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Defqon.1 Festival 2016

Noise Impact Assessment and Management Plan

Report Number 610.16140-R1

11 May 2016

Q-Dance Australia
466/311-315 Castlereagh Street
SYDNEY NSW 2000

Version: Revision 0

Defqon.1 Festival 2016

Noise Impact Assessment

and Management Plan

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
610.16140-R1	Revision 0	11 May 2016	Nicholas Vandenberg	Mark Blake	Mark Blake

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1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Q-Dance Australia Pty Ltd (Q-Dance) to prepare the Noise Impact Assessment and Management Plan for the noise impacts associated with the Defqon.1 Music Festival to be held at the Sydney International Regatta Centre on Saturday 17 September 2016 (2016 Festival).

The primary objective of this Noise Impact Assessment and Management Plan is to apply the appropriate noise limits at the surrounding residential locations established in the 2015 Noise Management Plan, update the existing noise model to predict the likely noise emissions at the surrounding residential locations and to detail procedures and strategies for minimising, managing and monitoring the noise impact produced by the sound reinforcement systems and various other noise sources related to the festival.

A glossary of the acoustical terminology used throughout this report is contained within **Appendix A**.

2 PROJECT DESCRIPTION

2.1 Sydney International Regatta Centre

The Sydney International Regatta Centre (SIRC) is located in Penrith, NSW. The venue was developed to cater for the rowing and kayak events during the 2000 Sydney Olympic Games. The Defqon.1 Festival is the largest event held at SIRC each year, with other smaller events, such as Penrith City Council's Australia Day Celebrations and various rowing regattas such as the GPS Head of the River rowing regatta.

Figure 1 provides an overview of the site location and the existing localised surroundings. **Figure 2** shows only the festival and associated camping area located across the lake.

Figure 1 Site Overview

Figure 2 Festival Area

2.2 Defqon.1 Festival

The Defqon.1 Festival has been held at SIRC since the inaugural event in 2009. Since then, the annual event has attracted more than 20,000 patrons, with the number of patrons growing each year.

The 2016 festival is proposed to feature 6 stages distributed across the festival site, as indicated in **Figure 2**. Additionally, it is proposed that helicopter joy flights will take place for patrons between 11.00 am to 6.00 pm on Saturday.

Based on the site layout and expected sound system size, the following grouping of stages has been made for assessment purposes. The hours of operation are as provided by Q-Dance and presented in **Table 1**.

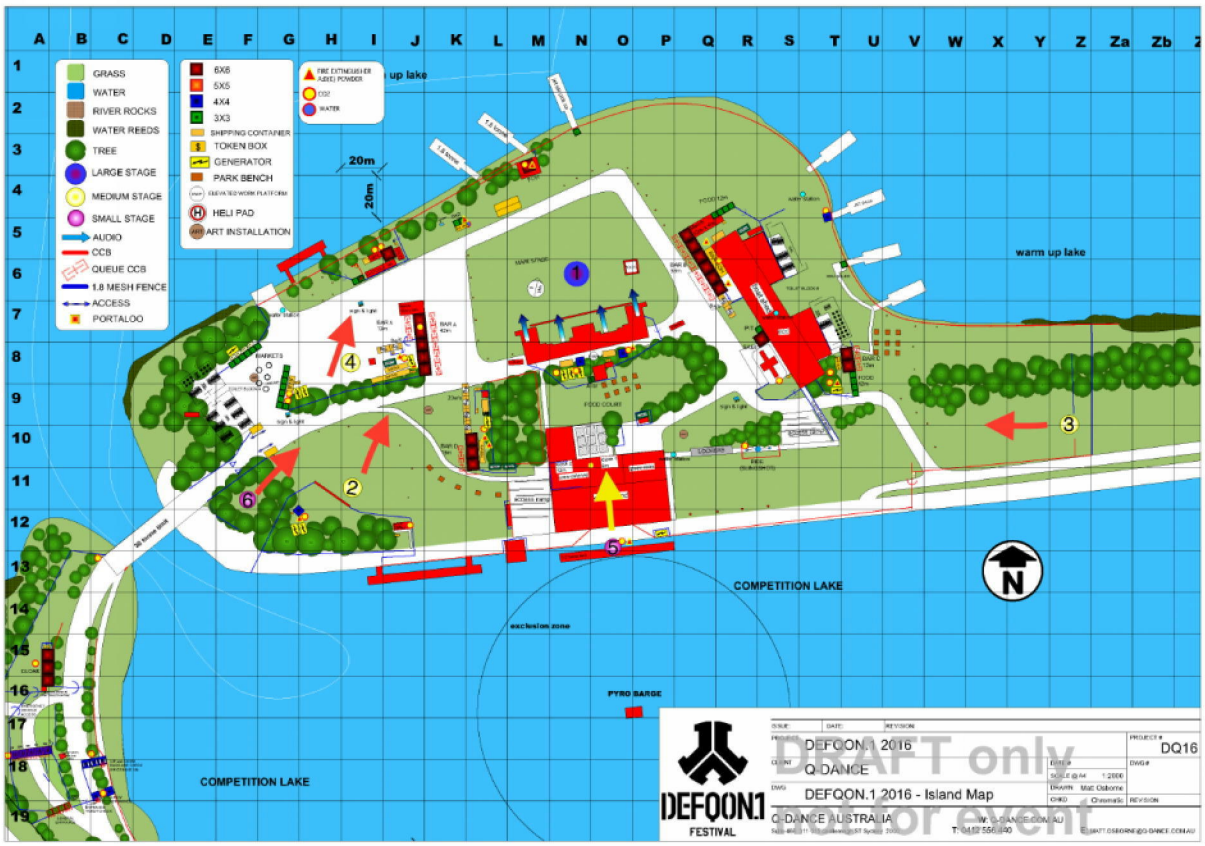
Table 1 Stage Description and Operation Times

Stage Name	Corresponding Stage Number	Stage Scale	Stage Description/ Sound System	Hours of Main Show Operation
Red	1	Main Stage	Ambient/Live Music	Saturday: 10:00 am to 11:00 am
			Main Show	Saturday: 11:00 am to 10:00 pm
			Ambient/Live Music	Saturday: 10:00 pm to midnight
White	5	Grand-stand	Ambient/Live Music	Saturday: 10:00 am to 11:00 am
			Main Show	Saturday: 11:00 am to 9:00 pm
			Ambient/Live Music	Saturday: 9:00 pm to midnight
Black	2	Medium	Ambient/Live Music	Saturday: 10:00 am to 11:00 am
			Main Show	Saturday: 11:00 am to 10:00 pm
			Ambient/Live Music	Saturday: 10:00 pm to midnight
Blue	3	Medium	Ambient/Live Music	Saturday: 10:00 am to 11:00 am
			Main Show	Saturday: 11:00 am to 11:00 pm
			Ambient/Live Music	Saturday: 11:00 pm to midnight
Magenta	4	Medium	Ambient/Live Music	Saturday: 10:00 am to 11:00 am
			Main Show	Saturday: 11:00 am to 11:00 pm
			Ambient/Live Music	Saturday: 11:00 pm to midnight
Purple	6	Medium	Ambient/Live Music	Saturday: 10:00 am to 11:00 am
			Main Show	Saturday: 11:00 am to 9:00 pm
			Ambient/Live Music	Saturday: 9:00 pm to midnight

As part of the entertainment program, it is proposed to have low levels of ambient/live music playing at all stages from 10:00 am to 11:00 am as patrons arrive, and after each stage concludes at the scheduled time until midnight, as detailed in **Table 1**.

