Our Ref: MR: TJ:11819

20 February 2020

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

Emailed to: anthony.barnes@planning.nsw.gov.au

ATTENTION: MR ANTHONY BARNES

Dear Anthony,

RE: KARUAH EAST QUARRY PROJECT MODIFICATION 8 (MP09_0175)
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION DATED 8 NOVEMBER 2019

I refer to the Department's request for additional information (RFI) dated 8th November 2019 requesting that the proponent address the matters raised in the NSW Environment Protection Authority's (EPA) submission dated 31st October 2019.

Prior to lodgement of this response, the proponent and its project team met with representatives of the NSW EPA (Mr Peter Jamieson, Ms Rebecca Akhurst, Ms Truda King, and Mr Christopher March) on 10th February 2020 to discuss the contents of the EPA submission.

The key outcomes of the meeting with EPA staff are summarised as follows:

- The EPA staff instructed the proponent to respond to its information request dated 31 October 2019.
- The EPA is aware that different Rating Background Levels (RBLs) are possible depending which of the two available RBL calculation methods is used (under the Noise Policy for Industry 2017 (NPfI)). The EPA prefers the use of the LAF90 method (Section 1.4 of the NPfI), which is the methodology used by Thearle Acoustics in its Noise Impact Assessment (NIA) submitted as part of MOD 8.
- Proposed operational noise criteria at Receptor G (which is located east of the quarry) is the NSW EPA's key consideration. The EPA will consider the proponent's response and

ADW JOHNSON PTY LIMITED
ABN 62 129 445 398

Sydney
Level 35 One International Towers
100 Barangaroo Avenue
Sydney NSW 2000
02 8046 7411
sydney@adwjohnson.com.au

Central Coast
5 Pioneer Avenue, Tuggerah NSW 2259
PO Box 3717, Tuggerah NSW 2259
02 4305 4300
coast@adwjohnson.com.au

Hunter
7/335 Hillsborough Road,
Warners Bay NSW 2282
02 4978 5100
hunter@adwjohnson.com.au

www.adwjohnson.com.au

confirm whether it supports the proposed operational noise limit at this location (which is 44dBA) or whether it considers that an alternate limit is more appropriate.

- The proponent's response should give consideration to the transitional provisions contained within the NPfI. EPA staff advised that the transitional provisions require their assessment to take into account the noise limits specified in the existing Project Approval.

- The response should give particular attention to what feasible and reasonable mitigation measures have been considered and implemented and what mitigation measures have been discounted and why.

- EPA staff sought clarification on project justification. EPA staff were advised that project justification had already been resolved to the satisfaction of the NSW DPIE in an ADW Johnson submission to the NSW DPIE dated 22 August 2019.

  Separately (and not discussed in the meeting), it is also noted by the proponent that in its first RFI dated 30 August 2019, the EPA confirmed that it '*does not object to reassessment of noise limits in line with the Noise Policy for Industry*'.

  Project justification for MOD 8 is resolved and is not detailed further in this submission.

- EPA staff enquired about community awareness of the project and requested clarification on what consultation has occurred. The proponent noted the following in this regard:

  - The Karuah East Quarry Community Consultative Committee (CCC) are aware of the MOD 8 application and support the application.
  - There were no public submissions received during the public exhibition phase of MOD 8. It is noted that the community representative members on the CCC filter information throughout the local community, including the receivers to the east of the quarry.
  - Anecdotally, the proponent understands that a community member who lives to the east of the quarry phoned the DPIE's assessment officer to confirm support for the noise mitigation measures that have been installed at the Karuah East Quarry.

  It is considered that appropriate community consultation has occurred for the MOD 8 proposal and this matter is resolved.

Provided below is a summary response to each of the points raised in the EPA submission and raised by the NSW EPA staff during consultation.

Please also find attached with this submission a response from Thearle Acoustics that addresses each of the items raised in NSW EPA submission in detail.

EPA Comment
1. *Additional information & justification that the calculated noise "rating background levels" (RBLs) are representative of the noise environment at the receivers. The noise RBLs in the Karuah East Quarry Noise Impact Assessment, prepared by Thearle Acoustics dated 10 June 2019 (the NIA) at Locations G, H and J are not consistent with other measurements conducted in the area, including the proponent's noise compliance monitoring reports, and do not appear to agree with the monitoring graphs in the report.*

Response

Thearle Acoustics are satisfied that the RBLs calculated in its NIA are representative of the noise environment at the receivers and have been calculated accurately in accordance with the Noise Policy for Industry (NPfI).

It was established at the meeting with EPA staff that this RFI matter particularly relates to receiver G (located east of the quarry).

The proponent commissioned the services of both of its acoustic consultants (Thearle Acoustics and SLR) to investigate the discrepancy between the calculated RBLs in the Thearle Acoustics NIA and the SLR noise compliance monitoring reports. This matter is detailed in the attached Thearle Acoustics Response. A summary is provided as follows:

- The Thearle Acoustics NIA calculated RBL in accordance with Section B1.4 of the NPfI (the LAF90 method).
- The SLR monitoring reports calculated RBL in accordance with Section B1.3 of the NPfI (the 10th percentile method).
- Noting the differences in the RBLs calculated, SLR undertook a 'Methodology Comparison' based on independent data (see **Attachment B** of this letter, which was presented by SLR at the EPA meeting on 10th February 2020). The 'Methodology Comparison' confirmed that different RBLs are possible depending on which RBL calculation method is used.
- Both Thearle Acoustics and SLR note that the NPfI does not specify a hierarchy of which method should be applied.

In response to the investigation, EPA staff confirmed that they are aware that differing RBLs are possible depending on which method is used.

EPA staff also confirmed that the LAF90 method is the EPA's preferred method for RBL calculation because it relies on modern technology as opposed to the 10th percentile method which was carried into the NPfI from the superseded NSW Industrial Noise Policy (2000).

The proponent notes that the Thearle Acoustics NIA calculated RBLs in accordance with the preferred LAF90 method. Accordingly, the proponent is of the position that the RBLs calculated in the NIA are valid and representative of the noise environment at the receivers.

EPA Comment
2. *Discussion and documentation demonstrating consideration of all feasible and reasonable noise mitigation measures at the premises. This may include, but should not be limited to, noise barriers or bunding (for example, along the haul road between the pit and processing plant, around loading areas) and noise attenuated fleet.*

Response

The proponent and Thearle Acoustics have given genuine consideration to all reasonable and feasible mitigation measures available. The mitigation measures implemented as well as those that were discounted (including justification why they were discounted) are detailed in the attached Thearle Acoustics response.

The process of analysing feasible and reasonable mitigation measures has been significant and the mitigation measures implemented are substantial. Below is a summary of the acoustic mitigation measures installed and those that were discounted:

Mitigation Measures Implemented

- Enclosure of the jaw crusher with 100mm thick concrete on the north, east and south elevations to a Sound Transmission Class (STC) of 40. The jaw crusher is also enclosed with a roof manufactured from Hushclad Ultimate with a STC of 28.

- Enclosure of the cone crushers on the northern and eastern elevations with Hushclad Ultimate with a STC of 28. The western and southern elevations were clad in standard colourbond sheeting due to the essential requirement for large openings and roller doors.

- Purchase and use of generator sets that are acoustically treated including:

    - Variable speed cooling fans powered by electric motors. The fans were selected to have a high efficiency blade profile to minimise aerodynamic noise.
    - Complete enclosure of the engine with acoustic louvres on the vents.
    - Muffler with high insertion loss to remove the risk of excessive low frequency noise or tonal frequency.

  The above measures have demonstrated effectiveness and are not a contributor to noise levels at the sensitive receivers.

