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24 November 2016
Ref: J0232-01-R1

Martins Creek Quarry Action Group
P.O. Box 500
PATERSON NSW 2421

Attn: Mr James Ashton

Dear James,

RE: ACOUSTIC REVIEW OF THE ENVIRONMENTAL IMPACT STATEMENT, MARTINS CREEK QUARRY

1. INTRODUCTION

The Environmental Impact Statement (EIS) for Martins Creek Quarry, prepared by Monteith & Powys Pty Ltd and various sub-consultants in September 2016, was placed on public exhibition by the Department of Planning & Environment (DP&E) for the period 13 October to 24 November 2016. This report describes results and conclusions arising from a review of the noise and blasting sections of the EIS, with the principal objective of the review to determine if the EIS contains a comprehensive and accurate assessment of noise and blasting impacts and to highlight any errors or deficiencies.

The review was commissioned by the Martins Creek Quarry Action Group (MCQAG) which is generally against the project. However, this report presents results from an unbiased review of the EIS as the author is not personally impacted by the existing quarry, does not anticipate being impacted by the project and does not have any relatives or close friends that are likely to be impacted by the project.

This review report is incomplete, particularly in relation to environmental noise levels from the quarry itself, due to a request to the EIS and Noise Impact Assessment (NIA) authors for additional information not being responded to in a timely manner. Further discussion of this issue is included in the 'operational noise levels' section. An addendum to this report will be prepared when a review of the noise model is completed.

2. NOISE

The EIS includes a Noise Impact Assessment (NIA) report in Appendix I, prepared by RCA Acoustics. This section presents comments and recommendations arising from a review of that report.

2.1 Existing Noise Environment

2.1.1 Measured Background Noise Levels

The NIA describes results from a survey to determine background noise levels at three locations:

Logger A – 94 Cory Street Martins Creek, opposite Cook Street approximately 1200 m south of the existing quarry's gravel processing and loading area; and

Logger D – Dungog Road, less than 100 m west of the quarry's extraction area.

Logger A returned background noise levels less than 30 LA90,15min, resulting in the minimum Project Specific Noise Level (PSNL) of 30 LAeq,15min. However, the measured background noise level of 33 LA90,15min returned by Logger D during the day period is likely to have been influenced by noise from the existing quarry, which is not appropriate according to the NSW Industrial Noise Policy (INP). The NIA is silent on the question of existing quarry noise levels at Logger D during the noise survey, indicating a failure to recognise this issue as an important element in any assessment to the INP.

RECOMMENDATION: Either the background noise survey needs to be repeated for Noise Assessment Group (NAG) 3 at a location that is not affected by existing quarry noise, or a conservative minimum PSNL of 35 LAeq,15min must be adopted for this area.

2.1.2 Measured Traffic Noise Levels

The NIA reports results from a survey of existing traffic noise levels at five locations:

- In front of 281 Dungog Road Vacy, although the NIA indicates the noise monitor was placed approximately 40 m from the road rather than adjacent to the residential façade approximately 100 m from the road as required by the NSW Road Noise Policy. The NIA is also silent on whether a suitable façade reflection correction was added to the free-field noise measurements;
- Within or adjacent to 21 King Street Paterson, although the map showing this location is unclear. The noise monitor was installed either on the footpath significantly closer to the road than any residential buildings, or within the property behind a significant steel fence which would act as a noise barrier. Either way, these results cannot be used without significant corrections to the measured levels to account for distance and shielding;
- In the front yard of 13 Duke Street Paterson. The NIA is silent on the exact location of the noise logger, however a discussion with the owner of this property indicated the microphone was placed approximately 0.5 m from the residential façade, at least partly behind a timber slat fence;
- On either Gresford Road or Tocal Road in the vicinity of William Street Paterson, although the exact location cannot be determined from the NIA therefore the noise measurement results at this location are of limited value; and
- At the rear of either 30 or 32 Hilldale Drive Bolwarra Heights, an unspecified distance from Tocal Road which limits the value of noise measurement results at this location.

Measured traffic noise levels at the last four locations were affected by an unspecified number of quarry trucks passing each logger, although the NIA reported an attempt to identify the number of quarry trucks by assuming all Class 9 vehicles were quarry trucks and all other vehicles were not. While it is true that a significant number of trucks visiting the quarry are Class 9 vehicles, a significant number of other trucks also visit the quarry on a daily basis. Equally, other Class 9 vehicles that are obviously not visiting the quarry can occasionally be observed passing through Paterson. The NIA does not report the number of trucks visiting the quarry, as indicated by weighbridge records, compared to the number of Class 9 and other heavy vehicles indicated by the traffic counters, during the noise surveys.