Figure 3 provides an overview of the proposed site layout and stage locations and provides an indication of the size of the stage.

Figure 3 Proposed Defqon.1 2016 - Festival Site Map



2.3 Sensitive Receivers

A number of representative residential receiver locations have been selected for the assessment of potential noise impacts within the surrounding areas. These receivers are identified in **Table 2** and **Figure 4**.

Table 2 Sensitive Receiver Locations

Receiver ID	Description	Suburb Location
R1_001	Cranebrook Road (Near Cranebrook Park)	Cranebrook
R1_002	Soling Crescent	Cranebrook
R1_003	Cranebrook Road (North)	Cranebrook
R2_001	Waterside Estate (North)	Waterside Estate
R2_002	Waterside Estate (Middle)	Waterside Estate
R2_003	Waterside Estate (south)	Waterside Estate
R2_004	Waterside Estate (south)	Waterside Estate
R3_001	Avoca Avenue	Emu Plains
R3_002	Gardenia Avenue	Emu Plains
R3_003	River Road (North)	Emu Plains
R3_004	River Road (South)	Emu Plains
R3_005	River Road(Middle)	Emu Plains
R4_001	Ambler Close	Emu Heights
R4_002	Strathdon Road	Emu Heights

Receiver ID	Description	Suburb Location
R4_003	Merlin Place	Emu Heights
R4_004	Riverbank Drive	Emu Heights
R5_001	Emu Plains Road	Mount Riverview
R5_002	Vista Parade	Mount Riverview
R6_001	Illingworth Road	Yellow Rock
R6_002	Singles Ridge Road	Yellow Rock
R7_001	Nepean Avenue	Penrith
R7_002	Bushranger Grove	Penrith
R8_001	Workman Place	Leonay
R9_001	Old Castlereagh Road	Castlereagh
R10_001	Church Lane	Castlereagh
R10_002	Hadley Park Homestead	Castlereagh
R11_001	Hawkesbury Road	Hawkesbury Heights

Figure 4

Sensitive Receiver Locations

LEGEND

Receiver

NOTES

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Project Name:
Defqon.1 Festival 2016

Prepared for:
Q-Dance Australia

Project No: **610.16140**

Scale	Date
1:47,885	09/05/2016

Drafted	Approved
05/05/2016	-

3 NOISE MANAGEMENT LEVELS

3.1.1 Receiver Noise Monitoring Locations

As part of the 2015 Noise Impact Assessment and Noise Management Plan, SLR established an appropriate Receiver Noise Management Level (Receiver NML) with reference to various case studies. In summary, the audience size provides an indication of the likely amplification required to provide an enjoyable experience for the crowd. As the Defqon.1 Festival is expected to attract close to 25,000 patrons, and this level of event is to occur only once each year, a higher Receiver NML is applicable similar to that currently implemented at other major event venues throughout NSW.

As established in the 2015 Noise Impact Assessment and Management Plan, **Table 3** presents the Residential NMLs adopted for the 2016 Festival.

Table 3 Residential Noise Management Levels

Monitoring Location	Noise Management Level
Residences	70 LAmax / 90 LCmax

However, the low levels of ambient music playing from 10:00 am to 11:00 am from all stages, and after each stage concludes at the scheduled time until midnight, as detailed in **Table 1**, are not to be audible at any receiver location.

3.1.2 Boundary Noise Monitoring Locations

As per the 2015 Noise Impact Assessment and Noise Management, SLR will implement real-time noise monitoring at five (5) boundary locations as it provides real-time data regarding the noise emissions from the venue.

The Boundary NMLs that were adopted for the 2015 Festival at the boundary monitoring locations will be adopted for the 2016 Festival and have been reproduced in **Table 4**.

Table 4 Boundary Noise Management Levels

Monitoring Location	Noise Management Level
Location A	90 LAmax /110 LCmax
Location B	90 LAmax /110 LCmax
Location C	90 LAmax /110 LCmax
Location D	90 LAmax /110 LCmax
Location E	80 LAmax /100 LCmax

The noise levels recorded via the real-time noise monitors at the boundary will be the primary measure to control the noise emissions from the Festival. Noise modelling and measurement results from the 2015 Festival confirm that if the Boundary NMLs are met then the Residential NMLs would also be achieved.

It should be noted that these NMLs have been derived for music noise only, and not noise generated from other activities such as the helicopter activities.

All NMLs have been selected given the successful management in previous years, generally minimal complaints and the current receivers' locations. If additional receivers are proposed within the potentially affected area, new NMLs should be derived for these locations.

4 NOISE IMPACT ASSESSMENT

A computer noise model was used to predict the noise emissions from the operation of the sound reinforcement systems and noise generated from helicopter activity to provide Q-Dance Australia with noise contour plots detailing the predicted noise impact on the surrounding areas. Furthermore, this allows SLR to focus on specific areas with higher predicted levels. The noise modelling was undertaken using SoundPLAN v7.1 software, developed by Braunstein and Berndt in Germany. The model used terrain data surrounding the venue (sourced from SLR's database), together with noise source data, ground cover, shielding by barriers and/or adjacent buildings and atmosphere information to predict noise levels at the surrounding residential locations presented in **Table 2**.

4.1 Music Noise

The noise model has been validated against the noise measurements conducted for the 2015 Festival and the data provided by Auditoria from previous years and has been calibrated to the overall L_{eq} noise levels measured at the boundary locations to within 2-3 dB, during a period where metrological impacts are believed to be minimal. It is anticipated that this discrepancy is due to the directivity of the sound systems.

This enables SLR to construct an accurate noise model to predict the likely L_{eq} noise emissions at the residential locations. Every effort has been undertaken to predict the Lmax noise levels, however, it should be noted that it is difficult to assess as it is highly dependent on the music, performers and sound system operators. The L_{max} noise levels have been based on the level difference between the L_{Aeq} and the maximum noise level measured at Location B over the course of the day (2015 Festival), and adjusted accordingly.

4.1.1 Main Event

The main event will start at 11:00 am and conclude at 11:00 pm on Saturday. However, some stages will cease from 9:00 pm, with Stage 1, Stage 2, Stage 5 and Stage 6 ceasing by 10.00 pm. The predicted worst-case noise level for each receiver area is presented in **Table 5** for all stages operating with a maximum stage noise level as presented in **Table 9**.

