 50-55dB(A) is applied for the National Park.

1.3 Meteorological Effects

With respect to assessment of noise impacts under adverse meteorological conditions, the '*Noise Impact Assessment. Grants Road Sand Quarry. Somersby Report No. 43.6523.R1:CFCD6 Rev 03 dated January 2013*' identified the following prevailing meteorological conditions that require consideration under the procedures of the *NSW*,

Industrial Noise Policy (INP):

- East wind: 90° at 3m/s
- North-north-west wind: 337.5° at 3m/s

Reference to the procedures documented in the *NSW, Industrial Noise Policy – Section 11.1.3*, the quarry will only be considered to be in non-compliance with the noise criteria if the sustained noise from the quarry is more than 2dB above the limit specified in *Condition 7* and not addressed or rectified.

2.0 PROJECT DESCRIPTION

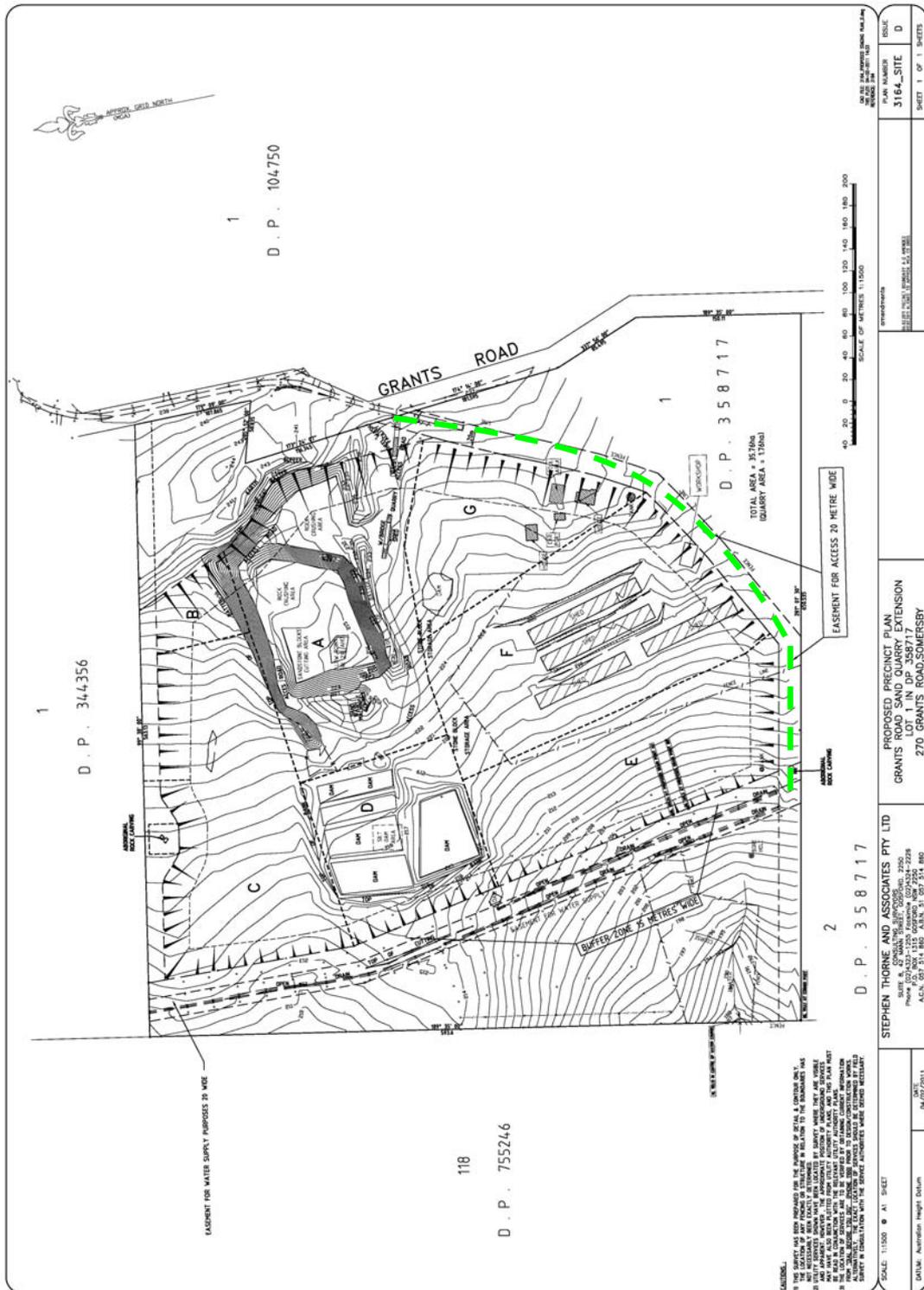
The quarry is located at the southern end of Grants Road and identified as Lot 1 DP 358717, 270 Grants Road, Somersby. The existing quarry operations are restricted to the north-east corner and central western portion of the site (*Figure 1*).

A 'Noise Impact Assessment. Grants Road Sand Quarry. Somersby Report No. 43.6523.R1:CFCD6 Rev 03 dated January 2013' was prepared by *Atkins Acoustics* and submitted to Department of Planning and Environment (DoPE). The application included extraction, processing and transportation of up to 250,000 tonnes per annum of various quarry products until 30 June 2044.

The extension to the existing Grants Road Sand Quarry, includes:

- Extraction, processing and transportation of up to 250,000 tonnes per annum of various grades of washed sand, mortar sand, sandstone blocks and retaining wall rocks for a period of approximately thirty (30) years.
- Total extraction of approximately nine point five (9.5) million tonnes (Mt) of extractable sand and sandstone.
- Extension of quarry by approximately twenty (20) hectares.
- Extraction to depth of thirty-five (35) metres.
- Extraction by dozer and excavator (no blasting is proposed).

Figure 1: Quarry Precincts and Acoustic Mound Location



----- Proposed Acoustic Mound

A comparison of the previous approval and current approved quarry operations is summarised below:

	Existing Consent (DA 22952)	Approval 08_0099
<i>Area to be quarried</i>	2 hectares	20 hectares
<i>Total resource extracted</i>	Limit of resource	9.5Mt
<i>Maximum annual production</i>	200,000t	250,000t
<i>Depth of extraction</i>	20m	35m
<i>Hours of operation</i>	7.00am to 6.00pm Mon to Fri	7.00am to 6.00pm Mon to Fri
	8.00am to 11.00am Sat	7.00am to 1.00pm Sat
<i>Employees</i>	5	up to 8
<i>Plant and equipment</i>	Dozer (1)	Dozer (1)
	Excavator (1)	Excavator (1) [#]
	Loaders (4*)	Loaders (4 [^])
	Dimension Stone Saw (1)	Dimension Stone Saw (1)
	Commander Screen (1)	Commander Screen (1)
	McCloskey Screen (1)	McCloskey Screen (1)
	Wet Sand Wash Plant (1)	Wet Sand Wash Plant (1)
<i>Average return daily truck trips</i>	24	30

* typically only 1 used at a time

[^] anticipate that 2 Loaders may operate simultaneously

[#] minimal intermittent use

2.1 Sensitive Receiver Locations

Potential noise sensitive areas identified in the vicinity of the quarry and addressed in this *NMP* include isolated rural residential dwellings located to the north ('Sammut' 210 Grants Road (Lot 105 DP 738384) and 200 Grants Road (Lot 106 DP 738384), east ('McGregor' 239 Grants Road (Lot 1 DP 104750) and 251-255 Grants Road (Lot 12 DP 1075554)) and south ('Ibels' 380 Somersby Falls Road (Lot 2 DP 358717)). In addition Brisbane Water National Park adjoins the site to the west.

The existing Grants Road Sand Quarry has been in operation since 2002. During this time, the quarry has demonstrated through annual plant and receiver noise audits, compliance at reference receiver locations. Additional information provided by the quarry operators and PAA through correspondence from Gosford City Council (Reference 1015437) confirmed that the quarry has not been subject to noise complaints during this period.

3.0 NOISE ASSESSMENT

3.1 Noise Modelling

A number of quarry operations and equipment schedules were considered for noise modelling, to represent typical worse case scenarios. The scenarios modelled were:

Scenario 1: *Area A*

- Wet Sand Wash Plant in western portion of Area A (existing) at RL228
- Commander Screen and Loader 1 on upper processing area within eastern portion of Area A (existing) at RL231
- Truck 1 route between upper processing area and site entry / exit (6 source points) RL231-233
- Stone saw in central portion of Area A (existing) at RL217

Area B

- Dozer on central portion of Area B at RL230

Area C

- McCloskey screen on eastern portion of Area C at RL234
- Loader 2 on eastern portion of Area C at RL230
- Truck 2 route from Area C along western edge of Area A to weighbridge and site entry / exit (10 source points) RL224-232

Scenario 2: *Area A*

- Wet Sand Wash Plant in western portion of Area A (existing) at RL228
- Commander Screen and Loader 1 on upper processing area within eastern portion of Area A (existing) at RL231
- Truck 1 route between upper processing area and site entry / exit (6 source points) RL231-233

Area B

- Stone saw in central portion of Area B at RL226

Area C

- Dozer on central eastern portion of Area C at RL226
- McCloskey screen on central western portion of Area C at RL223

- Loader 2 on central western portion of Area C at RL223
- Truck 2 route from Area C along western edge of Area A to weighbridge and site entry / exit (10 source points) RL224-232

Scenario 3: *Area A*

- Wet Sand Wash Plant in western portion of Area A (existing) at RL228
- Commander Screen and Loader 1 on upper processing area within eastern portion of Area A (existing) at RL231
- Truck 1 route between upper processing area and site entry / exit (6 source points) RL231-233

Area C

- Stone saw in central western portion of Area C at RL213

Area F

- Dozer on south-west portion of Area F at RL220
- McCloskey screen on south-east portion of Area F at RL224
- Loader 2 on south-east portion of Area F at RL224
- Truck 2 route from Area F along right of way on eastern boundary of site to site entry / exit (8 source points) RL225-235

Scenario 4: *Area A*

- Wet Sand Wash Plant in western portion of Area A (existing) at RL228
- Commander Screen and Loader 1 on upper processing area within eastern portion of Area A (existing) at RL231
- Truck 1 route between upper processing area and site entry / exit (6 source points) RL231-233

Area F

- Stone saw in south-east portion of Area F at RL221

Area G

- Dozer on south-east portion of Area G at RL231

- McCloskey screen on north-east portion of Area G at RL231
- Loader 2 on north-east portion of Area G at RL231
- Truck 2 route from Area G north and then east to site entry / exit (5 source points) RL231-233

The above scenarios represented a range of situations throughout the envisaged extraction program. They were considered to model the range of noise levels likely to be emitted from the quarry operation over the next thirty (30) years. The results of the noise modelling identified in the absence of additional noise controls and / or a reduction in equipment operating simultaneously, noise exceedances for a number of assessment locations.

3.2 Noise Management and Controls

To address the predicted noise exceedances, plant and equipment were ranked and noise contributors determined. As a result of the ranking, the following noise reductions were adopted for noise modelling:

Dozer	-4dB
Trencor	-3dB
McCloskey	-3dB
Sand wash plant	-8dB

The results of the revised modelling demonstrated that with the incorporation of noise controls, noise assessment goals were generally satisfied. Under some quarrying scenarios and adverse meteorological conditions, technical exceedances were predicted at A3-A5 and exceedances at A6. Based on the findings, the assessment recommended additional noise control and quarry management procedures including site management, weather monitoring, noise incident management and noise monitoring to address residual noise exceedances as outlined in *Appendix 1 – Statement of Commitments Item 10 (08_0099)*. To minimise noise impacts and maintain compliance with the approval assessment criteria the following measures / practices will be implemented as outlined in the *Statement of Commitments*, specifically:

- Engineered noise reduction measures (upgraded exhausts, enclosure / panels to engines, or localised plant specific shielding*) to achieve the following noise reductions and resultant Sound Power Levels (Lw):
 - Dozer 4dB Lw108dB(A);
 - Trencor (or Excavator + diamond saw) 3dB Lw109dB(A);
 - McCloskey 3dB Lw106dB(A); and,
 - Sandwash plant - air cooled 6 cylinder engine* 8dB Lw 104dB(A) (*smaller 4 cylinder engine is now operating with a purpose design enclosure and exhaust resulting in an 8dB reduction and does not require further attenuation*)
- Site mobile plant fitted and operated with low level or broadband ‘quacker’ reversing alarms;
- Plant and equipment maintained to ensure acoustic performance complies with the limits outlined in the Noise Impact Assessment (NIA – Report: 43.6523.R1:CFCD6 Rev 03 dated January 2013);
- Site Operational Management Plan (SOMP) developed to:
 - Manage the operation of Dozer, Trencor (or Excavator + diamond saw) and McCloskey to ensure they operate simultaneously;
 - document procedures to maximise site shielding and minimise number of plant operating simultaneously at exposed locations, particularly eastern and southern portions of quarry (Areas B, C, F and G);
 - manage extraction and processing plant / equipment where practical and feasible to one (1) item of plant when working <8m below natural ground level. All extraction to occur against the working face where practical;
 - manage site activities in conjunction with prevailing weather conditions to:
 - cease operations within Precinct F and G during north-north-west to west wind conditions (up to 3m/s) with respect to the dozer, Trencor (or Excavator + diamond saw) and McCloskey in exposed locations (<8m below natural ground level); and,
 - utilise periods during high winds >5m/s (particularly east to south-east winds) and / or rain and elevated background noise levels to work within exposed locations (Areas B, F and G)

- Construct acoustic earth mounds 3-4 metres above natural ground level along the southern and south-eastern quarry boundaries as shown in *Figure 1 (Figure 14 of the Environmental Assessment)* before commencing Precincts E, F and G (Stage 2 quarry development);
- Real time continuous monitoring of prevailing weather conditions including wind speed and direction at a height of ten (10) metres above ground level;
- Noise Incident Management and Reporting Procedures; and,
- Attended Compliance Noise Monitoring.

In terms of road traffic, the results of modelling have shown that the predicted noise levels from the Grants Road Sand Quarry trucks satisfy the *NSW, RNP* noise goals.

4.0 MONITORING PROGRAM

In order to verify that noise impacts are managed a noise monitoring program has been developed. Noise monitoring will be conducted twice a year, in addition to incident driven monitoring and / or where there are significant changes in site plant / equipment or extraction / processing methods.

4.1 Noise Monitoring Program and Locations

Noise monitoring of existing quarry operations was previously conducted at three (3) reference locations as shown in *Figure 2* and identified as:

- Location 1: *'Ibels' - 380 Somersby Falls Road*
- Location 2: *'McGregor' - 239 Grants Road*
- Location 3: *'Sammut' - 210 Grants Road*

An additional noise monitoring location is proposed within the National Park (Location 4) to the west of the quarry for assessing compliance to 'passive recreation areas'.

Figure 2: Site and Audit Measurement Locations



It is proposed to monitor noise impacts from the staged quarry expansion at the above four (4) reference locations. Monitoring procedures will include:

- Review of meteorological conditions and determination if suitable for noise measurements;
- Attended noise measurements over fifteen (15) minutes at each receiver noting aural observations, recording L_{A90} and L_{Aeq} noise levels and weather conditions (*wind speed and direction*);
- Determination of $L_{Aeq,15min}$ noise contribution from Grants Road Quarry activities for each receiver location;
- Review of GRS contributions compared to noise criteria (*Schedule 3 – Condition 7*) and *INP* level for National Park $L_{Aeq,15min}$ 50-55dB(A). Quarry will only be considered to be in non-compliance with the noise criteria if the sustained quarry noise is more than 2dB above the limit and not addressed or rectified;
- Inspection of site to confirm quarry operations at time of audit;

- Attended nearfield or midfield measurements of individual site plant and equipment to confirm operating noise levels and calculated sound power levels;
- Conduct second round of attended noise measurements at the reference monitoring locations over fifteen (15) minutes at each receiver noting aural observations, recording L_{A90} and L_{Aeq} noise levels and weather conditions (*wind speed and direction*);
- Determination of $L_{Aeq,15min}$ noise contribution from Grants Road Quarry activities at receivers;
- Consideration of any agreement with adjoining landowners (sensitive receivers) regarding noise and noise exceedances;
- If noise exceedances of the noise limits (*Schedule 3 – Condition 7*) and $L_{Aeq,15min}$ 50-55dB(A) limit for National Park are identified, investigate sources contributing to the exceedance and provide recommendations for ameliorative action or management for Quarry operator to avoid future exceedances of same type; and,
- the preparation of a Noise Monitoring Report.

4.2 Complaint Management

Quarry Manager or *Designate* who receive the reported incident will record where possible pertinent details at the time including name, address and telephone number or person reporting the incident, time/s of occurrence of alleged noise event, perceived source of noise, prevailing weather conditions and similar details that could be utilised to assist in the investigations of the noise incident. Quarry Manager to take the following steps to address alleged complaint:

- Review complaint details and investigate possible source/s
- If source/s identified, investigate alternative process, repair plant, alternative extraction / processing areas;
- If source of noise complaint not apparent, consider aural observations and noise measurements at complainant location to evaluate exposure;
- Review performance through feedback from Complainant and conduct noise measurements, if required; and,
- Reporting of ameliorative measures, results of any noise measurements, aural observations and complainant feedback to be held in Complaint Register and made available to Quarry Manager, Council, EPA or other authorised office as required.

In addition to the attended compliance noise monitoring and incident / complaint driven monitoring, the quarry operator proposes to conduct additional noise monitoring when there are significant changes in site plant / equipment or extraction / processing methods or a new precinct is being worked.

4.3 Instrumentation

Instrumentation for noise measurement shall be NATA or factory calibrated, and hold current *Certificates of Calibration*. The reference level of the instrument/s will be checked in the field prior to and after the measurements with a NATA or factory calibrated calibrator. Any variations with the reference field calibration level check will be noted. Statistical sound level meters will be set to A-weighting, fast response and fifteen (15) minute sampling periods.

4.4 Measurement Procedures

The ambient sound levels will be measured and recorded as percentile A-weighted sound levels. The parameters noted will include the “ L_{Aeq} ” the equivalent continuous level or the level equivalent to the energy average of noise levels occurring over the measurement period and the “ L_{A90} ”, the level exceeded for 90% of the measurement period and referenced as the “background or average minimum level.

Additional measurements will be undertaken, if required, to assist with the identification and assessing noise contributions from specific noise sources. It is noted that other noise sources (natural elements, traffic, other industry) may affect the measured levels and will need to be excluded from measurement results in order to quantify the noise contribution from GRS Quarry.

Where attended noise monitoring at the reference receivers is inconclusive, the nearfield measurements of site activities and plant and equipment may be utilised with calculations to assist in determining noise level contributions at receiver locations.

4.5 Personnel

The annual and incident driven noise audits and reporting will be conducted by an Accredited Noise Consultant, Acoustic Engineer or an Environmental Noise Officer who will be responsible for attending the noise monitoring locations, conducting noise measurements, monitoring plant and equipment, evaluation of the installed noise controls and assessing compliance status and effectiveness of the site operational management procedures.

4.6 Monitoring Intervals and Outcomes

Monitoring will be undertaken in accordance with procedures outlined in *Table 3*. Additional audits will be considered in response to reported noise incidents received, significant change in quarry operations or as directed by Council, DoPE / OEK / EPA.

