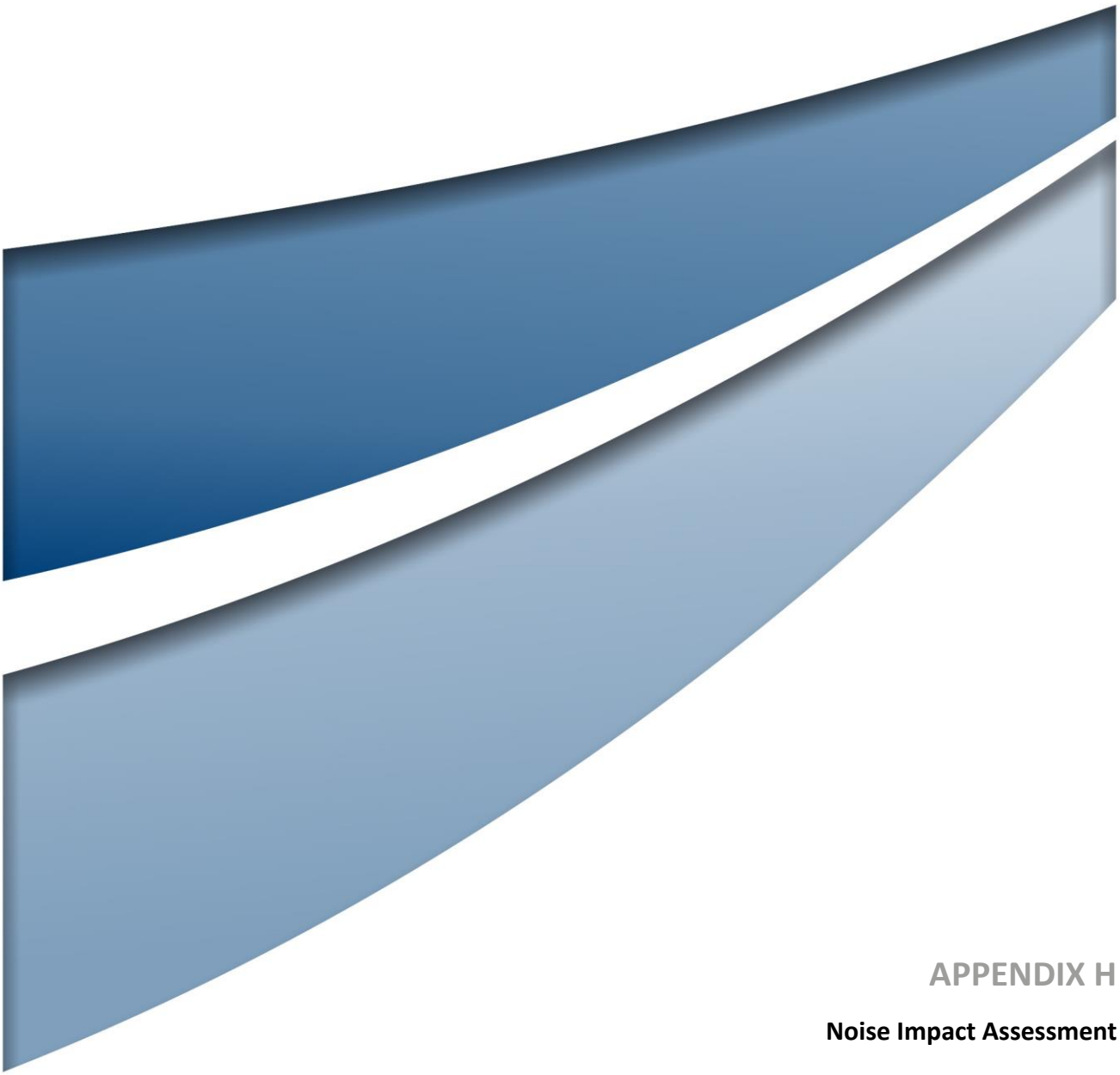

APPENDIX H

Noise Impact Assessment

NOISE IMPACT ASSESSMENT

Concrush Pty Ltd

21 Racecourse Rd, Teralba

Prepared for Umwelt Australia

Prepared by RCA Australia

RCA ref 13155-601/4

November 2018

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DOCUMENT STATUS						
Rev No	Comment	Author	Reviewer	Approved for Issue (Project Manager)		
				Name	Signature	Date
/0	Draft	Natasha Pegler	Alex Rees	AR		3.07.18
/1	Draft	Natasha Pegler	Alex Rees	AR		9.8.18
/2	Draft	Natasha Pegler	Alex Rees	AR		22.8.18
/3	Final	Natasha Pegler	Alex Rees	AR		27.8.18
/4	Final	Natasha Pegler	Alex Rees	AR		9.11.18

DOCUMENT DISTRIBUTION				
Rev No	Copies	Format	Issued to	Date
/0	1	Electronic (email)	Umwelt Australia	3.07.18
/0	1	Electronic report	RCA – job archive	3.07.18
/1	1	Electronic (email)	Umwelt Australia	9.8.18
/1	1	Electronic report	RCA – job archive	9.8.18
/2	1	Electronic (email)	Umwelt Australia	22.8.18
/2	1	Electronic report	RCA – job archive	22.8.18
/3	1	Electronic (email)	Umwelt Australia	27.8.18
/3	1	Electronic report	RCA – job archive	27.8.18
/4	1	Electronic (email)	Umwelt Australia	9.11.18
/4	1	Electronic report	RCA – job archive	9.11.18

Contents

APPENDIX D

ILLUSTRATIONS OF MITIGATION MEASURES

APPENDIX E

NOISE CONTOURS – FULL OPERATION (1.5 M ABOVE GROUND)

APPENDIX F

NOISE CONTOURS – GREEN WASTE (1.5 M ABOVE GROUND)

APPENDIX G

NOISE CONTOURS – WEEKEND (1.5 M ABOVE GROUND)

APPENDIX H

NOISE CONTOURS – EVENING (1.5 M ABOVE GROUND)

APPENDIX I

NOISE CONTOURS – NIGHT (LEQ)

APPENDIX J

NOISE CONTOURS – NIGHT (LMAX)

APPENDIX K

NOISE CONTOURS – FANS

RCA ref 13155-601/4

9 November 2018

Umwelt Australia
75 York St
Teralba NSW 2284

NOISE IMPACT ASSESSMENT FOR CONCRUSH SITE
21 RACECOURSE RD TERALBA

1 PROJECT DESCRIPTION

Concrush Pty Ltd (Concrush) is seeking development consent to increase the processing and storage capacity of the existing resource recovery facility located on part of Lot 2 DP 220347 at 21 Racecourse Road, Teralba, NSW. The Concrush increase to capacity project (the Project) will involve alterations and additions to the existing facility in order to provide greater on-site storage capacity that is sufficient for the increased level of throughput.

The Project is a State Significant Development (SSD) and requires approval under Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act), for which the Minister for Planning is the consent authority.

1.1 THE PROPONENT

The proponent for the Project is Concrush. Concrush was established in 2002 after recognising the need for a construction and demolition recycling facility in the Lake Macquarie region. Concrush is a locally owned and operated business based at Teralba.

The Concrush facility provides cost effective options for recycling of concrete, asphalt, bricks, pavers, roof tiles, wall and floor tiles, rock, sand, plasterboard and green waste for domestic households and commercial industry. These materials are then recycled into specification and non-specification quality products such as: roadbase, drainage aggregates, pipe bedding and haunch, packing fines, decorative aggregates and mulches. These products are used within the civil and construction industries or for commercial, domestic and household applications.

1.2 DESCRIPTION OF THE PROJECT

- Following strong demand for their recycling service, Concrush is seeking an increase to the processing and storage capacity of the existing facility. Concrush currently recycles approximately 108,000 tonnes of waste material per annum. Concrush is seeking approval for an increase in throughput capacity to up to 250,000 tonnes of waste material recycled per annum, including both construction and demolition waste and green waste. Concrush will require a waste storage capacity on-site that is sufficient for this level of throughput.
- The Project will be constructed over two stages to allow for the proposed Project elements to come online as required in line with increasing production.

A description of the individual elements of the proposed Project including additional plant and equipment are summarised below.

Table 1.1 *Proposed Project Components*

Component	Description
Hardstand areas	Hardstands will be constructed in material processing areas and stockpile areas (will require some site levelling). Hardstands will consist of 200 mm thick recycled roadbase). Internal access roads will have a two coat seal.
Material Processing Areas	Processing areas for the crushers and screens.
Waste and Product Stockpile Areas	Waste and product stockpiles will be established with a stockpile height of up to 10 m. It is anticipated that up to 150,000 tonnes of material will be stored onsite.
Upgrade of existing facilities	The existing weighbridge and office will be upgraded, and the existing lunch room and maintenance shed will be relocated to facilitate the new site layout.
Waste Tracking System	The existing Wasteman software will be used to track the details of all inbound and outbound loads
Production Compound	The relocated lunch room, toilet and maintenance shed will be grouped together to form a compound for production staff.
Retail Area	This area will be restricted to light vehicles and small trucks and will include an area for tipping and an area containing concrete bays of products for sale.
Storage Bays	Concrete storage bays will be constructed using 1 m^3 concrete blocks.