Table 5 Main Event Predicted Noise Levels

Receiver Area	Weather Conditions	LAeq	LCeq	LAmax	LCmax
R1_Cranebrook	Calm	49	70	57	78
	Adverse Wind	54	73	60	81
R2_Waterside Estate	Calm	56	76	63	83
	Adverse Wind	61	79	65	86
R3_Emu Plains	Calm	49	72	57	80
	Adverse Wind	54	74	59	82
R4_Emu Heights	Calm	54	77	61	85
	Adverse Wind	58	80	65	**88**
R5_Mount Riverview	Calm	48	71	57	79
	Adverse Wind	52	73	58	81
R6_Yellow Rock	Calm	48	71	56	79
	Adverse Wind	52	74	58	82
R7_Penrith	Calm	47	69	54	77
	Adverse Wind	51	72	56	79
R9_Old Castlereagh Road Receiver	Calm	57	78	65	86
	Adverse Wind	62	81	66	88

Receiver Area	Weather Conditions	LAeq	LCeq	LAmax	LCmax
R10_Castlereagh	Calm	51	73	58	81
	Adverse Wind	55	76	62	84
R11_Hawkesbury Heights	Calm	<30	50	33	58
	Adverse Wind	30	54	37	62

The L_{Cmax} noise contours for the festival are presented in **Appendix B**.

4.1.2 Soft Close

As part of the crowd control measures discussed in **Section 6.2**, Q-Dance will implement a soft finish to minimise the noise during egress. The soft finish is designed to allow patrons to slowly egress from the venue, by operating two of the stages longer prior to concluding with the ambient music. The predicted worst-case noise levels for each receiver area are presented in **Table 6** based on a L_{Ceq} noise level of 110 dBC.

Table 6 Soft Close Predicted Noise Levels

Receiver Area	Weather Conditions	LAeq	LCeq	LAmax	LCmax
R1_Cranebrook	Calm	31	54	38	61
	Adverse	35	56	41	64
R2_Waterside Estate	Calm	36	58	43	65
	Adverse	40	61	47	68
R3_Emu Plains	Calm	<30	54	37	61
	Adverse	33	56	40	64
R4_Emu Heights	Calm	38	57	44	61
	Adverse	43	60	49	67
R5_Mount Riverview	Calm	31	51	37	58
	Adverse	36	54	42	61
R6_Yellow Rock	Calm	<30	50	36	58
	Adverse	34	53	40	61
R7_Penrith	Calm	<30	50	34	58
	Adverse	<30	53	37	61
R9_Old Castlereagh Road Receiver	Calm	37	59	44	67
	Adverse	41	62	47	69
R10_Castlereagh	Calm	30	52	37	60
	Adverse	35	55	41	63
R11_Hawkesbury Heights	Calm	<30	31	<30	38
	Adverse	<30	34	<30	42

Additionally, **NO** MC's will be allowed to use the microphones after 10:00 pm to minimise any potential disturbance during this period. The only exception to this is when required for directional and safety announcements.

The L_{Cmax} noise contours for the soft close are presented in **Appendix C**.

4.2 Ambient Music

Similar to the 2016 Festival, the ambient music that is produced from each stage would not be audible at any residential receiver location. As such, SLR personnel will conduct attended noise surveys in the Mount Riverview area, in conjunction with analysis of the real-time noise monitors to ensure that the ambient noise level is not influenced by music noise. It should be noted that although noise levels at the boundary may not be affected by music, the location may be influenced by patrons or generators, as was observed during 2015 Festival.

Furthermore, based on a review of previous measured background noise levels and calculations, if the noise level at each of the stages does not exceed 90 dBC at 10 m from the stage then the noise targets at the residential receivers are anticipated to also be achieved. Nonetheless, it is anticipated that the ambient music will be lower than this.

4.3 Helicopter Noise

Q-dance intents to contract a supplier to provide helicopter joy rides for paying customers. The helicopters are proposed to consist of two AS350 Squirrels and one EC120 Colibri. The noise generated from helicopter activities has been predicted based on the proposed flight path, elevations and an average of 6 flights per hour per helicopter.

The proposed helicopter activities will only take place between 11:00 am and 6:00 pm on Saturday.

The maximum sound power levels provided in **Table 7** have been used throughout the modelling.

Table 7 Helicopter Sound Power Levels

Operation	Sound Power Level (dBA)
Ground Idle	109
Departure	121
Level Flying	127
Arrival	132

The resultant worst case predicted noise level are presented in **Table 8** and is presented graphically in **Appendix D**.

Table 8 Helicopter Noise Predictions

Receiver Area	LAeq(1hour)	LAmax
R1_Cranebrook	49 dBA	54 dBA
R2_Waterside Estate	52 dBA	58 dBA
R3_Emu Plains	58 dBA	66 dBA
R4_Emu Heights	52 dBA	58 dBA
R5_Mount Riverview	47 dBA	52 dBA
R6_Yellow Rock	42 dBA	47 dBA
R7_Penrith	58 dBA	65 dBA
R8_Leonay	56 dBA	65 dBA
R9_Castlereagh	58 dBA	64 dBA

As there is no specific criteria applicable for aircraft activity over a single day per year, the predicted noise levels are expected to be appropriate considering the limited duration of the helicopter activities over this period.

5 NOISE MANAGEMENT

The management of noise impacting on sensitive receivers surrounding the event will be controlled by:

- Developing strategies and procedures for reducing the noise impact at the surrounding residences.
- Ensuring compliance with the developed noise criteria at each of the surrounding residences through the development of an effective noise monitoring program incorporating real-time noise monitoring at the existing boundary locations and attended noise monitoring at residential locations.

6 NOISE MANAGEMENT STRATEGIES

SLR has been engaged to ensure that proper sound system design practices are carried out. Careful planning should be incorporated in the design of the different sound systems in order to provide appropriate audience coverage and sound levels whilst minimising the spill received at the surrounding residential locations. All sound systems should be operated by suitably qualified personnel.

6.1 Control of Sound Reinforcement Systems

SLR will be required to be in communication with Q-Dance organisers for the duration of the event. This ensures that any recorded exceedance of the NMLs caused from the amplified music would be reported immediately to Q-Dance and appropriate action taken to ensure compliance with NMLs is maintained.

Additionally, it is advised that all stages incorporate independent level control for the music and MC's microphone. This enables Q-Dance to have ultimate control on the levels independently as required.

6.2 Crowd Control

Q-Dance has established an effective crowd management strategy which will be implemented again in 2016. As part of this plan, a soft finish is proposed to continue this year. This soft finish enables patrons to slowly egress from the venue and as such reduce the number of patrons congregating at the venue.

6.3 Sound Check

Based on the observations and complaints received in relation to the 2015 Festival, it is recommended that sound checks be limited to Friday **ONLY** between 10 am and 8 pm. If required, sound checks on Saturday are only to occur after 9 am. If for any reason sound checks are required outside of these times, noise levels must not have a significant impact on residential receivers.

6.4 Stage Discussion

6.4.1 Main Stage (Red)

The main stage was considered to be very successful last year, as also reported in previous years, and is proposed to remain unchanged in terms of layout, orientation and audio system. Based on SLR's observations during the 2015 Festival, this stage is expected to have the biggest impact on the monitoring locations.

6.4.2 All Other Stages

Based on the modelling performed, the Stage Noise Management Levels (Stage NMLs) presented in **Table 9** for noise levels at 20 metres is to be set before the start of the 2016 Festival on the event day.

