APPENDIX Q: NOISE AND VIBRATION IMPACT ASSESSMENT

Document No: 181724-9247

Noise and Vibration Impact Assessment
Deep Creek Quarry
Limeburners Creek, NSW

Prepared for:
Ironstone Developments Pty Ltd
c/- Kleinfelder Australia Pty Ltd
Suite 3, 240-244 Pacific Hwy
Charlestown NSW 2290

Author:

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Neil Pennington
B. Sc. (Physics), B.Math. (Hons), MAIP, MAAS, MASA
Principal / Director

October 2021

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COMMONLY USED ACRONYMS

AHD	Australian Height Datum
ANZEC	Australian and New Zealand Environment and Council
ANZECC	Australian and New Zealand Environment and Conservation Council
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DECCW	Department of Environment, Climate Change and Water
DPE	Department of Planning and Environment
DRG	Division of Resources and Geoscience
EIS	*Environmental Impact Statement*
ENM	Environmental Noise Model
EPA	Environment Protection Authority
OEH	Office of Environment and Heritage
MIC	Maximum Instantaneous Charge
MS	Morning Shoulder
NPI	*NSW Noise Policy for Industry*
OP	overpressure levels
PNTLs	project noise trigger levels
PPV	peak particle vibration
PVS	Peak Vector Sum
RBL	Rating Background Levels
RH	relative humidity
RMS	Roads and Maritime Services
RNP	*NSW Road Noise Policy*
RTA	Renzo Tonin Associates
SEARs	Secretary's Environmental Assessment Requirements
SPL	Sound Pressure Level
VLAMP	*Voluntary Land Acquisition and Mitigation Policy*

EXECUTIVE SUMMARY

A noise and vibration impact assessment has been conducted for the proposed construction and operation of a quarry producing hard rock products at a Site located approximately 43km north of Newcastle and 11km northwest of Karuah, west of The Bucketts Way. The proposed operating hours are as follows.

Proposed Hours of Operation

Activity	Monday to Friday	Saturdays	Sundays or Public Holidays
Site establishment and construction	7:00am to 5:00pm	8:00am to 1:00pm	Nil
Extraction operations	7:00am to 5:00pm	8:00am to 1:00pm	Nil
Blasting operations	9:00am to 4:00pm	Nil	Nil
Processing operations	7:00am to 5:00pm	8:00am to 1:00pm	Nil
Product dispatch	6:00am to 6:00pm	6:00am to 1:00pm	Nil
Maintenance	24 hours / day	24 hours / day	Nil

Documents referred to in conducting the assessment include:

- *NSW Interim Construction Noise Guideline* (ICNG), EPA (2009);
- *NSW Noise Policy* for *Industry* (NPI), EPA (2017);
- *NSW Road Noise Policy* (RNP), OEH (2011);
- *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (ANZEC)*;* and
- *Voluntary Land Acquisition and Mitigation Policy* (VLAMP), DPE (2014).

Background noise levels

Ambient noise monitoring was conducted at one location (off Deep Creek Road) to establish noise trigger levels for nearby receivers. Project noise trigger levels were based on the EPA default minimum background noise levels of 35 dB(A),L90 (day) and 30 dB(A),L90 (evening and night).

Predicted noise criterion exceedances

Based on the worst-case meteorological conditions presented in the Air Quality assessment for the project (Todoroski Air Sciences, 2021) the predicted operational noise exceedances were limited to:

Receiver R25: 2dB exceedance under ESE winds during Stage 2, and at, but not exceeding noise criteria during ESE winds in other Stage 1 and 3.
Receiver R3 (associated property): 4-8 dB exceedance under WNW winds from Stage 2 onwards.
Receiver R4a (associated property): 4 dB exceedance under WNW winds from Stage 3 onwards.

A 1 dB construction noise exceedance was predicted at receiver R4a for a short period when initial roadworks would pass this location.

Receivers R3 and R4a are currently unhabituated with no approved dwelling. Ironstone Developments Pty has a negotiated agreement with these properties and management/mitigation of predicted noise impacts is not required.

Blast Impacts

Ground vibration and overpressure levels from blasting are predicted to be below the criteria for all receivers.

Off-site traffic noise

The off-site traffic noise criterion of 55 dB(A),$L_{eq(15hour)}$ for arterial roads would be achieved for all receivers, considering the cumulative impacts from DCQ and a potential future quarry at Booral.

In summary, the assessment has found that the Project would be able to operate in compliance with the appropriate criteria for operational and road traffic noise emissions and for potential blast overpressure and vibration impacts.

1.0 INTRODUCTION

Spectrum Acoustics Pty Ltd has been commissioned by Kleinfelder Australia Pty Ltd on behalf of Ironstone Developments Pty Ltd (the Applicant) to undertake an assessment of the Project to construct and operate a quarry producing hard rock products at a Site located approximately 43km north of Newcastle and 11km northwest of Karuah, adjoining the southern side of The Bucketts Way (see **Figure 1**).
This report provides:

- an overview of the acoustic environment around the Site, based upon recent and historical background noise measurements;
- an outline of the acoustic criteria relevant to the Project;
- an assessment of the predicted noise levels associated with the Project and as to the adverse impacts on the existing acoustic environment in vicinity of the proposed operations including traffic noise; and
- an outline of the required noise mitigation measures and monitoring.