- A review of mobile plant (loaders, excavators & articulated trucks) used on the site was undertaken. The review included testing the acoustic performance of a sample of Karuah East Quarry site machines in comparison to similar machines available on the market (that are not used by the proponent at the Karuah East Quarry). The loaders and excavators for Karuah East Quarry were found to be examples of the best available noise levels for the class of machine.

  Articulated trucks were identified to be a source of noise however Thearle Acoustics identified that as engines are already enclosed; further attenuation is highly unlikely to have any effectiveness. As a result of this, investigations were then

completed with the aim of minimising impact of articulated trucks through site design. The below measures have been implemented and have been found to benefit acoustic attenuation:

  - Inclusion of the dump hopper into the jaw crusher building. The results in the intermittent and highly audible noise generated by engines at high idle as the material slides against the steel body of the truck being considerably reduced.
  - Incorporation of windrows along the internal quarry haul roads. The barrier has the demonstrated effect of limiting potential high frequency noises from gearboxes or transmissions (therefore limiting any annoying characteristics).
  - Training of operators to use higher gears and lower engine acceleration where practical. Investigations identified that this measure results in reductions of up to 1-3dB.

- Other site design considerations implemented include:

  - Installation of the generators on the western side of the fuel tanks (which are adjacent to the cone crusher enclosure). This is a design consideration that has resulted in an additional minor barrier for noise to the east.
  - Openings for the crusher buildings (including the primary jaw crusher and secondary cone crushers) occurs on the western elevation of the buildings.
  - Arrangements for stockpiles encourage loading from the western side of the stockpile.
  - Road access away from the quarry pit and plant is downhill. Speed limits have been implemented to reduce the impact of exhaust noise generated by trucks leaving the site when under load.
  - Long term review of the quarry pit design to provide natural barriers to receivers to the east of the quarry earlier in the Karuah East Quarry life.

Mitigation Measures Not Considered Feasible or Reasonable

The following mitigation measures were considered and were determined not to be feasible or reasonable and have not been implemented:

- Installation of a 4m high barrier around stockpile areas. This mitigation measure was modelled by Thearle Acoustics and it was identified that the barrier will have minimal benefit for receivers east of the quarry. It was also identified that a barrier will not provide any overall benefit for intermittent or excess low frequency noise.

  Accordingly the proponent made the decision not to construct the 4m high barrier and alternatively investigated other mitigation measures with proven effectiveness (this includes the implemented measures discussed above).

  The MOD 8 application seeks to delete the 4m high barrier requirement from the Statement of Commitments (Appendix 6 of the Project Approval) and replace with the abovementioned mitigation measures installed.

- Separate operation of the primary (jaw crusher) and secondary (cone crushers) crushing plants. This measure will only provide the benefit of limiting the number of

pieces of equipment operating at any one time on the site (and therefore reduced noise emissions). This practice would substantially restrict the overall quantity of material that is able to be produced at the Karuah East Quarry (to a level below the approved extraction rate) and is not a sustainable (or feasible or reasonable) mitigation measure.

- Replacement of mobile equipment with other units available on the market. Investigations completed by Thearle Acoustics identified that mobile equipment used on site is best practice with no further opportunity for noise mitigation.

- Investigations were completed in relation to treatment of radiator inlets and outlets of the mobile equipment. The investigations confirmed that attenuation of these areas was impractical due to the additional restriction being placed on the cooling fans requiring higher fan speeds and as a result producing greater noise levels requiring attenuation. The overall effect resulted in no further noise reduction of the machine.

- Alternative exhaust systems for mobile equipment was investigated however this was discounted due to insufficient space on the machine and the increase in noise of the machine from removing the secondary muffler system and exhausting nearer to ground level.

- Receiver treatment at Location G. The proponent and Thearle Acoustics are of the position that receiver treatment at Location G is not feasible or reasonable for the following key reasons:

    - The proponent has already implemented substantial and effective acoustic treatment (as detailed above).
    - The NIA submitted as part of MOD 8 (Thearle Acoustics June 2019) confirms an RBL for Location G of 39dBA and a target operational noise criteria (day) of 44dBA. Combined with the abovementioned acoustic mitigation measures that have already been installed, receiver treatment at Location G is not necessary to achieve compliance with the NPfI.
    - The owner of Location G has not objected to the MOD 8 application.
    - Thearle Acoustics advise that Location G is a brick building, fitted with mechanical ventilation/comfort conditioning systems and the living areas of the residence are located on the eastern side of the building. As such, the building already meets the recommended mitigation requirements of the NPfI and no further treatment is required.

Summary Comments on Feasible & Reasonable Mitigation Measures

Exhaustive consideration of all feasible and reasonable mitigation measures has been completed by the proponent and Thearle Acoustics. Thearle Acoustics are of the position that the mitigation measures implemented have demonstrated effectiveness in reducing operational noise levels and the NIA achieves compliance with the requirements of the NPfI. On this basis it is considered that this process can be supported by the NSW EPA.

EPA Comment
3. *Details of any changes to the noise environment over time as a result of changes in quarrying, including moving deeper into the pit.*

Response

Thearle Acoustics has investigated the changing noise levels over time with particular reference to the change in profile of the extraction area. For the majority of the site, there is no identified change in landform or equipment that will result in any change to the site noise profile. Thearle Acoustics note that with the inclusion of the implemented mitigation measures (as detailed above) and increase in depth of the quarry pit, a natural bund will be formed that will prevent any offsite noise exceedances.

Notwithstanding this, when considering the quantity of mobile equipment within the quarry pit (approximately 5 at any one time) in comparison to the quantity of mobile equipment on the balance of the quarry site (approximately 35 at any one time), results in site noise levels within the quarry pit are insignificant when compared with the balance of quarry operations.

The mitigation measures implemented (as described above) are essential for the long term operation of the quarry, despite any changes in depth within the extraction area.

EPA Comment
In considering the modification application and potential variation of existing noise conditions, the EPA will consider the current assessment in addition to previous assessments including compliance reports, and any feasible and reasonable noise mitigation that can be implemented on the premises.

Response

At the meeting on 10th February 2020, EPA staff made specific reference to the transitional provisions of the NPfI. EPA staff advised that the transitional provisions contain a note that requires its assessment to take into consideration the existing consent (including existing approved noise limits).

The proponent and Thearle Acoustics have reviewed the transitional provisions (titled *'Implementation and transitional arrangements for the Noise Policy for Industry (2017))* and understand that clauses 1, 4 – 6 are applicable. Comment in relation to each clause is provided below:

1. *The NSW Industrial Noise Policy (2000) is withdrawn and is replaced by the Noise Policy for Industry (2017) except as described in points 2, 3 and 8 below.*

Comment – Noted.

4. *The Noise Policy for Industry (2017) will be used to assess and develop requirements for existing industrial developments / activities under the circumstances and through the process described in points 5 and 6 below.*

Comment – Noted.

5. *Modification to a planning approval:*
    a. *Where the planning authority requires a noise impact assessment to support the modification; or*
    b. *Where significant change to existing plant, equipment, or processes is proposed.*

Comment – Relevant to clause 5(a), a Noise Impact Assessment is necessary to support the MOD 8 application. Therefore assessment against the provisions of the NPfI is necessary.

Relevant to clause 5(b), it is noted that the NIA that currently forms part of the Project Approval (SLR, 2012) is an ageing document. Thearle Acoustics advise that the SLR NIA relied upon a number of assumptions relevant to plant, mobile equipment and site layout. Since the time that the SLR assessment was approved and the quarry became operational, a number of the assumptions for plant, mobile equipment and site layout have become superseded. The Thearle NIA submitted in support of MOD 8 considers actual site plant, equipment and site layout (as opposed to assumed) and is a substantially more accurate representation of the Karuah East Quarry operation.