Concrete Walls	A two metre high concrete wall will be constructed close to the southern Project site boundary using 1 m^3 concrete blocks. The wall will prevent stockpiled material encroaching on swale drains and moving offsite. Concrete walls may also be used to delineate other areas of the site.
Green Waste Pasteurisation	An aeration system using four electronically driven and computer controlled fans to push air through movable perforated pipes underneath the pasteurisation piles will be implemented in the green waste area. This system allows more control of oxygen levels in the pasteurisation process compared to the tradition turnover process.
Wheel Wash	A vehicle wheel wash bay will be constructed immediately after the exit weighbridge to reduce tracking of material onto public roads.
Concrete Washout Bay	A wet concrete washout bay will be constructed consisting of a bunded, impermeable area with an isolated catchment. Wet concrete and agitator washout will be captured in the concrete washout bay.
Water Management System	The existing Water Management System (WMS) will be upgraded involving resizing of existing sediment basins, new sediment basins, swale drains and a leachate dam and artificial wetland to treat nutrient runoff. Water tanks and associated poly pipe and pumps will be installed to allow collection and re-use of stormwater for dust suppression.
Trommel Screening Machine	Addition of a Trommel screening machine for sorting of green waste.
Primary Jaw Crusher	The primary jaw crusher will be replaced on a like for like basis as part of future operations.
Perimeter Landscaping - Mounds, Fencing and Lighting	Landscape mounds will be established on the perimeter to limit visibility. 1.8 m high security fencing and security lighting are also to be installed.
Utilities	The existing Ausgrid connection is via a power pole in the north east corner of the site. The power supply will be extended to the south west corner of the site via an underground connection.
Pug mill	A pug mill may be installed in the future to allow fast mixing of materials to produce products such as road base.
Ballast wash facility	A processing area may be dedicated to a ballast wash facility to allow for processing of rail ballast.

1.3 PROJECT STAGING

It is anticipated that the volume of materials recycled and products sold will increase over a period of time up to the maximum production level of 250,000 tpa. To most efficiently meet the increase in demand for recycling of materials and Concrush products, it is proposed to stage the Project by undertaking some elements of the site upgrade early and implementing other elements of the Project as required when a certain production level is reached. Two Project stages and the associated approximate production level have been identified as follows:

- Stage 1 – upon receipt of all approvals required for the Project
- Stage 2 – at approximately 200,000 tpa up to 250,000 tpa.

The key components of the two Project stages are described below.

Stage 1

Stage 1 would be implemented once all approvals have been granted. The key elements of Stage 1 are:

- Construction of all hardstand areas (processing areas and waste and product stockpiles).
- Creation of the retail area.
- Widen site access and install sliding gate.
- Re-configuration of existing exit only weighbridge to allow for vehicle exit and entry to facilitate entry to the site.
- Construct production compound by relocating maintenance shed and lunch room and toilet.
- Augment the existing water management system to incorporate the leachate dam, constructed wetland, additional sediment basins, drainage swales, flood mitigation bund, water storage tanks and sprinkler systems.
- Establish wheel wash, landscaping mounds, fencing, power line extension and lighting.
- Two coat seal of internal access roads.
- Replace primary jaw crusher.

Stage 2

Stage 2 would be implemented when production reaches approximately 200,000 tpa up to the Project limit of 250,000 tpa. The key elements of Stage 2 are:

- Relocation of the existing exit weighbridge, construction of a new entry weighbridge and establishment of the new weighbridge office.
- The existing entry weighbridge becomes the retail area weighbridge and the existing weighbridge office becomes the retail area weighbridge office.
- Construction of a new exit onto Racecourse Road from the retail area for light vehicles (less than 2 tonnes) only.

- Establish pug mill.
- Establish ballast wash facility.
- Establish trommel screening machine for green waste.
- Establish aeration system for green waste pasteurisation.

2 SURROUNDING AREA

Figure 1 shows the project area and nearby receivers. Existing residences were identified to the north (closest residence is approximately 330 m away) and south (closest residence is approximately 400 m away) of the project area. A retirement village is scheduled to be developed to the east (approximately 200 m), as are a number of new housing areas (approximately 200 m and 370 m). The closest receiver to the west is a large industrial facility (approximately 710 m).

Cockle Creek runs immediately east of the project area, and separates Concrush from receivers to the south and east.

3 EXISTING ACOUSTIC ENVIRONMENT

Sensitive receivers have been grouped into five noise catchment areas (NCA) for the purposes of quantifying the existing ambient acoustic environment. NCA 1 includes the nearby residences north of the project area. NCA 2 includes the residences south and east of the project area (including Bunderra Estate and an associated aged care facility which are currently being constructed). NCA 3 includes land zoned for public recreation. NCA 4 includes future residences to the east of the project area. NCA 5 includes an industrial receiver to the west of the project area. The surrounding land uses have been identified from aerial imagery, and are a mix of residential and industrial land uses and natural bushland. The noise catchment areas are shown in **Figure 1**. In accordance with the *Noise Policy for Industry* (NPI) (EPA, 2017), receivers in NCA 1 are considered to belong to the 'Residential – Suburban' category, NCA 2 and 4 belong to the 'Residential – Urban' category, NCA 3 belongs to the 'Area specifically reserved for active recreation' category, and NCA 5 belongs to the 'Industrial Premises' category. These categories have been assigned based on the land use, and residential categories were determined from measured background noise levels and the prevalence of transport noise at each location. Measured noise levels are discussed in **Section 3.1**.

Figure 1 *Project area ( ), monitoring positions ( ), and noise catchment areas ( )*

3.1 NOISE MONITORING

Noise monitoring was undertaken in three representative locations, indicated in **Figure 1**, to quantify the existing ambient acoustic environment. Noise loggers were deployed between 15 – 28 November 2017, and continuously recorded statistical noise data over 15-minute integration periods. The calibration of the noise loggers was checked before and after the monitoring period and was found to be within 0.5 dB tolerance of 94 dB; the monitoring is therefore considered valid. Additional notes regarding each noise logger are provided in **Table 3-1**.

Table 3-1 *Equipment details*

Make/Model	Serial Number	Monitoring location and period	Settings
SVAN / 971	12313	(NCA 1) 13 Racecourse Rd Teralba	'A' weighted 'Fast' time response
SVAN / 958	15440	(NCA 2) Back yard of 35 First St Boolaroo	'A' weighted 'Fast' time response
ARL / EL-215	194451	(NCA 4) Near intersection of TC Frith Ave and Main Rd	'A' weighted 'Fast' time response

It was possible to deploy noise loggers at existing residential properties in NCA 1 and NCA 2. The location of the noise logger for NCA 4 was chosen to adequately measure noise from the major roundabout on TC Frith Ave, which is the dominant noise source for the area.

The data was filtered to remove periods of rain and high wind, and then rating background levels (RBL) were calculated for each monitoring location in accordance with the NPI. A summary of the day / evening / night RBLs and overall L_{eq}'s are provided in **Table 3-2**, **Table 3-3** and **Table 3-4**.

Table 3-2 *NCA 1 - 13 Racecourse Rd background noise summary*

	Day	Evening	Night
RBL (dBA)	42	41	31
Overall L_{Aeq}	60	57	54

Table 3-3 *NCA 2 - 35 First St background noise summary*

	Day	Evening	Night
RBL (dBA)	49	42	32
Overall L_{Aeq}	67	67	62

Table 3-4 *NCA 4 - Intersection of TC Frith Avenue and Main Road background noise summary*

	Day	Evening	Night
RBL (dBA)	49	45	37
Overall L_{Aeq}	58	56	53

To supplement the unattended monitoring, attended measurements were taken at each monitoring location on 3 November 2017. Notes from these measurements are provided in **Table 3-5**.

Table 3-5 *Attended measurements summary*

Location	Time	L_{A90}, 15 min	L_{Aeq}, 15 min	L_{Amax}, 15 min	Observations
13 Racecourse Rd	12:08	41	59	71	Intermittent traffic noise on Racecourse Rd is dominant. Mostly light vehicles (~64 dBA); occasional heavy vehicles (~70 dBA - these cause L_{Amax}). Occasional trains on Main Northern Line (65-70 dBA). No audible industry noise.
	12:24	41	59	78	
35 First St	13:52	52	60	67	Constant road traffic noise on TC Frith Ave is dominant (~60 dBA). Distant traffic audible occasionally (~45 dBA). Occasional bird calls. Heavy vehicle passby responsible for L_{Amax}. No audible industry noise.