Table 3: Overview of Noise Monitoring Procedure

Frequency	Assessment Locations*	Period	Minimum Outcome
Half Yearly	<ul style="list-style-type: none"> ○ Residential Properties ○ ‘Sammut’ 210 Grants Road ○ ‘McGregor’ 239 Grants Road ○ ‘Ibels’ 380 Somersby Falls Road ○ National Park 	<ul style="list-style-type: none"> ○ Day <ul style="list-style-type: none"> ○ Monday to Friday (0700–1800 hours) OR ○ Saturday (0700-1300 hours) 	<ul style="list-style-type: none"> ○ Ambient statistical noise measurements ○ $L_{A90, 15min}$ and $L_{Aeq, 15min}$ measured levels ○ $L_{Aeq, 15min}$ noise contributions for GRS activities ○ Assessment of noise contribution against criteria ○ Inspection of site noise controls ○ Nearfield and / or midfield noise measurements of site plant and equipment ○ Assessment of compliance ○ Prevailing weather conditions ○ Preparation of Noise Audit Monitoring Report
Incident Driven	<ul style="list-style-type: none"> ○ Report address 	<ul style="list-style-type: none"> ○ To be agreed 	<ul style="list-style-type: none"> ○ $L_{A90, 15min}$ and $L_{Aeq, 15min}$ measured levels ○ $L_{Aeq, 15min}$ noise contributions for GRS activities ○ Prevailing weather conditions ○ Inspection of site noise controls ○ Nearfield and / or midfield noise measurements of site plant and equipment (<i>if required</i>) ○ Record findings and actions ○ Report findings to Management ○ Follow up with additional investigations if required ○ Report findings to Management and actions undertaken

Table 3: Overview of Noise Monitoring Procedure (cont.)

Frequency	Assessment Locations*	Period	Minimum Outcome
Significant changes in quarry operations	<ul style="list-style-type: none"> ○ Residential Properties ○ ‘Sammut’ 210 Grants Road ○ ‘McGregor’ 239 Grants Road ○ ‘Ibels’ 380 Somersby Falls Road ○ National Park 	<ul style="list-style-type: none"> ○ Day <ul style="list-style-type: none"> ○ Monday to Friday (0700–1800 hours) OR ○ Saturday (0700-1300 hours) 	<ul style="list-style-type: none"> ○ Ambient statistical noise measurements ○ $L_{A90, 15min}$ and $L_{Aeq, 15min}$ measured levels ○ $L_{Aeq, 15min}$ noise contributions for GRS activities ○ Assessment of noise contribution against criteria ○ Inspection of site noise controls ○ Nearfield and / or midfield noise measurements of site plant and equipment ○ Assessment of compliance ○ Prevailing weather conditions ○ Preparation of Noise Audit Monitoring Report

* unless an agreement is in place with adjoining landholder regarding noise and noise exceedances

If the monitoring identifies any trends with sustained exceedances of the noise criteria referenced in the Ministers Consent Conditions, the Department of Planning and Environment (DoPE) and affected residences will be notified, source of noise exceedance determined and additional noise mitigation investigated.

Options for mitigation of identified trends or sustained noise exceedances will be assessed in consultation with affected residences and the DoPE. Where sustained non-compliance is identified noise reduction programs will be investigated and options to minimise any potential impacts addressed.

4.7 Environmental Performance

The quarry operator will continue to review extraction methodology, equipment and processing operations throughout the life of the quarry to ensure that they are best management practice and using best available technology economically available to ensure ongoing compliance with noise limits and where possible improve environmental performance.

5.0 ROLES and RESPONSIBILITIES

This section provides an outline of the roles and responsibilities of the personnel involved in the operation of the quarry to ensure that noise impacts are managed to comply with the relevant noise criteria and not adversely impact the identified sensitive receivers. The personnel, roles and responsibilities are summarised below:

- Quarry Owner*
- reviewing and authorising the *NMP*;
 - designate environmental responsibilities to the *Quarry Manager*;
 - ensure sufficient resources are allocated such that the *NMP* commitments are adopted; and,
 - continual review and monitoring of environmental performance to ensure suitability and effectiveness of *NMP* and objectives.
- Quarry Manager*
- reviewing, maintaining, updating and implementing the *NMP*;
 - educate staff and contractors to ensure all relevant personnel are aware of their obligations under the *NMP*;
 - review identified noise issues or reported incidents and action;
 - co-ordination of activities and duties required under this *NMP*;
 - initial contact person in relation to reporting noise incidents;
 - provide advice to manage reported noise incidents;
 - designate an appropriately qualified person to provide specialist advice for managing noise as required; and,
 - periodic review to ensure the *NMP* is being implemented.
- Plant Operators / Drivers*
- aware of their responsibilities under the *NMP*;
 - aware of the noise sources in their work area and requirements under *NMP* to minimise noise impacts; and,

- inform the *Quarry Manager* without delay where changes in operation / extraction methods may result in noise impacts.

Contact details for the *Quarry Manager* will be posted at the Grants Road Sand quarry entry including phone number, mailing address and email contact details to provide the public and / or local residents contact details for general information enquiries and specific incident related information. Contact phone number will be available 24/7 and take the form of a recorded message system during evening and night hours that will be checked daily and matters requiring action forwarded to the appropriate personnel.

All quarry employees and contractors to be informed of their obligations in terms of minimising noise from quarry operations and truck movements on Grants Road. Quarry operator to provide regular ‘tool box talks’ or equivalent briefings and training to ensure best management practices and operating procedures of plant and equipment are being implemented by all employees and contractors.

6.0 NOISE MANAGEMENT SYSTEM

This *NMP* presents a Noise Management System (*NMS*) for the Grants Road Sand Quarry to ensure the noise criteria are met, address noise exceedances where they are detected, document how these exceedances are first reported, investigated and managed, and how future occurrences of the same exceedance type would be avoided.

The *NMS* comprises the following key quarry operational and management phases to ensure the noise criteria are met, specifically:

- Quarry operated in accordance with the operational scenarios and plant and equipment schedules reported in the EA Noise Assessment and presented in *Section 3.1*;
- Effective adoption of all measures outlined with the *Appendix 1 – Statement of Commitments Item 10 (08_0099)*;

- Extensive noise monitoring program incorporating annual, incident / complaint driven and ‘change in process / area’ triggers to review and assess noise compliance (*Section 4*);
- Complaints handling procedure (*Section 4.2*);
- Designated and trained employees and contractors to operate and manage the quarry; and,
- Ongoing review and assessment of best management practices and utilisation of best available technology economically available for quarry operations to ensure compliance with project noise limits.

6.1 Audit and Review

In addition to the annual monitoring, reporting and review as part of the Annual Reporting requirements assessing environmental performance including noise, an internal review of this *Noise Management Plan* will occur every five (5) years, or if changes to the site operations occur which increase the risk of noise exposure, or following a noise incident. Changes to the *NMP* will only occur if improvements are identified or as instructed by the DoPE. Changes to the *NMP* will be forwarded to the Secretary of DoPE for approval.

6.2 Records

The results of all noise monitoring will be held onsite and maintained by the *Quarry Manager* or designate.

ATTACHMENT 1: TERMS & DEFINITIONS

A-Weighted: See dB(A)

Adverse weather: Weather effects that enhance noise (that is, wind and temperature inversion) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).

Ambient noise: The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far.

Assessment background level (ABL): The single figure background level representing each assessment period day, evening and night (that is, three assessment background levels are determined for each 24-h period of the monitoring period). Its determination is by the tenth percentile method.

Assessment period: The period in a day over which assessments are made: day (0700-0800h), evening (1800 to 2200h) or night (2200 to 0700h).

Background Noise: The underlying level of noise present in the ambient noise, excluding the noise source under extraneous noise is removed. This is described using the L_{A90} descriptor.

Cumulative noise level: Refers to the total level of noise from all sources.

Day: The period between 0700 and 1800hrs (Monday-Saturday) and 0800-1800 (Sunday and Public Holidays).

dB: Abbreviation for decibel-a unit of sound measurement. Given sound pressure to a reference pressure.

dB(A): Unit used to measure “A-weighted”

sound pressure levels. A-weighting is an adjustment made to sound level measurement to approximate the response of the human ear.

A change of 1dB(A) in the level of a sound is difficult to detect, whilst a 3dB(A) to 5dB(A) change corresponds to a small but noticeable change in loudness. A 10dB(A) change corresponds to an approximate doubling or halving in loudness.

The table below lists examples of typical noise levels.

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Very noisy
110	Grinding on steel	
100	Loud car hone at 3m	Noisy
90	Construction site with pneumatic hammering	
80	Kerbside of busy street Loud radio or TV	Loud
70		
60	Department store General Office	Moderate to quiet
50		
40	Inside private office Inside bedroom	Quiet to very quite
30		
20	Unoccupied recording studio	Almost silent

Default parameters: In assessing meteorological enhancement of noise, refers to set values for weather parameters, such as wind speeds and temperature gradients, to be used in predicting source noise levels.

Equivalent Continuous Noise Levels: The level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Evening: Refers to the period between 1800-2200hrs.

Extraneous Noise: Noise resulting from activities that are not typical of the area. Atypical activities may include construction, and traffic generated by holiday periods and by special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous.

Feasible and reasonable measures:

Feasibility relates to engineering considerations and what is practical to build; reasonableness relates to the application of judgement in arriving at a decision, taking into account the following factors:

- noise mitigation benefits (amount of noise reduction provided, number of people protected)
- cost of mitigation (cost of mitigation versus benefits provided)
- community views (aesthetic impacts and community wishes)
- noise levels for affected land uses (existing and future levels, and changes in noise levels).

Fluctuating Noise: Noise that varies continuously and to an appreciable extent over the period of observation.

Greenfield site: Undeveloped land.

Impulsive Noise: Noise having a high peak of short duration, or a sequence of such peaks. A sequence of such peaks. A sequence of such impulses in rapid succession is termed 'repetitive impulsive noise'.

Intrusive Noise: refers to noise that intrudes above the background level by more than 5 decibels.

L_{A90}: The A-weighted sound pressure level that is exceeded for 90% of the time over which a given sound is measured. This is considered to represent the background noise.

L_{Aeq}: The equivalent continuous noise level

– the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Long-term annoyance: Prolonged annoyance over months and years.

Median: The middle value in a number of values sorted in ascending or descending order. Hence, for an odd number of values, the value of the median is simply the middle value. If there is an even number of values the median is the arithmetic average of the two middle values.

Meteorological conditions: wind and temperature inversion conditions.

Most-affected locations(s): Locations that experience (or will experience) offensive noise from the noise source under consideration. In determining these locations, one needs to consider existing background levels, exact noise source locations(s), distance from source (or proposed source) to receiver, and any shielding between source and receiver.

Negotiated agreement: An agreement involving the negotiation of an achievable noise limit in cases where the project specific noise levels cannot be met. The agreement is negotiated between the proponent and the OEH or the proponent and the community. Such an agreement is reached through balancing the merits of a development, the feasibility and reasonableness of available mitigation measures and the noise impacts produced.

Night: The period between 2200 and 0700 (Monday-Saturday) and 2200-0800 (Sunday and Public Holidays)

Noise criteria: The general set of non-mandatory noise level targets for protecting against intrusive noise (for example, background noise plus 5dB) and loss of amenity (for example, noise levels for various land uses).

Non-mandatory: With reference to the proposed policy, means not required by legislation. The proposed policy specifies criteria to be strived for, but the legislation does not make these criteria compulsory. However, the policy will be used as a guide to setting statutory (legally enforceable) limits for licences and consents.

Performed-based goals: Goals specified in terms of the outcomes/performance to be achieved, but not in terms of the means of achieving them.

Rating Background Level (RBL): the overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period (as opposed to over each 24-h period used for the assessment background level). This is the level used for assessment purposes. It is defined as the median value of:

- all the day assessment background levels over the monitoring period for the day
- all the evening assessment background levels over the monitoring period for the evening; or
- all the night assessment background levels over the night period

Receiver: The noise-sensitive land at which noise from a development can be heard.

Stationary noise sources: Sources that do not generally move from place to place, eg. industrial or commercial sources. In general, these include:

Individual stationary sources such as:

- heating, ventilating and air conditioning (HVAC)

- equipment,
- rotating machinery,
- impacting mechanical sources,
- other mechanical equipment and machinery such as conveyors.

Mobile sources confined to particular location such as draglines and haul trucks.

Facilities, usually comprising many sources of sound, including:

- industrial premises,
- extractive industries,
- commercial premises,
- warehousing facilities,
- maintenance and repair facilities.

(In this case, the stationary source is understood to encompass all the activities taking place within the property boundary of the facility).

Temperature inversion: An atmospheric condition where temperature increases with height above the ground.

ATTACHMENT 2: EPA CORRESPONDENCE

Atkins Acoustics

From: Alexander Beavis [Alexander.Beavis@epa.nsw.gov.au]
Sent: Wednesday, 3 September 2014 9:40 AM
To: Atkins Acoustics
Subject: RE: EPL 11240 - 240 Grants Road, Somersby

Carl,

Thank you for your email.

To confirm our discussion on the phone, while the Environment Protection Authority (EPA) encourages the preparation of strategies, programs and plans as useful tools for industry to ensure that it meets the environmental objectives specified in conditions of Environment Protection Licences, as a regulatory authority the EPA does not review or comment on these plans.

For EPA advice regarding noise issues specific to this project please see EPA's comments on the Environment Assessment from June 2013 available [here](#). In particular Attachments A & B discuss matters relevant to noise management at the site.

Feel free to call on 4908-6804 if you wish to discuss this matter further.

Yours sincerely

Alexander Beavis

Regional Operations Officer - Hunter | **NSW Environment Protection Authority** |

☎: 4908 6804 | 📠: 0459 073 885 | 📠: 4908 6810 |

✉: alexander.beavis@epa.nsw.gov.au

From: Atkins Acoustics [<mailto:atkinsacoustics@bigpond.com>]

Sent: Monday, 1 September 2014 10:36 AM

To: Beavis Alexander

Cc: 'Vanessa Colclough'

Subject: EPL 11240 - 240 Grants Road, Somersby

Alex,

Appreciate your time on the phone this morning. As discussed Condition 9 of the DoPE Consent (08_0099) requires the Proponent to prepare a Noise Management Plan (NMP), specifically item 9(a) requires the NMP to be prepared in consultation with the EPA.

From your preliminary comments, we understand that the EPA would typically not comment, review or 'approve' NMP's. Can you please confirm EPA position with respect to this specific project.

Regards,

Carl Fokkema

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Appendix 5

Air Quality Management Plan

Pacific Environment Operations
Pty Ltd





Report

GRANTS ROAD SAND QUARRY EXTENSION AIR QUALITY MANAGEMENT PLAN

GR & AK JONES C/- GRANTS ROAD SAND QUARRY

Job ID. 09203

15 JUNE 2016

PROJECT NAME: GRANTS ROAD SAND QUARRY EXTENSION AIR QUALITY MANAGEMENT PLAN

JOB ID: 09203

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PREPARED FOR: GR & AK Jones c/- Grants Road Sand Quarry

APPROVED FOR RELEASE BY: Jane Barnett

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1 INTRODUCTION

1.1 Background

The Grants Road Sand Quarry (GRSQ) is located approximately 8 km northwest of Gosford, on the Somersby Plateau at 270 Grants Road, Somersby NSW (Lot 1 DP 358717). The location of the quarry is shown in **Figure 1.1**. Brisbane Water National Park is located to the west of the site, Grants Road and Howe Aboriginal Reserve to the east, and rural properties are located to the north, south and east of the site. Nearby sensitive receptors to the site have been identified and are also shown in **Figure 1.1**. Located approximately 800 m north of the site is the existing Hanson Central Coast Sand quarry, situated on Reservoir Road and operated by Hanson Construction Materials Pty Ltd.

On 25 July 2014, the Department of Planning and Environment, granted Project Approval to GR & AK Jones for the Grants Road Sand Quarry Extension (the Project). The Project Approval Condition 12 of Schedule 3 requires the preparation of an Air Quality Management Plan (AQMP).

The AQMP provides a working document for day-to-day management of the site which will assist with ensuring the operation complies with approval requirements. The plan covers all aspects of air quality management on site including: monitoring; complaints handling; performance indicators; training; roles and responsibilities and the recommended revision procedure.

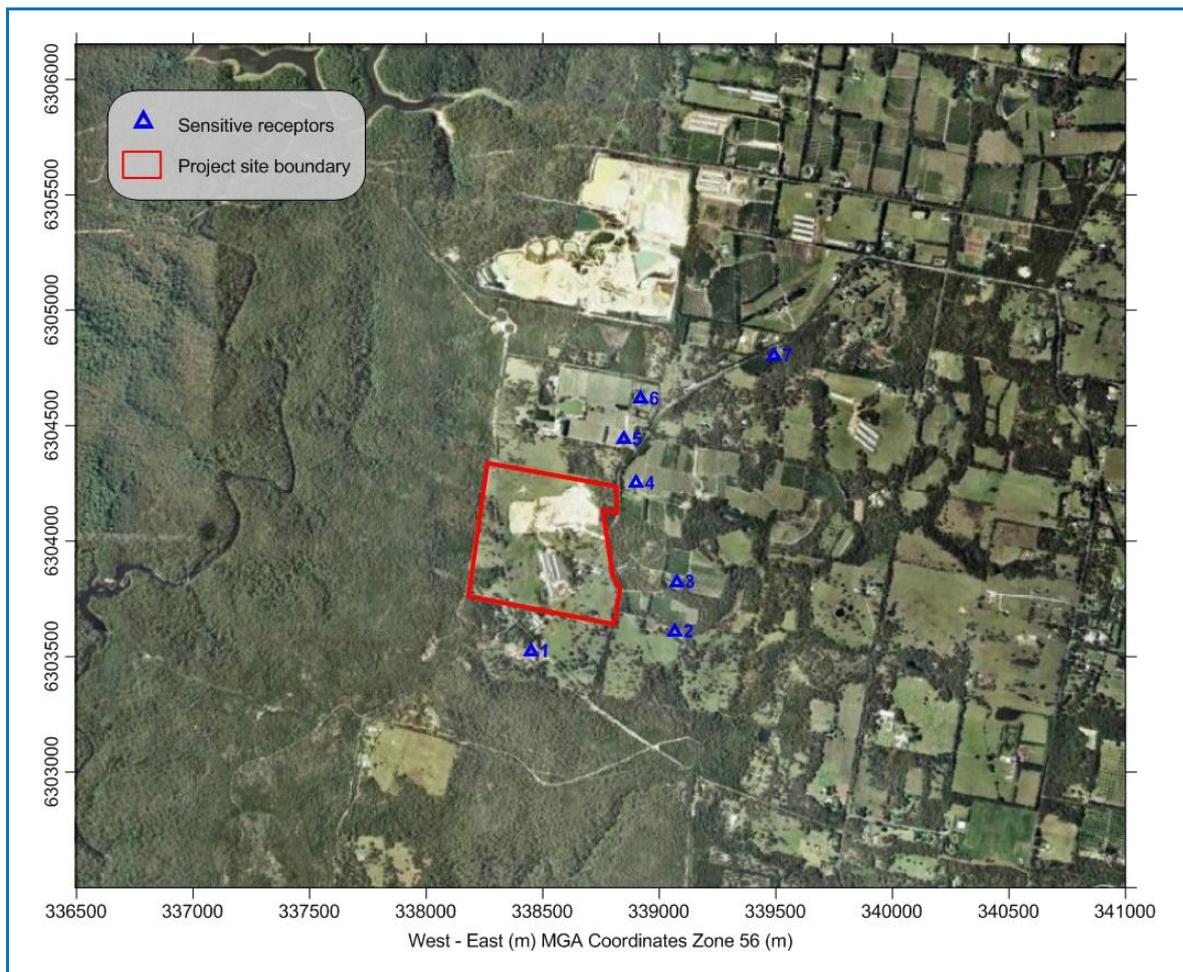


Figure 1.1: Project Site and Sensitive Receptors

1.2 Objectives of the Management Plan

This Air Quality Management Plan (AQMP) describes strategies for minimising and managing air quality (AQ) emissions for the Project. The AQMP forms part of the Environmental Management Strategy for the Project and has been developed in accordance with the consent operating conditions, as listed in **Table 1.1**.