6. *Environment protection license review/variation:*
    c) where existing environment protection license does not include noise requirements and the regulation of noise is warranted (for example, due to complaints or changing land uses) through a pollution reduction program; or

Comment – Not applicable as the existing EPL (EPL 20611) includes noise requirements. It is noted however that in late 2018 / early 2019 the proponent completed a Pollution Reduction Program in consultation with the NSW EPA.

d) where there is a change in the activity, or to existing plant, equipment or processes that may require noise assessment.

Comment – The same comment as 5(b) above applies to this item. Noting the changes from the modelled assumptions in the SLR 2012 NIA, an NIA that considers actual site plant, mobile equipment and layout (as opposed to superseded assumptions) is an outcome that should be promoted.

NOTE: *Where an application is made to vary requirements using the new policy, the NSW Environment Protection Authority (EPA) will take into account existing commitments and requirements, and performance against those requirements, as evidence of the ability of the proponent / licensee to implement reasonable and feasible measures to mitigate noise. That is, where a license holder meets current noise limits or can do so, this will be considered evidence that practical measures can be implemented to mitigate pollution for the purposes of s.45(d) of the Protection of the Environment Operations Act 1997 when the EPA makes a licensing decision.*

Comment – In response to this guidance note the proponent notes the following:

- The note requires the EPA to consider existing commitments and requirements, but it does not specify that existing commitments and requirements need to be maintained.

This is a rational approach because as large projects of this nature evolve, the ability to reassess operations against current policy and modern technologies is a positive outcome that should be promoted.

- Existing commitments and requirements, in particular the approved operational noise criteria and the 4m noise barrier around stockpile locations, was established as a result of a now largely superseded NIA (SLR, 2012) that was assessed against the superseded Industrial Noise Policy (2000). The SLR NIA relied upon assumptions on plant, mobile equipment and site layout, much of which is now superseded. Furthermore, the SLR background noise was recorded approximately 10 years ago.

  Commensurate with operations of the Karuah East Quarry commencing, performance in relation to the existing commitments and requirements demonstrated that further Noise Impact Assessment and mitigation was necessary. It is noted that in October 2018 the proponent was issued with a penalty infringement notice for failure to construct the 4m noise barriers and a caution was also issued for noise limit exceedances. As a result of this process, the proponent undertook the following steps:

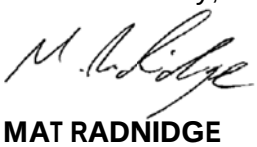
  - Assess the Karuah East Quarry operation in line with the current NSW NPfI 2017 including:
    - Use current background data (as opposed to the use of aged data from the SLR NIA (2012) that forms part of the current Project Approval); and
    - Model the operation based on actual site layout, actual plant equipment and quarry operation (as opposed to assumptions that were made in the SLR 2012 NIA).
  - Establish operational noise criteria at the nearest identified sensitive receivers, including two (2) new receivers located east of the quarry (approved following establishment of the Karuah East Quarry), identified as H and I within the Thearle Acoustic Assessment.
  - Investigate all feasible and reasonable noise mitigation measures to achieve compliance with the criteria established in the NPfI. These mitigation measures have been detailed earlier in this submission and are to replace the Statement of Commitment (currently contained in the Project Approval) for a 4m noise barrier around stockpile locations that has been modelled by Thearle Acoustics and demonstrated to have minimal effectiveness.

  It is considered that application of the current NPfI in the context of the current background noise environment; surrounding development; actual KEQ layout, operation & equipment; and actual noise mitigation measures is a positive outcome that can be supported.

The proponent and Thearle Acoustics are confident that the matters raised in the EPA's submission dated 31st October 2019 have been appropriately addressed and assessment of MOD 8 can continue.

Please do not hesitate to contact me should you wish to discuss this matter.

Yours Sincerely,



MAT RADNIDGE
SENIOR DEVELOPMENT PLANNER
ADW JOHNSON PTY LTD

Encl.:

- **Attachment A** – Thearle Acoustics Response Report dated 20 February 2020.
- **Attachment B** – NPfI RBL Methodology Comparison prepared by SLR January 2020.

ATTACHMENT A

THEARLE ACOUSTICS RESPONSE REPORT DATED 20/2/20

THEARLE
ACOUSTICS

4/56 Industrial Drive
East Mayfield NSW 2304

20 February 2020

NSW Environment Protection Authority
PO Box 488G
Newcastle, NSW 2300

Attention: Mr Peter Jamieson

Dear Mr Jamieson,

I refer to the meeting with yourself and other NSW EPA staff on 10 February 2020, the preliminary meeting on the 29 October 2019 and correspondence issued by the NSW EPA to the NSW DPIE dated 31 October 2019 in relation to proposed MOD 8 to the Karuah East Quarry (PA 09-0175). This document represents a formal response to the matters raised by the NSW EPA.

Item 1 – NSW EPA Letter dated 31 October 2019

1. *Additional information and justification that the calculated noise "rating background levels" (RBLs) are representative of the noise environment at the receivers. The noise RBLs in the Karuah East Quarry Noise Impact Assessment, prepared by Thearle Acoustics dated 10 June 2019 (the NIA) at Locations G, H and J are not consistent with other measurements conducted in the area, including the proponent's noise compliance monitoring reports, and do not appear to agree with the monitoring graphs in the report.*

Thearle Acoustics Response
The NSW EPA has noted differences between the RBL derived for the Noise Impact Assessment for MOD 8 and the quarterly monitoring completed for the Karuah East Quarry as part of the ongoing operational compliance monitoring. The differences relate specifically to locations G and H.

Location J is also identified in the NSW EPA correspondence however upon review this appears to be an error as the Noise Impact Assessment (NIA) applies a minimum RBL of 35 dBA in accordance with the NSW Noise Policy for Industry (2017) (NPfI). Further, there is no nearby quarterly noise data to provide commentary on Location J (nearest location 1.3 km away). Provided in Appendix A of this submission is a figure extracted from the NIA that shows the location of the sensitive receivers.

The NIA prepared by Thearle Acoustics uses the LAF90 method as described by the NSW NPfI (Section B1.4) to calculate RBL. Previous monitoring of the site completed by SLR Consulting used the 10th Percentile method noted in Section B1.3 of the NPfI.

As it was expected that a difference could exist between the two (2) available methods, Karuah East Quarry Pty Ltd engaged SLR Consulting to complete a review of both methods to understand what variation could reasonably be expected from the two (2) different approaches. This investigation confirmed that the two (2) methods produce different RBL's and the result is heavily dependent on the noise characteristics of the site being assessed.

These differences were discussed with the EPA in the meeting on the 10th February 2020 and it was acknowledged by EPA staff that differences in RBL exist between the 2 methods and that the LAF90

method is the more accurate method for determining the RBL. EPA staff also confirmed that the LAF90 method is their preferred method for calculating RBL.

Following the preliminary meeting with the EPA on the 29th October 2019, additional noise measurements were completed at Location G to provide a level of confidence of the RBL determined for the NIA. This monitoring was completed for the period 30th November 2019 through 21st January 2020 excluding the period between 24th December 2019 and 2nd January 2020 due to foreseeable differences in Pacific Highway traffic flows. Results presented are for the day period only as this period is specifically relevant to the operations of the Karuah East Quarry.

The results of this monitoring are presented in the Table 1. As the quarry was operational during this period at approximately 1/3rd of approved production, the LAF95 result has been included for comparative purposes only. Days not shown were either non-compliant due to weather conditions or excluded due to the Christmas / New Year Period.