This noise and vibration impact assessment has been prepared in accordance with the NSW Noise Policy for Industry (EPA, 2017), Road Noise Policy (OEH, 2011) and the Secretary's Environmental Assessment Requirements (SEARs) for the Project, issued on 19 February 2021 by the NSW Department of Planning and Environment (DPE). **Section 7** records the coverage of the requirements within this report.

1.1 Overview of the project

The proposed extraction area, as shown on **Figure 2**, has been defined based upon the occurrence of the underlying hard rock resource. The Project would utilise conventional drill and blast, load and haul and processing methods to produce up to 500 000tpa of quarry products. These products would principally be used for road pavement products, concrete and sealing aggregates, gabion, armour rock, decorative gravel, crusher fines and select fill.

Extraction would be undertaken in a staged manner, i.e. over four stages and an initial construction phase. Production during the initial stages of extraction would be lower (up to 300 000tpa) with production gradually ramped up in the years following site establishment (to 500 000tpa). It is expected that extraction would continue for a period of approximately 30 years following Project commencement. It is noted that both extraction and processing operations have been designed to optimise the recovery of resource whilst satisfying environmental and Site constraints.

Figure 2 displays the following principal components of the Project relevant to this assessment.

- Extraction Area - Stage 1 (Years 1-5)

  The Stage 1 extraction area would see approximately 6.7 ha of the extraction area undergoing extraction or processing and stockpiling. Stage 1 is unlikely to present any opportunity for progressive rehabilitation due to ongoing disturbance within the stage 1 footprint. In total up to 17 ha of the project area would be disturbed by the end of Stage 1.

- Extraction Area - Stage 2 (Years 5-11)

  The Stage 2 extraction area would see approximately 14.4ha of the extraction area undergoing extraction and processing stockpiling. This includes the 3.3 ha described in Stage 1. Due to the ongoing expansion of the extraction area the requirement to ramp up processing in line with the forecast production schedule (Section 3.3) Stage 2 does not offer any significant opportunity for

progressive rehabilitation due to ongoing disturbance within the Stage 2 footprint. In total up to 24.8 ha of the project area would be disturbed or modified up to the end of Stage 2 (including stockpiles and site infrastructure).

- Extraction Area - Stage 3 (Years 11-21)

  The Stage 3 extraction area will see approximately 17.7 ha of the extraction having undergone extraction and processing or stockpiling. As the extraction campaign progresses, progressive rehabilitation will be performed as per the progression depicted in Figures X to X. Stage 3 of the project sees the completion of extraction in the West of the pit area, and will present opportunity for progressive rehabilitation to occur over an area covering approximately 7.2 ha of the 17.7 ha disturbed to date within the extraction area. In total up to 28.1 ha of the project area would be disturbed up to the end of Stage 3 (including stockpiles and site infrastructure).

- Extraction Area - Stage 4 (Years 21-30)

  The Stage 4 extraction area will see approximately 18.8 ha of the extraction area having undergone extraction and processing or stockpiling. Stage 4 represents the final stage of extraction and significant rehabilitation being performed across the majority of the extraction area, prior to achieving final landform after the cessation of extraction. The Stage 4 extraction area will present opportunity for significant progressive rehabilitation to occur over an area covering approximately 6.4 ha within the extraction area, which along with the with 7.2 ha already commenced rehabilitation in Stage 3, sees 13.6 ha of the total 18.8 ha extraction area forecast to be rehabilitated by completion of Stage 4. In total up to 28.6 ha of the project area would be disturbed up to the end of Stage 4 (including stockpiles and site infrastructure).

- Quarry infrastructure area
  The quarry infrastructure area is located on the southern side of the extraction area and would incorporate an office, workshop, weighbridge and ancillary components.

- Product stockpiling area
  The main product stockpiling area would be located north of the quarry extraction area. (see **Figure 2**).

- Mobile processing plant
  The mobile processing plant would incorporate a crusher and screen and would be located on the quarry floor, typically following the lowest bench on the quarry floor.

- Internal roads
  A network of roads to provide access for off-road haul trucks between the extraction and processing area. And a central road extending in a northerly direction providing road registered trucks access to stockpiled materials on the quarry floor and in the Product Stockpiling Area.

- Quarry access road
  A sealed road extending from The Bucketts Way in the east to the southern side of the Quarry infrastructure area at its western extent. The access road will include some cut and fill to optimise the vertical alignment and reduce engine noise from trucks accessing the quarry.

Preliminary noise modelling was conducted to inform the project design and minimise off-site noise impacts. Specifically, the processing plant was located behind the eastern side of the northern toe of an existing hill and the progress of the quarry was then planned to extend to the south before working its way east with the quarry floor up to 40m below the top of the existing ridge.

Quarry products would be despatched by road using the existing road network with access to the Site via new intersection onto The Bucketts Way.