Intersection of TC Frith Avenue and Main Road	15:24	54	59	70	Constant road traffic noise from roundabout at TC Frith Ave/Main Rd (~60 dBA). Break squeal on heavy vehicle responsible for L_{Amax}. Reversing beeper audible, but not dominant. No audible industry noise.

3.2 PREVAILING WEATHER CONDITIONS

Modelled meteorological data for the project area was provided by Todoroski Air Sciences for the 2014-2016 period. The data was generated by applying the TAPM model to measured weather data at the Newcastle Nobbys weather station, to generate weather data suitable for analyzing according to the NPI. This modelled data was then analysed in accordance with Fact Sheet D from the NPI, with significant noise-enhancing conditions identified for each season.

The results showed that both wind and temperature inversion effects were significant at the project area. Relevant noise-enhancing meteorological conditions are provided in **Table 3-6**.

Table 3-6 *Noise-enhancing weather*

Relevant weather	Day	Evening	Night
Wind directions	NE, E, W, NW	N, NE, E, SE, SW, W, NW	N, NE, E, SW, W, NW
Inversions	N/A	N/A	Yes

Wind directions that will increase received noise at identified receivers are N, NW, W, SW, E; these directions are considered in this assessment. Temperature inversions are assessed for all significant wind directions that occur in winter during the night.

4 ASSESSMENT CRITERIA

4.1 OPERATIONAL NOISE

In 2017 the EPA released the NPI to supersede the *Industrial Noise Policy*. Assessment criteria have been determined for this project in accordance with the NPI. The NPI provides guidance on setting noise criteria and includes consideration of two types of criterion: amenity noise criteria and intrusive noise criteria.

4.1.1 AMENITY NOISE LEVEL

The purpose of the amenity noise criteria is to set reasonable cumulative industrial noise levels for an area based on the receiver land use. Table 2.2 of the NPI provides noise amenity criteria. The NPI states that to ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise, where the project amenity level is 5 dB less than the recommended amenity level. Relevant levels for this assessment are reproduced below in **Table 4-1**.

Note that the amenity noise level applies over the full assessment period, and average sound levels over the period will generally be lower than the worst-case 15 minute levels predicted in this assessment. An adjustment is therefore required to convert period criteria to 15 minute criteria. In accordance with Section 2.2 of the NPI, the equivalent 15 minute amenity criteria are equal to the period amenity criteria plus 3 dB.

Table 4-1 *Amenity noise levels from the NPI*

Receiver	Noise amenity level	Time of day	Amenity noise level, L_{Aeq}, dB	Project amenity noise level, $L_{Aeq, period}$, dB	Equivalent project amenity noise level, $L_{Aeq,15min}$, dB
Residential	Suburban (NCA 1)	Day	55	50	53
		Evening	45	40	43
		Night	40	35	38
	Urban (NCA 2 and NCA 4)	Day	60	55	58
		Evening	50	45	48
		Night	45	40	43
Active Recreation (NCA 3)		When in use	55	50	53
Industrial Receiver (NCA 5)		When in use	70	65	68

Note: The NPI determines the 'day' to be between 7 am and 6 pm, the 'evening' to be between 6 pm and 10 pm' and the 'night' to be between 10 pm and 7 am.

In **Table 4-1**, the Suburban category applies to NCA 1 and the Urban category applies to NCA 2 and 4. These categories have been assigned based on the RBL levels at each measurement location. In all cases noise from road traffic was the dominant noise source. Although the recreational use of NCA 3 is not clear, its high background level and location close to the intersection of TC Frith Ave and Main Rd make it unsuitable for passive recreation. It has therefore been classified as an active recreation area. NCA 5 is considered an industrial receiver.

The NPI also provides advice on adjusting the project amenity level in areas of high traffic noise. When traffic noise is more than 10 dB above the recommended amenity noise level, the project amenity criteria can be increased (due to the high traffic noise masking potential noise impacts from the development). While traffic noise was found to be a dominant noise source for NCAs 1-4 in this assessment, the traffic noise was not 10 dB above the amenity levels identified above. No adjustment to the project amenity levels have been made on that basis.

4.1.2 INTRUSIVENESS CRITERIA

The purpose of the intrusiveness criteria is to limit the degree of change a new noise source introduces to an existing environment, by limiting the $L_{Aeq, 15\ min}$ of the new noise source to 5 dB above the measured rating background level (RBL). The relevant intrusiveness criteria have been determined by adding 5 dB to the RBLs provided in **Table 3-2**, **Table 3-3** and **Table 3-4,** but not allowing the evening criteria to be higher than the day, and not allowing the night criteria to be higher than the evening, as advised by the NPI. The intrusiveness criteria only apply to residential receivers and are provided in **Table 4-2**.

Note that only residential receivers have a defined intrusiveness criterion, and so intrusiveness criteria have not been determined for NCA 3 or NCA 5.

Table 4-2 *Intrusiveness noise criteria*

NCA	Intrusiveness criteria, $L_{Aeq,15min}$, dB		
	Day	Evening	Night
NCA 1	47	46	36
NCA 2	54	47	37
NCA 4	54	50	42

4.1.3 PROJECT SPECIFIC CRITERIA

The project specific criteria at each receiver location then becomes the minimum of the amenity and intrusiveness criteria. The project specific criteria are presented in **Table 4-3**.

Table 4-3 *Project specific criteria*

Receiver	Project specific criteria, $L_{Aeq,\ 15\ min}$ dB		
	Day	Evening	Night
NCA 1	47	43	36
NCA 2	54	47	37
NCA 3	53	53	53
NCA 4	54	48	42
NCA 5	68	68	68

Note that these criteria are inclusive of all proposed operations at Concrush Teralba.

4.1.4 SLEEP DISTURBANCE CRITERIA

The NPI section 2.5 provides criteria for maximum levels at night. These criteria are intended to control sleep disturbance impacts at residences, and above these criteria a detailed maximum noise level event assessment is required.

NCA	Sleep Disturbance Screening Criteria	
	$L_{Aeq,15min}$, dB	L_{Amax}, dB
NCA 1	40	52
NCA 2	40	52
NCA 4	42	52

4.2 CONSTRUCTION NOISE

As construction noise is temporary, it is generally allowed a higher noise limit than ongoing operational noise. Guidelines for the assessment of construction noise are provided in the *Interim Construction Noise Guide* (ICNG) (Department of Environment & Climate Change, 2009). These levels are derived from the RBL, and depend on the time of day. Management threshold levels for nearby residences are presented in **Table 4-4**. According to the ICNG, the "Noise Affected" level is the level where there may be some community reaction to the noise. The "Highly Noise Affected" level is where communities may react strongly to noise.

Table 4-4 *Construction noise criteria – management levels*

	Standard Hours, $L_{Aeq,15min}$ dB		Out of Hours, $L_{Aeq,15min}$ dB		
	Noise Affected	**Highly Noise Affected**	**Day**	**Evening**	**Night**
NCA 1	52	75	47	46	36
NCA 2	59	75	54	47	37
NCA 3	65	-	65	65	65
NCA 4	59	75	54	50	42
NCA 5	75	-	75	75	75

Note: The ICNG defines "Standard Hours" to be between 7am-6pm on weekdays and 7am-1pm on Saturday. All other times are out of hours. Day, evening and night periods are defined as per the NPI.

All construction work assessed in this report is expected to occur in standard hours.

4.3 ROAD NOISE IMPACTS

The proposal has the potential to cause road noise impacts due to an increase in vehicles using public roads. The NSW Road Noise Policy (RNP) (DECC, 2011) provides non-mandatory assessment criteria to assist the process of planning approvals and to identify where mitigation measures may be required. Additional traffic that is generated due to the proposal will travel along Racecourse Rd, and York St through Teralba, roughly 1.5 km south of the project area. Receivers on the eastern side of Cockle Creek are not expected to be affected by increased traffic. Receivers to the north of the project area are not expected to be impacted by additional traffic due to the rail bridge over this section of the road, which imposes a height restriction.

The RNP sets two criteria for road traffic noise increases due to development: an upper bound criterion and a 'relative increase' criterion. To determine the relative increase criteria for day and night periods, existing traffic noise in the 15 hour Day period and 9 hour Night period needs to be determined. The relative increase criteria are then 12 dB above the existing levels.

RCA took traffic counts at 13 Racecourse Rd during the attended measurements discussed in **Section 3.1**. In these measurements, road traffic was found to be the dominant noise source.

The relevant noise criteria from the RNP has been reproduced below in **Table 4-5**.

Table 4-5 *RNP noise criteria for residential land uses*

Road category	Type of project	Assessment criteria, dB	
		Day	Night
Sub-arterial roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq, (15\ hour)}$ 60 dB (external)	$L_{Aeq, (9\ hour)}$ 55 dB (external)

Note: Day is defined as the period between 7 am – 10 pm, and night is defined as the periods between 10 pm – 7 am.