The NIA also considers existing quarry trucks to be a part of 'background traffic', to the extent of repeating the noise survey in November 2014 when it was discovered the first noise survey in August and September 2014 occurred during a time of relatively low truck numbers. It is not appropriate to justify proposed traffic noise levels compared to an elevated baseline, not only due to current court action questioning the legality of the existing truck numbers under the quarry's existing consent.

RECOMMENDATION: The NIA should specify exactly where each traffic noise monitor was located and whether distance and façade corrections are required and have been applied to measured data.

The NIA should report the number of quarry trucks and measured noise levels in each of the two noise survey periods, allowing an estimate of the effect of quarry trucks on measured noise levels.

The measured traffic noise levels must exclude existing quarry truck noise to present a correct baseline, either by identifying and removing noise from each quarry truck passby event or by other appropriate means such as careful correlation with weighbridge records.

2.2 Noise Criteria

2.2.1 Operating Noise Criteria

The NIA developed operating noise criteria according to the INP, although with incorrect background noise levels for NAG 3 as discussed above.

Table 8 in the NIA reports an existing ambient industrial noise level of 'n/a' at all receptors, despite Table 3 indicating an existing measured quarry noise level of nearly 55 LAeq,15min at 23 Station Street. The NIA reasonably states the quarry is the only significant source of industrial noise in the area, therefore the amenity criteria equal the acceptable noise levels in Table 8. It appears the NIA has reached the correct amenity criteria despite flawed logic.

Table 11 proposes alternative criteria, supposedly due to unspecified 'analysis' which shows the PSNL cannot be met after application of all reasonable and feasible mitigation measures. Section 7.1 of the NIA proposes a number of mitigation measures such as walls, earth barriers, enclosures and relocation of processing plant. There is no analysis of alternative mitigation measures including higher barriers, alternative operating strategies or machines or other potential mitigation measures. There is no mention of adjustment to operating hours to avoid noise impacts in the most sensitive hours. In the absence of proper analysis demonstrating there are no other reasonable and feasible options, alternative noise criteria cannot be accepted.

RECOMMENDATION: The PSNL at NAG3 should be recalculated based on the correct background noise levels determined in the absence of existing quarry noise.

The NIA should correct the flawed logic related to the effect of existing quarry noise levels on the amenity criteria derived in Table 8.

The alternative noise criteria listed in Section 5.7.2 and Table 11 of the NIA must be either deleted or properly justified.

2.2.2 Sleep Disturbance Criteria

The NIA correctly recognises that sleep disturbance criteria are currently uncertain, in the absence of clear research results correlating sleep disturbance with noise levels and character inside a bedroom, and a number of alternative criteria exist. The NIA adopts different criteria for the Martins Creek NAG (NAG 1) than adopted for the other NAG which, according to the NIA, is due to occasional train loading noise at night.

It seems appropriate to adopt the lower and more conservative criterion of 15 dBA above background level (ie. 45 LAmax) for all receptors, including those in NAG 1 when a train is not being loaded. It is also considered reasonable to relax the sleep disturbance criterion to some extent to allow occasional train loading at night, although it remains to be seen whether the NIA's proposed external criterion of 65 LAmax during train loading will protect residents from significant sleep disturbance.

RECOMMENDATION: The NIA should clarify the sleep disturbance criteria in relation to NAG 1, including the higher proposed criterion only applying during train loading at night and the lower and more conservative criterion of 45 LAmax applying to all NAG 1 receptors at other times.

2.2.3 Low Frequency Noise Criteria

The NIA states no source sound power levels show a dBC – dBA difference of more than 15 dB, therefore a low frequency correction is not required. However, the NIA does not list the source sound power spectra, in octave bands or 1/3 octave bands, to support this assertion. In any case the dBC – dBA test applies at the receptor, not at the source, therefore the NIA comments on the low frequency issue are based on incorrect logic.

Simple dismissal of this issue without proper analysis is not acceptable.

RECOMMENDATION: The NIA should present the source sound power levels in octave bands and properly determine the need for a low frequency correction to the predicted received noise levels.

2.2.4 Traffic Noise Criteria

Section 5.3 of the NIA states Station Street is a principal haulage route and therefore attracts higher traffic noise criteria than it would as a local road. However, principal haulage routes must be declared by a regulatory authority such as Dungog Shire Council, after proper assessment of traffic noise and other impacts associated with such a declaration. There is no evidence that Dungog Shire Council has declared Station Street as a principal haulage route for Martins Creek Quarry and the narrow road pavement, which would have been widened to carry significant heavy vehicle traffic as part of a declaration, indicates no such declaration has ever been made. This conclusion is consistent with Council's understanding of the current consent conditions which require 70% of quarry product to be transported by rail, limiting the truck traffic on Station Street. Station Street is therefore a local road and should be assigned the correct noise criteria.