The December 2019 and January 2020 monitoring data broadly correlates to the RBL determined for the NIA at Location G of 39 dBA with an LAF90 of 40 dBA and an LAF95 of 39 dBA for the period prior to the commencement of school holiday's and an LAF95 of 38 for the entire period monitored including the abnormal traffic flows generated by school holidays.

Based on the above information, we confirm that:

- The LAF90 and 10th Percentile methods produce different results and both are available to use through the NPfI.
- NSW EPA staff has confirmed that the LAF90 method is their preferred approach to RBL calculation.
- SLR Consulting have confirmed the variation in the application of both methods.
- Ongoing monitoring data supports the determination of an RBL of 39 dBA at Location G.
- Location J notes the minimum RBL required of the NSW NPfI of 35 dBA as referred to in the NIA and as such does not require further justification.
- Location H has a calculated RBL of 38 dBA in the NIA. As all monitoring information noted in the EPA Letter of 31 October 2019 was specifically in relation to Location G, no further justification of the noise level of Location H is required following confirmation that the RBL for location G is appropriate. It is also noted that during the EPA meeting, EPA staff confirmed that Location G was their key receiver of interest.

Overall, Thearle Acoustics are satisfied that the RBLs calculated in the NIA are representative of the noise environment at the receivers and have been calculated accurately in accordance with the NPfI.

Date	LAF90 – Day Period	LAF95 – Day Period
RBL – Complete Monitoring Period	40	38
RBL – 30 November to 21 December Only	40	39
30 Nov	39	37
1 Dec	36	35
3 Dec	44	43
4 Dec	42	41
5 Dec	41	40
6 Dec	40	38
7 Dec	40	39
9 Dec	38	37
12 Dec	43	42
13 Dec	37	36
14 Dec	34	33
15 Dec	35	33
16 Dec	47	46
17 Dec	42	41
3 Jan	35	34
4 Jan	34	33
5 Jan	46	45
6 Jan	39	36
7 Jan	35	34
8 Jan	43	42
9 Jan	43	42
10 Jan	34	34
11 Jan	45	44
12 Jan	42	41
13 Jan	40	39
14 Jan	36	34
15 Jan	35	34
16 Jan	36	35
17 Jan	43	42
18 Jan	42	41
19 Jan	39	37
20 Jan	34	33
21 Jan	43	42

Table 1: Location G Monitoring Results Dec 2019 - Jan 2020

Item 2 – NSW EPA Letter dated 31 October 2019

2. *Discussion and documentation demonstrating consideration of all feasible and reasonable noise mitigation measures at the premises. This may include, but should not be limited to, noise barriers or bunding (for example, along the haul road between the pit and processing plant, around loading areas) and noise attenuated fleet.*

Thearle Acoustics Response

Prior to submitting the Noise Impact Assessment as part of the MOD 8 application, Karuah East Quarry Pty Ltd invested substantial resources in identifying and installing feasible and reasonable noise mitigation measures. This process has resulted in industry best practice measures being installed.

Mitigation Measures Implemented

Noise mitigation measures installed include:

- Jaw Crusher. This was identified as a source of low frequency tonal and intermittent noise. This equipment was noted as being the primary source of annoyance to nearby residences. Work was completed around the Jaw crusher that included enclosing the crusher on the south, east and north sides as well as the roof. The walls were manufactured from 100mm concrete to approximate the requirements of Sound Transmission Class (STC) 40, while the roof was manufactured from Hushclad Ultimate with an STC of 28. It is noted that since installation, nearby receivers east of Karuah East Quarry have confirmed that they are very satisfied with the acoustic treatment and this has been evidenced in commentary made in the project's Community Consultative Committee.

- Cone Crushers. These were not yet operational at the time of identifying feasible and reasonable acoustic mitigation and as a result substantial effort was invested in identifying the likely characteristics of the cone crushers based on similar pieces of plant at other sites. They were noted as likely causing low frequency intermittent noise. As it was already planned to have the cone crusher building enclosed, effort was invested around what could be undertaken to further reduce the impact of the cone crushers. The result of this investigation was the North and East Walls of the enclosure were clad with Hushclad Ultimate with an STC of 28. The western and southern sides and roof were clad in standard Colorbond sheeting due to the large openings and roller doors on those sides. It was identified that these openings and roller doors were necessary for ongoing operation and as such were the subject of detailed analysis in the acoustic model. This identified that the openings were to be sealed as best as practical however roller doors were sufficient to no longer cause significant impact to the sensitive receivers. This sealing work was completed before commissioning of the secondary plant.

- As the site is to be powered by generators, investigations were completed prior to the purchasing of generator sets and the best possible option for acoustic treatment provided. Mainstream gensets were considered to be the most desirable option using readily available engines such as the CAT 3500 series, CERT series or Cummins QSK series. Based on these requirements it was possible to determine the best levels of attenuation and as such develop a specification for supply. The units purchased in 2019 were selected due to having the following characteristics:

  - Variable speed cooling fans driven by electric motors. The fans were ensured to have a high efficiency blade profile to minimise aerodynamic noise.
  - Complete enclosure of the engine with acoustic louvres on the vents.
  - Muffler with very high insertion loss thereby effectively dealing with the dominant engine characteristics and removing the risk of excessive low frequency noise or tonal characteristics.
  - Installation of the gensets on the western side of the genset fuel tank. While only a small adjustment it is likely to form a minor barrier for noise to the east.

  This specification has ensured that the generators are not a contributor to the noise levels at the sensitive receivers.

- Other fixed plant was considered in detail however it was noted that the acoustic model did not consider these sources as being significant to the overall noise level at the sensitive receivers.

- A review of mobile plant was undertaken and it was considered necessary to test a sample of site machines to ensure they were performing acoustically similar to other machines of their class. The loaders and excavators for Karuah East were found to be examples of the best available noise levels for the class of machine. Articulated trucks were identified to be a source of noise however as engines are already enclosed, further attenuation is highly unlikely to have any effectiveness.

- As a result of the above, investigations were completed with the aim of minimising impact of articulated trucks through site design. The following measures have been implemented on site and have been found to be of benefit in the acoustic model:
  - Inclusion of the dump hopper into the jaw crusher building. This meant that while the engines were at high idle and the material was sliding against the steel body of the truck, this intermittent and highly audible contribution was considerably reduced.
  - Incorporation of windrows along the haul roads. This small barrier has the effect of limiting any potential high frequency noises from gearboxes or transmissions thereby limiting any annoying characteristics.
  - Training of operators to use higher gears and lower engine revs where practical. While not a permanent solution, studies completed for Karuah East identified that between 1 – 3 dB reductions were possible.

- Other considerations:
  - The design of the site included making openings for crusher buildings on the western side of the buildings.
  - Arrangements for stockpiles preferred the loading away from the eastern side of the site.
  - Road access away from the site is downhill with strict speed limits in place while on the site. This reduces the impact of exhaust noise for trucks leaving the site while under load.
  - Long term review of the quarry pit design to provide natural barriers to the east of the quarry earlier in the quarry life

Mitigation Measures Not Considered Feasible or Reasonable

Alternative mitigation measures were considered but determined not to be feasible or reasonable and were excluded from the implementation program. These include:

- Installation of a 4m high barrier around stockpile areas. This item was included in the original statement of commitments for the quarry project approval. Through modelling of the site, it was identified that the barrier would have minimal effect on the receivers to the east of the quarry. Further, a 4m high barrier will not provide an overall benefit for intermittent or excess low frequency noise. As such, it was decided to not install the barrier and alternatively investigate other mitigation works with proven effectiveness.