Table 9 Stage Noise Management Levels

Stage Name	Corresponding Stage Number	Stage Description/ Sound System	Noise Management Level
White	5	Grandstand Stage	116 LCmax / 106 LAmax
Black	2	Medium Stage	116 LCmax / 106 LAmax
Blue	3		116 LCmax / 106 LAmax
Magenta	4		116 LCmax / 106 LAmax
Purple	6		116 LCmax / 106 LAmax
Blue & Magenta	3,4	Soft Close Stages	110 LCmax/ 100 LAmax
Ambient Music	All Stage	Ambient Music	Not audible at receiver

Based on these maximum noise levels, the noise levels experienced at the boundary and residential locations are predicted to comply with the respective NMLs.

6.4.3 Sound System Certification

The sound systems will be certified by SLR to ensure that the stages are suitable for the size of the audience area and achieves the Stage NMLs set out in **Table 9**. SLR will issue a certification letter to Penrith City Council prior to the event.

6.5 Helicopter Noise

The helicopter activities are expected to occur only between 11:00 am and 6:00 pm on Saturday. All appropriate measures have been implemented to minimise the noise emissions by engaging a contractor to provide only modern aircrafts.

SLR predicted the noise generated from the helicopter activity to be at an acceptable level for such a short duration of time and have provided noise contour plots of the predicted noise levels in **Appendix D**.

6.6 Control of Other Noise Sources

Whilst the sound reinforcement system will be the primary noise contributor at each residential location, other noise sources such as mechanical services need to be effectively controlled, which will be conducted by deploying generators with noise attenuators.

6.7 Annual Review of Management Plan

SLR will review the management plan and modelling results each year based on the findings and measurement results from the previous year in addition to the proposed layout and orientation of stages.

7 NOISE MONITORING PROGRAM

7.1 Instrumentation and Measurement Parameters

All acoustic instrumentation employed through the monitoring programme should be designed to comply with the requirements of AS 1259.2 2000, “Sound Level Meters” and carry current NATA or manufacturers calibrations certificates. All instrumentation should be programmed to record continuously statistical noise level indices in 15 minute intervals which may include L_{Amax}, L_{A1}, L_{A10}, L_{A90}, L_{Aeq} and L_{Cmax}.

The statistical noise exceedance levels (L_{AN}) are the levels exceeded for N% of the 15 minute interval. The L_{A90} represents the level exceeded for 90% of the interval period and is referred to as the average minimum or background noise level. The L_{Aeq} is the equivalent continuous sound pressure level and represents the steady sound level which is equal in energy to the fluctuating level over the interval period. The L_{Amax} and L_{Cmax} is the maximum weighted noise level recorded over the interval.

Instrument calibration is to be checked before and after each measurement survey, with the variation in calibration levels not to exceed ±0.5 dB.

7.2 Real-time Noise Monitoring

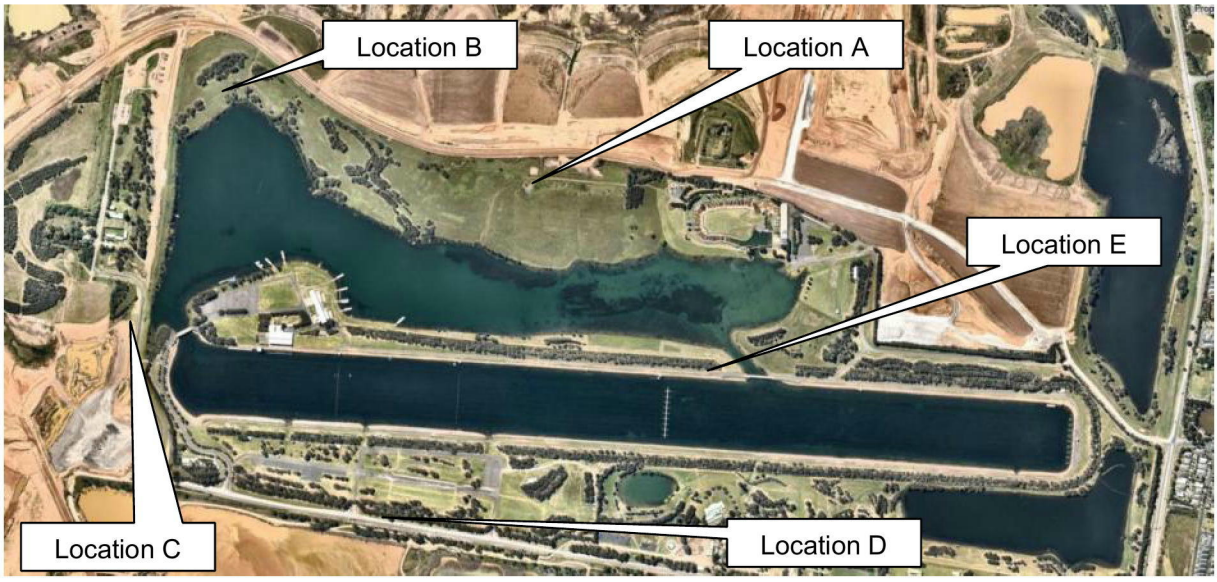
7.2.1 Boundary Monitoring

Boundary monitoring is proposed to be established at up to five (5) suitable locations as adopted during 2015 Festival. This monitoring arrangement will provide real-time noise levels to SLR of the noise levels currently experienced at the selected boundary locations. Based on these levels, it will enable SLR to assess whether any exceedance of NML may be experienced at residential locations based on the results of the noise modelling.

Although this will not solely be relied upon, positioning the monitors within a clearly audible range of the source enables SLR to clearly identify if the source of noise is from the event or other extraneous noise sources, which is likely to occur with the monitors that are proposed to be positioned off-site.

The proposed boundary monitoring locations are presented in **Figure 5**.