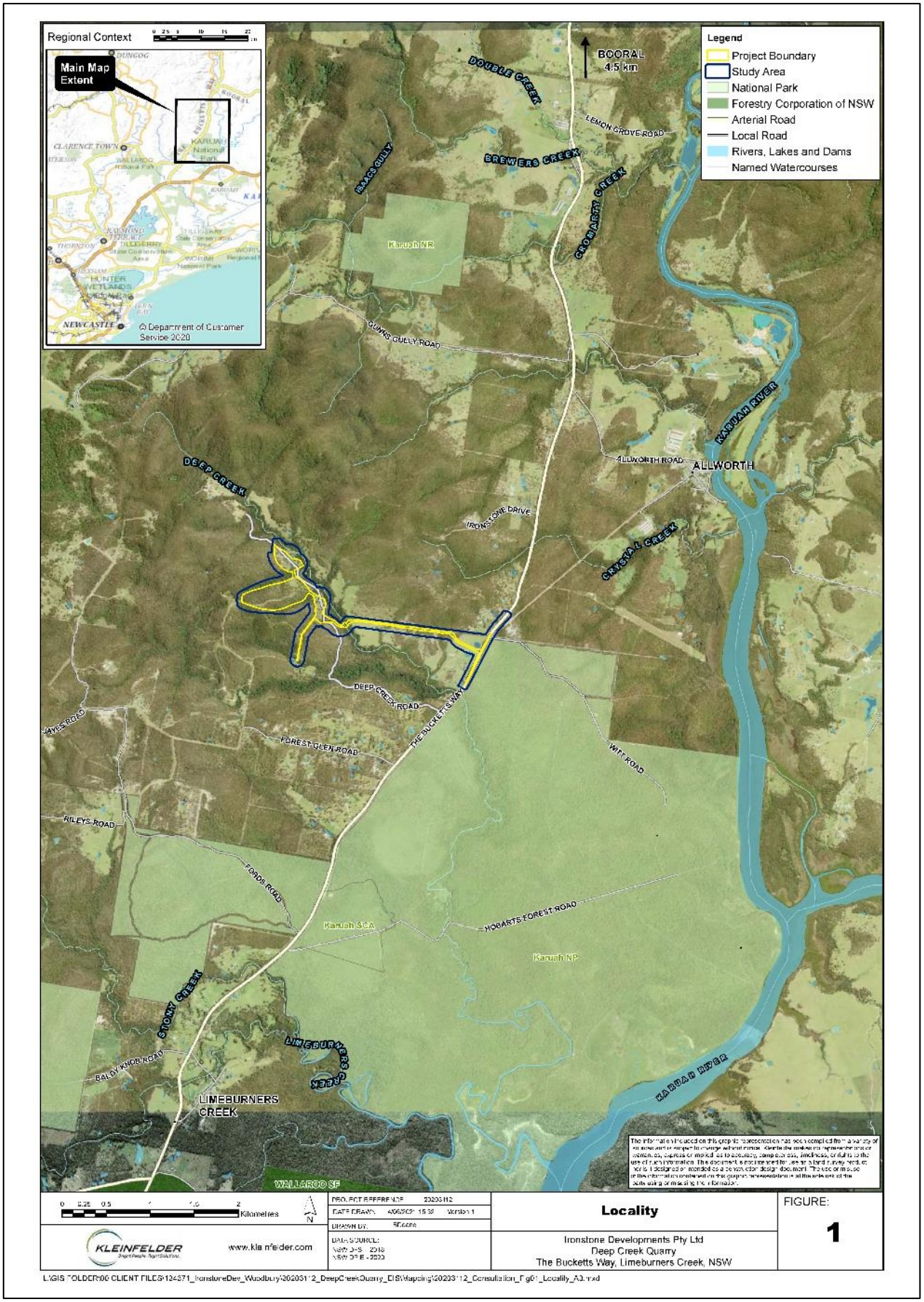


Figure 1: Locality Plan

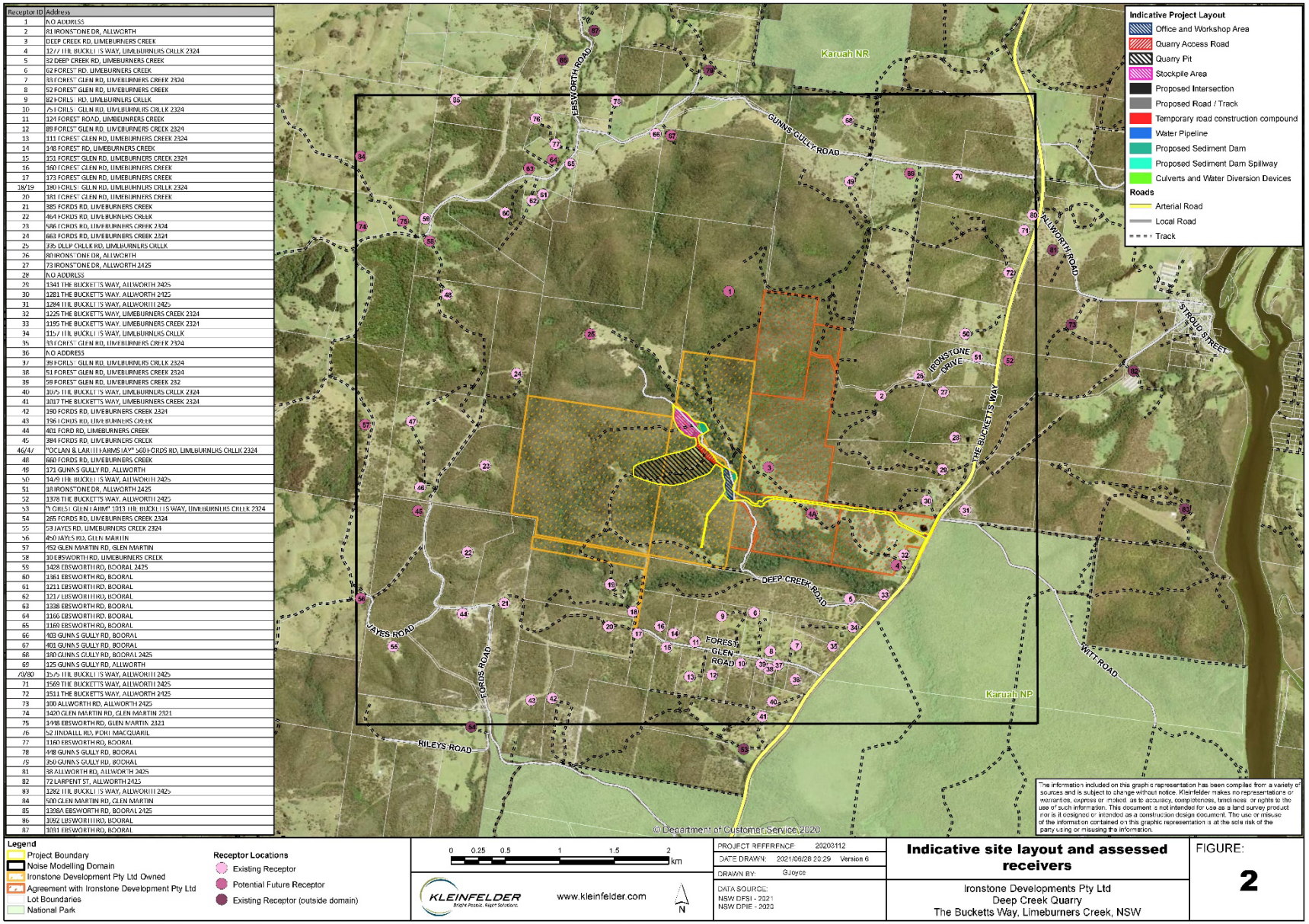


Figure 2: Indicative site layout and assessed receivers

Table 1 lists the proposed hours of operation for a range of activities that would be undertaken at the Site throughout the life of the Project.

Table 1
Proposed Hours of Operation

Activity	Monday to Friday	Saturdays	Sundays or Public Holidays
Site establishment and construction	7:00am to 5:00pm	8:00am to 1:00pm	Nil
Extraction operations	7:00am to 5:00pm	8:00am to 1:00pm	Nil
Blasting operations	9:00am to 4:00pm	Nil	Nil
Processing operations	7:00am to 5:00pm	8:00am to 1:00pm	Nil
Product dispatch	6:00am to 6:00pm	6:00am to 1:00pm	Nil
Maintenance	24 hours / day	24 hours / day	Nil

The hours nominated in **Table 1** are those that the Applicant would operate within, not that they would be operating throughout the entire nominated periods. That is, the nominated hours would provide the flexibility needed to undertake all Project-related activities, when required. The flexibility achieved by the proposed operating hours would be important in order that the Applicant can respond to large volume or urgent orders from its customers.

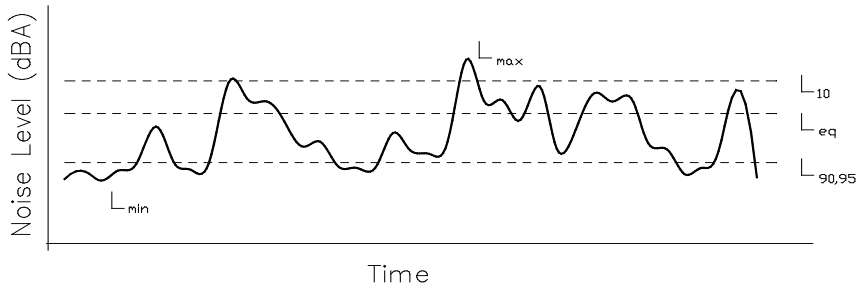
1.2 Assessed Receivers

Privately-owned residential properties within approximately 3 km of the Site were considered in this assessment as shown in Figure 2. Additional residences located at greater distances from the proposed extraction area are also included in the noise modelling domain.

2.0 DESCRIPTION OF TERMS

Table 3 contains qualitative descriptions of commonly used acoustical terms and is presented as an aid to understanding this report.