Section 5.7.6 and Table 12 present traffic noise criteria based in part on existing measured traffic noise levels, however as discussed previously the existing traffic noise levels were not correctly measured and reported. For example, while Figure 6 in the NIA is unclear, it appears traffic noise measurements were taken within 20 m from the Tocal Road pavement in Bolwarra Heights despite closest residences in this area being located further from the road. This, combined with the inclusion of existing quarry truck traffic noise in the measurements, presents a significantly elevated baseline. The traffic noise criterion for Tocal Road Bolwarra in Table 12, set 2 dBA above this elevated baseline, is therefore incorrect. Similar comments can be made for the other assessed residential areas along the existing and proposed haul route.

The NIA mentions a morning shoulder period, however the project proposes truck loading from 5:30 am which would result in trucks travelling north through Bolwarra before 5 am and through Paterson well before 5:30 am. Significant truck traffic is therefore proposed during the night period before 7 am, which cannot simply be dismissed as a shoulder period. The night traffic noise criteria, including sleep disturbance criteria, must be considered in the assessment for the period before 7 am.

RECOMMENDATION: Adjust traffic noise criteria based on correct baseline traffic noise levels.

Include night traffic noise criteria in Table 12 and assess noise from traffic before 7 am to the night criteria, rather than dismissing the period from before 5 am to 7 am as a shoulder period.

Add traffic related sleep disturbance criteria to the NIA.

2.2.5 Legacy Noise Issues

Section 5.8.4 discusses the potential difficulty in meeting INP noise criteria for a proposed expansion or other modification to an industrial development in cases where the existing development cannot meet relevant criteria. The NIA discussion would be correct if the existing development was meeting all relevant conditions of an existing consent, however that may not be the case given the current court case between Dungog Shire Council and Buttai Gravel Pty Ltd. It is not appropriate to use existing high noise levels to

justify future high noise levels, if the existing high noise levels are not permitted by the current consent either via production limits or noise criteria.

The community reports generally acceptable noise levels some years ago when production levels were significantly lower. The supposed 'legacy noise issues', if such issues are determined by DP&E to exist, have apparently only existed for a few years after many years free of such issues.

RECOMMENDATION: DP&E should consider whether legacy noise issues exist, and the extent of any issues, considering the currently unresolved question of existing quarry production levels compared to the current consent and the relatively recent nature of high operating and traffic noise levels. This question must be resolved in order to place predicted noise levels in their correct context.

2.3 Predicted Noise Levels

2.3.1 Operating Noise

Predicted noise levels from the quarrying, processing and loading activities on the site were calculated using noise model software based on the following input data:

Predicted terrain for various future stages – The NIA is silent on the ground surface types entered in the model, however it is reasonable to assume appropriate surface roughness parameters or types were adopted. The NIA comments on various noise barriers included in the model and presents a figure in Section 7.1 showing the approximate location of these barriers, however the figure is unclear, does not cover the entire site or extent of noise barriers and does not indicate the height or other design parameters of each barrier. The NIA comments on 8 m and 3 m barriers, however it is not clear where each barrier height applies and if there is physically sufficient space within the site for barriers up to 8 m high.

Earth barriers up to 8 m high will require significant construction effort and such barriers are generally located close to neighbouring residences. The construction fleet will operate, at least for a time, on the top of the barriers being constructed in full view of closest receptors, in contrast to operations which will occur behind the completed barriers. This contrasts with the NIA's claim in Section 1.2.3 that construction noise is similar to operating noise and does not require assessment.

RECOMMENDATION: The NIA should present clear figures showing the exact location, width and extent of proposed noise barriers and other data regarding height and/or RL for each barrier or section of barrier, for each assessed scenario or stage.

The NIA should properly assess construction noise levels as specifically required by the SEARs. As the NIA correctly states that the construction noise policy does not apply to extractive industries, construction noise levels require assessment to the INP noise criteria.

Predicted source locations – Table 14 in the NIA lists the noise sources included in each modelled scenario and the noise contour figures in Appendix B show some red cross symbols which presumably indicate source locations listed in Appendix D, however the NIA does not specify which source type is represented by each cross, the location of truck haul routes and area sources, and other parameters that are required to describe the noise model scenarios and reproduce the noise contours and noise level tables.

Section 5.7.2 states operational measures can be used to minimise noise from stripping operations, however no such operational measures are proposed.

RECOMMENDATION: The NIA should present clear figures and/or tables showing the exact location of modelled noise sources and haul routes, sound power levels for each source or route in octave bands and other data sufficient to reproduce the noise contours, for each assessed scenario or stage.

Details regarding all proposed operational noise control measures, perhaps in the form of a noise management plan and/or statement of commitments, is required to ensure the NIA reflects the proposed quarry management strategy and to demonstrate that practical management measures will achieve the stated noise levels and are technically and economically feasible.