- Separate operation of the primary (jaw crusher) and secondary (cone crusher) crushing plants. This option provides the basic benefit of limiting the number of pieces of equipment operating onsite at any given time (and therefore reduced noise emissions). This practice however would substantially restrict the overall quantity of product the quarry is able to produce to a level well below the approved extraction rate and is not a sustainable long term mitigation measure.

- Replacement of equipment with other units available on the market. This has been considered in detail with the mobile plant on the site tested to Australian and ISO Standards. It was identified that the machines used onsite are best practice with no further opportunity for noise mitigation identified.

- Investigations were also completed around what could be done to treat radiator inlets and outlets of the mobile equipment. Trials conducted determined that attenuation of these areas was impractical due to the additional restriction being placed on the cooling fans requiring higher fan speeds and as a result producing greater noise levels requiring attenuation. The overall effect resulted in no further noise reduction of the machine.

- Alternative exhaust systems have been considered however this have been discounted due to insufficient space on the machine and the increase in noise of the machine from removing the secondary muffler system and exhausting nearer to ground level.

- Receiver treatment at Location H - It should be noted that Location H, as a condition of its Development Consent (DA/69/2018), is required to have an acoustic review of the design prior to the issue of a Construction Certificate. This information was formally requested from Mid Coast Council by a GIPA procedure however the information was not released by Council (copyright issues were identified by Council). Notwithstanding, the NIA addresses this matter and details the residual noise impacts in detail in Section 7.3.

- Receiver treatment at Location G – Relative to Location G, reference should be made to AS/NZS2107. To assist with determining an appropriate daytime noise level, it is reasonably assumed that the category ‘Houses and apartment in suburban areas or near minor roads’ is appropriate with a design sound level up to 40 dBA applying for living and work areas.

  The recommended noise criteria is 4 dB above the design sound level of 40 dBA as defined by AS/NZS2107 and meets the requirements of a ‘Marginal’ residual noise level as per the NSW NPfI. It is noted that Location G is a brick building, fitted with mechanical

ventilation/comfort conditioning systems that are reasonably expected to have been maintained and that the living areas of the house are located around the eastern side of the building positioned away from the quarry. As such, the property already satisfies the mitigation requirements of the NSW NPfI and no further treatment is required. It is also noted that the landowner of receiver G has not raised any objection to MOD 8.

Summary of Feasible and Reasonable Mitigation Measures

In summary it is considered that the proponent has exhausted all feasible and reasonable mitigation measures. The mitigation measures implemented are effective and the NIA demonstrates compliance with the requirements of the NPfI.

Item 3 – NSW EPA Letter dated 31 October 2019

3. *Details of any changes to the noise environment over time as a result of changes in quarrying, including moving deeper into the pit.*

Thearle Acoustic Response

Consideration has been given to the changing noise levels of the site over time with particular reference to the change in profile of the extraction area. For the majority of the site, there is no identified change in landform or equipment which will result in any change to the site noise profile. With the inclusion of the implemented mitigation measures (previously noted) and increase in depth of the extraction area, a natural bund will be formed that is expected to the prevent any offsite noise exceedances. Notwithstanding this, when considering the quantity of equipment within the extraction area (approximately 5 at any one time) in comparison to the quantity of mobile equipment elsewhere on site (approximately 35 at any one time), results in site noise levels within the quarry pit are insignificant when compared with the balance of quarry operations. As such, a detailed analysis of the changes in the extraction area was deemed not appropriate.

Conclusion

Thearle Acoustics are confident that the NIA is appropriate for the site and complies with the NPfI. Further:

- The RBL has been calculated using the EPA preferred LAF90 method and the differences this method produces over the 10th percentile method are acknowledged by the EPA.

- Karuah East Quarry Pty Ltd has considered all feasible and reasonable mitigation for the site and has installed mitigation measures that are Industry Best Practice. Further, Location G, the location of primary interest to the EPA, already satisfies the requirements of the NPfI and no objections have been raised by landowner to MOD 8.

- It is not expected that the noise profile of the site will change over time. The majority of plant will continue to operate away from the extraction area and as such any change would be insignificant.

Thearle Acoustics have placed all reasonable care and skill into the preparation of the NIA and this response to the EPA. Thearle Acoustics consider that the EPA can support MOD 8 as complying with the requirements of the NPfI.

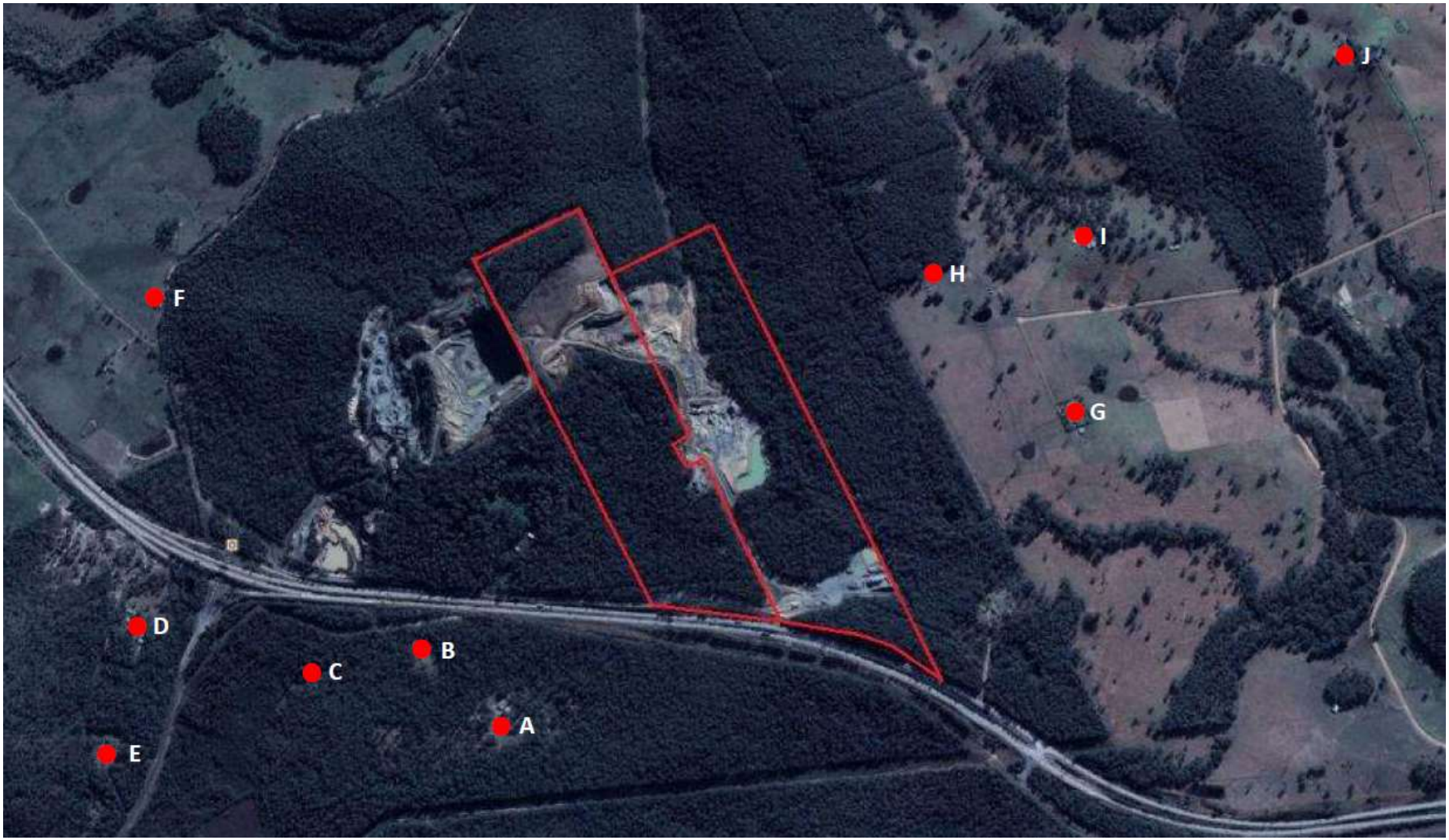
Please do not hesitate to contact me should you have any questions or comments.