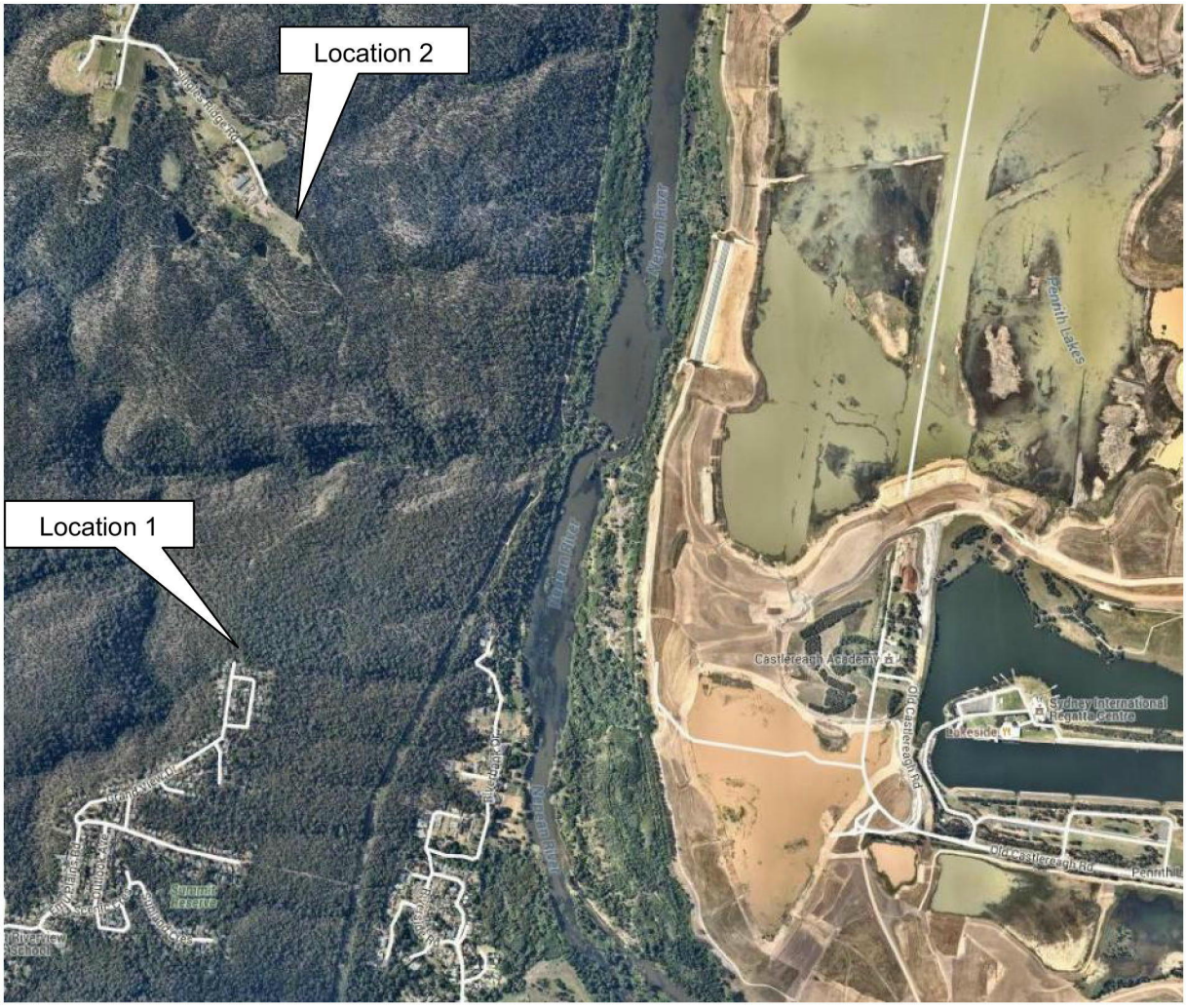
Figure 5 Real-time Boundary Noise Monitoring Locations



7.2.2 Residential Monitoring

Due to the large target area, SLR found it very ineffective to be travelling long distances between each receiver location. Accordingly, to facilitate the residential noise monitoring, two real-time noise monitors are proposed to be positioned within the Mount Riverview and Yellow Rock area as a result of the large volume of complaints received during the 2015 Festival (which were attributed to the noise enhancing atmospheric conditions that prevailed at the time). The proposed monitoring locations are presented in **Figure 6**. It must be noted that the final locations will be selected on the day of the event, as the monitoring locations are required to be removed from any extraneous ambient noise sources that may impact the measurements.

Figure 6 Real-time Residential Noise Monitoring Locations



It must be noted that this is likely to be influenced by other extraneous noise sources, and will be managed as deemed appropriate by SLR at the time of the survey. In the event that the cause of the exceedance is not clearly identifiable, an SLR representative will conduct an attended noise survey in the vicinity to quantify the contribution from the festival prior to providing any instructions to Q-Dance and sound system operators.

7.2.3 The Real-time monitoring System

The real-time monitoring system proposed in this sound management plan is a system comprised of monitoring stations located at each of the noise monitoring positions. Each station will consist of:

- A Class 1 01 dB Duo noise logger, or similar with the ability to transmit A-weighted and C-weighted SPL levels as well as 1/3 octave band data simultaneously. The unit will also store all measurement data locally during the event.
- Weather data will be recorded in at least one position.
- Rechargeable battery system.

SLR will be able to login to each of the units remotely to view and monitor the noise levels at each of the boundary locations. In the event that 3G connection drops out, the unit will continue to record the measured noise level for post analysis. An alternative method of connecting to the onsite network will be reviewed prior to the event to minimise the chance that the units may lose connection.

7.3 Attended Noise Monitoring

In addition to the real-time noise monitoring system proposed, SLR operator attended noise monitoring, using a Type 1 sound level meter, would be used at residential locations surrounding the site, particularly if any complaints are received through the complaints hotline established.

Attended noise monitoring will be conducted at locations within the Mount Riverview, Cranebrook, Emu Heights and Waterside Estate areas at the beginning of the event on Saturday to initially confirm the noise levels. Additional attended monitoring will be conducted in the event of a noise complaint and as required throughout the duration of the event.

These measurements will be performed without extraneous noise sources such as traffic where possible.

7.4 Pre-emptive Noise Management Measures

SLR will provide notice to Q-Dance organisers by issuing warnings when the noise levels are sustained within 5 dB of the Boundary NML. Additionally, the boundary monitors will automatically send SMS alerts to SLR staff throughout the duration of the event in the event of an exceedance of the Boundary NML.

7.5 Reporting

A report detailing the results of the noise monitoring conducted during the event will be submitted to Q-Dance within two (2) weeks of the event taking place. The report will include details of any exceedances, noting the duration; any complaints received and the appropriate action taken; and any future recommendations.

8 EVENT NOTIFICATION

Potentially affected residents should receive an event notification from Q-Dance Australia. The information provided in the letter box drop would include:

- The name of the event.
- The location and date of the event.
- The expected operation times.
- A complaints/information hotline telephone number.

- An email address providing residents with the ability to request further information and to register a complaint before, during and after the event.

The event notification distribution should include the areas of Cranbrook, Mt Riverview, Emu Heights, Penrith and Castlecrag, and for the 2016 Festival has been expanded to include the areas of Yellow Rock, Warrimoo and Winmalee as a result of the number of complaints received from this area during the 2015 Festival. The target area is indicated in **Figure 7**.

Figure 7 Event Notification Area

9 COMMUNITY INFORMATION AND COMPLAINTS HANDLING

In order to effectively manage any requests for information or respond to any public concerns in relation to the music event, the following systems will be established by Q-Dance for the event:

- An Information and Complaints Hotline Telephone Number (TBA).
- An Information and Complaints Email Address (community@Q-Dance.com.au)

9.1 Information and Complaints Hotline

The information and complaints hotline will be established and operated by Q-Dance staff before, during and after the event. The operator is responsible for recording the required information in a complaints handling system as detailed in **Section 9.3**.

9.2 Information and Complaints Email

The information and complaints email account will be established and detailed in the letterbox drop and the local newspaper. This will enable the residents to contact Q-Dance and voice their concerns and ask questions prior to the event. Q-Dance will be responsible for recording the required information in a complaints handling system as detailed in **Section 9.3**.

9.3 Complaints Handling System

Information to be collected by Q-Dance as part of the complaint handling system will include, but not limited to the following:

- Source of complaint.
- Date and time of the complaint.
- Complainants name and contact details.
- Complainant's location.
- Nature and source of the complaint.
- Action taken.
- Follow up with complainant.

The operator is further required to contact SLR and notify them of the noise complaint location for further assessment.

Q-Dance will endeavour to respond to any complaint or request for information within one (1) working day before and after the event, and within one (1) hour during the event.

The information collected by Q-Dance will be provided to SLR for inclusion in the post-event report.

An example of the proposed community hotline log and notification record is contained within **Appendix E** and **Appendix F**, respectively.