Table 1.1: Grants Road Sand Quarry Extension Approval Conditions (Schedule 3, Condition 11 – Operating Conditions)

Schedule 3, Condition 11 Operating Conditions	Relevant Section of AQMP
The Proponent shall:	
(a) implement best management practice to minimise the dust emissions from the project;	Section 5
(b) regularly assess air quality monitoring data and relocate, modify and/or stop operations on site to ensure compliance with the air quality criteria in this approval;	Section 7
(c) minimise the air quality impacts of the project during adverse meteorological conditions and extraordinary events;	Section 8
(d) implement all reasonable and feasible measures to minimise the release of greenhouse gas emissions from the site;	Section 6
(e) minimise the area of surface disturbance and maximise progressive rehabilitation of the site; and	Section 5
(f) carry out regular air quality monitoring to determine whether the project is complying with the relevant conditions of this approval,	Section 7
to the satisfaction of the Secretary.	

The requirements for the preparation of the AQMP are outlined in **Table 1.2**.

Table 1.2: Grants Road Sand Quarry Extension Approval Conditions (Schedule 3, Condition 12 – Air Quality Management Plan)

Development Consent Requirement – Air Quality and Greenhouse Gas Management Plan	Relevant Section of AQMP
The Proponent shall prepare and implement an Air Quality Management Plan for the project to the satisfaction of the Secretary. This plan must:	
(a) be prepared in consultation with EPA, and submitted for approval to the Secretary for approval by the end of November 2014;	Appendix A
(b) describe the measures that would be implemented to ensure: <ul style="list-style-type: none"> ▪ compliance with the relevant conditions of approval; ▪ best practice management is being employed; and ▪ the air quality impacts of the project are minimised during adverse meteorological conditions and extraordinary events; 	Sections 7 and Section 8
(c) describe the proposed air quality management system;	Section 8
(d) include an air quality monitoring program that: <ul style="list-style-type: none"> ▪ is capable of evaluating the performance of the project; ▪ includes a protocol for determining any exceedances of the relevant conditions of approval ▪ effectively supports the air quality management system; and ▪ evaluates and reports on the adequacy of the air quality management system 	Section 7

Additional requirements for the AQMP are outlined in Schedule 5 Condition 3 and are listed in **Table 1.3**.

Table 1.3: Grants Road Sand Quarry Extension Approval Conditions (Schedule 5, Condition 2 – Management Plan Requirements)

Development Conditions Requirement – Management Plan Requirements	Relevant Section of AQMP
The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:	
(a) detailed baseline data;	Section 4
(b) a description of: <ul style="list-style-type: none"> • the relevant statutory requirements (including any relevant approval, licence or lease conditions); • any relevant limits or performance measures/criteria; • the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures; 	Section 2
(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits or performance measures/criteria;	Section 5
(d) a program to monitor and report on the: <ul style="list-style-type: none"> • impacts and environmental performance of the project; • effectiveness of any management measures (see c above); 	Section 7 and Section 8
(e) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	Section 8
(f) a program to investigate and implement ways to improve the environmental performance of the development over time;	Section 8
(g) a protocol for managing and reporting and: <ul style="list-style-type: none"> • incidents; • complaints; • non-compliance with statutory requirements; and • exceedances of the impact assessment criteria and/or performance criteria; and 	Section 9
(h) a protocol of periodic review of the plan.	Section 11

2 AIR QUALITY CRITERIA AND APPLICABLE LEGISLATION

The management plan complies with the following legislation and standards:

- The Protection of the Environment Operations (Clean Air) Regulations 2010
- The Approved Methods for the Sampling and Analysis of Air Pollutants in NSW guideline (EPA, 2005)

2.1 Air Quality Assessment Criteria

In accordance with Schedule 3, Condition 10 of the Approval, all reasonable and feasible avoidance and mitigation measures are employed to ensure that particulate matter emissions generated by the project do not exceed the criteria listed in Tables 2, 3, 4 and 5 of the Approval (reproduced in this report as **Table 2.1**, **Table 2.2**, **Table 2.3** and **Table 2.4** and, respectively), at any residence on privately-owned land. An exceedance of any of these criteria constitutes an air quality incident.

Table 2.1: Long Term criteria for particulate matter

Pollutant	Averaging period	^d Criterion
Total suspended particulate (TSP) matter	Annual	^a 90 µg/m ³
Particulate matter <10 µm (PM ₁₀)	Annual	^a 30 µg/m ³

Table 2.2: Short Term criteria for particulate matter

Pollutant	Averaging period	^d Criterion
Particulate matter <10 µm (PM ₁₀)	24 hour	^a 50 µg/m ³

Table 2.3: Long Term criteria for deposited dust

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
^c Deposited dust	Annual	^b 2 g/m ² /month	^a 4 g/m ² /month

Table 2.4: Impact assessment criterion for crystalline silica

Pollutant	Averaging period	Criterion
^e Chronic Reference Exposure Level (REL) (PM ₄)	Annual	3 µg/m ³

Notes to Tables

^a Total impact (i.e. incremental increase in concentrations due to the project plus background concentrations due to all other sources);

^b Incremental impact (i.e. incremental increase in concentrations due to the project on its own);

^c Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method;

^d Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity agreed by the Secretary in consultation with the EPA; and.

^e Crystalline silica must be analysed in accordance with a test method approved by the Department of Health

3 PROJECT OVERVIEW

The Grants Road Sand Quarry (formerly known as “Somersby Sand Quarry”) commenced operation in September 2000 with approval to quarry 2 hectares with a total resource extraction of 200,000 tonnes. Approval has been granted to increase production to extract more than 250,000 tonnes of material per year of a total resource of approximately 9.5 Million tonnes (Mt). The total approved quarry area is 20 hectares (ha) and will be staged to allow for progressive rehabilitation to commence as each stage (precincts A through to G) is completed. The proposed staging plan for the site is shown in **Figure 3.1**.

The extraction will be carried out by dozer and excavator activities, no blasting would be required. The product to be extracted is estimated to be 50% sand product (of which 30% will be unwashed and 20% washed) and 50% dimension stone.

The screening machines will be relocated to each precinct for the respective stages. The product will be screened then loaded for dispatch off-site. Material to be washed will be transported to Precinct A where the wash plant will be located, washed material will be loaded onto trucks directly from this location for dispatch off-site.

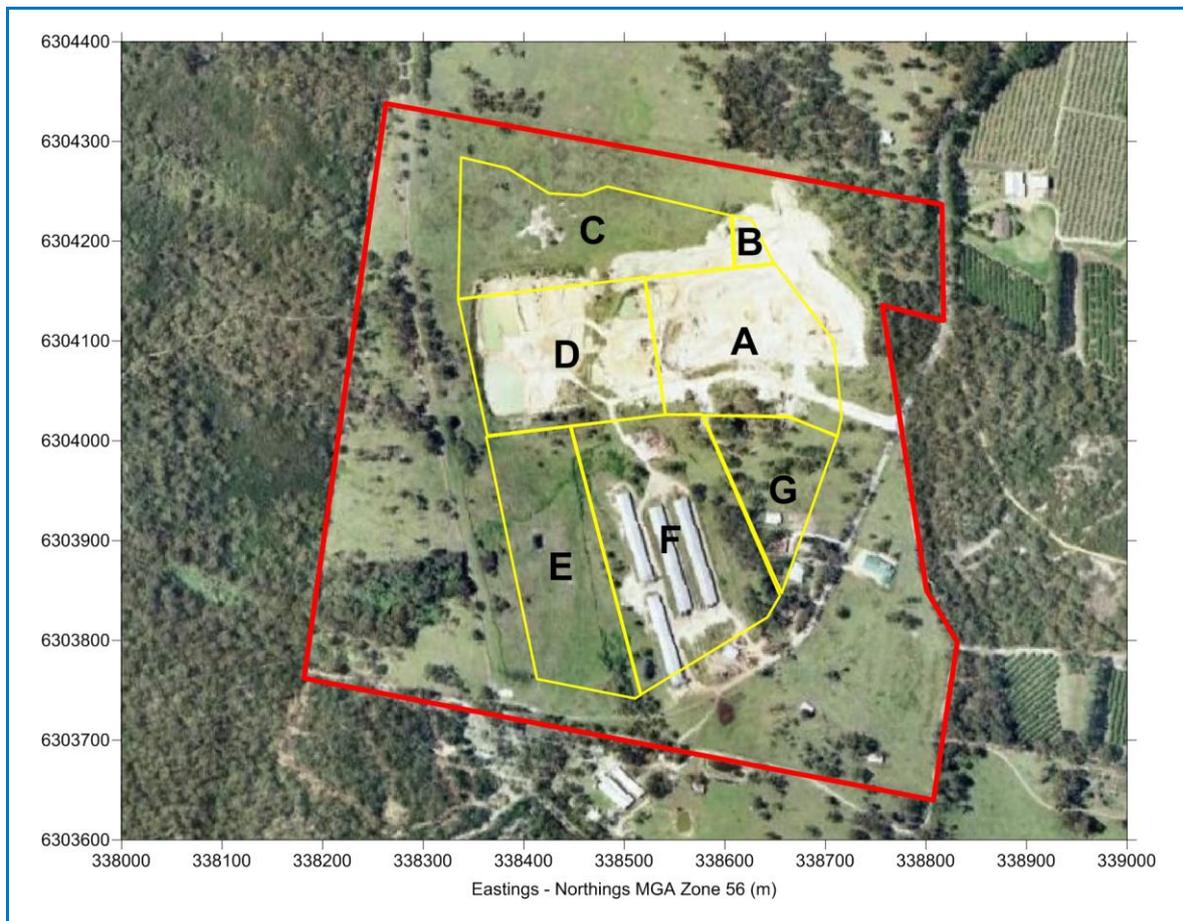


Figure 3.1: Project Stages

3.1 Sources of Emissions to Air

3.1.1 Dust Emissions

Potential sources of significant dust emissions from the Project include:

- Stripping topsoil by bulldozer,
- Wind erosion from exposed areas,
- Dozer ripping/pushing sand,
- Wheel generated dust, and
- Screening.

3.1.2 Greenhouse Gas Emissions

The processes listed in **Section 3.1.1** above will also result in the generation of greenhouse gas emissions. The main sources of greenhouse gases generated by the project are identified as follows:

- Fuel combustion (mainly diesel) associated with the use of plant and equipment,
- Indirect emissions associated with electricity use, and
- Indirect emissions associated with the transport of product.

3.2 Air Quality Impact Assessment

In 2013, Pacific Environment (formerly PAEHolmes) completed an Air Quality Impact Assessment (AQIA) for the GRSQ (**PAEHolmes, 2013**). The assessment investigated the potential air quality impacts of the extension with respect to air quality and greenhouse gas emissions.

Dispersion modelling was used to predict off-site dust concentration and dust deposition levels as well as crystalline silica concentrations, due to the dust generating activities that would occur as a result of the Project. Emissions inventories were developed for two representative stages (C and F), chosen to represent worst case impact when activities are closest to sensitive receptors. The dispersion conditions for the area were characterised based on regional and local meteorological data and predictions made for the maximum 24-hour PM_{2.5} and PM₁₀, annual average crystalline silica, PM_{2.5}, PM₁₀ and TSP concentrations and annual average dust deposition.

Detailed modelling in the AQIA included predictions of air quality impacts both from the Project in isolation, and cumulatively. The assessment determined that the Project in isolation was unlikely to result in exceedances of the EPA's air quality assessment criteria, but that there was potential for some exceedances of the short-term cumulative PM₁₀ criteria. There were no predicted exceedances of the crystalline silica chronic reference exposure level.

The predictions presented in the AQIA incorporated a level of conservatism due to worst case assumptions and the nature of dispersion modelling. As a result, it is expected that actual ground level concentrations would be lower than those predicted during normal operation of the Project.

4 EXISTING ENVIRONMENT

4.1 Meteorology

Local meteorological data are available at the Gosford (Narara Research Station) Bureau of Meteorology (BoM) Automatic Weather Station (AWS) site. Data from 2007 were analysed and used for dispersion modelling in the air quality assessment (**PAEHolmes, 2013**). Annual and seasonal windroses compiled from these data are presented in **Figure 4.1**.

Windroses show the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points – N, NNE, NE, etc. The bar at the top of each windrose diagram represents winds blowing from the north (i.e. northerly winds), and so on. The length of the bar represents the frequency of occurrence of winds from that direction, and the colour of the bar sections correspond to wind speed categories, the lighter colour representing the lightest winds.

On an annual basis winds from the east are most predominant with a good proportion of winds from the east-northeast. Spring, summer and autumn, winds distribution patterns all follow similar patterns with winds predominantly from the east and east-northeast with some strong winds from the southeast. In winter winds predominantly occur from the north-northwest and north.

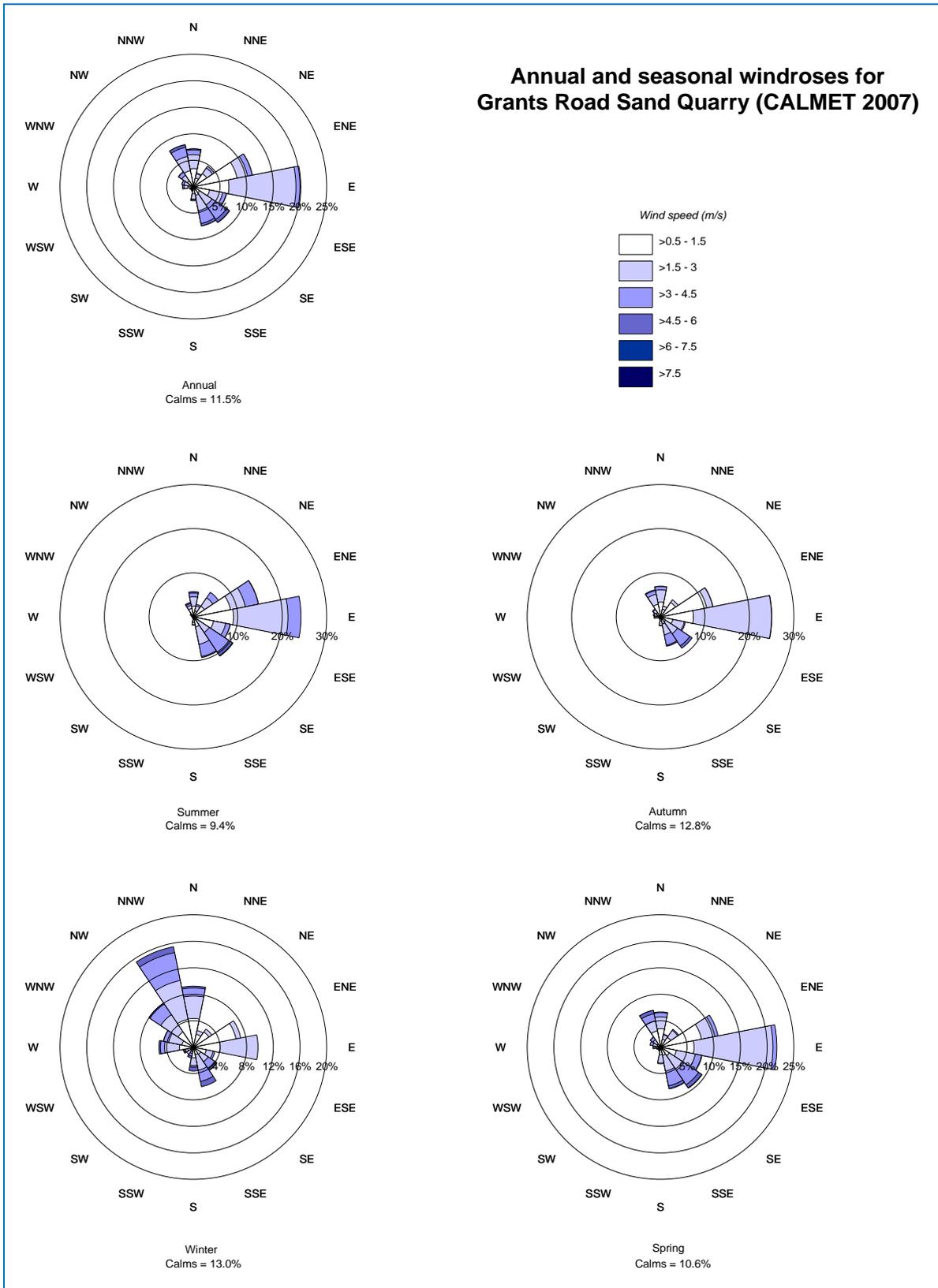


Figure 4.1: Annual and Seasonal Windroses for Grants Road Sand Quarry (2007)

4.2 Ambient Air Quality Data

Monitoring has been undertaken in the Somersby area for the EA undertaken for the Somersby Field Project (R.W. Corkery & Co., 2000). Monitoring for dust deposition and PM₁₀ was undertaken from September 2005 to November 2006, at a location approximately 3 km north of the Grants Road Quarry. The monitoring data are summarised in **Figure 4.2** and **Figure 4.3**.

The 24-hour PM₁₀ concentrations recorded from September 2005 to November 2006 vary significantly and show seasonal patterns, as expected. There were two days during this period when the 24-hour average PM₁₀ was greater than the EPA impact assessment criteria of 50 µg/m³. It is noted that the NEPM Ambient Air Quality standard for 24-hour PM₁₀ is also 50 µg/m³ but allows for 5 exceedances in a year, to account for regional events such as bushfires, dust storms and back burning etc.

The annual average PM₁₀ concentration for the monitoring period was 17.7 µg/m³ and the average dust deposition level recorded for the period (15 months) was 1.2 g/m²/month. Both of these levels are well below their respective air quality criterion.