In addition to the criteria stated above, the RNP application notes state that where the existing road noise exceeds, or is within 2 dB of the relevant noise criterion, the total road noise after the development should be limited to an increase of 2 dB. If it can be shown that the total road noise will increase due to the new development by 2 dB or less, it follows that the RNP objectives have been met.

4.4 CONSTRUCTION AND OPERATIONAL VIBRATION

Vibration can cause annoyance among sensitive receivers. Vibration limits in order to reduce such impacts are provided in *Assessing Vibration: A technical guideline* (DEC, 2006). Construction and operational vibration is expected to be negligible at distances greater than 100 m. Given that the nearest sensitive receiver is further than this (200 m from the project area), vibration is not discussed further in this report.

5 CONSTRUCTION NOISE ASSESSMENT

Noise impacts from construction were assessed using computer software CadnaA (version 2017). The ISO 9613-2 algorithm was implemented, which incorporates the equivalent of a 2 m/s source to receiver wind in all directions or a moderate temperature inversion. The result is that the modelled predictions are made under 'noise enhancing' meteorological conditions. This provides some conservatism in the predictions made. The model uses a general ground coefficient of 0.5 to represent the mixture of ground surfaces, including water and vegetated ground. Ground contour data for the project area was incorporated into contour maps for the Newcastle LGA in RCA's database.

5.1 CONSTRUCTION DESCRIPTION

Noisy construction work will be undertaken as detailed below:

- Site clearing – Removing vegetation and leveling of new area of site
- Road and hardstand construction – constructing roads and hardstands at locations shown in **Appendix C**.
- Pipe and pole installation – Minor excavations for installation of underground pipes and light poles
- Fencing construction – Manual construction of fences.

There will be some further construction work on site, such as the erection of new structures, that will have minimal noise-generating tools in use. These construction stages are not considered in this assessment.

Noise sources associated with each stage are presented in **Table 5-1** below.

Table 5-1 *Noise model scenarios - construction*

Plant modelled	Adopted sound power data, dBA	No. of plant included in each scenario			
		Scenario 1: Site clearing	**Scenario 2: Road and hardstand construction**	**Scenario 3: Pipe and pole installation**	**Scenario 4: Fencing construction**
Trucks idling with material	98	1	1	-	1
Excavator clearing land or digging	105	1	-	1	-
Wheeled loader loading/unloading truck	111	1	-	-	-
Traxcavator clearing land	105	1	-	-	-
Water cart suppressing dust at work site	98	1	1	-	-
Compactor compressing road base	114	-	1	-	-
Roller smoothing and compacting road	105	-	1	-	-
Grader smoothing road	115	-	1	-	-
Plate compactor compacting filled areas	108	-	-	1	-
Grinder cutting metal for fence	109	-	-	-	2

A model has been prepared for each construction scenario. In all cases, noise sources were clustered near the eastern border of the project area, the area closest to the identified residential receivers. This ensures the models represent a conservative situation.

5.2 MODEL RESULTS

Predicted noise levels at each NCA are compared against the management levels for standard hours in **Table 5-2**.

Table 5-2 *Predicted noise levels at residences from construction work*

	Standard Hours Criteria $L_{Aeq,15min}$, dB		**Predicted Noise Level** $L_{Aeq,15min}$, dB			
	Noise Affected	Highly Noise Affected	Site Clearing	Road & Hardstand	Pipes & Poles	Fencing construction
NCA 1	52	75	43	47	41	34
NCA 2	59	75	51	56	47	43
NCA 3	65	-	50	54	48	41
NCA 4	59	75	49	51	45	39
NCA 5	75	-	38	42	33	26

Based on the predicted noise levels, no identified noise sensitive receivers will experience noise levels above the criteria during construction.

6 OPERATIONAL NOISE ASSESSMENT

The operational noise assessment was conducted using a modified version of the CadnaA computational model used for the construction noise assessment. The operational assessment used the same contour data and ground absorption coefficient (0.5). As assessments of operational noise are required to account for noise-enhancing weather conditions, the CONCAWE propagation model was used with weather data determined in **Section 3.2**.

In consultation with Concrush staff, a list of noise sources on site was developed. These sources were assigned to a number of scenarios based on expected operations. The modelled scenarios represent typical worst-case 15 minute scenarios for operation, with the maximum amount of plant operating simultaneously and noise sources moved close to the residential receivers. (The exception to this is Scenario 6, which predicts maximum levels for the assessment of sleep disturbance.) An overhead view of the model and positions of sources is shown in **Appendix C**.

Sound power data used in the models have been taken from a number of sources: the UK Department for Environment, Food & Rural Affairs 2005 construction equipment database, manufacturer's data, field measurements by other acoustic consultants, and RCA's field measurements at Concrush and other locations. (Further details of RCA field measurements at Concrush are presented in **Appendix B**.)

Table 6-1 *Noise model scenarios - operation*

Plant modelled	Adopted sound power data, dBA	No. of plant included in each scenario						
		Scenario 1 – Full production and sales	Scenario 2 – Green waste shredding	Scenario 3 – Weekend activities	Scenario 4 – Evening Work	Scenario 5 – Night Work	Scenario 6 – Night Maximum Levels	Scenario 7 - Fans
Trucks entering/exiting or receiving product	98	4	4	4	-	2	2-	-
Cars entering/exiting or receiving product	87	4	4	4	-	-	-	-
Grinder in maintenance shed	109	1	1	1	-	-	-	-
Pressure washer in plant storage area	99	1	1	1	-	-	-	-
Wheeled loaders working at stockpiles	111	2	2	1	1	1	1	-
Small loader loading cars	102	1	1	1	-	-	-	-
Excavators working at stockpiles	105	3	3	3	-	-	-	-
Concrete pulveriser heads on excavators	80	2	2	2	-	-	-	-
Jaw crusher crushing concrete	108	1	1	1	-	-	-	--
Impact crusher crushing concrete	107	1	1	1	-	-	-	-
Cone crusher crushing concrete	116	1		1	-	-	-	-
Screens sorting crushed concrete	110	2	2	2	1	-	-	-
Vacuum pumps serving the cone crusher and one screen	92	2	2	2	1	-	-	-
Pugmill operating	106	1	1	1	-	-	-	-
Water cart running a circuit around stockpiles	98 (line source – spread over circuit)	1	1	1	-	-	-	-
Trommel Screen screening green waste	102	-	1	-	-	-	-	-
Ballast wash operating	110	1	1	1	-	-	-	-
Shredder processing green waste (assumed 50% active time)	Processing – 111 idle - 97	-	1	-	-	-	-	-
Tipping Truck	118	-	-	-	-	-	1	-
Fans in green waste area	82	4	4	4	4	4	4	4

6.1 MODEL RESULTS

A summary of the modelling results is presented below in **Table 6-2**. Modelling showed that westerly wind was a worst-case direction for NCAs 1-4, and easterly wind was the worst case for NCA 5. During the night, noise impacts were found to be greater with a temperature inversion and 2 m/s wind than a 3 m/s wind, so the results with these conditions are presented.

Noise contours for each modelling scenario are shown in **Appendix E**, **Appendix F**, **Appendix G**, **Appendix H**, **Appendix I**, **Appendix J**, and **Appendix K**.

These predictions assume all mitigation in **Section 8.2.2** is in place. These include:

- Constructing noise barriers and bunds on site to screen plant
- Limiting the maximum plant that can be in use simultaneously in Scenario 2 (green waste shredding)
- Restricting use of plant during evening and night
- At night, placing constraints on where noisy plant can operate to enable noise levels at residences are minimized.

Scenarios where the predicted noise level exceeds the relevant criteria are ***indicated in bold (with the exceedance margin in brackets)***.

Table 6-2 *Model results*

Receiver	Project specific criteria, dB(A)			Sleep Disturbance screening criteria, dB(A)		Predicted noise level, dB(A)						
	Day $L_{Aeq, 15min}$	Evening $L_{Aeq, 15min}$	Night $L_{Aeq, 15min}$	Night $L_{Aeq, 15min}$	Night Max L_{AMax}	Scenario 1 – Full production and sales (day)	Scenario 2 – Green waste shredding (day)	Scenario 3 – Weekend activities (day)	Scenario 4 – Evening Work (evening)	Scenario 5 – Night Work (night)	Scenario 6 – Night L_{Amax} Levels (night)	Scenario 7 – Fans (night)
NCA 1	47	43	36	40	52	***51 (4 dB)***	***50 (3 dB)***	***50 (3 dB)***	43	***44 (8 dB)***	49	18
NCA 2	54	47	37	40	52	***55 (1 dB)***	***56 (2 dB)***	***55 (1 dB)***	47	***42 (5 dB)***	51	30
NCA 3	53	53	53	-	-	53	53	52	41	40	50	24
NCA 4	54	48	42	42	52	51	51	50	42	38	46	24
NCA 5	68	68	68	-	-	46	45	46	39	32	44	12

6.2 NOISE IMPACTS

As indicated in **Section 6.1**, the predicted noise levels account for all reasonable and feasible mitigation measures that Concrush has committed to. Further mitigation measures were considered during the project work which would have further reduced the noise impacts. However, they were considered to be not reasonable or feasible, as discussed in **Section 8.1** and **Table 8-1**.