Yours Sincerely

Michael Thearle
Director
Thearle Acoustics

APPENDIX A

Location of Sensitive Receivers


J
I
H
F
G
D
B
C
A
E

ATTACHMENT B

NPfI (2017) RBL METHODOLOGY COMPARISON PREPARED BY SLR JANUARY 2020

NPfI RBL Methodology Comparison

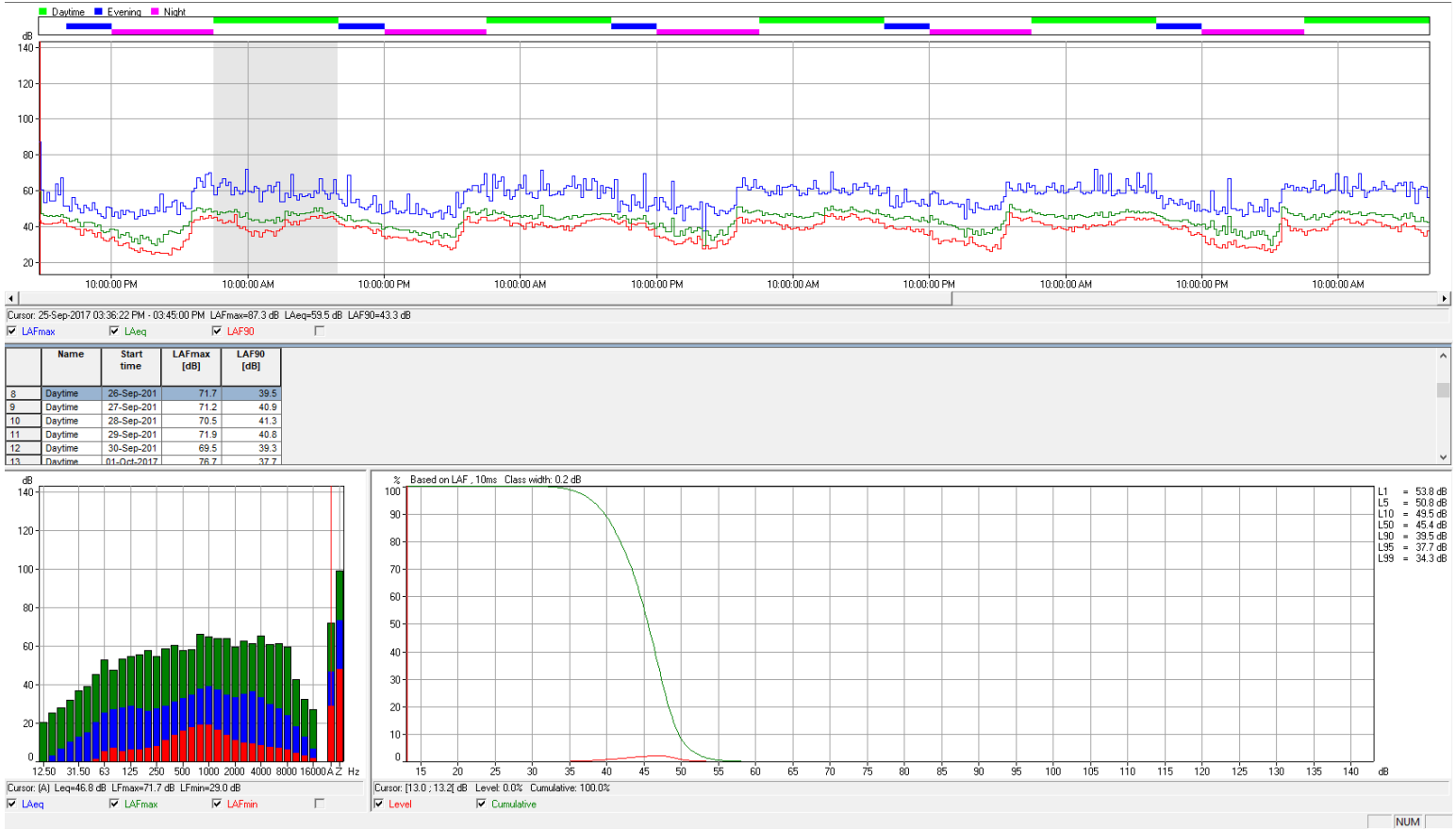
global **environmental** and **advisory** solutions

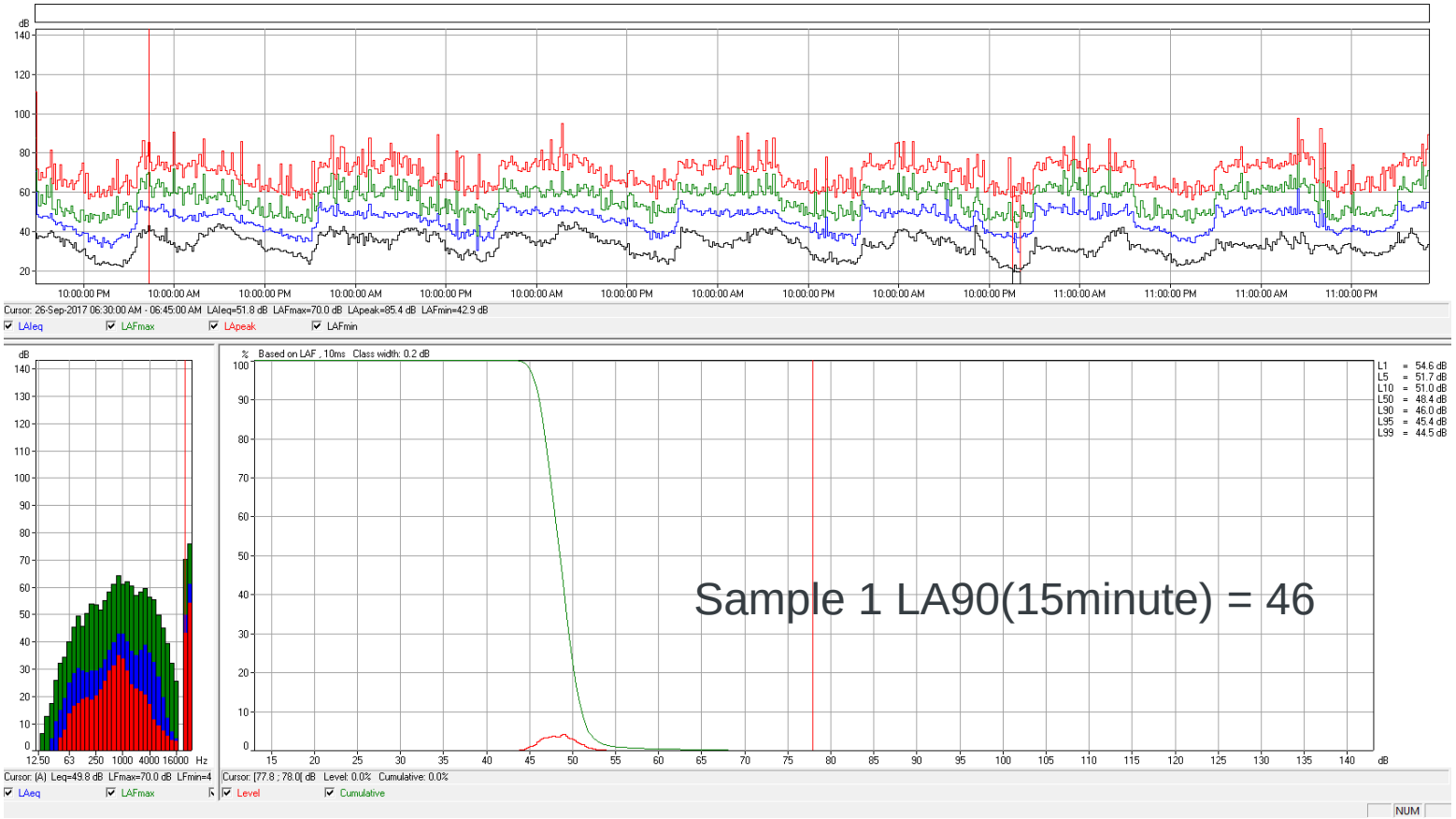
	Day RBL	Evening RBL	Night RBL
Method 1	38	36	29
Method 2	41	38	31
Difference	**-3**	**-2**	**-2**