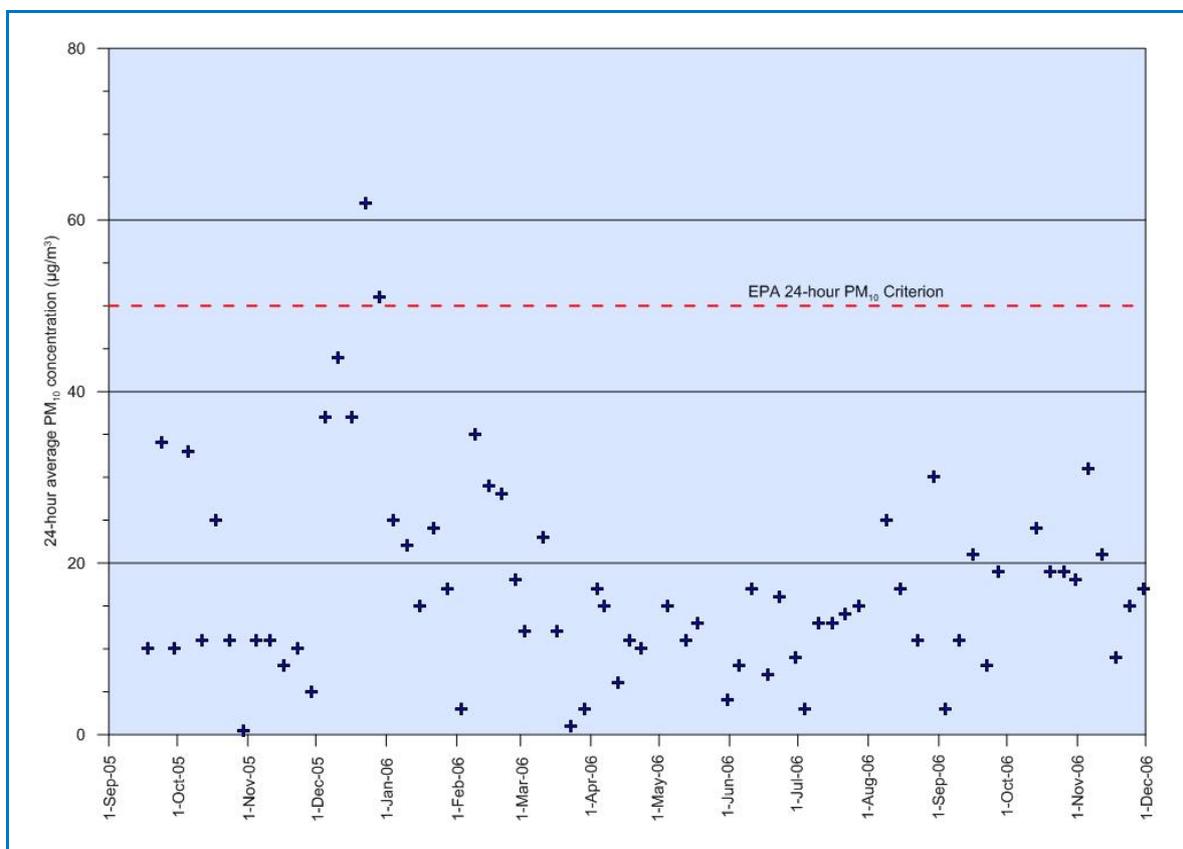


Figure 4.2: Measured 24-hour average PM₁₀ concentrations in the Somersby area

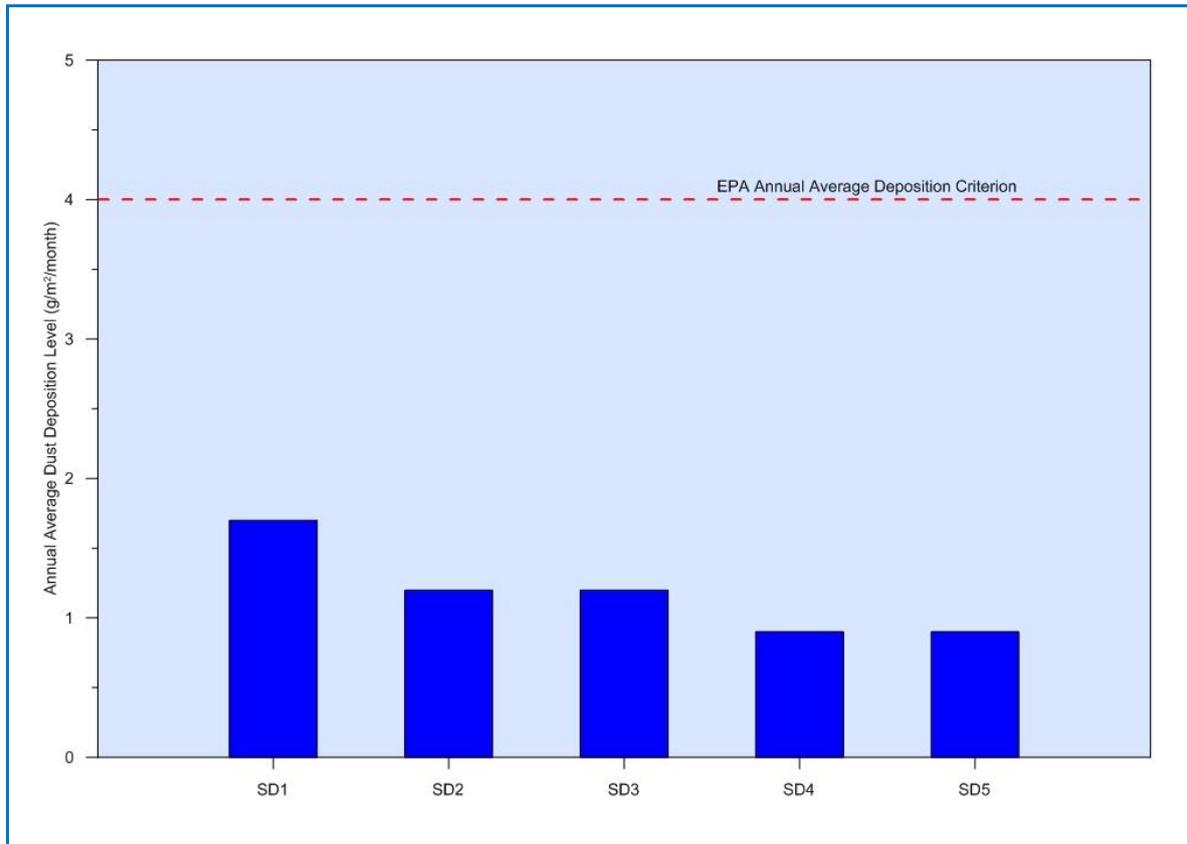


Figure 4.3: Measured dust deposition (insoluble solids) levels in the Somersby area

4.3 Greenhouse Gas Emissions

The Greenhouse Gas emissions for each year of the Project were estimated in the air quality assessment prepared in 2013 and are summarised in **Table 4.1**.

Table 4.1: Greenhouse Gas emission estimates per year

Parameter	Value	Units
Scope 1 Emissions	738	tonnes CO ₂ -e / year
Scope 2 Emissions	60	tonnes CO ₂ -e / year

5 AIR QUALITY MITIGATION AND MANAGEMENT

Mitigation and best practice management measures were identified in the AQIA for the Project, and these include:

- Watering of unsealed roads
- Use of wheel-wash and operation of sealed road from wheel-wash to the front gate
- Covering of loads during hauling
- Watering of stockpiles when necessary
- Limiting vehicle speed on-site
- Limiting area of disturbed land and progressive rehabilitation of completed areas.

Table 5.1 provides a summary of these measures and their relevant performance indicators and timing.

The protocol for compliance evaluation is detailed in **Section 8.1** and a number of meteorological triggers are described to limit exceedances of the impact assessment criterion. Relevant on-site staff will also regularly review meteorological conditions to understand triggers for amending operations where needed.

Table 5.1: Dust Management Practices at Grants Road Sand Quarry

Action	Monitoring Method	Timing	Performance Indicator	Responsibility for Implementation
Haul road watering	Visual inspection	Ongoing as required, at all times when haul trucks are using unsealed roads (not when it is raining and roads are already wet)	No visible dust above vehicle wheel arches	Quarry Manager
Wheel wash	N/A	Ongoing	N/A	Quarry Manager
Covering of loads	Inspection of trucks leaving the site	Ongoing	100% of loads leaving site are covered	Quarry Manager
Watering of stockpiles	Measurements of wind speed to trigger watering (above 8 m/s)	As required	Prevent excessive windblown dust from stockpiles during high winds	Quarry Manager
Limiting speeds onsite	N/A	Ongoing	30 km/h onsite speed limit	Quarry Manager
Limiting disturbed land and progressive rehabilitation	N/A	As required	Compliance with quarry plan and rehabilitation plan	Quarry Manager

6 GREENHOUSE GAS MITIGATION AND MANAGEMENT

The main sources of greenhouse gases generated by GRSQ are listed below. Greenhouse gas management will focus on emissions management and reductions associated with:

- Fuel combustion associated with the use of plant and equipment,
- Indirect emissions associated with electricity use, and
- Indirect emissions associated with the transport of product.

All reasonable and feasible measures to minimise the release of greenhouse gas emissions from the site will be implemented. A summary of the measures used to manage and minimise greenhouse gas emissions at the GRSQ are listed in **Table 6.1** below.

Section 7.3 presents details of monitoring that will take place to measure greenhouse gas emissions.

Table 6.1: Greenhouse Gas Management Practices at Grants Road Sand Quarry

Action	Timing	Performance Indicator	Responsibility for Implementation
Review opportunities to increase energy efficiency such as minimising haul distances, reducing trips by coordinating delivery and removal of materials etc..	Ongoing	Energy is reduced	Quarry Manager
Consideration of the use of alternative fuels where economically and practically feasible	Ongoing	Identify potential energy efficiency and improvement	Quarry Manager
Regular maintenance of diesel powered equipment to ensure operation at peak efficiency	Ongoing as required	Energy efficiency is maximised	Quarry Manager
Consideration of energy efficiency for all electrical equipment, appliances, lighting and hot water system	Ongoing	Energy efficiency is maximised	Quarry Manager

7 AIR QUALITY MONITORING PROGRAM

7.1 Meteorological Monitoring

Schedule 3, Condition 13 of the Approval requires that;

“For the life of the project, the Proponent shall ensure that there is a suitable meteorological station operating in the vicinity of the site that complies with the requirements in the *Approved Methods for Sampling of Air Pollutants in New South Wales* guideline.

As described in **Section 4.1**, meteorological data from Gosford were used in conjunction with other prognostic data for dispersion modelling purposes in the Air Quality Assessment (**PAEHolmes, 2013**). However, consultation with the EPA (email from Peter Jamieson on 26 September 2014 and shown in **Appendix A**) has indicated that this station will not be suitable for the purposes of ongoing management at the GRSQ site.

Although GRSQ previously had a weather station installed at the site, it did not comply with the relevant Australian standard (AS 2923 – 1987: “*Ambient Air Guide for the measurement of horizontal wind for air quality applications*”). GRSQ has since installed a new weather station at the site which complies with this Australian standard. The parameters measured are summarised in **Table 7.1**.

Table 7.1: Weather Station Parameters

Parameter	Units	Frequency	Averaging Period	Sampling Method
Rainfall	mm	Continuous	1-hour	AM-4
Temperature @ 2 m	°C		15 minute	AM-4
Temperature @ 10 m	°C			AM-2 and AM-4
Wind Speed @10 m	m/s			AM-2 and AM-4
Wind Direction @ 10 m	Degrees			AM-2 and AM-4
Sigma Theta	Degrees			AM-2 and AM-4
Solar Radiation	W/m ²			AM-4

7.2 Air Quality Monitoring

Schedule 3, Condition 12(d) of the Project Approval states that the air quality management plan must include an air quality monitoring program that is capable of evaluating the performance of the project. The Approval Conditions do not specify the type of equipment to be used to monitor PM₁₀, however, the proponent has committed to installing High Volume Air Samplers (HVAS) for compliance monitoring. One HVAS has already been deployed towards the southeast corner of the site and is co-located with the new meteorological station. The DP&E has requested that in the event of complaints a second HVAS sampling location be identified. While the Department does not specify a location, it would make sense for it to be situated on a property near where the complaints were made. It is unlikely that this will be required in practice as there has not been a complaint to date.

The Department has also requested that two deposition gauges be installed to monitor deposited dust. It is proposed that one of these is located on the southern boundary between the operations and the nearest southern residence. A suitable location for the second gauge would be in the northeast corner of the site where the nearest northern residences are.

Monitoring data will be reviewed in March each year as part of the annual reporting requirements discussed further in **Section 11.1**. Depending on the findings of each annual review, and in consultation with the relevant authorities, monitoring requirements may be discontinued or augmented.

The HVAS monitoring will be operated in accordance with *AS/NZS 3580.9.6:2003 Methods for sampling and analysis of ambient air – Determination of suspended particulate Matter – PM₁₀ – high volume air sampler with size selective inlet – gravimetric method*.

The dust deposition monitoring will be operated in accordance with *AS/NZS 3580.10.1:2003 Methods for sampling and analysis of ambient air – Method 10.1: Determination of particulate matter – Deposited matter – Gravimetric method*.

As listed in Appendix 1, Subject 11 of the Approval, GRSQ have also committed to carrying out campaign monitoring for respirable crystalline silica (RCS). The monitoring will be carried out on a day of maximum throughput and in accordance with Australian Standard (*AS 2985-2009*) – *Workplace atmospheres – Method for sampling and gravimetric determination of respirable dust*. This monitoring will be repeated quarterly in the first year of the quarry extension and if more than two consecutive results demonstrate low risk monitoring may be discontinued, after consultation with the relevant authorities.

7.3 Greenhouse Gas Monitoring

Greenhouse gas monitoring throughout the year will be undertaken primarily through the monitoring of diesel use, oil and grease use and electricity use for Scope 1 and 2 emissions.

Monitoring will be undertaken in accordance with the requirements of the National Greenhouse and Energy Reporting Act 2007 (NGER Act) and the National Greenhouse and Energy Reporting Regulations 2008 (**NGER, 2008**).

As a result of reporting under the NGER Act, emissions data will be made available publically via the Department of Climate Change and Energy Efficiency website: www.climatechange.gov.au.

Table 7.2 lists the greenhouse gas related monitoring that will be completed at the GRSQ.

Table 7.2: Greenhouse Gas Monitoring

Parameter	Monitoring Point	Frequency of Monitoring	Emissions Calculated	Comments
Diesel Use	Calculated from invoices	Annually	Emission factor to convert kL use to tonnes of CO2-e	Reported from invoices. Opening stock and Deliveries minus Closing Stock equals usage
Oil Use	Calculated from invoices	Annually	Emission factor to convert kL use to tonnes of CO2-e	
Grease Use	Calculated from invoices	Annually	Emission factor to convert kL use to tonnes of CO2-e	
Electricity Use	Calculated from invoices	Annually	Emission factor to convert kWh use to tonnes of CO2-e	

7.4 Data Handling Procedures

Data from the HVAS monitoring station will be handled as follows:

- Samples retrieved from monitoring instrumentation on a six day cycle
- Samples sent to a laboratory for analysis
- Data entered into electronic database (or similar) for comparison with relevant air quality criteria
- Data compared with relevant criteria and any exceedances noted and investigated.

8 AIR QUALITY MANAGEMENT SYSTEM

The Air Quality Management System will be implemented by the Environmental and Community Coordinator (or delegate), using monitoring data obtained as described in **Section 7**.

8.1 Protocol for Compliance Evaluation

The following section outlines the protocol for how compliance against the Impact Assessment Criteria will be evaluated and reported. Proving compliance with the conditions as written is not always straightforward. It may be difficult, for example, to distinguish between the dust generated from the project and any other sources in the area.

The following protocol for compliance testing will be conducted to determine if elevated levels recorded at the Compliance site have resulted from, or are likely to have resulted from, dust generated at the site.

8.1.1 Compliance with the 24-hour Average PM₁₀ Criterion

Compliance with the 24-hour PM₁₀ goal will be assessed at the monitoring site, using the exposed HVAS filter papers. Where 24-hour PM₁₀ concentrations are below the levels indicated for the impact assessment criterion, no further action is required and results are reported with no additional analysis.

Where air quality monitoring data are above the levels indicated for the impact assessment criterion, the following additional analysis will be conducted to test non-compliance.

- Investigate the meteorological data for the period to determine dominant wind direction, average wind speeds, percentage calm conditions (< 0.5 m/s) and significant periods of strong winds (> 5.4 m/s).

Where the dominant wind direction is not blowing across the site and towards the monitoring location, the level above the impact assessment criteria is unlikely to have resulted from site activities and does not represent non-compliance.

Where the dominant wind direction is blowing across the site and towards the monitoring location, the following additional analysis is required to determine if dust from the site has contributed to the elevated levels and / or if wind-blown dust from other upwind sources are also contributing.

- Determine if the wind speeds are conducive to wind erosion from exposed surfaces (moderate winds > 5.4 m/s) or if calm conditions were prevalent (< 0.5 m/s). Calm conditions can result in poor dispersion of activity dependent emissions from the site, however, wind erosion from exposed surfaces would not be expected to occur under these conditions.
- Obtain a site activity log for the elevated level day to determine what activities were occurring and characterise the activities based on being wind speed independent, wind speed dependent or wind erosion sources.
- Request additional microscopic analysis of the exposed filter paper to determine the likely dust source (i.e. is the dust similar or different to material handled at the site).

On the basis of the wind conditions, the activities occurring on-site and the potential contribution from upwind sources, determine the likelihood of the Project contributing to elevated levels above the impact assessment criterion.

8.1.2 Compliance with the Annual Average PM₁₀ Criteria

It is noted that the long term Impact Assessment Criterion is applicable to an averaging period of one year, and until sufficient representative data are collected, compliance with the long term criteria cannot be tested. The analysis presented in **Section 8.1.1** can be applied similarly for annual average

impacts, by comparing the monitoring station data to annual wind patterns and annual average background / regional pollutant levels.

If compliance with the annual average PM₁₀ criterion is achieved, then the annual average TSP will also comply. Separate TSP monitoring is not proposed.

8.1.3 Compliance with the Annual Average Crystalline Silica Criterion

This criterion is to assess the exposure of quarry workers to respirable crystalline silica. Compliance will be assessed based on results from the monitoring outlined in **Section 7.2**. Monitoring will be conducted on a campaign basis, on a day of maximum throughout during the first year of the quarry extension. This will be repeated quarterly and if two consecutive results demonstrate low risk the monitoring will be discontinued.

8.1.4 Compliance with the Annual Average TSP and Dust Deposition Criteria

There is currently no monitoring proposed for TSP or dust deposition. In their Recommended Conditions for this proposal, the NSW EPAs Condition 27 states that "The Proponent must prepare, implement and maintain an ambient air quality network to monitor PM₁₀", and did not specifically request other metrics such as TSP and dust deposition to be monitored. It is suggested that if the annual average PM₁₀ criterion is met then this will also be the case for the annual average TSP criterion.

A larger operation to the north of the Grants Road Quarry site has historically undertaken dust deposition monitoring and levels were found to be well below the criterion (see **Section 4.2**). The air quality impact assessment for the proposed expansion also predicted very low levels off-site. It is unlikely that the dust deposition criterion would be exceeded if the Project complies with the annual PM₁₀.

8.1.5 Non-Compliance and Corrective Action

Where the compliance evaluation indicates non-compliance with the Impact Assessment Criteria, the following actions will be undertaken:

- Identify the activities that were occurring at the time of the non-compliance
- Determine the activities that were most likely contributing to the non-compliance
- Review the process and current controls in place for these activities

Corrective action may be required and involve modification of activities or program to avoid any recurrence or minimise its adverse effects.