The residual noise impacts are assessed according to NPI Section 4. Table 4.1 in this section of the NPI (reproduced as **Table 6-3** below) defines exceedance classifications that are used to determine the significance of exceedances.

Table 6-3 *Reproduction of Table 4.1 from the NPI*

If the predicted noise level minus the project noise trigger level is:	**And the total cumulative industrial noise level is:**	**Then the significance of the residual noise level is:**
≤ 2 dB(A)	Not applicable	Negligible
≥ 3 but ≤ 5 dB(A)	< recommended amenity noise level Or > recommended amenity noise level but the increase in total cumulative industrial noise level resulting from the development is less than or equal to 1 dB	Marginal
≥ 3 but ≤ 5 dB(A)	> recommended amenity noise level and the increase in total cumulative industrial noise level resulting from the development is more than 1 dB	Moderate
> 5 dB(A)	≤ recommended amenity noise level	Moderate
> 5 dB(A)	> recommended amenity noise level	Significant

The project specific criteria are exceeded at receiver points in NCA 1 and NCA 2. During the day, this exceedance is up to 4 dB at NCA 1 and 2 dB at NCA 2.

According to Section 4.2 of the NPI, an exceedance of less than 2 dB is considered negligible, as the difference would not be discernible by the average listener. This exceedance occurs during the day on the western edge of NCA 2. **Figure 2** marks the extent of these noise impacts for Scenario 2, which is the scenario where the greatest area of NCA 2 is affected. Figure 2 indicates that this negligible exceedance only impacts a small proportion of NCA 2, while the majority of NCA 2 is predicted to comply with criteria.

Figure 2 *Extent of noise impacts in NCA 2 for Scenario 2 (Green waste shredding). The daytime noise criterion is exceeded for all future receivers in the red region ( ) and receivers in the blue region ( ) exceed by more than 2 dB.*

An exceedance of 4 dB which does not exceed the amenity noise level is considered marginal. Marginal noise exceedances will occur at residences in NCA 1, immediately north of the project area, during the day time.

During night works, NCA 2 will experience an exceedance of 5 dB, which does not exceed the amenity level. The NPI considers this a marginal exceedance. At NCA 1, the exceedance is 8 dB, and exceeds the recommended amenity noise level. This is a significant exceedance.

RCA note that night operations as modelled in Scenario 5 are an unusual occurrence for the site, and will typically occur only based on market demand. The modelled noise levels represent minimal equipment configurations for loading activities only, with no processing occurring, and it is not considered feasible to further reduce the plant in use. Standard night activities (Scenario 7) do not exceed the night time criteria.

6.3 MAXIMUM NOISE LEVEL EVENTS

The predicted $L_{Aeq,15min}$ from night operations exceeds the trigger level for a sleep disturbance assessment at NCA 1 and the western edge of NCA 2 (small number of receivers within the 40 dBA contour line shown in **Appendix I**). Accordingly impacts from the maximum noise level are considered for these NCAs.

The maximum noise level L_{AMax} that will occur at night will come from trucks tipping out concrete waste. RCA were able to measure a truck tipping concrete while on site at Concrush, and included this in a CadnaA model of maximum levels (Scenario 6 in **Table 6-2**). Residences in NCA 1 will receive maximum levels of 49 dB L_{AFMax} and NCA 2 will receive 51 dB L_{AFMax}. These levels exceed the RBL of each NCA by 18 dB at NCA 1 and 19 dB at NCA 2.

The RNP advises that internal noise levels of 55 dB or less are unlikely to awaken people from sleep. As the highest external level received (51 dB at NCA2) is less than this, noise from night time activities is not expected to awaken residents in any NCA.

Night time activities were found to trigger the requirement to closer investigate the predicted L_{Amax} levels received by residences. Predicted L_{Amax} levels have been reviewed against sleep disturbance advice provided in the RNP and have been found that they will not likely cause awakenings.

7 ROAD NOISE IMPACTS

In order to determine existing traffic numbers, traffic logging was conducted at 21 Racecourse Rd by external consultants. Data for current and forecast traffic to the Concrush site from the Traffic Impact Assessment have also been utilised. Based on these numbers, RCA have determined expected traffic flows that residences on Racecourse Rd will experience and are given in **Table 7-1**. It was assumed that all traffic from Concrush will travel on the road south of the project area, due to the height restriction on the road to the north. There are no residences immediately south of the Concrush site; the residences that will be affected by additional traffic are those along York St, Teralba. This area is a 50 km/h speed zone.

Table 7-1 *Current and predicted traffic movements*

		Day (7am-10pm)	Night (10pm-7am)
Current Traffic (Racecourse Road)	Light	2510	272
	Heavy	255	27
Current Concrush Traffic	Light	39	Nil
	Heavy	92	Nil
Predicted Concrush Traffic	Light	101	Nil
	Heavy	276	90
Predicted Future Traffic	Light	2572	272
	Heavy	439	117

Attended measurements were conducted at 2a York St to supplement the logged background data. Sound exposure level (SEL) values for individual vehicle passbys were then extracted from the 1-second logged data. The SEL of a light vehicle passby was 67 dB(A) and a heavy vehicle passby was 76 dB(A). Traffic noise at the measurement position could then be determined for both current traffic and predicted future traffic. Calculated levels are presented in **Table 7-2**.

Table 7-2 *Total traffic noise levels on Racecourse Rd*

	Day ($L_{Aeq,15hr}$)	Night ($L_{Aeq,9hr}$)
Current traffic noise	56	49
Future traffic noise	59	55

The predicted traffic noise is less than the criteria given in **Table 4-5** for both day and night periods. The predicted traffic noise is therefore considered to comply with the RNP.

8 MITIGATION MEASURES

8.1 ALL MITIGATION MEASURES CONSIDERED

Over the course of this assessment, multiple possibilities for mitigation were considered. These options are summarized below.

Table 8-1 *Analysis of potential reasonable and feasible mitigation*

Mitigation item	Applicable to	Is it feasible?	Is it reasonable?	Is the item recommended?
Undertake work during standard hours	Construction noise	Yes	Yes	Yes
Turn off plant when not in use	Construction noise	Yes	Yes	Yes
Ensure plant is regularly maintained, and repair or replace plant that becomes noisy	Construction and operational noise	Yes	Yes	Yes

Mitigation item	Applicable to	Is it feasible?	Is it reasonable?	Is the item recommended?
Arrange work site to minimize the use of movement alarms on vehicles and plant	Construction noise	Yes	Yes	Yes
Avoid dropping materials from a height	Construction noise	Yes	Yes	Yes
Bund around northern side of Raw Material Stockpile and Processing Area	Operational noise	No – would impede traffic movement through site	Yes	No
Bund along eastern side of Raw Material Stockpile and Processing Area	Operational noise	Yes	Yes	Yes
Barrier installed immediately north of crushing plant	Operational noise	No – crushing plant relocates throughout the processing area and barriers would obstruct use of equipment	Yes	No
Temporary barrier installed around crushing plant in evening	Operational noise	No – barriers would obstruct use of equipment	Yes	No
Wall along south side of Raw Material Stockpile and Processing Area	Operational noise	Yes	Yes	Yes
Operate cone crusher and green waste shredder at different times	Operational noise	Yes	Yes	Yes
Do not operate crushers in evening	Operational noise	Yes	Yes	Yes
Control position of loading operations at night	Operational noise	Yes	Yes	Yes
Positive driver behavior training	Road noise	Yes	Yes	Yes
Consult community regarding noise impacts	All	Yes	Yes	Yes
Conduct noise monitoring if a complaint is received	All	Yes	Yes	Yes
Conduct routine quarterly noise monitoring at NCA 1 and NCA 2	Operational noise	Yes	Yes	Yes

Mitigation item	Applicable to	Is it feasible?	Is it reasonable?	Is the item recommended?
Conduct attended and unattended noise monitoring at NCA 1 when night time operations begin.	Beginning of night time operations	Yes	Yes	Yes

8.2 RECOMMENDED MITIGATION MEASURES

Concrush has committed to all recommended mitigation measures from **Table 8-1**. Concrush's noise management plan will be updated to include these measures which are discussed further below.

8.2.1 CONSTRUCTION NOISE

- Undertake work during standard hours (7am-6pm weekdays, 7am-1pm Saturday).
- Turn off plant when not in use.
- Ensure plant is regularly maintained, and repair or replace plant that becomes noisy.
- Arrange work site to minimize the use of movement alarms on vehicles and plant.
- Avoid dropping materials from a height.