	Method 1 ABL	Method 2 ABL	Difference
Day1	36.8	39.5	**-2.7**
Day2	39.2	40.9	**-1.7**
Day3	38.6	41.3	**-2.7**
Day4	38.5	40.8	**-2.3**
Day5	37.2	39.3	**-2.1**

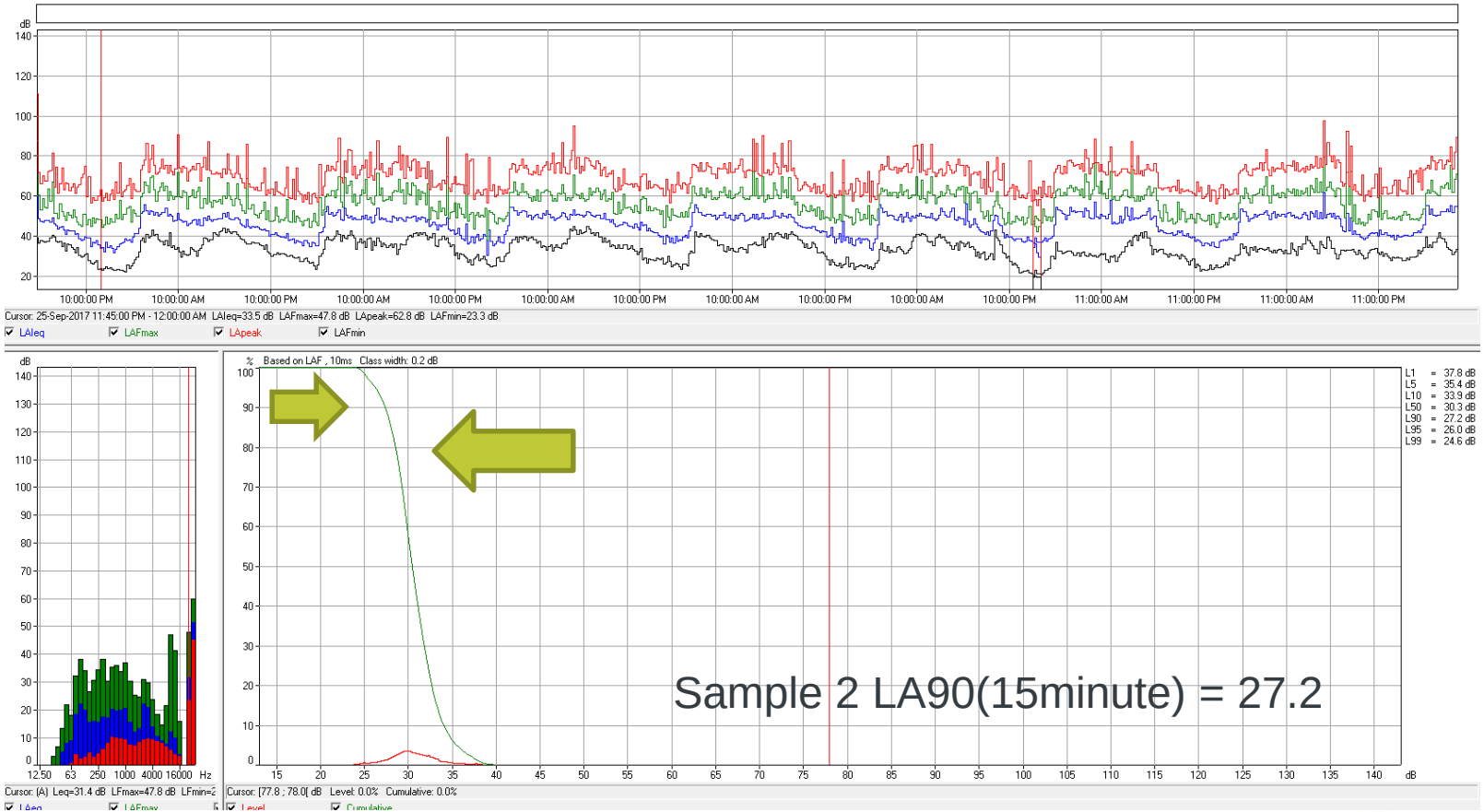
	Method 1 ABL	Method 2 ABL	Difference
Evening1	32.6	34.4	**-1.8**
Evening2	36.7	38.1	**-1.4**
Evening3	37.9	39.2	**-1.3**
Evening4	36.1	37.7	**-1.6**
Evening5	35.3	37.6	**-2.3**
Evening6	32.8	34.2	**-1.4**