8.1.6 Implementation of Air Quality Mitigation and Management Measures

This stage of the protocol involves the implementation of the air quality mitigation and management measures (**Section 5**). The operations manager will be responsible for the timely implementation of the selected measures.

8.1.7 Review of Air Quality Mitigation and Management Measures Employed

The effectiveness of the adopted measures will be assessed against the relevant criteria identified in **Section 2.1**. The management strategy phase of the protocol will be revisited as required.

In addition, the Environmental and Community Coordinator (or delegate) will note any trends in the monitoring data that may emerge in regards to particular operating scenarios or meteorological conditions.

The outcomes of the Air Quality Management System will be reported in the Annual Review.

9 COMPLAINTS RESPONSE PROTOCOL

9.1 Introduction

In accordance with Schedule 5, Consent Condition 2 (g), the AQMP will detail the procedures for managing and reporting complaints in relation to air quality.

The objective of the Complaint Response Protocol is to facilitate prompt and comprehensive responses to community concerns that relate to air quality. The Protocol will be the responsibility of the Environmental and Community Manager (or delegate).

9.2 Assessment

Preliminary investigations will commence as soon as practical of the complaint receipt to determine likely causes of the complaint using information regarding prevailing meteorological conditions, the nature of activities taking place and recent air quality monitoring results.

This preliminary investigation will be used to develop specific mitigation measures which will be presented to the landowner.

9.3 Implementation of Mitigation Measures

Those mitigation measures developed as a result of the complaint investigation will be implemented by the operations manager. Following implementation, monitoring will further assess the effectiveness of the additional dust control measures.

9.4 Management of Complaints Where Criteria are Exceeded

Complaints will be managed as detailed in the overall Environmental Management Strategy for the site. Any complaints will be logged in the complaints register, which will document the following information:

- Date and time the complaint was logged,
- Personal details, if provided by the complainant,
- Nature of the complaint,
- Actions taken or if no action taken then the reason why, and
- Follow up with the complainant.

In the event of a complaint, where dust levels are demonstrated to be below the relevant criteria (see **Section 2**) the resolution process will be one of informed discussion involving the complainant and the Environmental and Community Coordinator (or delegate). The complainant will be made fully aware of the monitoring and reporting procedures used at the site. Every effort will be made to ensure that concerns are addressed in a manner that results in a mutually acceptable outcome.

10 ROLES AND RESPONSIBILITIES

In addition to the specific responsibilities for dust and greenhouse gas management which are outlined in **Section 5** and **Section 6**, general roles and responsibilities for the implementation of the AQMP are presented in **Table 10.1**.

Table 10.1: Roles and Responsibilities

Task	Responsibility	Timing
Monitoring of air quality in accordance with Section 7 .	Environmental and Community Coordinator	Ongoing
Assessment of air quality data against relevant criteria outlined in Section 2 .	Environmental and Community Coordinator	Ongoing
Exceedances of air quality criteria to be managed in accordance with the Air Quality Management System described in Section 8 .	Environmental and Community Coordinator	As required
Air quality complaints to be responded to and recorded in accordance with the Complaints Response Protocol in Section 9 .	Environmental and Community Coordinator	As required
Annual Review to include air quality results, complaints, mitigation measures undertaken and a review of the performance of monitoring and measures undertaken in accordance with Section 11 .	Environmental and Community Coordinator	Annually
Regular review of the AQMP to be completed in accordance with Section 11 .	Environmental and Community Coordinator	As required

11 REPORTING AND REVIEW

11.1 Annual Review

In accordance with Schedule 5, Condition 4 of the Approval, GRSQ will, by the end of March each year, or timing as may be agreed by the Secretary, review the environmental performance of the project to the satisfaction of the Secretary. This review must:

- describe the development (including any rehabilitation) that was carried out in the past calendar year, and the development that is proposed to be carried out over the current calendar year;
- include a comprehensive review of the monitoring results and complaints records of the project over the past calendar year, which includes a comparison of these records against:
 - relevant statutory requirements, limits of performance measures/criteria;
 - requirements of any plan or program required under this approval;
 - the monitoring results of previous years; and
 - the relevant predictions in the EA
- identify any non-compliance over the past calendar year, and describe what actions were (or are being) taken to ensure compliance;
- identify any trends in the monitoring data over the life of the project;
- identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and
- describe what measures will be implemented over the current calendar year to improve the environmental performance of the project.

11.2 Community Consultative Committee

In accordance with Schedule 5, Condition 6, if directed by the Secretary, a Community Consultative Committee (CCC) will be established and operated in general accordance with the *Guidelines for*

Establishing and Operating Community Consultative Committees for Mining Projects and to the satisfaction of the Secretary.

11.3 Incident Reporting

In accordance with Schedule 5, Condition 7, GRSQ will notify the Secretary of any incident in relation to air quality. Within 7 days of the date of the incident, the Proponent shall provide a detailed report on the incident, and such further reports as may be requested.

11.4 Regular reporting

In accordance with Schedule 5, Condition 8, GRSQ will provide regular reporting on the environmental performance of the development on its website, in accordance with the reporting arrangements in any plans or programs approved under the conditions of this approval.

11.5 Access to Information

By the end of November 2014 and in accordance with Schedule 5, Condition 11, GRSQ will make copies of the following publically available on its website:

- the EA
- the Statement of Commitments
- the conditions of this approval
- all current statutory approvals for the project
- approved strategies, plans or programs required under the conditions of this approval
- a comprehensive summary of the monitoring results of the project, reported in accordance with the specifications in any conditions of this approval, or any approved plans or programs
- a complaints register, updated monthly
- the annual reviews of the project
- any independent environmental audit, and GRSQ's response to the recommendations in any audit
- minutes of the CCC meetings (if a CCC is required)
- any other matter required by the Secretary.

The above information must be kept up-to-date.

11.6 Independent Environmental Audit

An Independent Environmental Audit will be undertaken by 30 June 2015, and every three years thereafter (unless directed otherwise by the Secretary). In accordance with Schedule 5, Condition 9 of the approval, the audit will:

- be conducted by a suitable qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary
- include consultation with the relevant agencies
- assess the environmental performance of the project and assess whether it is complying with the requirements in the approval and any relevant EPL (including any assessment, plan or program required under these approvals)
- review the adequacy of any adopted strategies, plans or programs required under the abovementioned approvals

- recommend measures or actions to improve the environmental performance of the project, and/or any assessment, strategy, plan or program required under these approvals.

In accordance with Schedule 5, Condition 10, within six (6) weeks of completion this audit, or as otherwise agreed by the Secretary, GRSQ will submit a copy of the audit report to the Secretary, together with its response to any recommendations contained in the audit report.

11.7 Review

In accordance with Schedule 5, Condition 5 of the approval, within 3 months of:

- an annual review (**Section 11.1**)
- an incident report (**Section 11.3**)
- an audit report (**Section 11.6**), or
- any modification to the conditions of the approval, (unless the conditions require otherwise),

GRSQ will review the strategies, plans and programs required under the approval to the satisfaction of the Secretary. Where the review leads to revisions in any such document, then within four (4) weeks of the review the revised document will be submitted for the approval of the Secretary.

12 REFERENCES

AS2724.3 - 1984 - Determination of total suspended particulates (TSP) - High volume sampler gravimetric method

AS/NZS 3580.1.1:2007 "Methods for sampling and analysis of ambient air - Guide to siting air monitoring equipment".

AS/NZS 3580.9.8:2008 "Methods for sampling and analysis of ambient air - Method 9.8 Determination of suspended particulate matter - PM10 continuous direct mass method using a tapered element oscillating microbalance analyser".

AS/NZS 3580.9.6:2003 "Methods for sampling and analysis of ambient air - Determination of suspended particulate matter - PM(sub)10 high volume sampler with size-selective inlet - Gravimetric method".

AS/NZS 3580.10.1:2003 "Methods for sampling and analysis of ambient air - Determination of particulate matter - Deposited matter - Gravimetric method".

EPA (2005), "Approved methods for the sampling and analysis of air pollutants in NSW" New South Wales EPA 59-61 Goulburn Street, Sydney, NSW, August 2005.

NGER (2008), National Greenhouse and Energy Reporting (Measurement) Determination

PAEHolmes (2013), "Air Quality Impact Assessment – Extension of Grants Road Quarry", prepared for Peter Andrews & Associates Pty Ltd, January 2013. Job number 3837

R.W. Corkery & Co. (2000), "Environmental Assessment – Somersby Fields Project, Somersby Fields Partnership", prepared for Somersby Fields Partnership.

APPENDIX A – CORRESPONDENCE FROM NSW EPA

RE: Question regarding Grants Road Quarry meteorological station monitoring requirement

1 message

Peter Jamieson <Peter.Jamieson@epa.nsw.gov.au>

26 September 2014 at 13:14

To: Jane Barnett <jane.barnett@pacific-environment.com>, EPA Hunter Region <hunter.region@epa.nsw.gov.au>

EF13/3171

Dear Ms Barnett

The met station is to assess instances of elevated pollutants identified by ambient monitoring.

While the Gosford BOM site might have been OK when used in conjunction with TAPM and CALMET to provide "synthesised weather data" for the purposes of modelling, for investigating actual incidents we would want something closer and more representative of what is being experienced at the quarry on a particular day.

Grants Rd Quarry is reasonably small at the moment, but is approved to get much bigger. Large quarries generally have their own met stn. In the interim until Grants Rd gets to a larger scale we would be comfortable if they sourced their data from another nearby source that is representative of the weather at the site. Our letter from Feb 2014 noted for the weather stn

"The location of the site chosen for the station and details of equipment, measurement and maintenance/service procedures and schedules to be installed and maintained must be submitted in writing to the EPA and approved in writing by the EPA before any sampling or analysis is carried out. The meteorological monitoring station must be calibrated at least once every 12 months. The EPA is to be provided with data on request on a Microsoft ® Office software compatible format."

This still applies

Regards

Peter Jamieson

Head Regional Operations Unit | **NSW Environment Protection Authority** |

☎: (02) 4908 6818 | 📠: (02) 4908 6810 | ✉: peter.jamieson@epa.nsw.gov.au

From: Jane Barnett [mailto:jane.barnett@pacific-environment.com]

Sent: Wednesday, 24 September 2014 11:03 AM

To: Jamieson Peter

Subject: FW: Question regarding Grants Road Quarry AQMP

Good morning Peter,

I sent the email below to Alexander Beavis but I understand he is on leave and his out of office reply says to contact you. Are you able to assist with the following enquiry.

Kind regards, Jane

Jane Barnett

Principal Consultant – Air Quality

M: 0412 558 366

P: 02 9870 0900

Suite 1, Level 1, 146 Arthur Street, North Sydney

E: jane.barnett@pacific-environment.com



www.pacific-environment.com

This email may contain confidential and/or private information.
If you received this email in error please delete and notify sender.

From: Jane Barnett [<mailto:jane.barnett@pacific-environment.com>]

Sent: Wednesday, 24 September 2014 10:55 AM

To: 'alexander.beavis@epa.nsw.gov.au'

Subject: Question regarding Grants Road Quarry AQMP

Good morning Alexander,

I am currently preparing the Air Quality Management Plan for the Grants Road Sand Quarry at Somersby

Application Number: 08_0099

Proponent: GR and AK Jones

As stated in the Approval the plan must be prepared in consultation with the EPA, I have a question regarding the meteorological station requirement.

The air quality assessment was carried out using data from the Bureau of Meteorology's AWS data at Gosford (Narara Research Station). This station is about 5km east of the Grants Road site. The wind speed, direction and temperature data from Gosford were combined with TAPM outputs and used to compile the CALMET meteorological file for use with the CALPUFF dispersion model. This is all described in the air quality assessment completed in 2013.

The Approval Conditions (Schedule 3 Condition 13) state that the project is to ensure there is a suitable meteorological station operating in the vicinity of the site, but it doesn't state the purpose. I am assuming it is needed to respond to exceedances / complaints to determine the possible source of dust (either the project / other operations in the area / regional events).

My question is, would the EPA consider the Gosford weather station 'in the vicinity' of the site and suitable for the purposes for which it is required, or given the local terrain would the preferred operation be for the station to be either onsite or in the immediate vicinity?

Any comment or advice would be greatly appreciated.

Kind regards, Jane

Jane Barnett

Principal Consultant – Air Quality

M: 0412 558 366

P: 02 9870 0900

Suite 1, Level 1, 146 Arthur Street, North Sydney

E: jane.barnett@pacific-environment.com

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PLEASE CONSIDER THE ENVIRONMENT BEFORE PRINTING THIS EMAIL



Appendix 6

Traffic
Management Plan
Grants Road Sand



Traffic Management Plan

PURPOSE

This program sets out the management strategies in place at Grants Rd Sand Quarry for controlling traffic to prevent collision between vehicles, earth moving equipment and pedestrians, minimize traffic dust and noise on local residences and comply with the Mine Health and Safety Regulation 2007.

SCOPE

This program applies to all earth moving equipment, vehicles and people working at and visiting the quarry. It applies to:

- all company earth moving equipment and vehicles
- all contractors' earth moving equipment and vehicles
- all vehicles entering the quarry including visitors, suppliers and customer trucks
- all employees, contractors and visitors walking at the quarry

REFERENCES

Mine Health & Safety Regulation 2007, clause 39
Institute of Quarrying – Safety Management Workbook 2011
GRS Mine Safety Management Plan

PROCEDURES

This Traffic Management Plan sets out rules to be followed at Grants Rd Sand Quarry to prevent the possibility of the collision between earth moving equipment, vehicles and pedestrians. It has been prepared following the recognition that such collision is possible and the fact that the Mine Health & Safety Regulation 2007 identifies such interaction as a prescribed hazard and a high risk.

The rules as set out must be read in conjunction with the accompanying drawing of the traffic flow, see Figure 1.

The procedures and rules for traffic movement and for the interaction of pedestrians with traffic is set out in the **Traffic Management Plan, Drivers Code of Conduct and Site Safety Rules** and is based on the following key elements:

1. All people entering the quarry, must adhere to the hours of operation, between 7am and 6pm, Monday to Friday, between 7am and 1pm, Saturday and at no time Sunday or public holiday.
2. All people entering the quarry, must make contact with the production manager or loader operator as indicated at the sign at the entrance of the

quarry, for directions as to where to proceed. Customer trucks and visitors must follow the instructions on the sign at the entrance and contact either the loader operator (for customers) on the two way radio (UHF Channel 10) or the production manager on mobile 0418 116 861 (for visitors). They should then wait instructions before proceeding into the quarry.

3. Visitors must park in the Visitors Car Park and after contacting management, wait for a management representative to meet them. Visitors are not to walk off on their own into and around the quarry.
4. Customer trucks are to keep strictly to the "Customer Truck Route" as shown in Figure 1. This route takes them on the left hand side of the office to the sand stockpiles where they are to wait to be loaded. Truck drivers are not to get out and walk around on their own.
5. Where possible the operation of earth moving equipment will be used only in the quarry production area and will be kept separate from customer truck movement. Where this is not possible customer truck drivers are to be warned of any possible hazards over the two way radio.
6. All visitors to the quarry including customer truck drivers are to be inducted in the Site Safety Rules, Drivers Code of Conduct and this Traffic Management Plan.
7. The speed limit at the quarry is 20 Km/hour.
8. By adhering to the speed limit within the quarry of 20 km/hour, drivers should adhere to a 50km/hour speed limit on Grants Road and refrain from using truck exhaust brakes. Complying with our hours of operation, ensuring the roads are maintained and kept smooth and the regular noise monitoring that is undertaken allows Grants Rd Sand to minimise the impact of truck movements on local residences and road users.
9. The use of the wheel wash to remove sand from the wheels for all trucks leaving the quarry, the dust suppression measures of wetting down of stock piles as necessary and haul roads together with the weekly dust monitoring that takes place helps to diminish the impact of dust on local residences.

Steven Jones
Production Manager

Written: 14th October, 2014

Reviewed: 12th April, 2016

Drivers Code of Conduct

The rules are set out as follows:

CUSTOMER TRUCKS and CONTRACTORS

1. All customer truck drivers and contractors must on entering the quarry, contact the loader operator on UHF Channel 10 and be given instructions for loading. They are then to proceed to the loading area and wait to be loaded.
2. All trucks must enter and exit the quarry in a forward direction.
3. Trucks will not be loaded prior to 7 am and must be loaded and have exited the quarry premises by 6 pm.
4. To minimise the impact of truck movements on local residences and road users, drivers should adhere to a 50km/hour speed limit on Grants Road and refrain from using truck exhaust brakes.
5. All customer truck drivers and contractors must be inducted on an annual basis.
6. All truck drivers and contractors must comply with the speed sign of 20 Km/hour within the quarry and give way to all quarry vehicles and equipment.
7. Truck drivers must remain in the cabin of their trucks and wear seat belts at all times unless invited to speak with the loader operator or management.
8. Truck drivers must notify management if they have passengers in their cabin and must not allow any passenger to leave the cabin while at the quarry.
9. Once the truck is loaded, the driver is not to drive away until signalled by the loader operator.
10. All laden vehicles entering or leaving the site have their loads covered.
11. Prior to leaving the quarry all trucks remove loose material from the vehicle and pass through the wheel wash bay.

QUARRY VEHICLES AND EARTH MOVING EQUIPMENT

1. Quarry equipment is not to operate in the presence of vehicles or pedestrians. Every effort must be made to avoid possible collision.
2. If approached by pedestrians, equipment operators must stop immediately and either signal the pedestrian to keep clear or climb down and speak with them. No equipment is to be operated in the vicinity of pedestrians.