Table 2 Definition of Acoustical Terms

Term	Definition
dB(A)	The quantitative measure of sound heard by the human ear, measured by the A-Scale Weighting Network of a sound level meter expressed in decibels (dB).
SPL	Sound Pressure Level. The incremental variation of sound pressure above and below atmospheric pressure and expressed in decibels. The human ear responds to pressure fluctuations, resulting in sound being heard.
STL	Sound Transmission Loss. The ability of a partition to attenuate sound, in dB.
Lw	Sound Power Level radiated by a noise source per unit time re 1pW.
Leq	Equivalent Continuous Noise Level - taking into account the fluctuations of noise over time. The time-varying level is computed to give an equivalent dB(A) level that is equal to the energy content and time period (for noise assessments this is typically 15 minutes).
Lmax	Maximum Noise Level – used to assess the potential for disturbance from impact noise at night time
L1	Average Peak Noise Level - the level exceeded for 1% of the monitoring period.
L10	Average Maximum Noise Level - the level exceeded for 10% of the monitoring period.
L90	Average Minimum Noise Level - the level exceeded for 90% of the monitoring period and recognised as the Background Noise Level. In this instance, the L90 percentile level is representative of the noise level generated by the surrounds of the residential area.
Significant Noise descriptors 	

3.0 EXISTING ENVIRONMENT AND CRITERIA

The existing meteorological and acoustical environments of the Site and its surrounds have been studied to determine prevailing conditions and to allow noise goals to be set.