Source sound power levels – Table 15 in the NIA lists the modelled sound power levels in dBA, however this is not sufficient to define the characteristics of each source. The source sound power spectra, in octave or 1/3 octave bands, is required to correctly calculate received noise levels as low and high frequency sounds behave quite differently over distance and barriers. In addition, not all of the listed source sound power levels are correct. For example, Table 15 lists a sound power level of 103 dBA for a Cat 988H, compared to manufacturer's data showing a sound power level of 114 dBA (or 111 dBA with an optional sound suppression kit). Similarly, a sound power level of 101 dBA is listed for a Cat 980H compared to manufacturer's data indicating a sound power level of 113 dBA. An extract from the manufacturer's specifications for each machine is attached to this report.

A large road truck is listed with a sound power level of 92 dBA, compared to a typical 108 dBA from this source which is 16 dBA higher. These errors have a corresponding effect on received noise levels, which means the NIA is underpredicting received noise levels by up to 16 dBA but more likely around 10 dBA.

There are a number of differences between the listed sound power levels in Table 15 and in the equivalent tables in Appendix D, for example for the Rotary crusher building west wall, the Jacques crusher building wall (south vs west) and the rail loader sound power level.

In Year 5, the primary crusher building is modelled with a sound power level of 76 dBA according to Appendix D, however Section 7.1 simply says "engineering noise control treatments" when referring to this building. No indication of exactly what engineering controls are proposed to achieve a reduction of approximately 45 dBA, from 121.5 dBA to 76 dBA, is included in the NIA.

RECOMMENDATION: The NIA should present octave or 1/3 octave sound power data for each modelled source and ensure all modelled sound power levels are realistic and achievable by actual plant and equipment operating or proposed to operate within the quarry. If the listed sound power levels result from on-site noise measurements as claimed in the NIA, then the on-site noise measurements should be repeated using the correct procedure with plant and equipment operating in a more representative manner.

The tables of sound power levels in the NIA and appendices should be corrected to be consistent with the actual operating sources and the noise model input files.

Detailed engineering drawings of proposed acoustic treatments are required to justify proposed noise reductions in the order of 45 dBA from some sources such as the primary crusher building, as such reductions are likely to be very difficult to achieve and can certainly not be achieved by installing steel cladding or other common industrial building materials. The drawings should include details regarding personnel and equipment access, acoustically controlled ventilation, vibration isolation and other aspects of the design required to achieve such significant noise reductions. The NIA should also describe management measures, such as keeping doors and any windows closed and maintenance of silencers and other important acoustic elements, to ensure the design noise reductions are achieved and maintained over the long term.

Modelled atmospheric conditions – Section 3.1 of the NIA states winds are not significant according to Bureau of Meteorology data, however no evidence is presented to support this claim. Sections 3.1 and 6.1.1 state the noise model considered the effect of noise enhancing winds from the south east, north east and west, however no justification for these wind directions is included and potentially affected receptors exist in other directions not covered by these wind directions. Section 3.1 states drainage flows are not a feature of the area, however no evidence is provided to justify this statement.

RECOMMENDATION: The NIA should present a proper assessment of weather conditions in the area according to the INP including winds in all time periods, temperature inversions and drainage flows.

The noise model results should be updated to reflect the revised weather conditions (and other important parameters such as source sound power levels discussed in this report).

Confirmation of the predicted noise levels – A request for electronic copies of noise model input files, or compatible equivalents, was made over 1 month before the end of the EIS exhibition period. The purpose of this request was to set up an equivalent noise model and confirm the calculated noise levels in the EIS, particularly due to the lack of relevant data in the EIS as described above. This request was made with the assistance of DP&E's Mr Thomas Watt. Noise model files were received on 21 November 2016, 3 days before the end of the exhibition period, and will require a supplementary submission after the exhibition period to report on any issues.

RECOMMENDATION: The NIA author(s) should be required to make all requested files available in a timely manner, although the time to do this has now passed. DP&E staff should consider commissioning an independent review and confirmation of the noise model inputs given the significant issues with various input data described above and the high residual noise impacts predicted in the NIA compared to INP criteria at some receptors.

Modifying factors – The NIA does not correctly assess, or at least does not demonstrate correct assessment, of modifying factors defined in the INP that have significant potential to apply to the development, including tonal and low frequency noise.

RECOMMENDATION: The NIA should ideally present 1/3 octave predicted noise levels to demonstrate quarry noise will not be tonal as defined in the INP. This should specifically include reverse alarms fitted to mobile machines which are not currently mentioned or assessed in the NIA.

The NIA must predict noise levels in octave bands or at least predict both dBC and dBA levels at all receptors to determine the need for the low frequency modifying factor required by the INP.

Noise contour figures – the noise levels represented by the contours are unclear, as the colour order shown in the contours does not seem to match the colour order indicated in the legends.

RECOMMENDATION: The NIS should show recalculated noise contours after correcting the sources etc as described above, then ensure the contour colours match the legend colours or label the contours with the dBA values to resolve ambiguous noise levels.