PEDESTRIANS

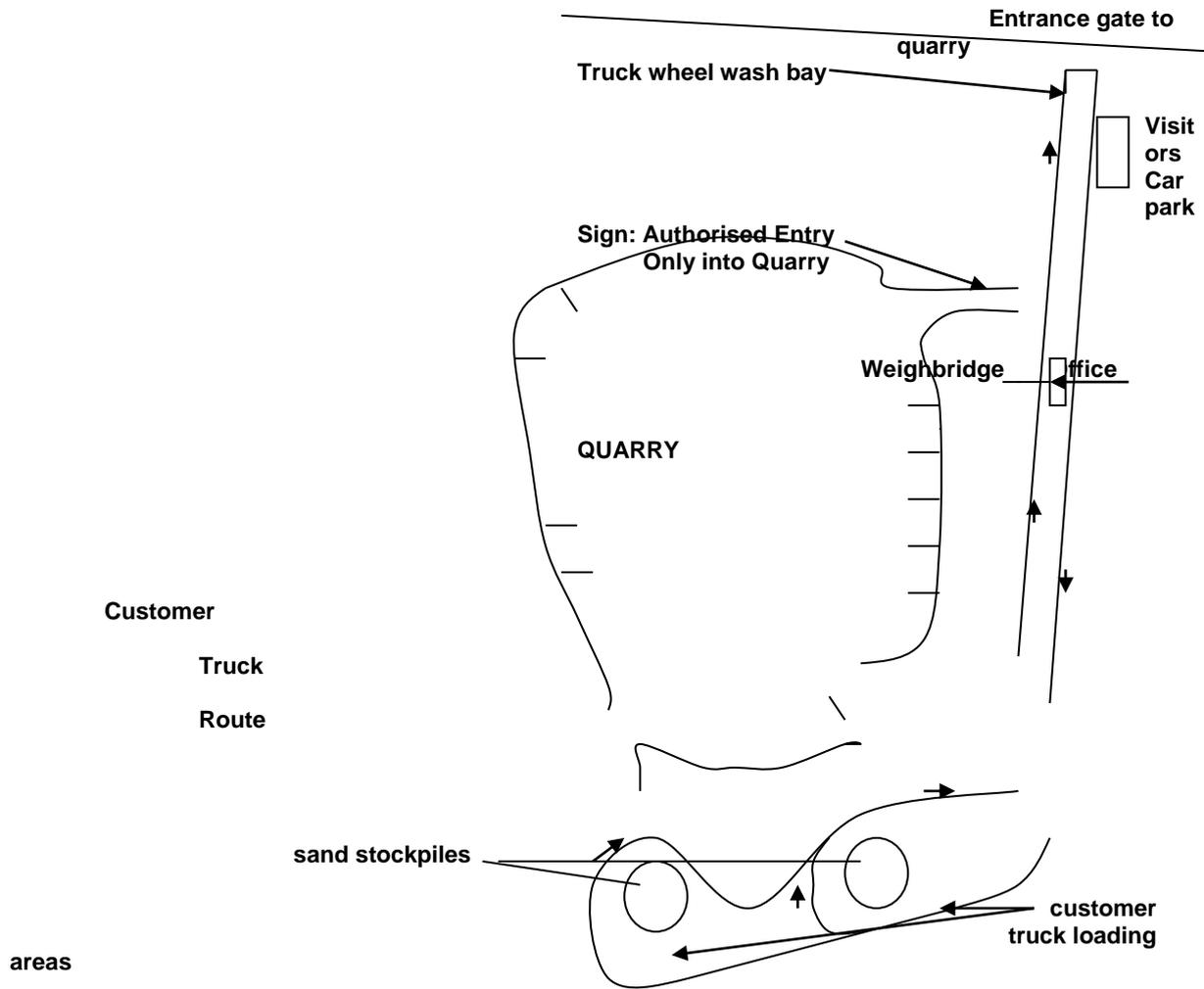
1. All pedestrians are to keep well clear and not approach operating mobile equipment, vehicles and trucks, to ensure they are not run over.
2. Pedestrians who wish to speak with a loader operator or truck driver are to signal the operator or driver and wait until the loader or vehicle has stopped and the operator climbs down, before they approach.
3. No pedestrian is to climb up onto any loader, truck or vehicle unless invited to do so by the operator and must not ride on the loader, truck or vehicle unless in an approved seat.

ENFORCEMENT

1. These traffic rules will be strictly enforced.
2. Employees found not complying will be subject to the company's enforcement policy of being re-inducted. Contractors and Truck Drivers found not complying will be asked to leave the site, the management of their company informed and be re inducted prior to re entering the site. Any further non-compliance from Truck Drivers and Contractors will result in the offending driver/contractor being banned from the site.

Steven Jones

Production Manager
FIGURE 1: Plan of Traffic Flow



Write name and sign to verify you have understood and will comply with the rules:

Steven Jones
Production Manager

NAME:..... SIGNATURE:.....

DATE:...../...../.....

COMPANY:.....

Site Safety Rules

The following site safety rules apply at Grants Rd Sand:

1. All visitors, customers and contractors must be inducted and sign off on these rules and the accompanying Traffic Management Plan rules, before they are allowed to enter the site. When on site they must comply with all rules and any directions given to them by management. Failure to comply will result in them being asked to leave the site.
2. All visitors must sign the Visitors Book before entering the site and on leaving the site. While on site they must remain in the company of management unless they are given permission to do otherwise.
3. All contractors must comply with the sites Mine Safety Management Plan and all applicable legislation. Contractors will be subject to a special induction which complies with legislation.
4. Every visitor, customer and contractor must contact the Production Manager Steven Jones on mobile 0418 116 861 (for visitors or contractors) and the loader operator on the two-way radio, UHF Channel 10, for truck drivers. No person is to proceed onto site without permission.
5. All signs must be obeyed including the speed sign of 20 Km/hour. Heavy vehicles have the right of way and seat belts must be worn at all times.
6. Illegal Drugs and Alcohol are not permitted on site and drug and alcohol testing may be carried out at any time at the discretion of management. Persons refusing to be tested or testing positive will be required to leave the site immediately. Limits are zero for drugs & 0.02 for alcohol.
7. Personal Protective Equipment must be worn as required for any work carried out by contractors. All visitors must wear high visibility clothing i.e. reflective vests and safety foot wear.
8. If any person is unsure of any matter that may affect their safety, they are to ask management for immediate clarification. All hazards and incidents must be reported immediately to management.
9. All people must keep well clear of all operating mobile equipment and trucks at all times to ensure they are not run over. In order to speak to an equipment operator they must wait until they have the operator's attention and the operator has stopped and signals them to approach or the operator gets out of the machine.
10. All people are to keep well clear of operating plant such as screens and conveyors so as not to get caught up in moving machinery.

11. Any person witnessing an emergency such as an accident or fire, are to notify management immediately. Otherwise they are to ring 000 or 112 (mobile) for the necessary emergency services.

12. Consideration must be given to the safety and well being of all other people on site. Anybody demonstrating uncooperative or offensive behaviour including damage to property, serious verbal or physical abuse, dangerous practical jokes and unsafe work practices will be asked to leave site.

Write name and sign to verify you have understood and will comply with the rules:

***Steven Jones
Production Manager***

NAME:..... SIGNATURE:.....

DATE:...../...../.....

COMPANY:



Appendix 7

Aboriginal Cultural Heritage Management Plan

Insite Heritage Pty Ltd





INSITE HERITAGE

PTY LTD

PO Box 98

Wangi Wangi NSW 2267

admin@insiteheritage.com.au

P 0249755818

ABN 70 110 716 080

**Grants Road Sand Quarry Extension
Aboriginal Cultural Heritage Management Plan
(Project Approval No. 08_0099)**

Prepared for

Peter Andrews & Associates

On behalf of

GR & AK Jones

October 2015



INSITE HERITAGE
PTY LTD

Project Coordinators	Peter Andrews & Associates Insite Heritage P/L	V Colclough Managing Director Angela Besant Director
Our Reference	Grants Road Sand Quarry Extension Aboriginal Cultural Heritage Management Plan GRSQE_ACHMP	
Date	October 2014	
Authors	A Besant Director Liz Wyatt Snr Archaeologist	
Version	V3 Final 8.10.2015	

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1.0 Introduction

Grants Road Sand Quarry has received approval (Project Approval No. 08_0099) under Section 75J of the *Environmental Planning and Assessment Act 1979* for the extension of the existing quarry operations located at Lot 1 DP358717, 270 Grants Road Somersby.

Insite Heritage were commissioned by Peter Andrews & Associates on behalf of GR & AK Jones to prepare a Aboriginal Cultural Heritage Management Plan (ACHMP) to satisfy the relevant Conditions of Consent issued for the project by the NSW Minister for Planning, Department of Planning and Environment (DoPE).

1.1 Background & Project Overview

The Grants Road Sand Quarry commenced operation in 2002 with development approval for quarrying of 2 hectares and maximum annual production of 200,000 tonnes per annum (PA&A Pty Ltd 2013). The Grants Road Sand Quarry Extension and existing Grants Road Sand Quarry will incorporate approximately 20 hectares of the site and includes the extraction of up to 250,000 tonnes per annum over a 30 year period (PA&A Pty Ltd 2013).

1.2 Scope & Objectives

The intent of this ACHMP is to provide guiding policies and principles for the management of Aboriginal cultural heritage values throughout the project area and adjacent biodiversity offset areas in accordance with the Conditions of Consent and the Statement of Commitments for the project (refer Appendix B & C). The ACHMP provides the framework for the protection of Aboriginal cultural heritage values throughout quarrying operations, rehabilitation and post extraction.

Condition 30 of the DoPE approval outlines that the proponent will;

- Prepare and implement an Aboriginal Cultural Heritage Management Plan
- Be prepared in consultation with OEH and local Aboriginal stakeholders; **(Section 2.1 & Appendix D)**
- Include a description of the measures that would be implemented for:
 - i. protecting, monitoring and managing Aboriginal sites within the site, including the biodiversity offset strategy; **(Section 2.4, 2.5, 2.6, 2.7, 2.13)**
 - ii. maintaining and managing reasonable access for Aboriginal stakeholders to cultural heritage items on site and in the biodiversity offset areas; **(Section 2.8)**
 - iii. managing the discovery of any human remains or previously unidentified Aboriginal objects on site, including (in the case of human remains) stop work provisions and notification protocols; **(Section 2.11 & 2.12)**
 - iv. ongoing consultation with the local Aboriginal stakeholders in the conservation and management of Aboriginal cultural heritage both on-site and in the biodiversity offset areas; **(Section 2.3 & 2.4)**

- v. ensuring any workers on site receive suitable heritage inductions prior to carrying out any activities which may disturb Aboriginal sites, and that suitable records are kept of these inductions; and **(Section 2.10 & Appendix E)**
- vi. the long term management of the Aboriginal cultural heritage values of the site post extraction operations and rehabilitation of the site. **(Section 2.7)**

1.3 Statutory Requirements

The Grants Road Sand Quarry Extension has been assessed under Part 3A of the *EP&A Act*. Projects assessed and approved under Part 3A do not require subsequent approval under Part 6 of the *National Parks and Wildlife Act 1974 (NPW Act 1974)*.

All activities are still subject to Section 91 and Section 96 of the *NPW Act 1974* that requires the reporting of all new sites. Section 96 requires a Care and Control Permit be in place for the long term storage and management of any artefacts salvaged, should this be required. A Care and Control Permit requires the support of all Aboriginal stakeholders.

Appendix B includes the Conditions of Project Approval 08_0099. The proponent has also made a Statement of Commitments with respect to archaeology for the project (refer Appendix C).

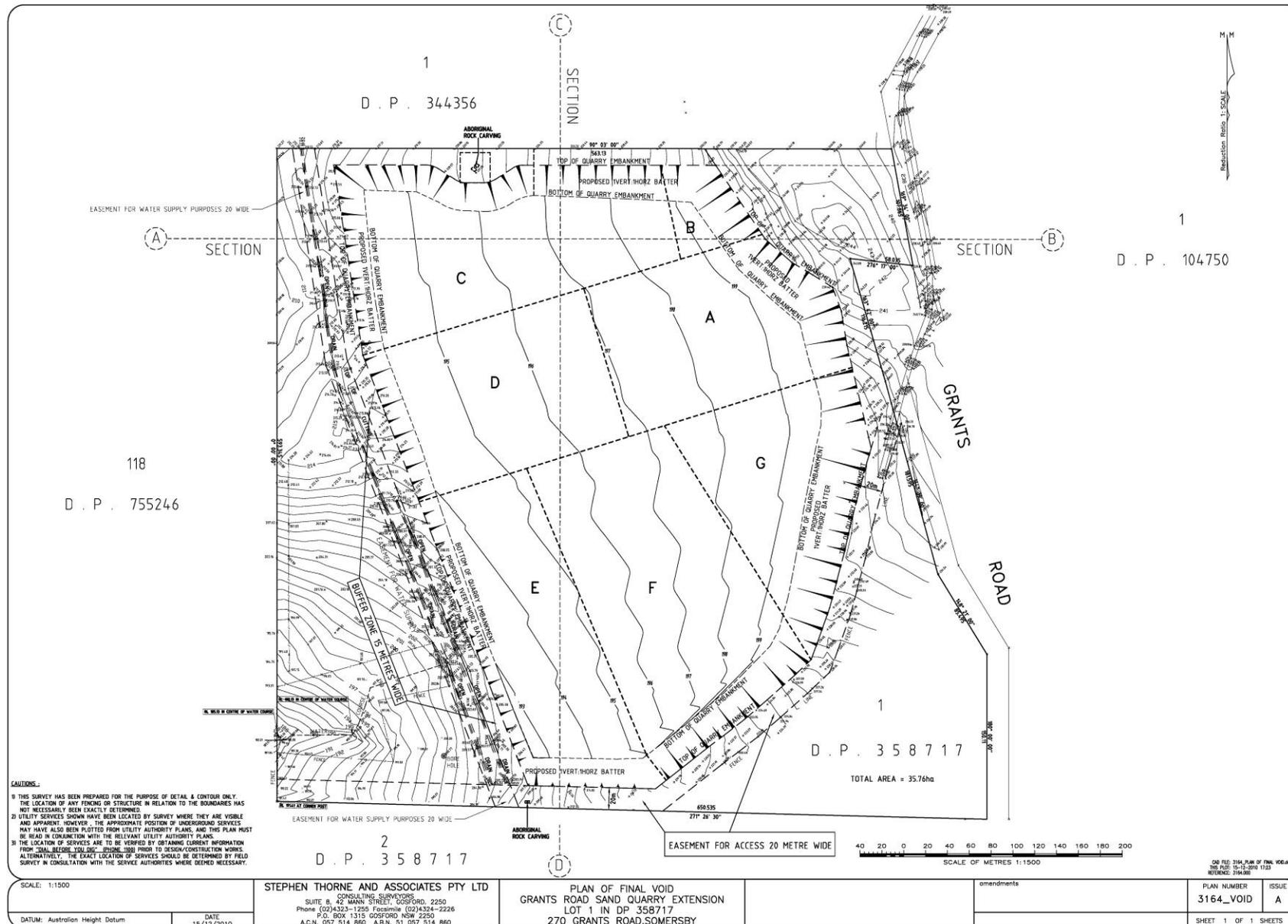


Figure 1 Plan of approved quarry expansion (courtesy PA&A).

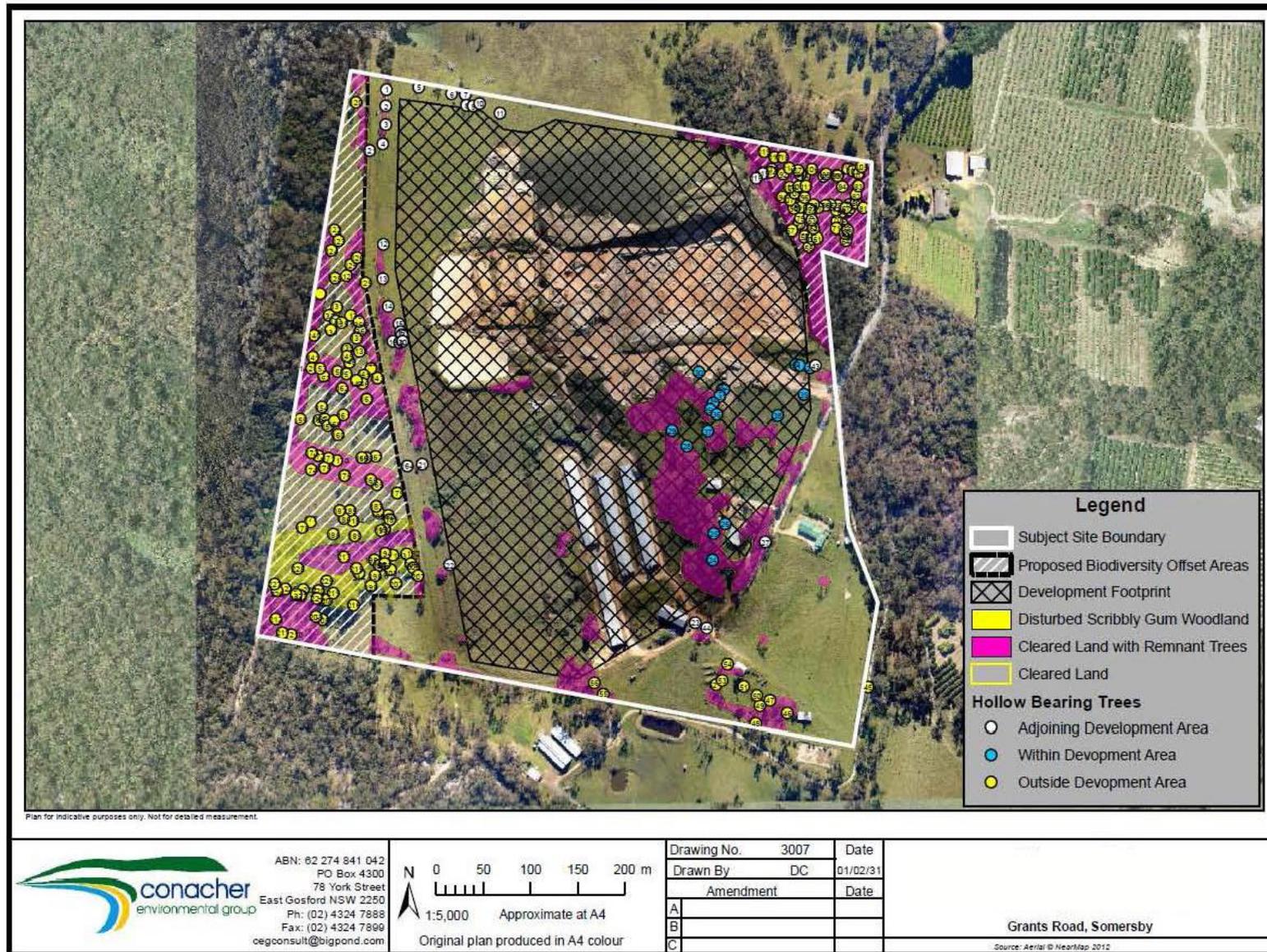


Figure 2 Development Footprint of Grants Road Sands Quarry Extension and Biodiversity Offset Area.

2.0 Aboriginal Cultural Heritage Management

The ACHMP is the tool for the management of Aboriginal cultural heritage during the operation, rehabilitation and post extraction of the Grants Road Sand Quarry Expansion project.

The operation of the quarry will be required to comply with environmental protection procedures instigated by conditions of approval and State standards and requirements. The ACHMP will be integrated into broader environmental management systems for the site.

2.1 Aboriginal Stakeholder Consultation

Aboriginal community consultation for the project commenced in 2007 as part of the initial Aboriginal archaeological assessment process. Following a hiatus in the project, the community consultation process was recommenced in 2012-2013 in accordance with the OEH *Aboriginal Community Consultation Guidelines for Proponents* (OEH 2010).

As per Condition of Consent 30 (b), the Aboriginal Cultural Heritage Management Plan has been developed in consultation with the local Aboriginal Stakeholders. The local Aboriginal stakeholders for the project are represented by the following organisations who registered their interest in the project following the 2012-2013 consultation process:

Darkinjung Local Aboriginal Land Council

Contact Representative: Ms Suzanne Naden, Ms Sharon Hodgetts

Guringai Tribal Link Aboriginal Corporation

Contact Representative: Ms Tracey Howie

Aboriginal stakeholder consultation for the development of the ACHMP has involved the following processes and has also been directed by requests received from the stakeholders during the review period.

- The review of the draft ACHMP,
- Incorporation of responses and recommendations into the final ACHMP for submission to DoPE.