8.2.2 OPERATIONAL NOISE

- Construct a bund to 3.5 m above finished ground level along the eastern side of the "Raw Material Stockpiles and Processing Area". The bund can be formed from stockpile material, but the stockpile must be continuous and minimum 3.5 m high at all points. Crushers and screens (except for the trommel screen used for green waste) will not be used outside this area. The bund should meet the wall along the southern boundary described below and should block line of sight between the area and NCA2.
- Construct a wall to 3 m above finished ground level along the southern boundary of the "Raw Material Stockpiles and Processing Area".
- Crushers will not be used after 6pm.
- The cone crusher will not be used when green waste shredding is occurring.
- After 10pm, only truck loading and tipping operations should occur. Loading should only occur from the westernmost stockpiles, and the front end loader used for loading should remain to the west of these stockpiles at all times. Truck engines should be turned off while waiting to be loaded.
- Routine quarterly noise monitoring will be conducted by an experienced noise consultant during the day time to monitor and report on operational noise. Two 15-minute measurements are conducted at the most impacted receiver in NCA 1 and a representative location within NCA 2. Noise monitoring procedures will be finalized in the updated noise management plant.

- Night time operational noise will be monitored during the first two nights that operations occur. Recommended monitoring will consist of a combination of attended monitoring from 9 pm – 10 pm, and the use of an unattended noise logger that will be deployed at the most impacted residence to continuously record audio, pending land owner agreement. Site noise levels will be determined from observations made during attended monitoring and by reviewing the unattended audio. Additional targeted mitigation will be considered upon review of this monitoring data. Noise monitoring procedures will be finalized in the updated noise management plant.

A suggested layout of bunds and barriers is illustrated in **Appendix D**.

8.2.3 ROAD NOISE

While the objectives of the RNP are anticipated to be met, the increased traffic volumes along York Street may potentially cause annoyance among the community. Positive driver behavior will assist to mitigate against this, and is to be included as a training topic in site inductions for contractors. Driver expectations should be included in a driver Code of Conduct.

9 CONCLUSION

This report has assessed noise and vibration impacts from the construction and operation of the proposed expanded operations at Concrush Teralba, as well as road noise impacts from increased traffic.

Construction noise and road noise were not predicted to cause noise impacts above relevant criteria at nearby receivers. No vibration impacts are anticipated during either construction or operation activities.

Operational noise is predicted to exceed noise criteria in NCA 1 for proposed day time and night time activities. Operational noise is predicted to exceed noise criteria for a small portion of NCA 2 receivers during day time operations. The extent of impacts is predicted to increase in NCA 2 during night time loading operations, though sleep awakenings are considered unlikely when reviewed against sleep disturbance advice provided in the RNP. It is also noted that night time operations will only occur as required to serve market demand, and noise generated from standard night activities will not exceed the noise criteria.

Concrush have committed to all mitigation measures that were identified to be reasonable and feasible. This includes scaling back night time operations to include only the minimum required plant. With the mitigation measures listed in **Section 8.2**, potential noise impacts are reduced as far as is reasonable and feasible.

Yours faithfully
RCA AUSTRALIA

Natasha Pegler
Acoustic Consultant

Appendix A

Terms and Definitions

TERMS AND DEFINITIONS

dB(A)	Unit of sound pressure level, modified by the A-weighting network to represent the sensitivity of the human ear.
SPL	The incremental variation of sound pressure from the reference pressure level expressed in decibels.
SWL (L_W)	Sound Power Level of a noise sources per unit time expressed in decibels from reference level $W_{O.}$
L_X	Statistical noise descriptor. Where (x) represents the percentage of the time for which the specified noise level is exceeded.
L_{eq}	Equivalent continuous noise level averaged over time on an equivalent energy basis.
L_1	Average Peak Noise Level in a measurement period.
L_{10}	Average Maximum Noise Level in a measurement period.
L_{90}	Average Minimum Noise Level in a measurement period.
L_{max}	Maximum Noise Level in a measurement period.
SEL	Sound exposure level – the equivalent 1-second sound level for an event
Background Noise Level	Noise level determined for planning purposes as the one tenth percentile of the ambient L_{A90} noise levels.
PO	Reference Sound Pressure for the calculation of SPL in decibels.
WO	Reference Sound Power for the calculation of SWL in decibels.

Appendix B

Site Sound Pressure Measurements

Date	Plant	Measurement Distance (m)	Octave Band Leq (dBZ)								L_{eq} (dBA)
			63	125	250	500	1000	2000	4000	8000	
7/2/18	HL770-9	4	92	82	78	77	79	72	64	59	81
7/2/18	Screen	5	87	77	78	76	75	75	76	70	82
7/2/18	Screen	10	84	76	77	75	73	72	71	65	79
7/2/18	Screen	15	84	76	76	71	70	70	68	61	76
7/2/18	Screen	6	88	81	79	79	76	77	76	69	83
7/2/18	Screen	11	85	79	81	75	74	73	71	64	80
7/2/18	Screen	16	88	79	73	73	70	69	67	60	76
7/2/18	Excavator	6	86	81	82	78	78	76	72	64	83
7/2/18	Tipping truck	6	89	88	83	89	82	80	77	66	89 L_{AMax}
22/2/18	Shredder Idle	10	50	48	55	66	69	65	60	49	72
22/2/18	Shredder Active	10	60	74	78	84	85	82	77	70	89
22/2/18	Shredder Active	20	55	70	70	74	79	76	71	63	82

Appendix C

Site Plan & Sources Layout

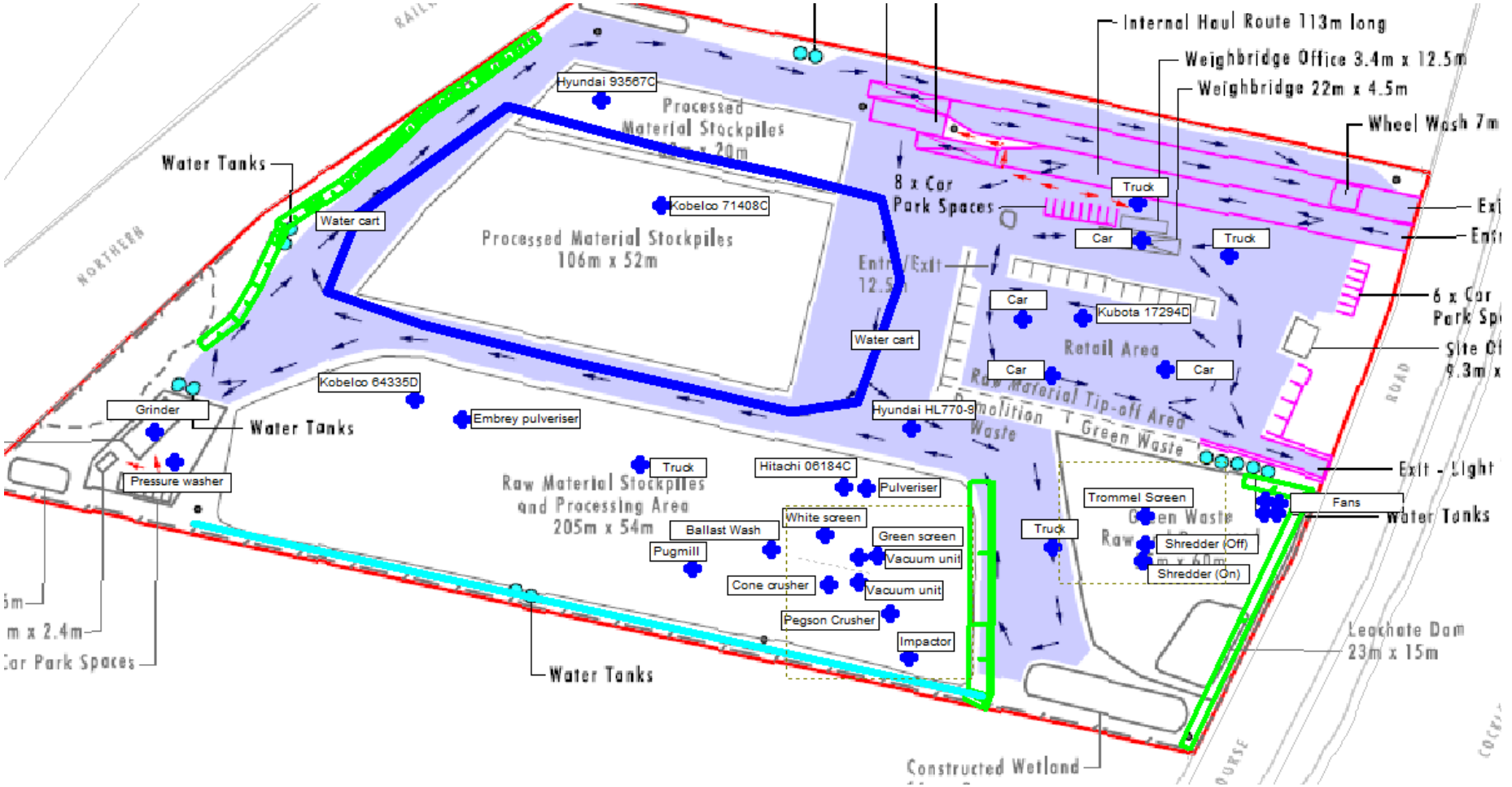

Figure 3 *Positions of noise sources for day and evening activities in the CadnaA model. Some sources were moved between different scenarios (eg loaders moving between stockpiles and green waste areas).*