3.1 Meteorology

The atmospheric conditions most relevant to noise assessments are temperature inversions, gentle winds (indicative of possible wind shear) and relative humidity. The NSW Noise Policy for Industry (NPI) (EPA, 2017) states that wind effects need to be assessed where source to receiver winds (at 10m height) of 3m/s or below occur for 30% or more of the time in any season in any assessment period.

The meteorological data analysis conducted for the Project by Todoroski Air Services (TAS 2021) was used to determine relevant meteorological conditions for this noise impact assessment. Data was analysed for the Beresfield (NSW OEH), Williamtown RAAF and Paterson (Tocal) meteorological stations, as well as computer modelling using the CALMET software. The worst case of these, the CALMET predictions, found that winds up to 3m/s occurred for more than 30% of the time from the NNE, WNW and ESE during various seasons when assessed with the EPA's Noise Enhancement Wind Analysis (NEWA) methodology. Pasquill stability class F was found to occur for more than 30 % of the time. Since there are no proposed major noise-generating activities during night time hours, ie extraction and blasting, inversions will not be considered. Worst case noise impacts at all assessed receivers are covered by the three assessed wind directions.

The following points are the most significant with respect to noise propagation and were adopted as parameters for noise modelling.

- Extremes of relative humidity (RH) are rarely experienced during daytime hours. A value of 70% RH was adopted.
- Neutral atmospheric conditions (20°C, no wind).
- Winds, 3 m/s from the NNE, WNW and ESE.

3.2 Existing Acoustic Environment

In order to quantify the existing acoustic environment at typical receivers surrounding the quarry, a Rion NL- 42 environmental noise logger was deployed from 20-27 November 2018 at a site located approximately 150 m from The Bucketts Way off Deep Creek Road, between R5 and R33 displayed on Figure 2 (see location map in **Appendix A**.

This location is closer to The Bucketts Way than many receivers, but further than others that front The Bucketts Way. Noise criteria (project noise trigger levels) were established with consideration of the logged noise levels and its location for all other receivers and these were adopted for this assessment.

Table 3 summarises the ambient LAeq and Rating Background Levels (RBL, L_{A90}) noise levels arising from the noise measurements according to procedures in the NSW NPI. A plot of the raw data is included in Appendix A.

Table 3

Ambient LAeq and Rating Background Levels (RBLs) at logger location on Deep Creek Road, dB(A)

Location	Leq(day)	Leq(eve)	Leq(night)	L90(day)	L90(eve)	L90(night)
Deep Creek Road, 150m from intersection with The Bucketts Way	47	42	42	36	32	32

Receivers further from The Bucketts Way than the logger location may experience lower background noise levels.

3.3 Project Noise Trigger Levels

Project-generated noise within the Site is required to be assessed against the provisions of the NPI. In relation to the residences surrounding the Site, the NPI specifies two noise criteria: *intrusiveness and amenity criteria*.

The *Intrusiveness Criterion* limits Equivalent Continuous Noise Level (Leq) from the industrial source to a value of 'background plus 5dB'. That is, the Rating Background Level (RBL) for the time period, plus 5 dB(A). The RBL (L_{A90}) is defined as the overall single figure background level representing each assessment period.

The *Amenity Criterion* aims to protect against excessive noise levels where an area is becoming increasingly developed. Amenity criteria are dependent upon the nature of the receiver area and the existing level of industrial noise. There is no significant existing industrial noise near the Site and the residential area that is potentially affected by noise emissions from the Project is best described acoustically as an area dominated by environmental noise with some road traffic noise.

Time periods for assessment as defined in the NPI are:

- Daytime – 7:00am (8:00am on Sundays) to 6:00pm;
- Evening – 6:00pm to 10:00pm; and
- Night – 10:00pm to 7:00am (8:00am on Sundays).

The area surrounding the site is not impacted by significant traffic or industrial noise levels and the intrusiveness criteria become the most stringent.

The measured noise levels at the logger off Deep Creek Road were impacted by road traffic noise, due to the minimal distance between it and The Bucketts Way (approximately 150m). Due to this, a conservative noise level reduction will be adopted to meet the default minimum daytime background noise level of 35 dB(A).L90, as per the NPI. The adopted noise trigger level for all receivers is shown in **Table 4**.

Table 4

Rating Background Levels and PNTLs – dB(A)

Location	RBL* L_{A90}	Trigger levels/PNTLs $L_{Aeq(15minute)}$
All Receivers	35	40
* NPI default minimum daytime RBL.		

3.4 Maximum Noise Levels

The potential for sleep disturbance from maximum noise level events from the Project during the night-time period 6 am – 7 am needs to be considered. Product dispatch during this period would involve loading of empty trucks and movement of the trucks to and from The Bucketts Way.

Where the subject development/premises night-time noise levels at a residential location exceed:

- $L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or
- L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,

Other factors that may be important in assessing the extent of impacts on sleep include:

- how often high noise events will occur;
- the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the subject development;
- whether there are times of day when there is a clear change in the noise environment (such as during early-morning shoulder periods); and
- current scientific literature available at the time of the assessment regarding the impact of maximum noise level events at night.

Maximum noise level event assessments should be based on the L_{AFmax} descriptor on an event basis under 'fast' time response. The detailed assessment should consider all feasible and reasonable noise mitigation measures with a goal of achieving the above trigger levels of which **52 dB(A),L_{max}** will be the adopted criterion applicable to night-time noise emissions from loading of product haulage trucks between 6am and 7am.