2.1.1 Responses to the Draft ACHMP

Following circulation of the draft ACHMP, responses to the draft document were received from both RAPs and are included below. A summary of recommendations made by DLALC and GTLAC is provided in Section 2.1.2 below.



Local Aboriginal Land Council
DARKINJUNG

168 Pacific Highway Watanobbi NSW 2259
PO Box 401 Wyong NSW 2259
Phone (02) 4351 2930
Fax (02) 4351 2946
ABN 99 583 297 167
Email darkinjung@dlalc.org.au

Angela Besant
Director Insite Heritage Pty Ltd
PO Box 98
Wangi Wang NSW 2267

7 November 2014

Dear Angela,

RE: Grants Road Sand Quarry Extension Aboriginal Cultural Heritage Management Plan October 2014.

Thank you for the opportunity to formally respond to the plan as noted above.

Darkinjung LALC has now reviewed the plan and provides the following issues and recommendations that we wish Insite Heritage Pty Ltd and Perter Andrews and Associates Pty Ltd to consider.

Issues:

- Darkinjung LALC's first involvement in regards to the project was undertaken in 2007; seven years ago and as a result many of the recommendation from that assessment are outdated, particularly concerning the type of suitable development and extent of buffer zones in relation to Aboriginal cultural heritage sites.
- Darkinjung LALC's second involvement was in 2013 where Darkinjung LALC produced the *Aboriginal Cultural Heritage Assessment Report, Grants Road Quarry Project, 270 Grants Road Somersby Report to Insite Heritage Pty Ltd*. Two of the recommendations within that report include the following,
 - Recommendation 1 states, that the Grants Road Quarry extension not be approved.
 - Recommendation 2 states, that in relation to site Grants Road RE1, 45-3-3343 the proposed 10 metre buffer zone is insufficient to protect the site, the Aboriginal cultural landscape and the connection to other cultural heritage site within close proximity (such as Howe Aboriginal Area).
- The *Australia ICOMOS, Australia ICOMOS Charter for Places of Cultural Significance, 2013* (the Burra Charter), including *Australia ICOMOS Practice Note, The Burra Charter and Indigenous Cultural Heritage Management, November 2013* (the Practice Note); has not been address in relation to this site. This includes,
 - Cultural significance is the sum of the qualities or values that a place has, including the five values—aesthetic, historic, scientific, social and spiritual—that are listed in Article 1.2 of the *Burra Charter*.
 - *Cultural significance is embodied in the place itself, its fabric, setting, use, association, meaning, records, related places and related objects*

1

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- The site is not just the tangible engraving and the rock which it is located upon, but a 'place' that includes the area and immediate surroundings.
- It is understood that rock engraving rarely occur in isolation and further engravings either occur on the same rock platform (rock exposure) of adjacent platforms.
- Nearby sandstone exposures have not been cleared of turf/ vegetation and soil.
- There has been no night inspect of this site and nearby sandstone exposures to assess for engravings which are not visible during the day in harsh sun light.

Aboriginal cultural heritage is a living culture and our cultural sites are not relics from the past. It is culturally offensive to destroy the area adjacent to or surrounding an Aboriginal cultural heritage place especially one which holds high cultural significant to the Aboriginal Community.

This type of development is not appropriate for an area which is extremely rich in Aboriginal cultural heritage. The cultural heritage and cultural landscape of the area has already been compromised by the existing quarry and compounded by Pioneer sand quarry to the north.

The extension to the existing quarry contributes to an accumulative effect, an on-going deterioration of the cultural landscape and Aboriginal cultural heritage sites and places.

The Aboriginal cultural landscape and the tangible and intangible cultural values have not been taken into account. As a result Darkinjung LALC do not support the extension of the open cut sand quarry within such close proximity to Aboriginal culture heritage sites, particularly when the tangible and intangible cultural values and extent of the site is not known.

Recommendations:

1. The extent of the sandstone under the turf/ topsoil around the site Grants Road RE1, 45-3-3343 should be re-established.
2. The area should then be cleared of grass/ topsoil beyond the original extent (edge) of the site examined in 2007 to determine if further isolated sandstone platforms exist.
3. The area should undergo night inspected using NSW NPWS night recording methods to establish if further engraving sites may be present. This should be conducted before any sand quarrying or associated works commence.
4. Nearby areas of exposed sandstone should also undergo the recommendations above.
5. The above should be carried out before fencing the site, as the construction of the fence may impact potential Aboriginal sites, particularly rock engravings that may be located beneath the turf/topsoil.
6. The buffer zone between sites Grants Road RE1, 45-3-3343 is not sufficient to protect the site, Aboriginal cultural landscape and cultural values and should be at very minimum be extended to the south and to the edge of the existing quarry.
7. The site should be inspected by an Aboriginal Cultural Law Expert approved by Darkinjung LALC to better understand tangible and intangible extent of the site and to determine appropriate management actions.
8. The Aboriginal cultural landscape and the tangible and intangible cultural values for this site must be researched and understood once again to determine appropriate management actions.

9. The *Australia ICOMOS, Australia ICOMOS Charter for Places of Cultural Significance, 2013* (the Burra Charter), including *Australia ICOMOS Practice Note, The Burra Charter and Indigenous Cultural Heritage Management, November 2013* (the Practice Note); should be followed.
10. Along with the recommendations above the recommendations within Darkinjung LALC's 2013 report and Insite Heritage Grants Road Sand Quarry Extension Aboriginal Cultural Heritage Management Plan October 2014 should be adhered to.

If you wish to discuss these issues or recommendations please do not hesitate to contact me on the number listed above.

Thanking you



Sharon Hodgetts
Senior Project Officer Culture and Heritage



**Guringai Tribal Link
Aboriginal Corporation**

ABN 18 351 198 069. ICN 4270

*Traditional Owners of the NSW Central Coast
and the Northern Beaches of Sydney.*

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3rd November, 2014

Angela Besant
Archaeologist
Insite Heritage Pty.Ltd
PO Box 98
WANGI WANGI, NSW 2267

Emailed to: admin@insiteheritage.com.au

Dear Angela,

***Re: Grants Road Sand Quarry Extension, Aboriginal Cultural Heritage Management Plan (Draft)
Project Approval No. 08_0099***

Guringai Tribal Link Aboriginal Corporation have read and discussed the Draft Aboriginal Cultural Heritage Management Plan (ACHMP) for the Grants Road Sand Quarry Extension (GRSQE), 270 Grants Rd, Somersby NSW, Lot 1 DP 358717 (Project Approval No. 08_0099) and although we oppose to the Quarry Extension due to the Somersby Plateau being an extremely culturally sensitive area which is evident by the majority of sandstone engravings and other Aboriginal sites within close proximity to and including 270 Grants Rd, we recommend the following be added to the Recommendations contained within the Draft ACHMP by Insite Heritage P/L.;

1. That the Howes Aboriginal Place/Reserve Monitoring Program be reviewed prior to the commencement of the quarry extension, to consider the additional and extended amount of ground surface vibration due to the Extension Approval consisting of 20 hectares of affected land as opposed to the 2 hectares in the existing quarry and the extraction tonnage increasing from 200,000tonnes per year to 250,000 tonnes per year.
2. That surrounding vegetation and that within the Howes Reserve and the Biodiversity Offset Area (BOA) also be included in the Monitoring Program for the duration of GRSQE, to assess the potential danger to them from the disturbance to and removal of the natural filtration system (aquifer) that sustains them.
3. Quarterly remunerated inspections by a GTLAC Representative of Aboriginal sites #45-3-3343 and #45-3-3344 upon commencement of earthworks within the GRSQE.
4. Annual remunerated inspections of Aboriginal sites within Howes Rd Aboriginal Place/Reserve upon commencement of earthworks within GRSQE.
5. Within the 'Consequences of Impacting on an Aboriginal Object' that the word 'suspect' (If you suspect...) also be in red bold to emphasize, even if they (staff/contractors & visitors) SUSPECT they have located an Aboriginal object/site that they are required by Law to report it to the appropriate person.

Respectfully yours,

Tracey-lee Howie
Director
(contacts above)

2.1.2 Summary of RAP Recommendations to the Draft ACHMP

Response / Recommendation	RAP	How addressed in final ACHMP
Oppose the quarry extension as the Somersby Plateau is extremely culturally sensitive	GTLAC & DLALC	The Dept Planning took this view into account at the time of determination (refer EIS)
Request review of the monitoring programme for the Howes Aboriginal Reserve prior to the commencement of the quarry extension	GTLAC	The review period for Howes Aboriginal Reserve is every 5 years. There has been no evidence of impact from the quarry on the Reserve so there is no justification to increase frequency of monitoring.
That the surrounding vegetation within the Howes Aboriginal Reserve and Biodiversity Offset Area to be included in the Monitoring Programme for the duration of the GRSQE	GTLAC	The biodiversity offset area will be subject to full inspection prior to any disturbance including plantings (Sect 2.4). Cultural values identified at that time will be incorporated into the Howes Aboriginal Reserve monitoring program.
Quarterly remunerated inspections of sites 45-3-3343 and 45-3-3344 upon commencement of earthworks	GTLAC	The Statement of Commitments undertakes to have a site inspection at 12 months after approval. The monitoring is then incorporated into the 5 yearly monitoring inspections. Aboriginal access to the site, by arrangement, is required by the conditions of consent.
Annual remunerated inspections of sites within the Howes Aboriginal Reserve	GTLAC	The monitoring program was set at 5 yearly intervals in the original quarry consent. Remuneration is subject to private negotiations.
To bold the word SUSPECT in the 'Consequences of Impacting on an Aboriginal Object'	GTLAC	Amended refer Appendix E
The 10m buffer zone around 45-3-3343 is inadequate	GTLAC	The ten metre buffer was negotiated at the time of the EIS and is taken from the outer edge of the stone exposure. The quarry bund wall has been set back at 10.5m with a 2.5m access for construction and maintenance as agreed with RAPs at the time of assessment.
The extent of sandstone under 45-3-3343 to be re-established	DLALC	The extent of the sandstone was determined during the EIS, the edge of the outcrop was found to drop away quickly as seen in Figure 3. The buffer zone

		<p>around the exposure will ensure the full extent of the exposure is protected.</p> <p>The protective fencing posts will not be driven into rock.</p>
Grass to be cleared beyond original extent of 45-3-3343 to determine if further sandstone platforms exist	DLALC	Stripping back grass would have runoff implications and open the area to weed infestation. Extent of exposure was determined during the EIS.
Night inspection of the area following NSW NPWS night recording methods prior to commencement of works	DLALC	Sandstone exposures across the project area were inspected at the EIS stage. Under the access agreement of this management plan if DLALC wish to undertake night time inspections of the sites, this can be organised with the quarry manager.
Nearby areas of sandstone to undergo same investigation works	DLALC	As above
Buffer zone of site 45-3-3343 is inadequate and not sufficient to protect the site, Aboriginal cultural landscape and cultural values. Request buffer zone at a minimum is extended to the south.	DLALC	The established buffer zone was determined at the time of the EIS with DLALC input (Dave Pross) on the basis of the extent of the sandstone exposure. The mine plan that has been approved does not have scope for extension to the south.
Request for inspection of 45-3-3343 by an Aboriginal Cultural Law Expert approved by DLALC	DLALC	The conditions of consent allow for access by the Aboriginal community by arrangement. DLALC should contact the quarry manager to arrange such an inspection.
The Aboriginal cultural landscape and the tangible and intangible cultural values for 45-3-3343 must be researched and understood once again to determine appropriate management actions.	DLALC	It is difficult to re-assess the site post approval. There is the opportunity for DLALC to arrange site visits and research the cultural values of the site further with their resources. Such information may assist with the development of cultural landscape mapping for the region.

2.2 Known Aboriginal Cultural Heritage Resource

There are two recorded Aboriginal archaeological sites within the GRSQE Project.

45-3-3343 Grants Rd RE 1

6304060 N 338241 E (GDA)

This site comprises an anthropomorphic engraving on a sandstone exposure of 7.9m x 7.8m. The engraving is of a man with a round head, eyes, wings and a right 'club foot' and genitals. The outline of a circular object, possibly a bag was also identified above the right wing and a small crescent shaped mundoe (360mm x 90mm) located 1m below the right club foot. The engraving is approximately 2m x 2m in size. At the time of location there were noted two scrape marks from farm machinery on the sandstone.

Compass points were taken around the extremities of the engraving (see Figure 3 below). It was found that the head and genitals of the engraving are on an N-S alignment, whilst the wings or arms are aligned in an E-W orientation. The genitals of the figure are also approximately aligned in the direction of Mt White, a location of high spiritual and cultural significance. The end point of the genitals has a bearing of 210°. Mt White is not directly visible from the site. The right wing of the figure points to the Aboriginal reserve directly opposite the quarry on Grants Rd where a number of engravings are located. The left wing is orientated at 270-290°, which is the direction of Glenworth Valley, where another similar club footed figure is located.

The site is of high cultural significance to the Aboriginal community.

45-3-3344 Grants Rd RE 2

6303559 N 338075E (GDA)

A small mundoe (circular engraving) located on a sandstone outcrop located in the vehicle access route. The exposure is 4m x 2m and the engraving 100mm x 100mm and about 50mm deep. The vehicle access has been moved around the feature.



Figure 3 AHIMS 45-3-3343 The Anthropomorphic figure Grants Rd RE 2

2.3 Ongoing Consultation

In order to maintain ongoing consultation, the registered Aboriginal stakeholders for the project will be kept informed of the projects progress on a 6 monthly period for the life of the projects development. The information will be provided by newsletter.

The registered Aboriginal stakeholders will also be involved in the ongoing conservation and management of Aboriginal cultural heritage within the GRSQE project area and in the Biodiversity Offset Area (BOA) through the following processes:

- Cultural Heritage Assessment of the Biodiversity Offset Area
- Development of any required management and mitigation measures for cultural heritage within the BOA.
- Involvement in required ongoing monitoring works for the duration of the project in accordance with the Statement of Commitments including the monitoring program for the Howes Aboriginal Reserve and Grants Rd RE1.
- Any additional process as developed through the review process of the draft ACHMP.

2.4 Biodiversity Offset Area

An Aboriginal Cultural Heritage Assessment of the Biodiversity Offset Area (BOA) will be undertaken with the registered Aboriginal stakeholders for the project. The assessment will be undertaken prior to any vegetation planting, maintenance or clearance works proposed to be undertaken in the BOA.

Aboriginal cultural heritage sites identified by the ACHA within the BOA will be managed in accordance with the conditions of this ACHMP; Section 2.11 Discovery of Previously Unknown Objects or Cultural Sites.

The results of the ACHA of the BOA will inform any required works (such as vegetation planting or clearing) within the the BOA to ensure that impacts to any identified cultural heritage values are avoided.

Any sites located will be recorded, updated on AHIMS and within the ACHMP. The updated ACHMP will be provided to the registered Aboriginal Stakeholders, DoPE and OEH prior to any vegetation planting or clearing within that area.

2.5 Protection of Sites

The two archaeological sites located within the project area will not be impacted by the quarry works.

Site 45-3-3343 Grants Rd RE 1 will be fenced. The fencing will be offset from the margins of the sandstone exposure by 8 metres in all directions. The bund wall between the top of the quarry cut and 45-3-3343 will be constructed of block rather than the earth bund wall to be constructed around the remainder of the quarry. The fencing of the site will allow a 2.5m egress between the bund wall and the site fencing. An approximately 4.5m egress will be

available between the site fencing and the property boundary (see Figure 4 below). As per the statement of commitments a 10 meter buffer is required on the southern, eastern and western boundaries of the site.

Site 45-3-3344 Grants Rd RE 2 is a small mundoe and will be adequately protected by the track diversion put in place upon its recording.

Where specific cultural sites have been fenced the fencing will carry signage stating:

**“Cultural Heritage Site – Do Not Enter
Contact - (Project manager details)”**

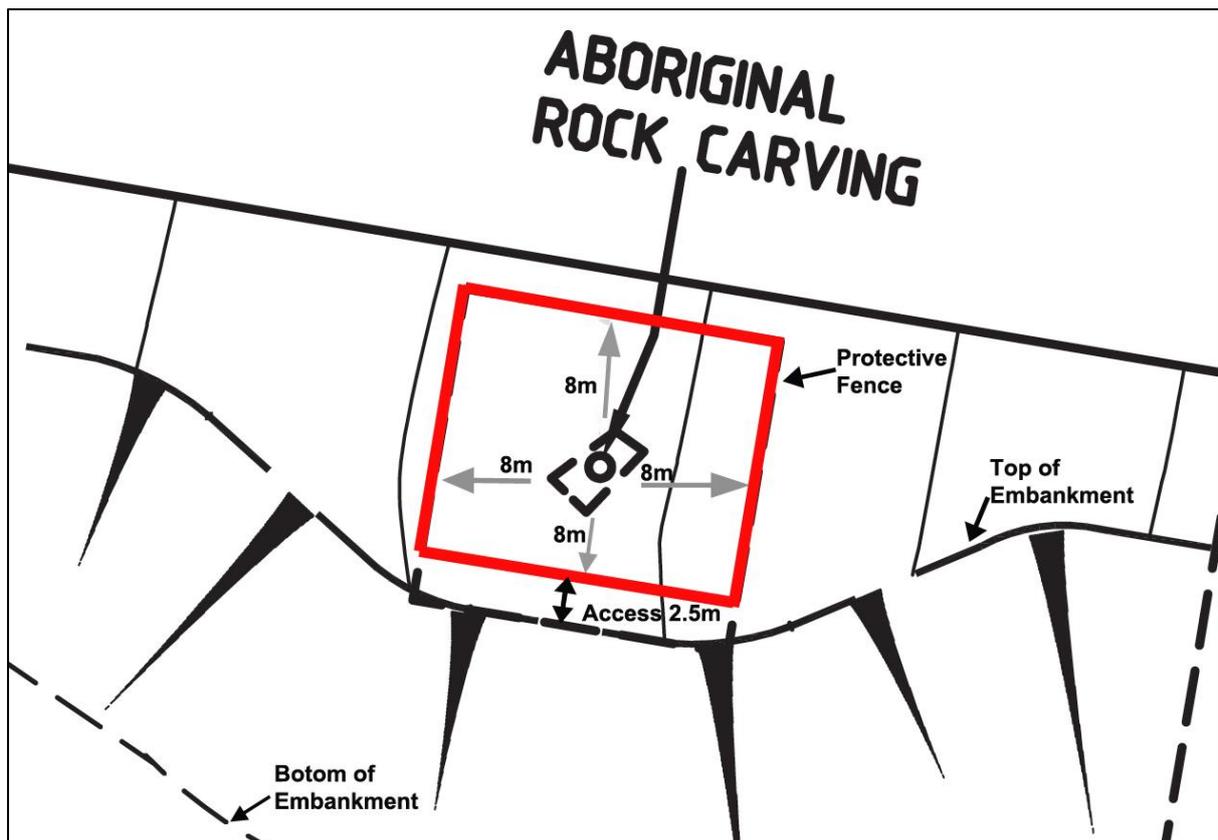


Figure 4 The layout of fencing AHIMS 45-3-3344 (Grants Sands RE1)

2.6 Ongoing Monitoring & Management of Aboriginal Sites

The fencing of the site RE1 45-3-3343 will be maintained for the duration of the quarry operation and rehabilitation period.