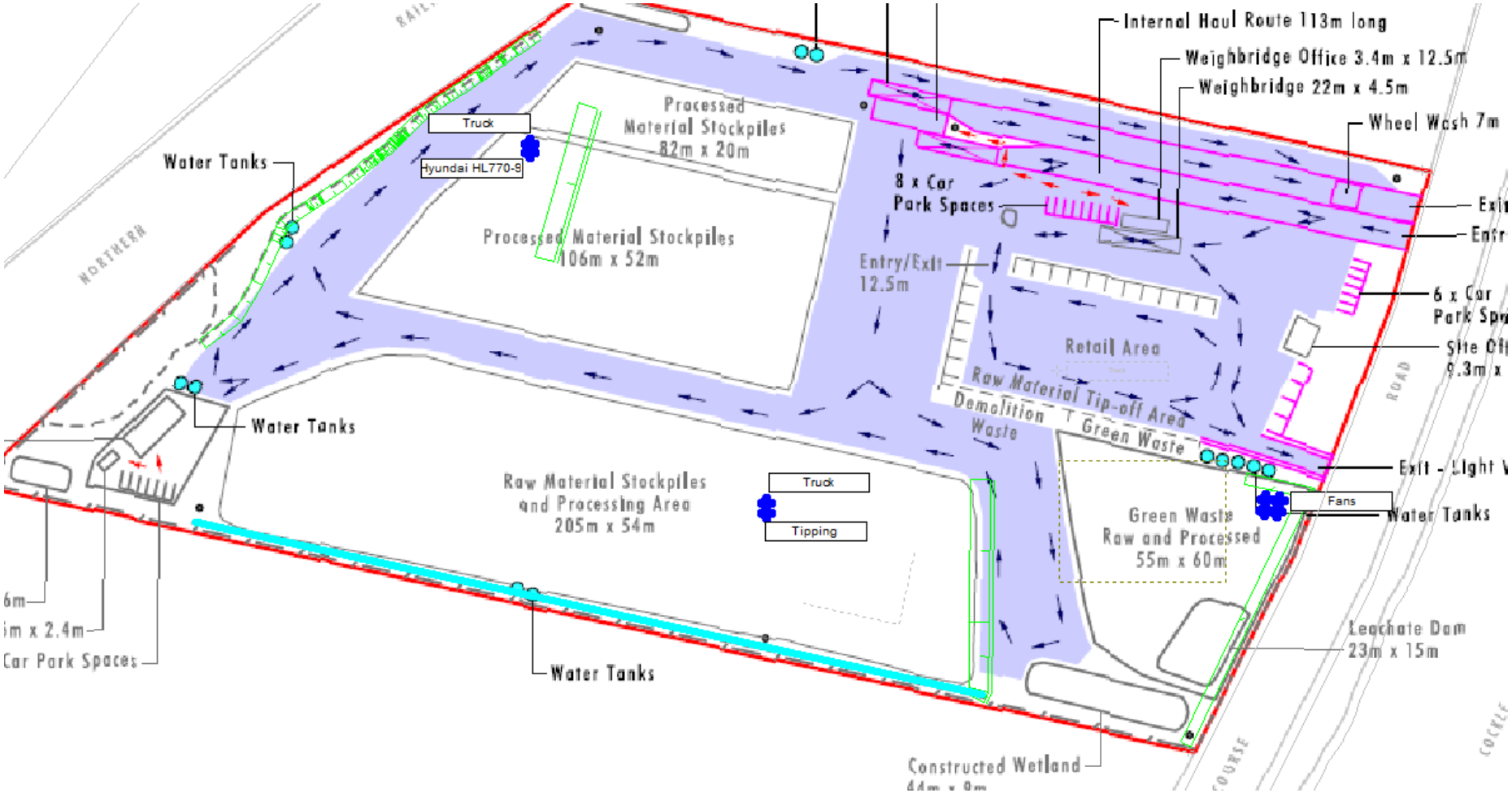

Figure 4 *Positions of noise sources for night activities in the CadnaA model.*

Appendix D

Illustrations of Mitigation Measures

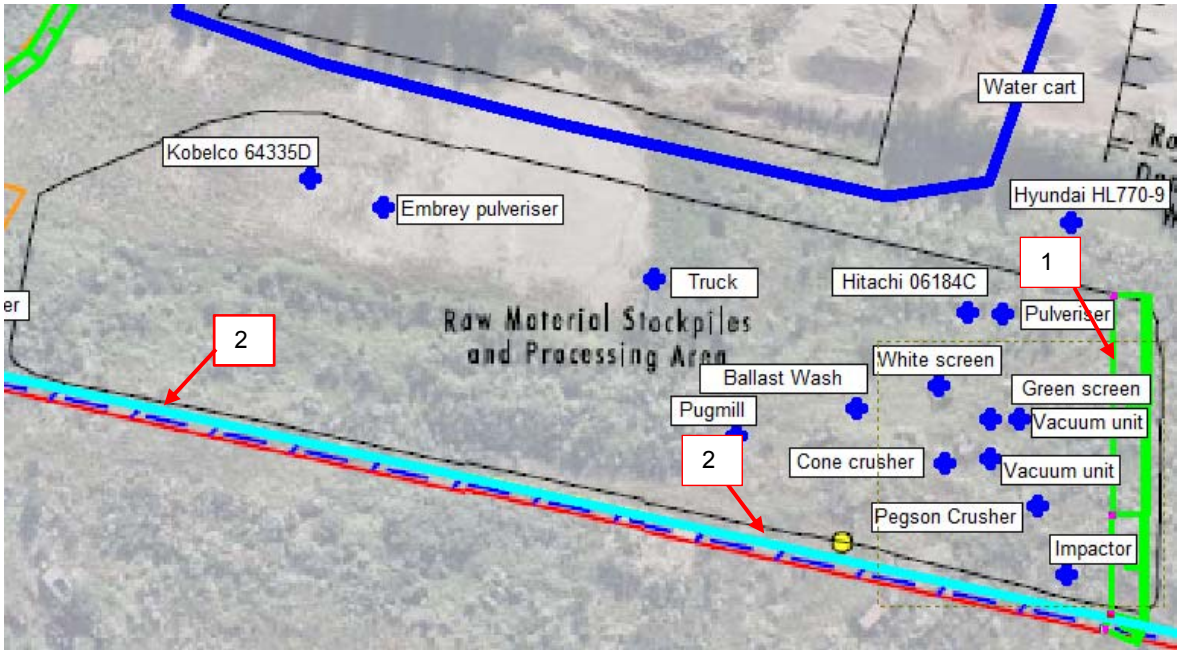

Figure 5 *Mitigation measures for normal operation (full operation, weekend operation, and green waste scenarios)*

1: 3.5 m bund east of raw material stockpile and processing area

2: 3m barrier along southern boundary of stockpile area

All heights indicated are above finished ground level.