3.5 Construction Noise

Noise criteria for the initial period of constructing access roads and site preparation earthworks in the surface infrastructure area are derived for the EPA's Interim Construction Noise Guideline (ICNG, 2009). Construction works should be confined to the EPA's "standard recommended hours" of 7am – 6pm Monday-Friday and 8am-1pm on Saturday. Construction works outside these hours would usually require approval from the consent authority and must comply with the operational noise trigger levels discussed in Section 3.3.

The applicable construction noise management level is equal to the RBL + 10 dB. Adopting the EPA default minimum daytime RBL of 35 dB(A),L90 as discussed in Section 3.3, gives a construction noise management level of 45 dB(A),Leq(15min). Exceedances of this level at non-project related residential receivers usually triggers the requirement for consideration of reasonable and feasible noise management or control measures.

3.6 Traffic Noise

In NSW, noise from vehicle movements associated with an industrial source is assessed in terms of the NPI if the vehicles are not on a public road. If the vehicles are on a public road, the *NSW Road Noise Policy* (RNP) applies. Noise from the Project must, therefore, be assessed against the project noise trigger levels of the NPI and also the criteria in the RNP.

The RNP recommends various criteria based on the functional categories of roads applied by the Transport for NSW (TfNSW). The TfNSW differentiates roads based on a number of factors including traffic volume,

heavy vehicle use, or through local traffic, vehicle speeds and applicable traffic management options. Vehicles accessing the Site will do so via The Bucketts Way which falls under the TfNSW definition of an arterial road.

Table 5 shows the noise criteria relevant to arterial roads extracted from Table 3 of the RNP. For the assessment of traffic noise, the daytime period is from 7:00am to 10:00pm, whilst night is from 10:00pm to 7:00am.

Table 5
Road Traffic Noise Criteria

Situation	Recommended Criteria	
	Day (7:00am to 10:00pm)	Night (10:00pm to 7:00am)
Existing residences affected by additional traffic on existing freeway/ arterial/sub-arterial roads generated by land use developments	Leq (15-hour) 60	Leq (9-hour) 55

This assessment conservatively considers a criterion of 55 dB(A),Leq(1-hour) to apply between 6am and 7am.

3.7 Blasting and Vibration

Blast overpressure and ground vibration criteria for human comfort and building damage are discussed below. The most stringent criteria will be adopted for the Project.

3.7.1 Human Comfort

Noise and vibration levels from blasting are assessable against criteria proposed by the Australian and New Zealand Environment and Conservation Council (ANZECC) in their publication *"Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration – September 1990"*. These criteria are summarised as follows:

- The recommended maximum overpressure level for blasting is 115 dB;
- The level of 115 dB may be exceeded for up to 5% of the total number of blasts over a 12-month period, but should not exceed 120 dB at any time;
- The recommended maximum vibration velocity for blasting is 5 mm/s Peak Vector Sum (PVS);
- The PVS level of 5 mm/s may be exceeded for up to 5% of the total number of blasts over a 12-month period, but should not exceed 10 mm/s at any time;
- Blasting should generally only be permitted during the hours of 9 am to 5 pm Monday to Saturday, and should not take place on Sundays and Public Holidays; and
- Blasting should generally take place no more than once per day.

3.7.2 Building Damage Criteria

Building damage assessment criteria are nominated in AS 2187.2-1993 *"Explosives – Storage, Transport and Use. Part 2: Use of Explosives"* and summarised in **Table 6.**

Table 6

Building Damage Vibration Criteria

Building Type	Vibration Level (mm/s)	Airblast Level (dB re 20 μPa)
Sensitive (and Heritage)	5	133
Residential	10	133
Commercial/Industrial	25	133

The annoyance (ANZECC) criteria in Section 3.6.1 are more stringent than the building damage criteria and will be taken as the governing criteria.

4.0 ASSESSMENT METHODOLOGY

4.1 Modelled Scenarios

A full description of the Project is given in the EIS. In discussion with the Applicant, it was determined that the following construction and three operational noise scenarios represent worst case potential for noise impacts at the surrounding residential receivers. These scenarios and noise source locations are indicated in **Figures 3-6**. Noise modelling using the Environmental Noise Model (ENM v3.06) was undertaken for the atmospheric conditions described in Section 3.1.