The sites 45-3-3343 and 45-3-3344 will be incorporated into the Howes Aboriginal Monitoring program. That monitoring program occurs every five years in accordance with the conditions of approval for the existing quarry (DA 22952).

In addition an inspection will be carried out one year post approval (25th July, 2015) or post fencing and at the time of inspection of the biodiversity area, which ever arises first.

2.7 Long Term Management of Aboriginal Cultural Heritage Values

The known sites Grants Rd RE1 and Grants Rd RE2 will remain in-situ following post extraction and rehabilitation. The sites will be included into the long term monitoring program for the Howes Aboriginal Reserve.

Any newly identified sites within the BOA will also be incorporated into the long term monitoring program for the Howes Aboriginal Reserve. Any sites located within the BOA will be avoided by biodiversity enhancement activities.

2.8 Aboriginal Stakeholder Access to Cultural Heritage Sites

To facilitate Aboriginal stakeholders, their friends and families access to cultural heritage sites within the project area (and any identified the sites in the BOA) the following protocols will be implemented.

The first point of contact should be the Quarry Manager.

The Quarry Manager will ensure that all safety issues are addressed prior to allowing access.

Records of sites located within the GRSQE and BOA areas will be available on request at the site office for registered stakeholders to review. Access to protected sites within the GRSQE and BOA (if any) will also be provided on request of a registered Aboriginal stakeholder. Access to sites and records will require a minimum of 7 days notice.

Aboriginal community members who are not stakeholders may contact the Quarry Manager requesting access. Access will be considered on a case by case basis.

Field work, including monitoring inspections, will be undertaken with the registered Aboriginal stakeholders for the project.

2.9 Incident and Complaint Management

All incidents impacting or potentially impacting on the Aboriginal cultural heritage values of the site will be reported to the project manager. An internal incident report shall be prepared. The Registered Aboriginal Parties for the project shall be informed of the incident and the actions taken where required.

Incidents will be immediately reported to the Department of Planning and Infrastructure as per legislative requirements.

2.10 Site Inductions

The induction of site workers and sub-contractors shall include a brief of the Aboriginal cultural heritage values of the site and a procedure for identifying previously unknown objects / Aboriginal Cultural Heritage Sites. An example of Aboriginal Cultural Heritage Awareness for inductions is located in Appendices E. This component of the induction will

be developed in consultation with the Registered Aboriginal Parties for the project and may include images of the known sites located within the subject area.

Records of the personnel whom have undertaken the Aboriginal Cultural Heritage Awareness component of the induction will be maintained onsite by the Project Manager.

2.11 Discovery of Previously Unknown Objects or Cultural Sites

Upon discovery of a previously unknown object or cultural site the following actions will be undertaken:

- Works are to cease in the area.
- OEH, RAPs for the project and an archaeologist to be immediately contacted.
- Identified object / feature to be inspected by the RAPs and archaeologist.
- Site to be recorded and lodged on the Aboriginal Heritage Information Management System.
- A plan of management for the newly identified object / feature to be developed in consultation with OEH, RAPs and the archaeologist.

2.12 Discovery of Potential Human Remains

The following procedure is to be followed if **possible human remains** are uncovered:

- In the event that any potential human skeletal remains are uncovered during works, all work in the immediate area of the remains will stop immediately. The incident will be immediately reported to Site Manager and the NSW Police.
- Human skeletal remains can be subject to three different acts: Coroner's Act 1980, the National Parks & Wildlife Act 1974 and the Heritage Act 1977. The appropriate Act and therefore management of the site will be determined by the NSW Police and OEH.
- Work will not proceed in the immediate area until clearance is provided by the relevant authority.

The procedure undertaken will be documented in an incident report. The report will be made available to OEH / NSW Police on request.

2.13 Reporting

2.13.1 Biodiversity Offset Area

The Biodiversity Offset Area (BOA) will be inspected by an archaeologist and RAPs prior to any revegetation or other works. Any sites located will be recorded, updated on AHIMS and within the ACHMP. The ACHMP prescribes the avoidance of sites by revegetation activities. The updated ACHMP will be provided to the registered Aboriginal stakeholders, DoPE and OEH prior to any vegetation planting or clearing within that area.

2.13.2 Cultural Heritage Monitoring Reporting

The monitoring of the sites will be undertaken upon completion of the protective fencing and signage of the Grants Road RE1 site or one year after approval (25th July 2015) whichever ever arises first.

The Grant Sands sites (45-3-3343 and 45-3-3344) will be included in the existing monitoring program for the Howes Aboriginal Reserve. This will also include any sites identified in the BOA. The monitoring of the sites will be reported to OEH as part of the Howes Aboriginal Reserve Monitoring program. This requires a monitoring inspection on a five yearly basis (every five years).

Following completion of installation of protective fencing for the Grants Road RE1 site, an inspection was undertaken in July 2015. Inspections were also undertaken by Darkinjung Local Aboriginal Land Council and Guringai Tribal Link Aboriginal Corporation as invited by Grants Sands.

3.0 References

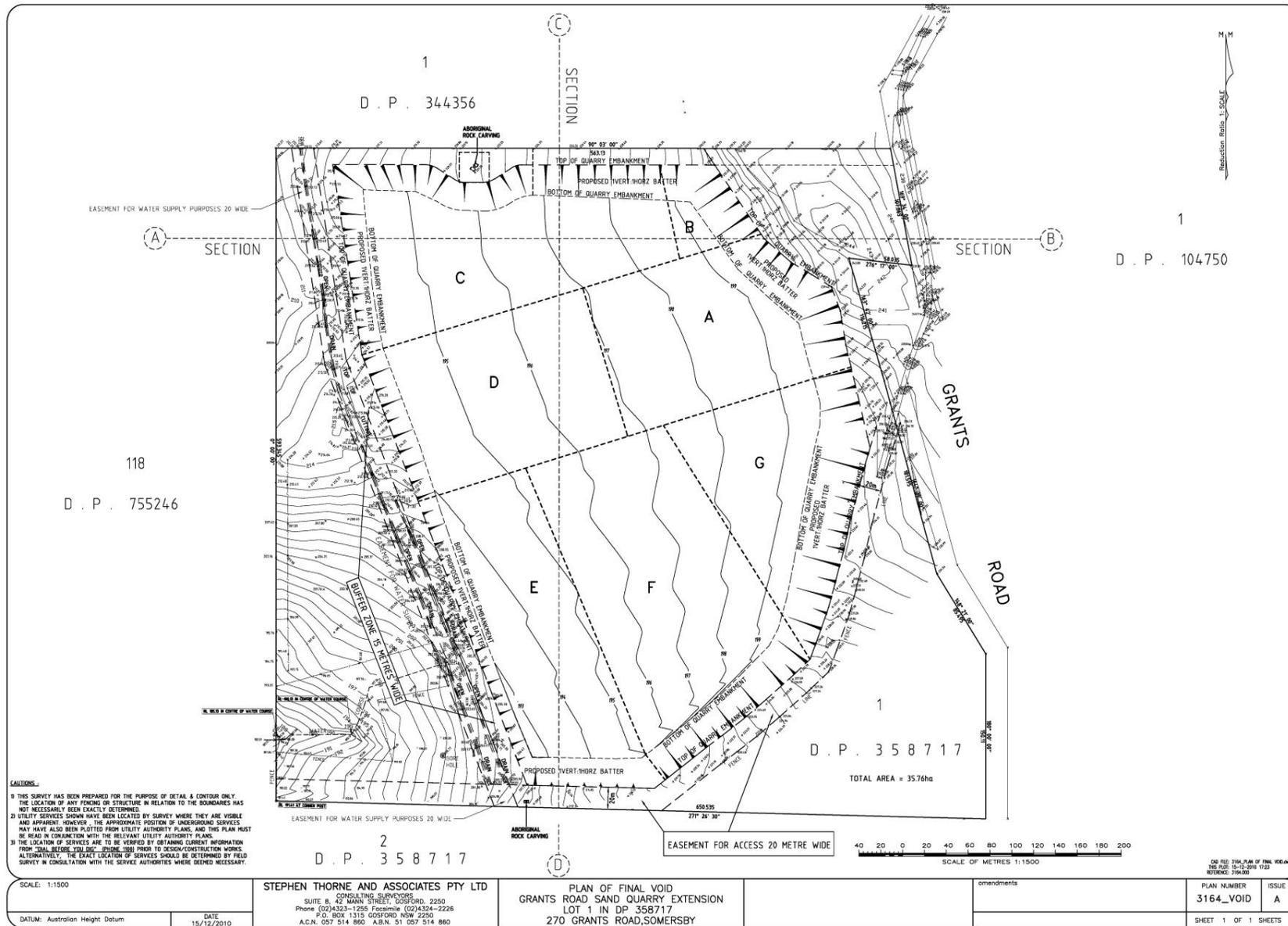
Insite Heritage 2007 Grants Road Sand Quarry. Unpublished report to Pacrim Environmental Warners Bay

Insite Heritage 2013 Grants Road Sand Quarry Extension. Unpublished report to Peter Andrews & Associates Pty Ltd.

Insite Heritage 2012 Howes Aboriginal Reserve – Monitoring Report. Unpublished report to GK & AK Jones Grants Road Sand Quarry.

Peter Andrews & Associates 2013 *Grants Road Sand Quarry Extension Environmental Assessment Project Application No 08_0099*. Unpublished report to GK & AK Jones.

Appendix A The Approved Grants Road Sand Quarry Extension Plan



CAUTIONS:

- 1) THIS SURVEY HAS BEEN PREPARED FOR THE PURPOSE OF DETAIL & CONTOUR ONLY. THE LOCATION OF ANY FENCING OR STRUCTURE IN RELATION TO THE BOUNDARIES HAS NOT NECESSARILY BEEN EXACTLY DETERMINED.
- 2) UTILITY SERVICES SHOWN HAVE BEEN LOCATED BY SURVEY WHERE THEY ARE VISIBLE AND APPARENT. HOWEVER, THE APPROPRIATE POSITION OF UNDERGROUND SERVICES MAY HAVE ALSO BEEN PLOTTED FROM UTILITY AUTHORITY PLANS, AND THIS PLAN MUST BE READ IN CONJUNCTION WITH THE RELEVANT UTILITY AUTHORITY PLANS.
- 3) THE LOCATION OF SERVICES ARE TO BE VERIFIED BY OBTAINING CURRENT INFORMATION FROM LOCAL RESIDENTS, LOCAL GOVERNMENT, OR PRIOR TO COMMENCEMENT OF CONSTRUCTION WORKS. ALTERNATIVELY, THE EXACT LOCATION OF SERVICES SHOULD BE DETERMINED BY FIELD SURVEY IN CONSULTATION WITH THE SERVICE AUTHORITIES WHERE DEEMED NECESSARY.

SCALE: 1:1500
 DATUM: Australian Height Datum
 DATE: 15/12/2010

STEPHEN THORNE AND ASSOCIATES PTY LTD
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 A.C.N. 057 514 860 A.B.N. 51 057 514 860

PLAN OF FINAL VOID
 GRANTS ROAD SAND QUARRY EXTENSION
 LOT 1 IN DP 358717
 270 GRANTS ROAD, SOMERSBY

amendments

PLAN NUMBER
 3164_VOID
 ISSUE
 A
 SHEET 1 OF 1 SHEETS

courtesy Peter Andrews & Assoc.

Appendix B Conditions of Consent

HERITAGE

Heritage Management Plan

30. The Proponent shall prepare and implement an Aboriginal Cultural Heritage Management Plan for the project to the satisfaction of the Secretary. This plan must:

(a) be prepared by suitably qualified person(s) whose appointment has been approved by the Secretary;

(b) be prepared in consultation with OEH and local Aboriginal stakeholders;

(c) be submitted to the Secretary for approval by the end of November 2014;

(d) include a description of the measures that would be implemented for:

- protecting, monitoring and managing Aboriginal sites within the site, including the biodiversity offset strategy;
- maintaining and managing reasonable access for Aboriginal stakeholders to cultural heritage items on site and in the biodiversity offset areas;
- managing the discovery of any human remains or previously unidentified Aboriginal objects on site, including (in the case of human remains) stop work provisions and notification protocols;
- ongoing consultation with the local Aboriginal stakeholders in the conservation and management of Aboriginal cultural heritage both on-site and in the biodiversity offset areas;
- ensuring any workers on site receive suitable heritage inductions prior to carrying out any activities which may disturb Aboriginal sites, and that suitable records are kept of these inductions; and
- the long term management of the Aboriginal cultural heritage values of the site post extraction operations and rehabilitation of the site.

Appendix C Statement of Commitments

Subject	Commitments	Timing
13. Heritage	Grants Rd RE1 and RE2 sites are to be preserved	Continuous
	Incorporate a ten (10) meter buffer on the southern, eastern and western boundary of the anthropomorphic figure (Grants Rd RE1).	For the life of the quarry
	The bund wall for the quarry extension in the area of Grants Rd RE1 to be constructed of block wall rather than earth in between the engraving and the boundary.	Prior to the quarrying of Precinct C.
	The engraving (Grants Rd RE1) is incorporated into the monitoring programme currently in place for the Howes Aboriginal Reserve.	Five yearly
	A protective fence is constructed 8 meters around each site of the Grants Rd RE1 site to prevent inadvertent damage. The fence should incorporate appropriate signage to ensure the access within the fence zone is limited to maintenance activities such as grass cutting.	Prior to the quarrying of Precinct C.
	Traffic is to be directed around the small mound at the Grants Rd RE2 site to ensure minimal disturbance.	Continuous
	An additional monitoring site visit be undertaken to review the recommendations effectiveness to protect the site.	12 months after the project approval.
	The quarry operator to develop and implement an Aboriginal Cultural Heritage Induction Program for all personnel associated with quarry operations. A register is to be kept of staff/contractors that have been inducted.	Prior to the commencement of the quarry extensions.
	Should any materials suspected of being of Aboriginal occupation origin be located during the quarry operations that work cease in that location immediately and that the Office of Environment & Heritage be contacted immediately.	For the life of the quarry.

Appendix D Consultation Log

Date	Action	From	To	Comments
25 th July 2014	Project Approval	DoPE	Grant Sands	
2 nd September 2014	Approval for authorship of the ACHMP	DoPE	Peter Andrews + Associates	
7 th October 2014	Draft ACHMP sent to Aboriginal Community and OEH for comment	Insite Heritage	Darkinjung LALC Guringai Tribal Link Aboriginal Corporation Nicole Davies OEH.	Comments close on the 4 th of November 2014
13 th October 2014	Informal response received from OEH regarding draft ACHMP	OEH	Insite Heritage	<i>Paraphrased OEH will only provide comment on the final document. OEH is interested in the RAPs feedback to ensure the Aboriginal community is satisfied that the cultural significance of the two known sites and the surrounding landscape is adequately protected/managed.</i>
4 th November 2014	Request from DLALC for extension of time to review ACHMP to Friday 7 th November	DLALC	Insite Heritage	Extension requested approved. GTLAC also notified of extension
7 th November 2014	Response to draft ACHMP provided	DLALC	Insite Heritage	Response to submission incorporated into CHMP
7 th November 2014	Response to draft ACHMP provided	GTLAC	Insite Heritage	Response to submission incorporated into CHMP
28 th August 2015	Response to draft ACHMP received from Department			
8 th October 2015	Final ACHMP incorporating the Departments comments provided to OEH for comment	Insite Heritage	Nicole Davis Archaeologist- Planning Hunter Central Coast Region OEH	

Appendix E Aboriginal Cultural Heritage Induction

Aboriginal Cultural Heritage Induction

Grants Road Sands Quarry Extension

The Grants Road Sand Quarry Extension is located within the traditional country of the Guringai Language Group. The Hawkesbury sandstone country on the NSW Central Coast is rich in the evidence of Aboriginal occupation. There are more than 4,000 known rock engraving sites in the greater Sydney region. Other site types common on the Central Coast are rock shelters with art and or archaeological deposit, artefact scatters and isolated artefacts, rock shelters, art sites (paintings and engravings), modified trees, hearths, stone arrangements, grinding grooves, burials, and shell middens. Example images of some of these types of sites are provided below.

Rock Engravings / Art

Rock engravings are particularly common in the vicinity of Grant Road Sand Quarry. Engravings can be anthropomorphic (based on a human form), or animals, mythical creatures or symbols.

Two engravings have been located on this site, including the figure of a man, whom is associated with ceremonial traditions. There are also numerous engravings conserved in the Howes Aboriginal Reserve on the southern side of Grants Road. Engravings are highly significant to the Aboriginal community and are protected (as all Aboriginal objects are) by Legislation.



Anthropomorphic Figure – Grants Road Sand Quarry.



Symbolic circular grooves – Howes Aboriginal Reserve.

Hearths

A hearth is a camp fire place which can be found associated with artefact scatters, rock shelters or midden. Hearths are important as they may contain charcoal fragments that can be dated by carbon dating techniques.

Stone Artefacts

Stone artefacts were used for many day to day purposes such as butchering and skinning animals, grinding seeds and nuts, manufacturing wooden artefacts and for hafting to make tools (axes, spear points). They may be associated with other types of cultural material such as ochre, charcoal, shell or bone¹.

¹ Burke & Smith 2004:204



Types of Stone Artefacts - Broken Flake



Types of Stone Artefacts - Cores and Flakes



Grinding Flat



Muller / Pestle

Grinding Grooves

Formed by abrasion on fine grained sandstone outcrops or boulders. Generally located near a water source. Grooves result from the forming and sharpening of ground stone tools, such as axes.



Scarred Trees

Trees where bark has been removed for manufacture of items such as canoes, containers, shields or medicines, or as fibre for making twine.



Consequences of Impacting on an Aboriginal Object

Under the NPW act (1974) it is an offence to knowingly or unknowingly impact on an Aboriginal object. The following penalties apply to Corporations as well as individuals:

Offence	Maximum penalty: Individual	Maximum penalty: Corporation
A person must not harm or desecrate an Aboriginal object that the person knows is an Aboriginal object.	2,500 penalty units (\$275,000) or imprisonment for 1 year <hr/> 5,000 penalty units (\$550,000) or imprisonment for 2 years or both (in circumstances of aggravation)	10,000 penalty units (\$1,100,000)
A person must not harm or desecrate an Aboriginal object (strict liability offence).	500 penalty units (\$55,000) <hr/> 1,000 penalty units (\$110,000) (in circumstances of aggravation)	2,000 penalty units (\$220,000)
A person must not harm or desecrate an Aboriginal Place (strict liability offence).	5,000 penalty units (\$550,000) or imprisonment for 2 years or both	10,000 penalty units (\$1,100,000)

If you **SUSPECT** that you have come across Aboriginal objects/s in the vicinity of your works area **STOP WORK** immediately, secure the area and contact the Project Supervisor and the Archaeologist / Registered Aboriginal Parties for the project.

If you suspect that you have come across **human remains** during your works, **STOP WORK** immediately, secure the area and contact the NSW Police and the Office of Environment & Heritage.

Please **RESPECT** Aboriginal sites on this work site and do not enter areas that are fenced and have signage:

**“Cultural Heritage Site – Do Not Enter
Contact - (*Project manager details*)”**

If, for any reason, entry to a cultural heritage site is required please contact your supervisor.