High predicted noise levels – In some cases, predicted noise levels are more than 5 dBA over relevant INP PSNLs with proposed barriers and other control measures in place, however no assessment of additional or alternative noise control measures is included in the NIA. The NIA therefore does not demonstrate that all feasible and reasonable mitigation measures have been implemented, therefore there is no justification for predicted noise levels over the PSNLs. This issue, combined with the calculated noise levels being significantly underpredicted as discussed above, is a strong indicator that the project represents a production intensity that is incompatible with the short buffer distances to closest residences.

Section 6.4.2 of the NIA includes significant discussion on the predicted noise levels, in general concluding compliance with relevant criteria will occur although with some predicted exceedances. However, when the noise model is updated with the correct sound power levels and received noise levels recalculated, this

section must be rewritten to acknowledge significant exceedances of the criteria at closest residences which will then trigger further investigation into additional noise mitigation measures as required by the INP.

It is likely that sufficient noise mitigation and management measures can be adopted to result in substantial compliance with the criteria however the EIS, *as it currently stands*, does not correctly demonstrate compliance or near-compliance can be achieved. The project, *as it is currently described*, does not appear to be approvable in its current form once noise levels are correctly recalculated.

2.3.2 Road Traffic Noise

The NIA reports a difference of less than 1 dBA between measured and calculated traffic noise levels, presumably at the noise logger locations, which indicates the CoRTN noise model has been correctly applied. However, the incorrect baseline traffic noise levels, incorrect traffic noise criteria adopted for the day period, lack of comparison between calculated noise levels and the night traffic noise criteria, no assessment of other haul routes such as Butterwick Road and Brandy Hill Drive, no assessment of cumulative traffic noise levels with traffic associated with the Brandy Hill Quarry project and lack of assessment of traffic related sleep disturbance are all issues that required significant revision of the NIA.

The revised NIA is expected to show significant exceedances of the traffic noise criteria, in particular the +2 dBA relative criteria, at a number of residences along the various haul routes and is therefore expected to include an assessment of feasible and reasonable mitigation measures. Mitigation measures applied to individual residences or road realignment works may not be reasonable or feasible, however other measures such as a later start time for truck loading to avoid traffic related sleep disturbance (perhaps combined with an off-site product stockpile adjacent to an arterial road that allows early morning truck transport away from residential areas) and a significant increase in product transport by rail are examples of mitigation measures that should be considered.

RECOMMENDATION: The NIS should be revised to show correct baseline traffic noise levels in the absence of existing quarry traffic.

The NIS should recalculate noise levels at receptors with and without proposed quarry traffic to indicate the correct increase in traffic noise levels due to the quarry, particularly for comparison with the 'relative increase' traffic noise criteria.

The NIS should assess traffic related sleep disturbance to various representative receptors along the haul routes.

The NIS should consider traffic noise levels from all proposed routes, not just through Paterson and Bolwarra, including cumulative traffic noise levels for routes common to Brandy Hill Quarry traffic.

The NIS should comprehensively consider mitigation measures including truck transport times, the proportion of product despatched by rail, any alternative transport routes and other measures to show all feasible and reasonable mitigation measures have been applied to the project.

2.3.3 Rail Traffic Noise

The circumstances associated with the proposed rail siding extension are unclear. Section 2 of the NIS states the extended rail siding will only be implemented if there is demonstrated additional demand for product transported by rail, however the same section also states the current short siding is inefficient and is likely to prevent a significant increase in rail transport volumes. These two statements indicate a Catch-22 situation which will result in rail volumes remaining low unless a concerted effort into seeking opportunities for rail transport is made. The project includes train loading 24 hours per day and acknowledges significant resulting noise impacts at Station Street residences, however there is no evidence to suggest that this will result in lower average daily truck volumes through local communities including Paterson and Bolwarra. This aspect of the project will therefore most likely result in greater noise impacts.

Apart from the rail loading issue, the NIA is correct that train movements to and from the quarry will result in only a minor increase in average daily rail noise levels at receptors along the route.

The NIA proposes a significant noise wall be constructed adjacent to the rail siding to reduce loading noise to nearest residences, however an assessment of construction noise associated with this wall is not included despite the wall being proposed close to residences.

RECOMMENDATION: The NIS should more clearly justify the proposed 24 hour rail loading and associated significant noise impacts to nearby residents in the more sensitive night period, ideally including guaranteed reductions in truck numbers on local and regional roads to reduce impacts on the community as a whole, or at least to avoid an increase in noise impacts as currently proposed.

The NIA should assess construction noise associated with the proposed rail siding noise wall, and associated with the proposed extension of the rail siding, to nearest residences as specifically required by the SEARs.

3. BLASTING

The EIS includes a blasting report in Appendix I, prepared by Peter Bellairs Consulting Pty Ltd. A review of the blasting report raises no significant comments or issues.