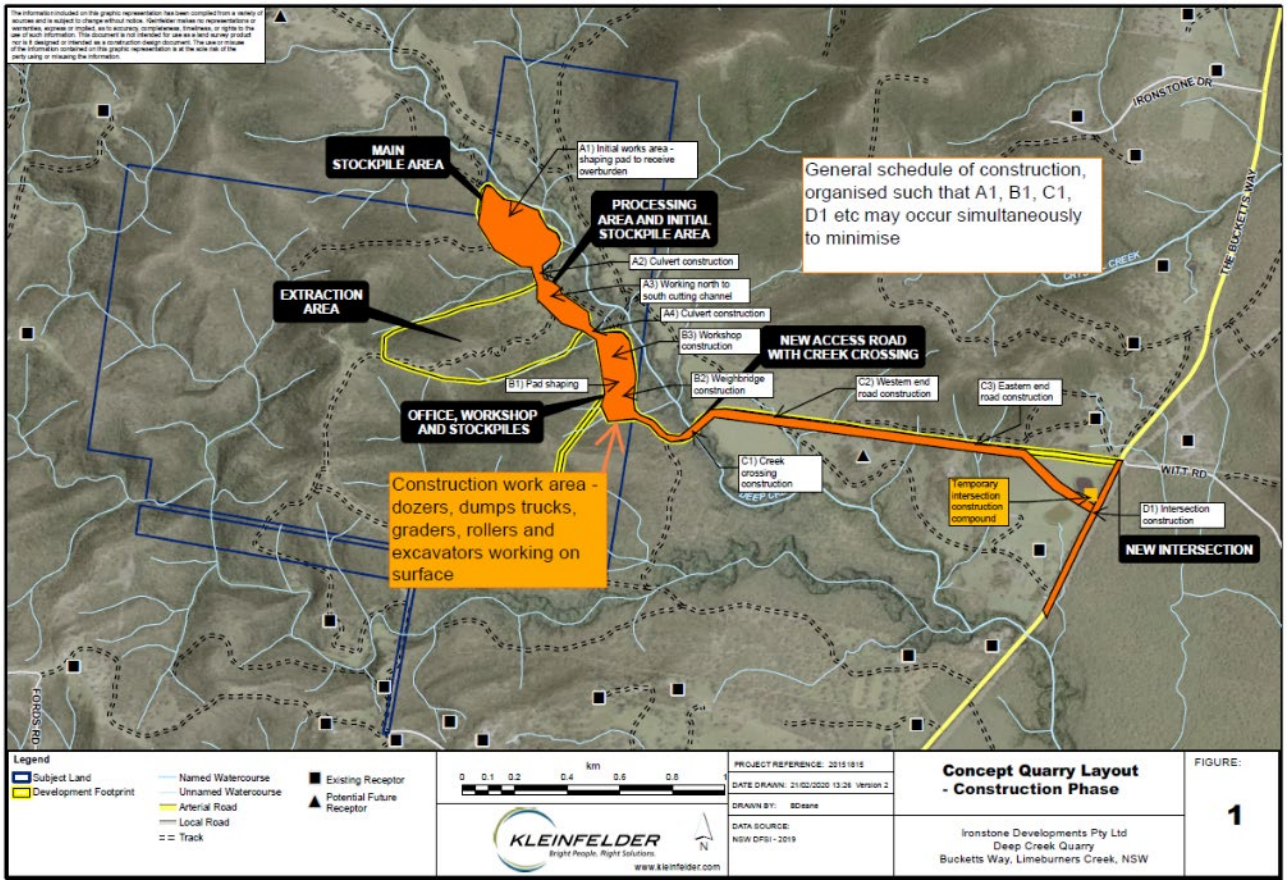
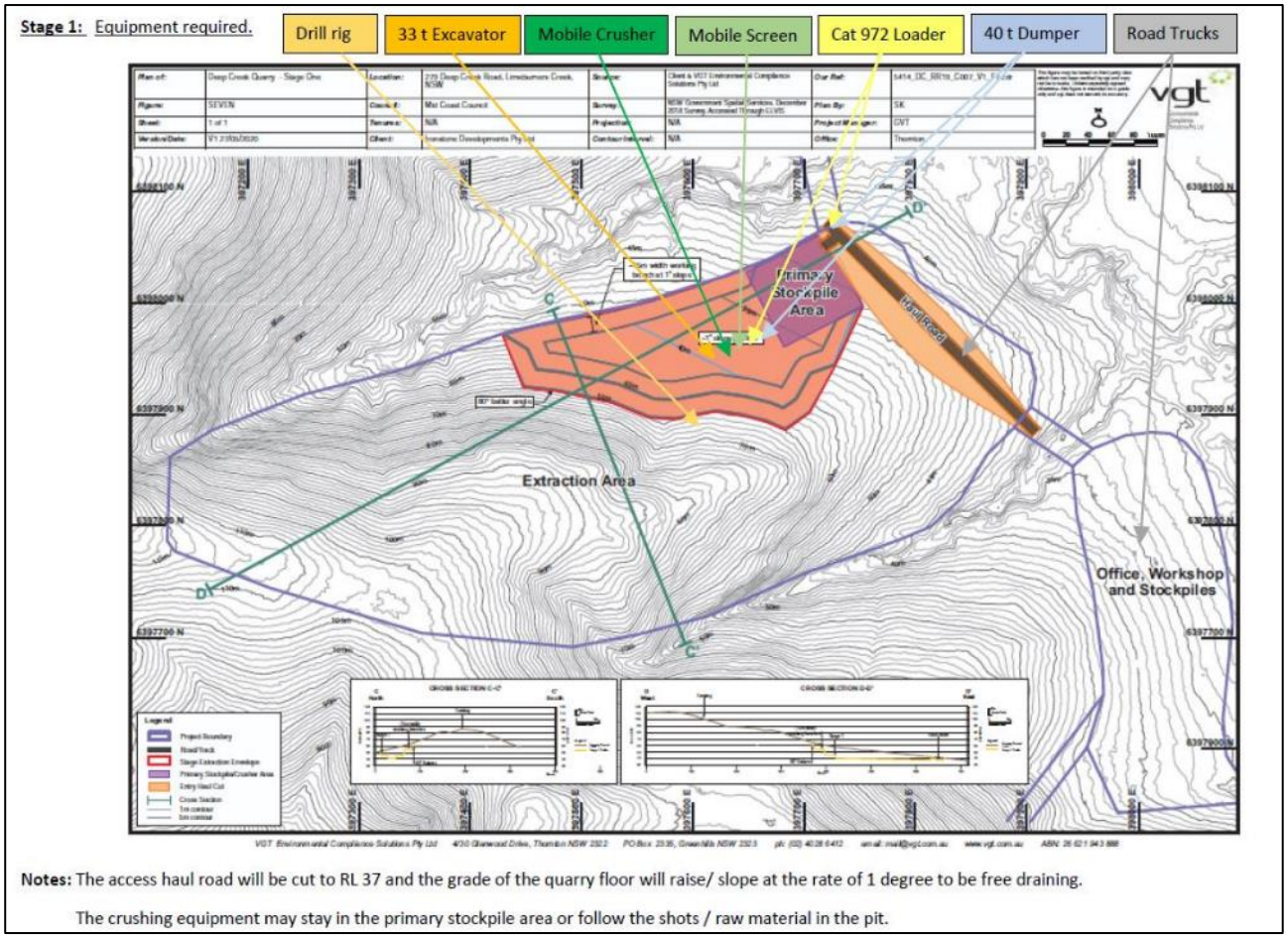