9.4 Liaison with Local Police and Penrith Council

Q-Dance personnel will ensure that Local Police Station officers and Penrith Council are aware of the community hotline telephone number established. They will be requested to give this telephone number to any persons complaining about noise from the music event to ensure that all complaints are captured by the complaints handling system. This will guarantee a robust record of community impact from the event.

9.5 Management Response Strategy

Response measures, which will be adopted following noise complaints or exceedance, would include:

- Identify the cause of the complaint. This will be done by conducting an operator attended noise survey at the complainant's residence to quantify the noise emissions and determine if an exceedance of the noise criteria has occurred.
- If an exceedance is measured, reassess the mitigation techniques employed.
- If a management strategy is unsuccessful, re-evaluate the mitigation strategies being used.
- Following the adoption of the noise mitigation, a further noise survey would be conducted at the complainant's residence to ensure the success of the mitigation strategy.

10 CONCLUSION

SLR has undertaken an assessment of potential noise impacts associated with the 2016 Defqon.1 Festival (music festival) located at the Sydney International Regatta Centre. Noise emissions from the music festival have been predicted at residential receivers surrounding the venue and are expected to comply with the Residential Noise Management Levels established for these receivers. Based on the noise modelling performed, Boundary Noise Management Levels aligned with the Residential Noise Management Levels have been established for the purpose of conducting real-time compliance monitoring.

Noise generated from helicopter activity associated with the festival has also been predicted on a worst case scenario and is not considered to have a significant impact on the surrounding residents primarily due to the duration of this activity.

Acoustic Terminology

1 Sound Level or Noise Level

The terms 'sound' and 'noise' are almost interchangeable, except that in common usage 'noise' is often used to refer to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. The human ear responds to changes in sound pressure over a very wide range. The loudest sound pressure to which the human ear responds is ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or L_P are commonly used to represent Sound Pressure Level. The symbol L_A represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2×10^{-5} Pa.

2 'A' Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dBA is a good measure of the loudness of that sound. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dBA or 2 dBA in the level of a sound is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels

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

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as 'linear', and the units are expressed as dB(lin) or dB.

3 Sound Power Level

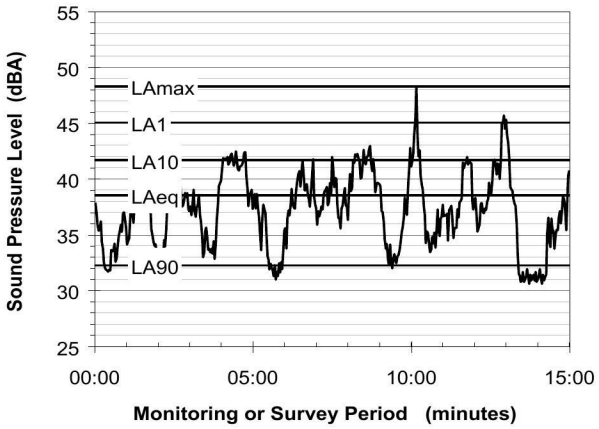
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or L_W, or by the reference unit 10^{-12} W.

The relationship between Sound Power and Sound Pressure may be likened to an electric radiator, which is characterised by a power rating, but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4 Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels L_{AN}, where L_{AN} is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the L_{A1} is the noise level exceeded for 1% of the time, L_{A10} the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

L_{A1} The noise level exceeded for 1% of the 15 minute interval.

L_{A10} The noise level exceed for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

L_{A90} The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

L_{Aeq} The A-weighted equivalent noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

When dealing with numerous days of statistical noise data, it is sometimes necessary to define the typical noise levels at a given monitoring location for a particular time of day. A standardised method is available for determining these representative levels.

This method produces a level representing the 'repeatable minimum' L_{A90} noise level over the daytime and night-time measurement periods, as required by the EPA. In addition the method produces mean or 'average' levels representative of the other descriptors (L_{Aeq}, L_{A10}, etc).

5 Tonality

Tonal noise contains one or more prominent tones (ie distinct frequency components), and is normally regarded as more offensive than 'broad band' noise.

6 Impulsiveness

An impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.

7 Frequency Analysis

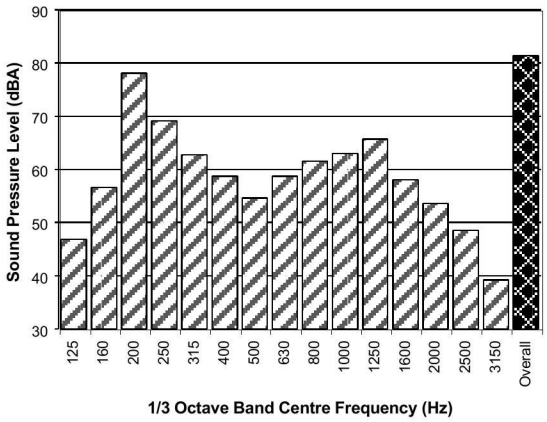
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal. This analysis was traditionally carried out using analogue electronic filters, but is now normally carried out using Fast Fourier Transform (FFT) analysers.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (3 bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



8 Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of 'peak' velocity or 'rms' velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as 'peak particle velocity', or PPV. The latter incorporates 'root mean squared' averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements. Where triaxial measurements are used, the axes are commonly designated vertical, longitudinal (aligned toward the source) and transverse.

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/V_o), where V_o is the reference level (10^{-9} m/s). Care is required in this regard, as other reference levels may be used by some organizations.

9 Human Perception of Vibration

People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

10 Over-Pressure

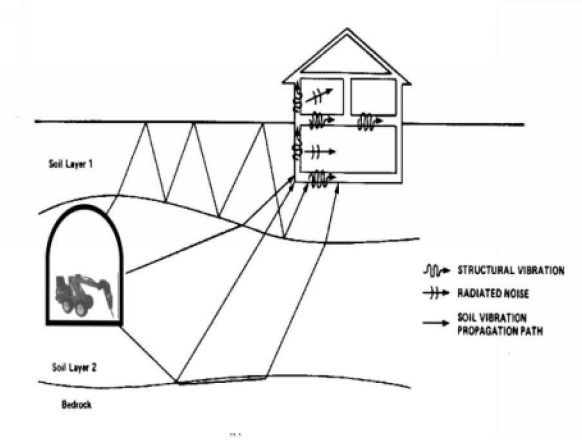
The term 'over-pressure' is used to describe the air pressure pulse emitted during blasting or similar events. The peak level of an event is normally measured using a microphone in the same manner as linear noise (ie unweighted), at frequencies both in and below the audible range.