Appendix E

Noise Contours – Full Operation (1.5 m above ground)

LEGEND

- Approximate location of receivers
- Approximate location of bunds
- Approximate location of barriers
- Approximate location of noise sources

L_{Aeq}, Noise Contours, dB

to 30	51-55	76-80
31-35	56-60	81-85
36-40	61-65	86-90
41-45	66-70	91-95
46-50	71-75	96-100

NOTE:
Aerial image taken from Nearmap,
June 15 2018
(used in accordance with commercial licence)

N

0 50 100 200 300 400
metres

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FULL PRODUCTION AND SALES
15min L_{Aeq}
21 RACECOURSE ROAD
TERABLA

CLIENT	Concrush Pty Ltd			RCA Ref	13155-601/6
DRAWN BY	NP	SCALE	1:5,000 (A3)	SCENARIO 1	REV 3
APPROVED BY	AR	DATE	9/11/2018	OFFICE	NEWCASTLE

Appendix F

Noise Contours – Green Waste (1.5 m above ground)

LEGEND

- Approximate location of receivers
- Approximate location of bunds
- Approximate location of barriers
- Approximate location of noise sources

L_{Aeq}, Noise Contours, dB

to 30	51-55	76-80
31-35	56-60	81-85
36-40	61-65	86-90
41-45	66-70	91-95
46-50	71-75	96-100

NOTE:
Aerial image taken from Nearmap,
June 15 2018
(used in accordance with commercial licence)

N

0 50 100 200 300 400
metres

RCA AUSTRALIA
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GREEN WASTE
15min L_{Aeq}
21 RACECOURSE ROAD
TERABLA

CLIENT	Concrush Pty Ltd			RCA Ref	13155-601/6
DRAWN BY	NP	SCALE	1:5,000 (A3)	SCENARIO 2	REV 3
APPROVED BY	AR	DATE	9/11/2018	OFFICE	NEWCASTLE

Appendix G

Noise Contours – Weekend (1.5 m above ground)

LEGEND

- Approximate location of receivers
- Approximate location of bunds
- Approximate location of barriers
- Approximate location of noise sources

L_{Aeq}, Noise Contours, dB

to 30	51-55	76-80
31-35	56-60	81-85
36-40	61-65	86-90
41-45	66-70	91-95
46-50	71-75	96-100

NOTE:
Aerial image taken from Nearmap,
June 15 2018
(used in accordance with commercial licence)

N

0 50 100 200 300 400
metres

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WEEKEND
15min L_{Aeq}
21 RACECOURSE ROAD
TERABLA

CLIENT	Concrush Pty Ltd			RCA Ref	13155-601/6
DRAWN BY	NP	SCALE	1:5,000 (A3)	SCENARIO 3	REV 3
APPROVED BY	AR	DATE	9/11/2018	OFFICE	NEWCASTLE

Appendix H

Noise Contours – Evening (1.5 m above ground)

LEGEND

- Approximate location of receivers
- Approximate location of bunds
- Approximate location of barriers
- Approximate location of noise sources

L_{Aeq}, Noise Contours, dB

to 30	51-55	76-80
31-35	56-60	81-85
36-40	61-65	86-90
41-45	66-70	91-95
46-50	71-75	96-100

NOTE:
Aerial image taken from Nearmap,
June 15 2018
(used in accordance with commercial licence)

N

0 50 100 200 300 400
metres

RCA AUSTRALIA
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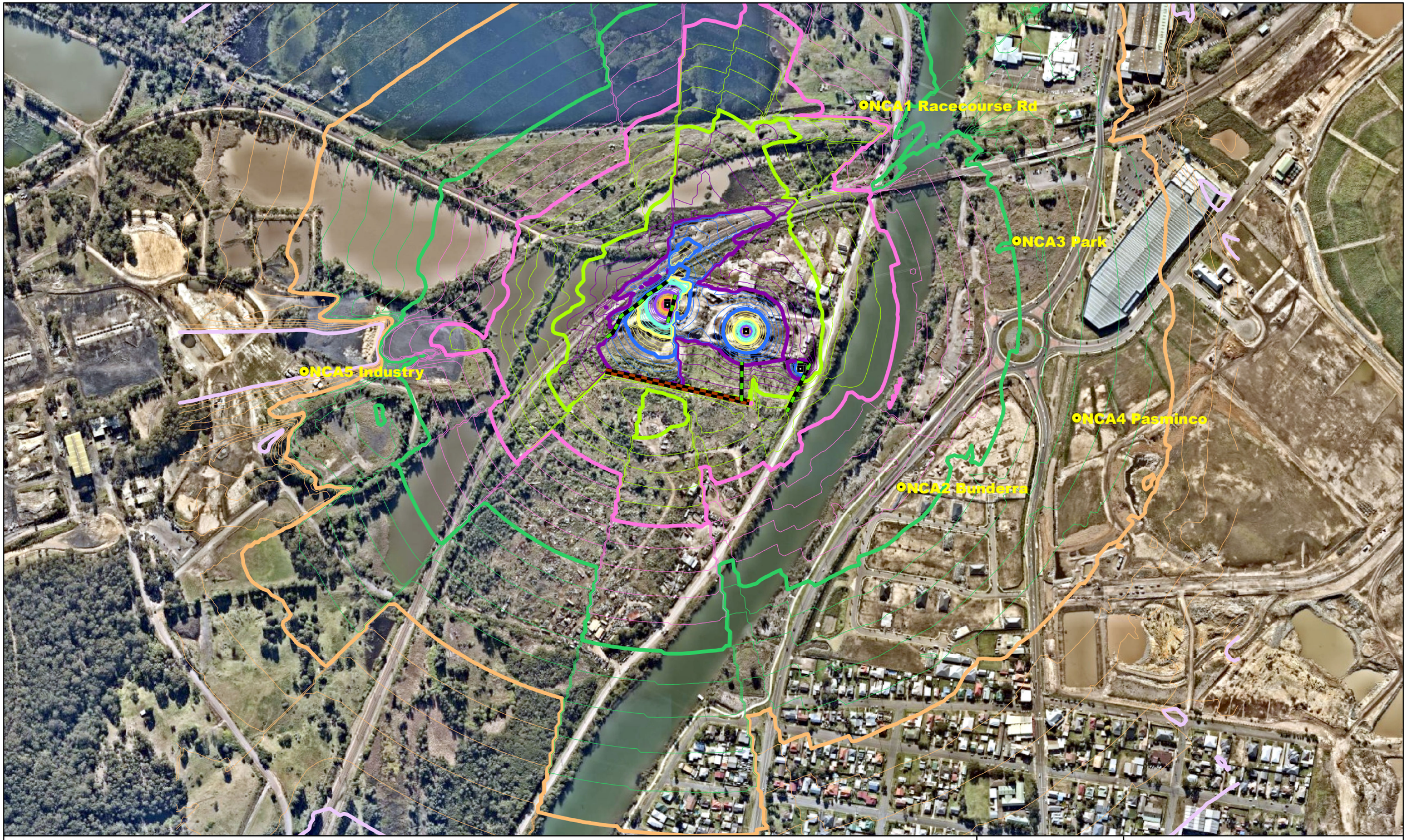
EVENING
15min L_{Aeq}
21 RACECOURSE ROAD
TERABLA

CLIENT	Concrush Pty Ltd			RCA Ref	13155-601/6
DRAWN BY	NP	SCALE	1:5,000 (A3)	SCENARIO 4	REV 3
APPROVED BY	AR	DATE	9/11/2018	OFFICE	NEWCASTLE

Appendix I

Noise Contours – Night (Leq)



LEGEND

- Approximate location of receivers
- Approximate location of bunds
- Approximate location of barriers
- Approximate location of noise sources

L_{Aeq}, Noise Contours, dB

to 30	51-55	76-80
31-35	56-60	81-85
36-40	61-65	86-90
41-45	66-70	91-95
46-50	71-75	96-100

NOTE:
Aerial image taken from Nearmap,
June 15 2018
(used in accordance with commercial licence)

N

0 50 100 200 300 400
metres

RCA AUSTRALIA
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NIGHT
15min L_{Aeq}
21 RACECOURSE ROAD
TERABLA

CLIENT	Concrush Pty Ltd			RCA Ref	13155-601/6
DRAWN BY	NP	SCALE	1:5,000 (A3)	SCENARIO 5	REV 3
APPROVED BY	AR	DATE	9/11/2018	OFFICE	NEWCASTLE

Appendix J

Noise Contours – Night (LMax)

LEGEND

- Approximate location of receivers
- Approximate location of bunds
- Approximate location of barriers
- Approximate location of noise sources

L_{AMax}, Noise Contours, dB

to 30	51-55	76-80
31-35	56-60	81-85
36-40	61-65	86-90
41-45	66-70	91-95
46-50	71-75	96-100

NOTE:
Aerial image taken from Nearmap,
June 15 2018
(used in accordance with commercial licence)

N

0 50 100 200 300 400
metres

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NIGHT INSTANTANEOUS LMAX
21 RACECOURSE ROAD
TERABLA

CLIENT	Concrush Pty Ltd			RCA Ref	13155-601/6
DRAWN BY	NP	SCALE	1:5,000 (A3)	SCENARIO 6	REV 3
APPROVED BY	AR	DATE	9/11/2018	OFFICE	NEWCASTLE

Appendix K

Noise Contours – Fans

LEGEND

- Approximate location of receivers
- Approximate location of bunds
- Approximate location of barriers
- Approximate location of noise sources

L_{AMax}, Noise Contours, dB

to 30	51-55	76-80
31-35	56-60	81-85
36-40	61-65	86-90
41-45	66-70	91-95
46-50	71-75	96-100

NOTE:
Aerial image taken from Nearmap,
June 15 2018
(used in accordance with commercial licence)

N

0 50 100 200 300 400
metres

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

FANS
21 RACECOURSE ROAD
TERABLA

CLIENT	Concrush Pty Ltd			RCA Ref	13155-601/6
DRAWN BY	NP	SCALE	1:5,000 (A3)	SCENARIO 7	REV 0
APPROVED BY	AR	DATE	9/11/2018	OFFICE	NEWCASTLE