The Martins Creek and Vacy communities, particularly in the area of View Street and Wayaka Close generally north of the quarry, perceive blasting impacts as unacceptable despite the published blast monitoring data indicating compliance with relevant criteria. The significant difference between the community's perceptions, and what would conventionally be expected from the community given the acceptable blast monitoring results, raises the question of potential reasons for this difference. The following options seem possible although not necessarily likely:

Option 1 - The blast monitoring data at one or more locations may be incorrect and significantly understate vibration and/or overpressure levels. This option would require the monitoring instruments to be incorrectly calibrated, operated or installed, all of which appear unlikely assuming a competent blasting contractor.

It is noted that blast monitoring results at 338 Dungog Road, approximately 640 m from the centre of the extraction area, are usually only slightly higher than monitoring results at Wayaka Close approximately 1350 m from the extraction area. Based on the difference in scaled distance to the two monitoring locations, vibration levels at 338 Dungog Road are expected to be approximately 3.3 times greater and overpressure levels are expected to be approximately 10 dB higher. Monitoring data for 2016 indicates 338 Dungog Road vibration levels are 1.6 times higher on average, while overpressure levels are 13 dB higher on average. The overpressure differences are consistent with expectations, however the vibration levels are not. There may be significant differences in ground conditions (such as soil type and depth) between the two locations, therefore this unexpected result does not necessarily indicate errors in monitoring data.

Independent monitoring of a blast event on 17 November 2016 just after 2 pm was completed at 4 Wayaka Close in an attempt to resolve this option, using an Instantel Minimate Plus, serial number BE12695 hired from Global Acoustics, installed in the back yard at least 3 m from the southern façade of the residence. Following is a comparison of results reported by the proponent and independently obtained:

Parameter	Vibration mm/s PPV	Overpressure dBL pk
Proponent	1.88	99.2
Bridges Acoustics	1.71	100.0

These results are consistent, indicating the published blast monitoring results are reliable at least for this blast and presumably for all other blasts.

Option 2 - The community may be unusually sensitive to blasting impacts. This is possible given the community's opposition to the quarry, however the reported impacts such as items falling from shelves during a blast event and significant reactions from residents and visitors indicates real rather than just perceived impacts. This option is difficult to determine and resolve.

Option 3 - The residential buildings in this area may be unusually sensitive to vibration, due to construction materials and/or methods or issues with foundation design or construction, and may be unusually susceptible to cracking or other damage. This option is more likely to apply to a few individual residences rather than a large number of them, therefore appears unlikely at first glance. A full and independent geotechnical and structural investigation of multiple residences would most likely be required to resolve this option.

Appendix I of the EIS also includes a geology and blast vibration assessment prepared by VGT Pty Ltd which reports differences in surface or near-surface rock types at various locations within the quarry and the nearby residential area. The report concludes there is no direct geological linkage between the quarry and residents, which was meant to imply there was no particular or unusual reason for ground vibration to transmit from the blast sites to residences. However, it is relatively common to find different rock types at various locations around a quarry or other site and ground vibration can effectively transmit through rock type boundaries, particularly where the adjacent layers are formed from rock of a similar density and strength and there are no large faults or other discontinuities that can create subsurface voids or other features that affect vibration propagation. Data presented in the report therefore does not necessarily indicate an unusually strong or conversely an unusually weak geological connection between the quarry and residences.

The unexpected difference between measured ground vibration levels at Dungog Road and Wayaka Close described above, that is generally inconsistent with the differences in distance from the quarry to each monitoring location, indicates there is a stronger geological connection between the quarry and Wayaka Close than there is between the quarry and Dungog Road assuming the blast monitoring results are valid. Whether the Wayaka Close connection is stronger than normal, or whether the Dungog Road connection is weaker than normal, cannot readily be determined.

RECOMMENDATION: The proponent should be required to further investigate blasting issues to resolve the community's concerns, either by commissioning independent blast monitoring to confirm vibration and overpressure levels and/or by commissioning independent investigations into geotechnical and structural issues for a number of the apparently worst affected residences.

An inspection of two of the blast monitoring locations on 17 November 2016 indicates:

- The Dungog Road monitoring location is on the road reserve adjacent to the driveway of 338 Dungog Road, approximately 50 m further from the quarry than the residence, and on what appears to be soft deep soil at the base of a large tree. All of these factors have the potential to affect, and most likely reduce, measured vibration levels. Assuming residents allow access to their property for blast monitoring, a better location would be on or near the driveway closer to the residence, on harder ground away from large trees, to ensure representative monitoring results are obtained.
- The Wayaka Close monitoring location is on the footpath in front of 4 Wayaka Close near the intersection with View Street, according to adjacent residents. An inspection of this site, at the exact location residents advised the monitor was located an hour previously, indicated a lack of obvious ground disturbance. In particular, holes left by geophone ground spikes could not be found and no disturbance indicating the spike holes were filled in was noted. In contrast, the Dungog Road monitoring location showed obvious fresh ground spike holes and other minor ground disturbance after the blast on 17 November 2016. The lack of visible ground disturbance at Wayaka Close indicates the geophone was not correctly fixed to the ground which would significantly affect vibration monitoring

results at this location, however no definite conclusions can be drawn as the monitor was not directly observed.