11 Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed 'structure-borne noise', 'ground-borne noise' or 'regenerated noise'. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

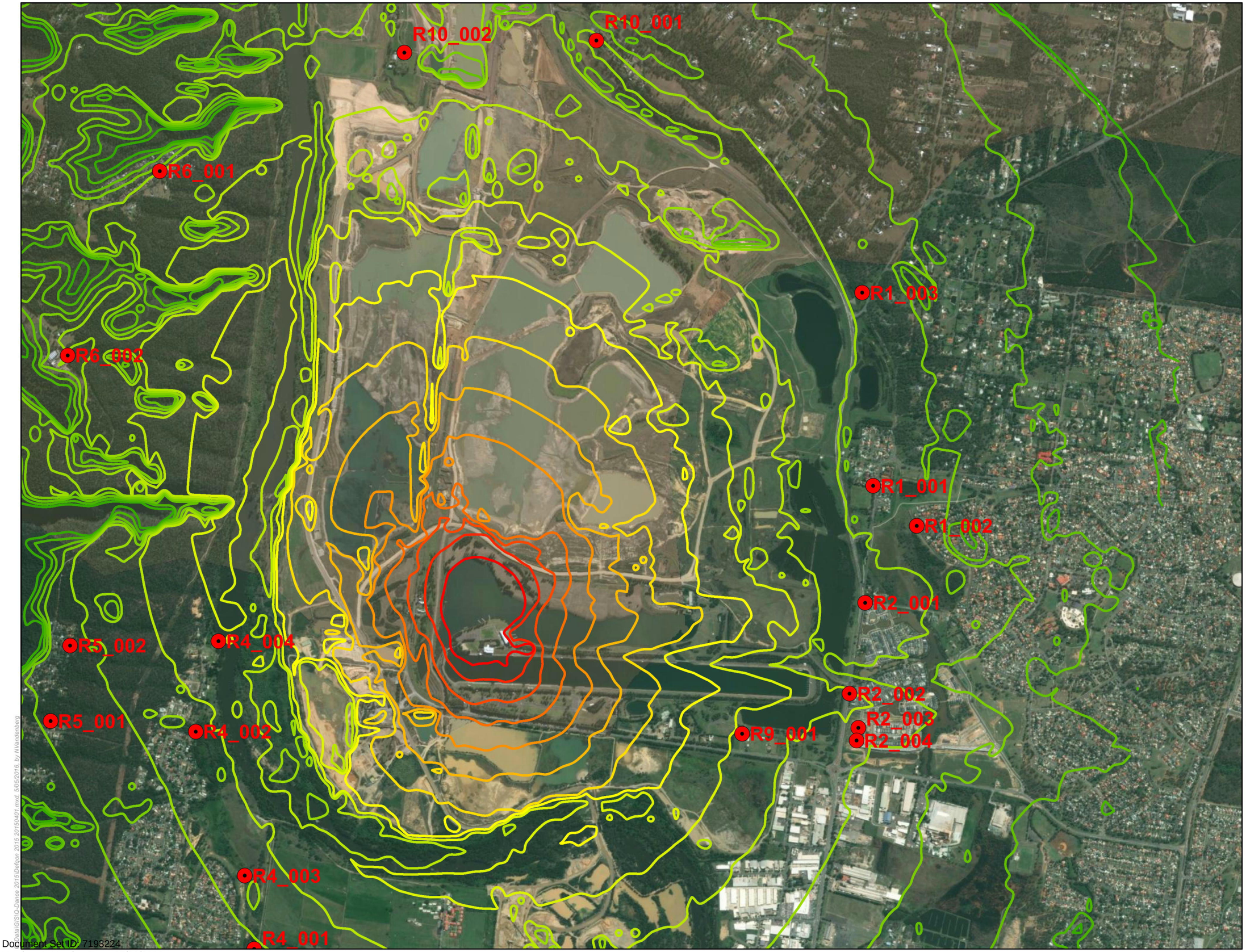
Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The following figure presents the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise

Appendix B — Sensitive Receiver Locations and Predicted Noise Levels - Festival LCMax 3m/s



LEGEND

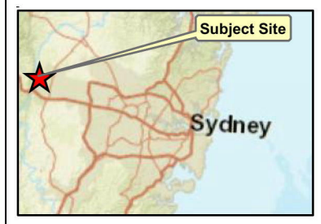
- Receiver

LCMAX 2016

ISOVALUE

- 70.00
- 70.01 - 73.00
- 73.01 - 76.00
- 76.01 - 79.00
- 79.01 - 82.00
- 82.01 - 85.00
- 85.01 - 88.00
- 88.01 - 91.00
- 91.01 - 94.00
- 94.01 - 97.00
- 97.01 - 100.00
- 100.01 - 103.00
- 103.01 - 106.00
- 106.01 - 109.00
- 109.01 - 112.00

NOTES



0 125 250 500 750

Metres

N

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Prepared for:
Q-Dance Australia