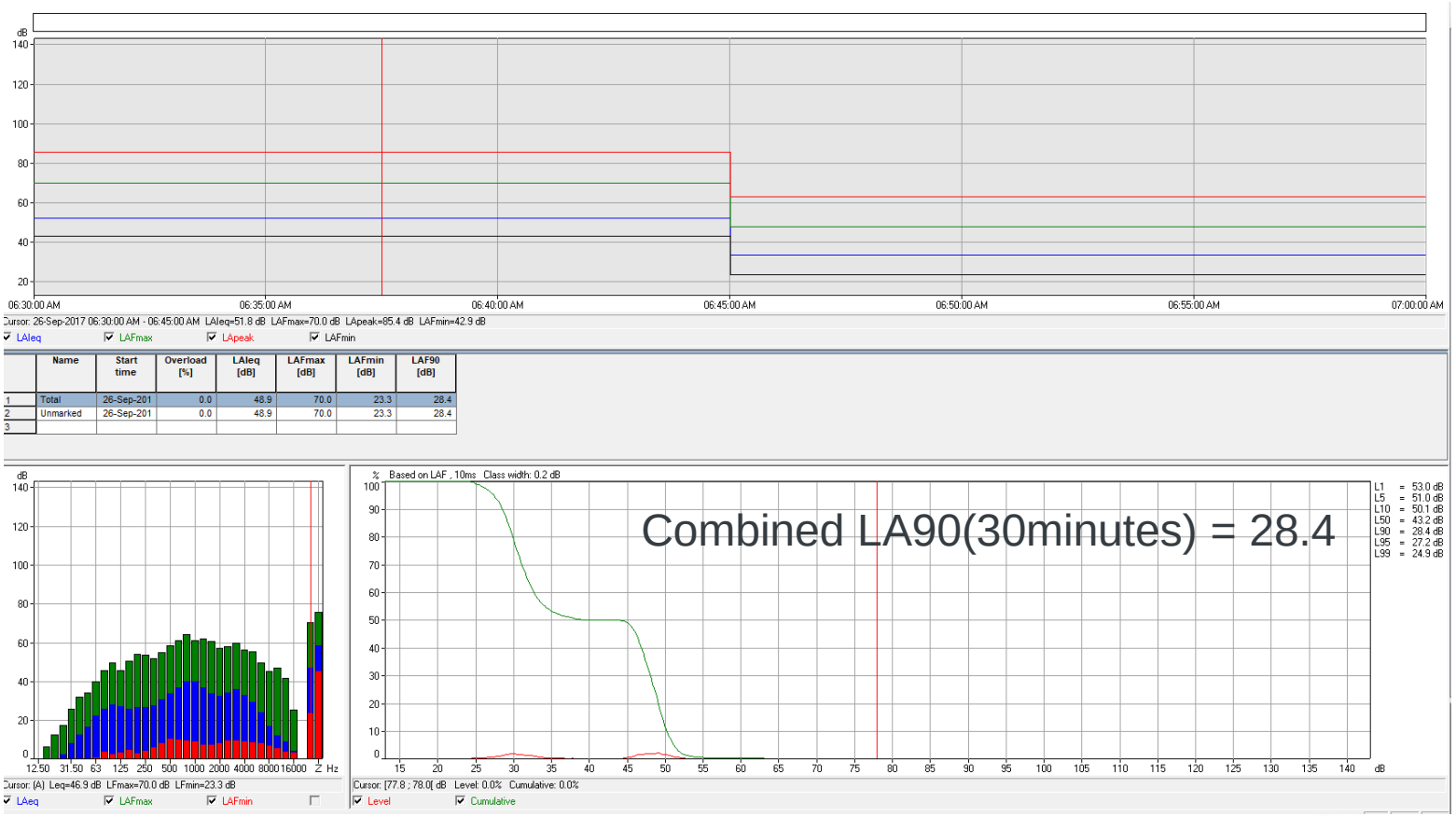
	Method 1 ABL	Method 2 ABL	Difference
Night1	24.9	26.7	**-1.8**
Night2	29.0	31.3	**-2.3**
Night3	28.5	30.6	**-2.1**
Night4	28.5	30.7	**-2.2**
Night5	27.5	28.6	**-1.1**


Daytime
Evening
Night
dB
140
120
100
80
60
40
20
10:00:00 PM
10:00:00 AM
10:00:00 PM
10:00:00 AM
10:00:00 PM
10:00:00 AM
10:00:00 PM
10:00:00 AM
10:00:00 PM
10:00:00 AM
Cursor: 25-Sep-2017 03:36:22 PM - 03:45:00 PM LAFmax=87.3 dB LAeq=59.5 dB LAF90=43.3 dB
LAFmax
LAeq
LAF90
Name
Start time
LAFmax [dB]
LAF90 [dB]
8 Daytime 26-Sep-201 71.7 39.5
9 Daytime 27-Sep-201 71.2 40.9
10 Daytime 28-Sep-201 70.5 41.3
11 Daytime 29-Sep-201 71.9 40.8
12 Daytime 30-Sep-201 69.5 39.3
13 Daytime 01-Oct-2017 76.7 37.7
dB
140
120
100
80
60
40
20
0
12.5 31.5 63 125 250 500 1000 2000 4000 8000 16000 A Z Hz
Cursor: (A) Leq=46.8 dB LFmax=71.7 dB LFmin=29.0 dB
LAeq
LAFmax
LAFmin
% Based on LAF , 10ms Class width: 0.2 dB
100
90
80
70
60
50
40
30
20
10
0
15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 dB
L1 = 53.8 dB
L5 = 50.8 dB
L10 = 49.5 dB
L50 = 45.4 dB
L90 = 39.5 dB
L95 = 37.7 dB
L99 = 34.3 dB
Cursor: [13.0 ; 13.2[dB Level: 0.0% Cumulative: 100.0%
Level
Cumulative
NUM



Sample 1 LA90(15minute) = 46


dB
140
120
100
80
60
40
20
10:00:00 PM
10:00:00 AM
10:00:00 PM
10:00:00 AM
10:00:00 PM
10:00:00 AM
10:00:00 PM
10:00:00 AM
10:00:00 PM
10:00:00 AM
10:00:00 PM
11:00:00 AM
11:00:00 PM
11:00:00 AM
11:00:00 PM
Cursor: 25-Sep-2017 11:45:00 PM - 12:00:00 AM LAleq=33.5 dB LAFmax=47.8 dB LApeak=62.8 dB LAFmin=23.3 dB
LAleq
LAFmax
LApeak
LAFmin
dB
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
12.5
63
250
1000
4000
16000
Hz
Cursor: (A) Leq=31.4 dB LFmax=47.8 dB LFmin=2
% Based on LAF , 10ms Class width: 0.2 dB
100
90
80
70
60
50
40
30
20
10
0
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
dB
L1 = 37.8 dB
L5 = 35.4 dB
L10 = 33.9 dB
L50 = 30.3 dB
L90 = 27.2 dB
L95 = 26.0 dB
L99 = 24.6 dB
Cursor: [77.8 ; 78.0[dB Level: 0.0% Cumulative: 0.0%
Level
Cumulative
Sample 2 LA90(15minute) = 27.2


dB
140
120
100
80
60
40
20
06:30:00 AM
06:35:00 AM
06:40:00 AM
06:45:00 AM
06:50:00 AM
06:55:00 AM
07:00:00 AM
Cursor: 26-Sep-2017 06:30:00 AM - 06:45:00 AM LAeq=51.8 dB LAFmax=70.0 dB LApeak=85.4 dB LAFmin=42.9 dB
LAeq
LAFmax
LApeak
LAFmin
Name
Start time
Overload [%]
LAeq [dB]
LAFmax [dB]
LAFmin [dB]
LAF90 [dB]
1 Total 26-Sep-201 0.0 48.9 70.0 23.3 28.4
2 Unmarked 26-Sep-201 0.0 48.9 70.0 23.3 28.4
3
dB
140
120
100
80
60
40
20
0
12.5 31.5 63 125 250 500 1000 2000 4000 8000 16000 Hz
Cursor: (A) Leq=46.9 dB LFmax=70.0 dB LFmin=23.3 dB
LAeq
LAFmax
LAFmin
% Based on LAF , 10ms Class width: 0.2 dB
100
90
80
70
60
50
40
30
20
10
0
15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 dB
L1 = 53.0 dB
L5 = 51.0 dB
L10 = 50.1 dB
L50 = 43.2 dB
L90 = 28.4 dB
L95 = 27.2 dB
L99 = 24.9 dB
Cursor: [77.8 ; 78.0[dB Level: 0.0% Cumulative: 0.0%
Level
Cumulative
Combined LA90(30minutes) = 28.4

Why the difference?

- Both methods are fundamentally different and measure ‘different’ things
- LAF90(Day) = Level exceeded for 1.1 hours over the whole day. (11x0.1 = 1.1)
- “Method 1” 10th percentile method is sensitive to the distribution of “quiet” over the day. I.e. when the quiet period occurs and for how long over individual 15 minute periods.
- (10th percentile day looks at the 4.4th lowest value in the list of individual 15 minute values. Therefore you only need 5 individual 15 minute samples containing periods of 1.5 minutes in length (7.5 minutes in total over a day) to determine the RBL. Significantly less than the 1.1 hours of “Method 2”.