RECOMMENDATION: The proponent should ensure existing blast monitoring procedures are appropriate and ensure adequate training of monitoring personnel to avoid potentially incorrect monitoring results.

3. VIBRATION

Vibration from blasting is discussed in the EIS and above, however vibration from quarry vehicles travelling on public roads has not been addressed in the EIS but has been mentioned as a significant issue by some residents of homes close to the road. There is no information in the EIS to determine whether road related vibration is an issue compared to relevant criteria and, if so, what mitigation measures would be appropriate.

RECOMMENDATION: The proponent should measure existing ground vibration levels produced by heavy vehicles travelling on public roads, particularly at the closest and worst affected residences, to determine compliance with criteria and likely future compliance. In the event of existing and/or predicted future non-compliance with criteria, the EIS should propose mitigation measures.

5. CONCLUSION

This brief summary of issues identified during an acoustic review of the Martins Creek Quarry EIS has indicated significant issues exist with a high potential to materially affect the results and conclusions of the EIS. A number of conclusions regarding no or minimal acoustic impact are based on erroneous data or assessment methods, where in fact there is a high chance of significant and unacceptable impacts at one or more receptor properties from the project as currently proposed.

It is clear that the project has the potential to provide environmental benefits to some residents, particularly those on Station Street Martins Creek who are currently exposed to noise from both the processing plant and truck movements. However the potential benefits for these residents would, at least in part, be offset by the proposal to load trains at any time of the day or night, with subsequent noise and potentially sleep disturbance impacts to these same residents.

Other residents such as those on Dungog Road north of Grace Avenue, who currently receive minimal traffic noise from quarry trucks, will receive a significant increase in both site and traffic noise levels due to the proposed access direct to Dungog Road.

Many residents should expect a progressive increase in noise and blasting impacts as production increases to the proposed level of 1.5 Mtpa, particularly those along the primary haul route through Paterson and Bolwarra who would also receive significant truck noise earlier in the morning than at present.

Please contact the undersigned for any further information or discussion.

Yours faithfully,

MARK BRIDGES BE (Mech) (Hons) MAAS
Principal Consultant

APPENDIX A - Extract from Caterpillar Wheel Loader Specifications

The following extracts from the Specifications for the Caterpillar 980H and 988H Wheel Loaders, including only the front page and the relevant page showing highlighted external noise levels from each document, have been included to support Section 2.3.1 of this review report.

The Caterpillar webpages describing each machine are available at:

Caterpillar 980H:

http://www.cat.com/en_AU/products/new/equipment/wheel-loaders/medium-wheel-loaders/16932909.html

Caterpillar 988H:

http://www.cat.com/en_AU/products/new/equipment/wheel-loaders/large-wheel-loaders/17770689.htm

The original Specification documents from which the attached extracts were obtained were downloaded from:

Caterpillar 980H:

http://s7d2.scene7.com/is/content/Caterpillar/C10132874

Caterpillar 988H:

http://s7d2.scene7.com/is/content/Caterpillar/C609127

For each machine the second link allows downloading of the Specification document, however the resulting file is missing an extension of .pdf due to apparent errors in Caterpillar's website. Manually adding this extension to each file after it is downloaded allows it to open in Adobe Reader or another pdf reading program.

980H
Wheel Loader

Engine Model	Cat® C15 ACERT™	
Maximum Net Power (1,800 rpm)		
ISO 9249/SAE J1349 (metric)	264 kW	359 hp
ISO 9249/SAE J1349 (imperial)	264 kW	354 hp
Bucket Capacities	4.31-8.20 m^3	5.64-10.73 yd^3

Operating Weight	29 945 kg	65,999 lb

• For 5.4 m^3 (7.0 yd^3) general purpose bucket with BOCE.

Sound

- The sound values indicated below are for specific operating conditions only. Machine and operator sound levels will vary at different engine and/or cooling fan speeds. The cab was properly installed and maintained. The tests were conducted with the cab doors and the cab windows closed. Hearing protection may be needed when the machine is operated with a cabin that is not properly maintained, or when the doors and/or windows are open for extended periods or in a noisy environment.
- The declared dynamic operator sound pressure level for a standard machine configuration, measured according to the procedure specified in "ISO 6396:2008" is 75 dB(A) with the cooling fan speed set at maximum value.
- The declared dynamic exterior sound power level for a standard machine configuration, measured according to the procedures specified in "ISO 6395:2008" is 113 dB(A) with the cooling fan speed set at maximum value.
- The declared average exterior sound pressure level for a standard machine configuration, measured according to the procedure specified in "SAE J88:2013 – Constant Speed Moving Test," is 77 dB(A). The measurement was conducted under the following conditions: distance of 15 m (49.2 ft), moving forward in second gear ratio with the cooling fan speed set at maximum value.