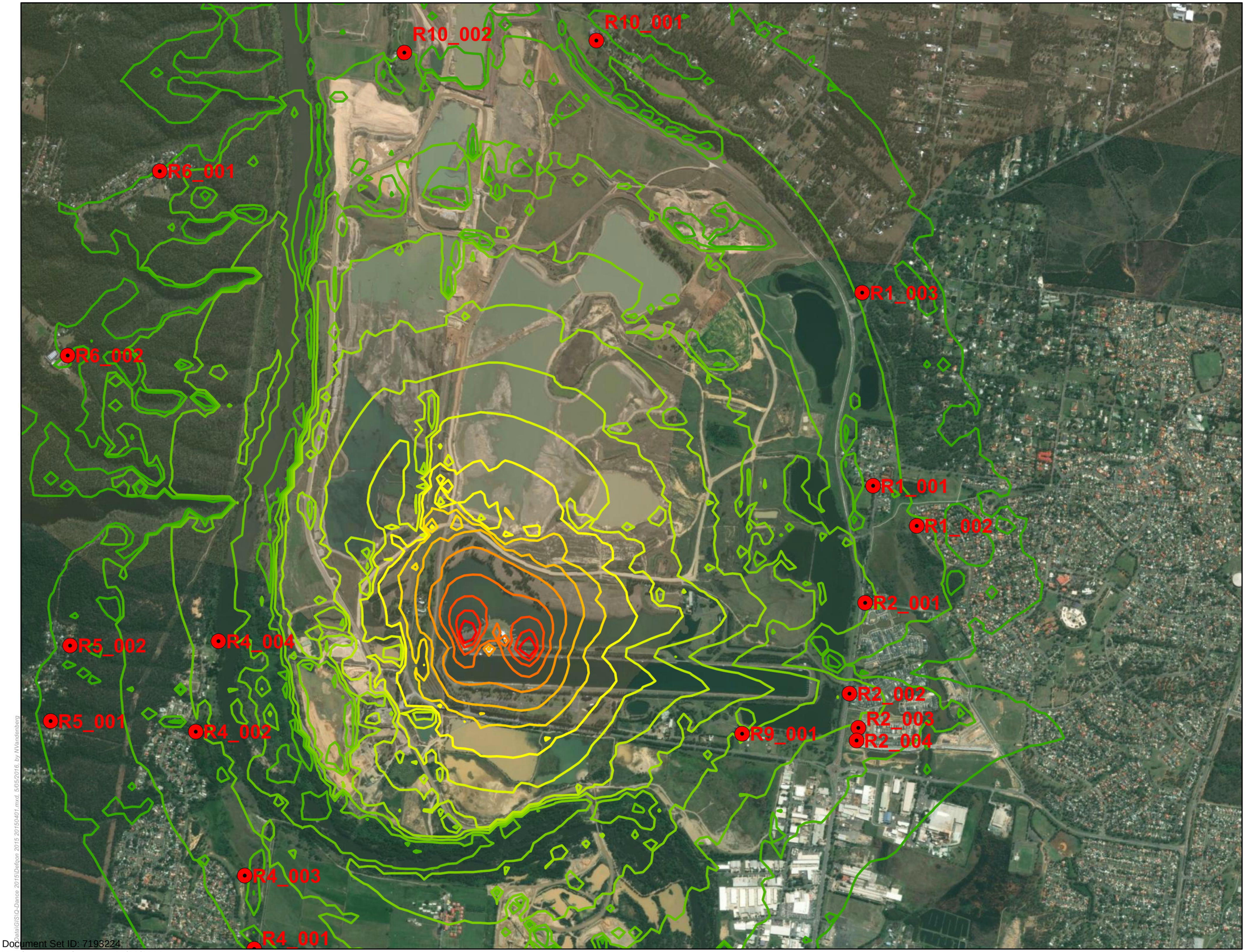
Project No: **610.16140**

Scale	Date
1:47,885	09/05/2016

Drafted	Approved
05/05/2016	-

Appendix C

Sensitive Receiver Locations and Predicted Noise Levels - Soft Close LCMax 3m/s



LEGEND

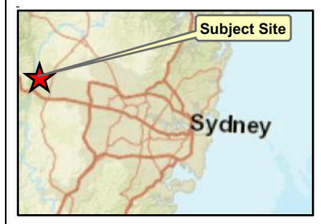
- Receiver

Soft Close 2016

ISOVALUE

- 60.00
- 60.01 - 63.00
- 63.01 - 66.00
- 66.01 - 69.00
- 69.01 - 72.00
- 72.01 - 75.00
- 75.01 - 78.00
- 78.01 - 81.00
- 81.01 - 84.00
- 84.01 - 87.00
- 87.01 - 90.00
- 90.01 - 93.00
- 93.01 - 96.00
- 96.01 - 99.00
- 99.01 - 102.00

NOTES



0 125 250 500 750

Metres

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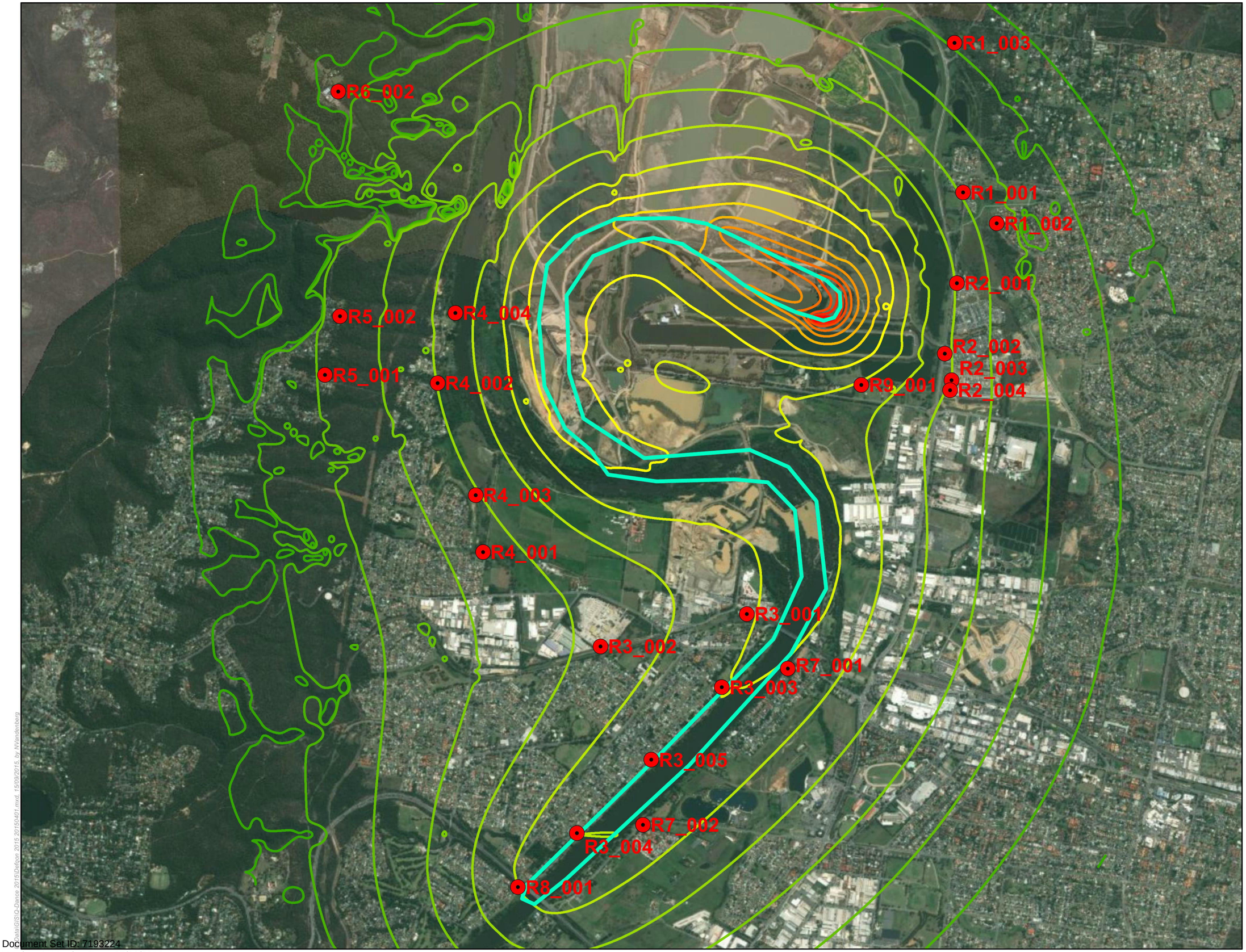
05/05/2016	-

Appendix D

Sensitive Receiver Locations and Predicted Noise Level - Helicopter LAeq(1hour)



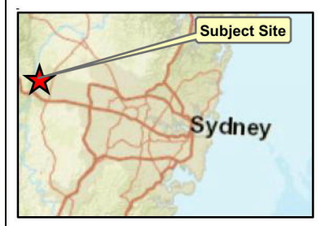
LEGEND

Helicopter LAeq 1hr

ISOVALUE

- 40.00
- 40.01 - 43.00
- 43.01 - 46.00
- 46.01 - 49.00
- 49.01 - 52.00
- 52.01 - 55.00
- 55.01 - 58.00
- 58.01 - 61.00
- 61.01 - 64.00
- 64.01 - 67.00
- 67.01 - 70.00
- 70.01 - 73.00
- 73.01 - 76.00
- 76.01 - 79.00
- 79.01 - 82.00
- Helicopter Flight Path
- Receiver

NOTES



0 125 250 500 750 1,000

Metres

N

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Scale	Date
1:47,885	05/05/2016

Drafted	Approved
05/05/2016	-

DEFQON.1 COMMUNITY HOTLINE LOG

No	Date	Time	Name	Address	Nature of call	Details Y/N
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						

Defqon.1 Community Notification Record

Date		Time		Logged by (name)		Reference number	

Source of notification	Community	Police	Council

Received via	Community Hotline	Community email	Other:	

Caller Contact Details	Name:	
Address:		
Phone number/email:		
Details of complaint/enquiry		
Action taken		
Response given		