Sound Level Information for Machines in European Union Countries and in Countries that Adopt the "EU Directives"

- The declared dynamic operator sound pressure level for a standard machine configuration, measured according to the procedures specified in "ISO 6396:2008," is 72 dB(A) with a cooling fan speed set at 70 percent of the maximum value.
- The sound power level that is labeled on the machine is 109 Lwa. The measurement was made according to the test procedures and conditions that are specified in the European Union Directive "2000/14/EC" as amended by "2005/88/EC."

Service Refill Capacities

Fuel Tank – Standard	453 L	120 gal
Cooling System	83 L	22 gal
Crankcase	64 L	17 gal
Transmission	62 L	16 gal
Differentials and Final Drives – Front	87 L	23 gal
Differentials and Final Drives – Rear	87 L	23 gal
Hydraulic Tank	125 L	33 gal

988H
Wheel Loader

Engine		
Engine Model	Cat® C18 ACERT®	
Gross Power	414 kW	555 hp
Net Power – ISO 14396	397 kW	540 hp
Net Power – EEC 80/1269	373 kW	501 hp

Operating Specifications		
Rated Payload	11.4 tonnes	12.5 tons
Operating Weight	50 144 kg	110,549 lb
Buckets		
Bucket Capacities	6.4 m^3-7.7 m^3	8.3 yd^3-10 yd^3

Buckets

Bucket Capacities	6.4 m^3-7.7 m^3	8.3 yd^3-10 yd^3
Max. Bucket Capacity	7.7 m^3	10 yd^3

Axles

Maximum Single-Wheel Rise and Fall	568 mm	22.4 in
Front	Fixed	
Rear	Oscillating ±13°	

Brakes

Brakes	Meet SAE ISO 3450:1996

Cab

Cab – ROPS/FOPS	Meets SAE and ISO standards
Sound Performance	Meets ANSI, SAE and ISO standards

- Cat cab with integrated Rollover Protective Structure (ROPS) and Falling Object Protective Structure (FOPS) is standard.
- ROPS meets SAE J1040 APR99 and ISO 3471:1994 criteria.
- FOPS meets SAE J231 JAN81 and ISO 3449:1992 Level II criteria.
- The operator sound exposure Leq (equivalent sound pressure level) measured according to the work cycle procedures specified in ANSI/SAE J1166 OCT98 is 76 dB(A), for the cab offered by Caterpillar, when properly installed, maintained and tested with the doors and windows closed.
- Hearing protection may be needed when operating with an open operator station and cab (when not properly maintained or doors/windows open) for extended periods or in noisy environment.
- The exterior sound pressure level for the standard machine measured at a distance of 15 m (49.2 ft) according to the test procedures specified in SAE J88 JUN86 mid-gear-moving operation is 81 dB(A).
- The machine sound power level is 114 dB(A) measured according to the test procedures and conditions specified in ISO 6395:2008 for standard machine configuration. The measurement was conducted at 70 percent of the maximum engine cooling fan speed.
- The machine sound power level is 111 dB(A), measured according to the test procedures and conditions specified in ISO 6395:2008 for a sound suppression machine configuration. The measurement was conducted at 70 percent of the maximum engine cooling fan speed.
- The operator sound pressure level is 72 dB(A), measured according to the test procedures and conditions specified in ISO 6306:2008 for a sound suppression machine configuration. The measure was conducted at 70 percent of the maximum engine cooling fan speed.

Steering

Steering	Meets SAE and ISO standards
Total Steering Angle	86 Degrees

- Full hydraulic, load-sensing steering system meets SAE J1511 FEB94 and ISO 5010:1992 specified standards.
- Center point frame articulation.
- Front and rear wheels track.

Loader Hydraulic System

Main Hydraulic System Output at 2,010 rpm and 6900 kPa (1,000 psi)	492 L/min	130 gal/min
Relief Valve Setting	35 000 kPa	5,075 psi
Cylinders, Double Acting: Lift, Bore and Stroke	220 × 911 mm	8.7 × 35.9 in
Cylinder, Double Acting: Tilt, Bore and Stroke	220 × 1770 mm	8.7 × 69.7 in
Pilot System, Gear-Type Pump Output at 2,010 rpm and 2500 kPa (363 psi)	76 L/min	20.1 gal/min
Relief Valve Setting (low idle)	2400 kPa	348.1 psi

- With SAE 10W oil at 66° C (150° F).