Figure 3: Scenario 1 - Construction



Notes: The access haul road will be cut to RL 37 and the grade of the quarry floor will raise/ slope at the rate of 1 degree to be free draining.

The crushing equipment may stay in the primary stockpile area or follow the shots / raw material in the pit.

Figure 4: Scenario 2 – Stage 1

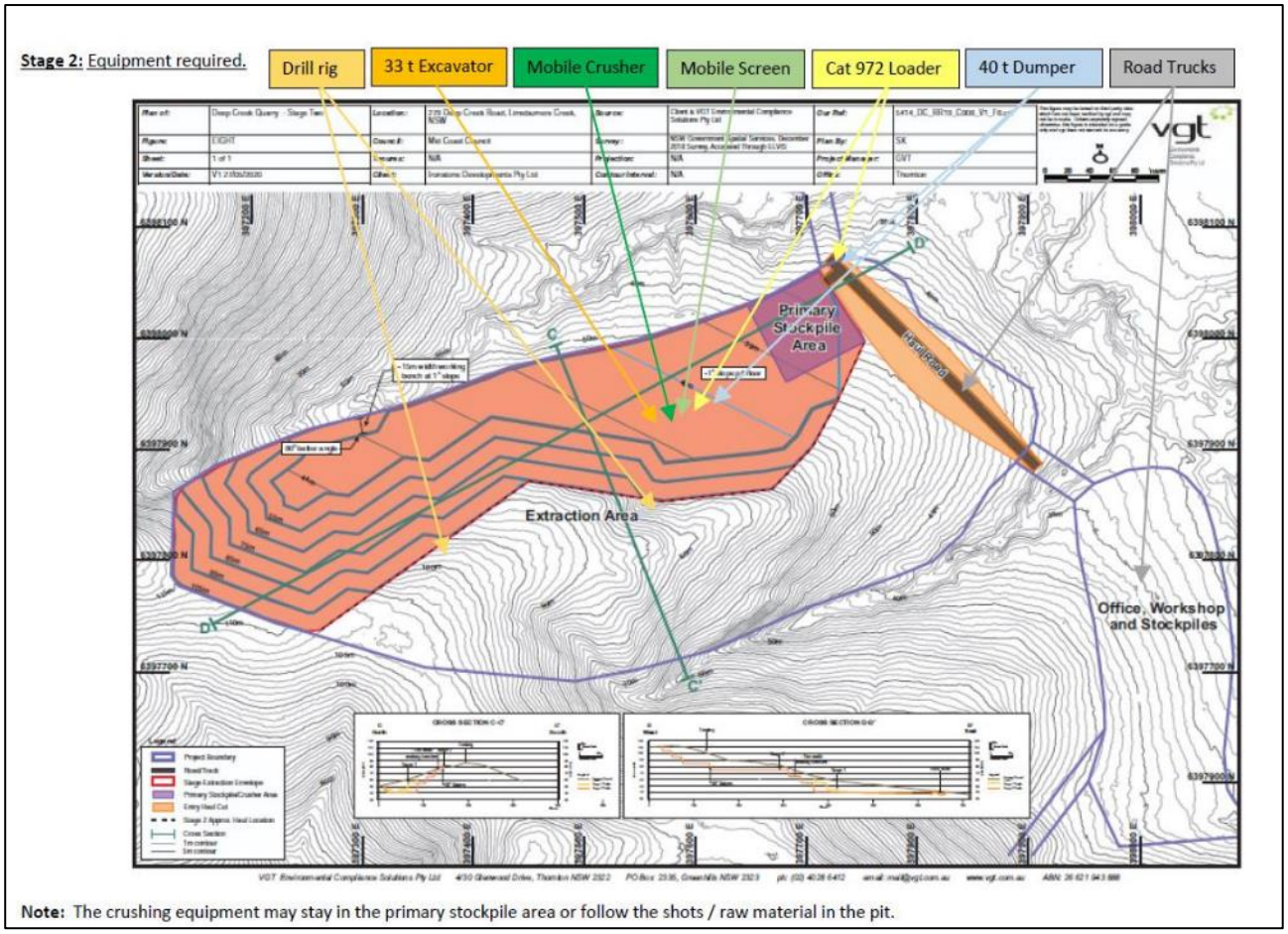
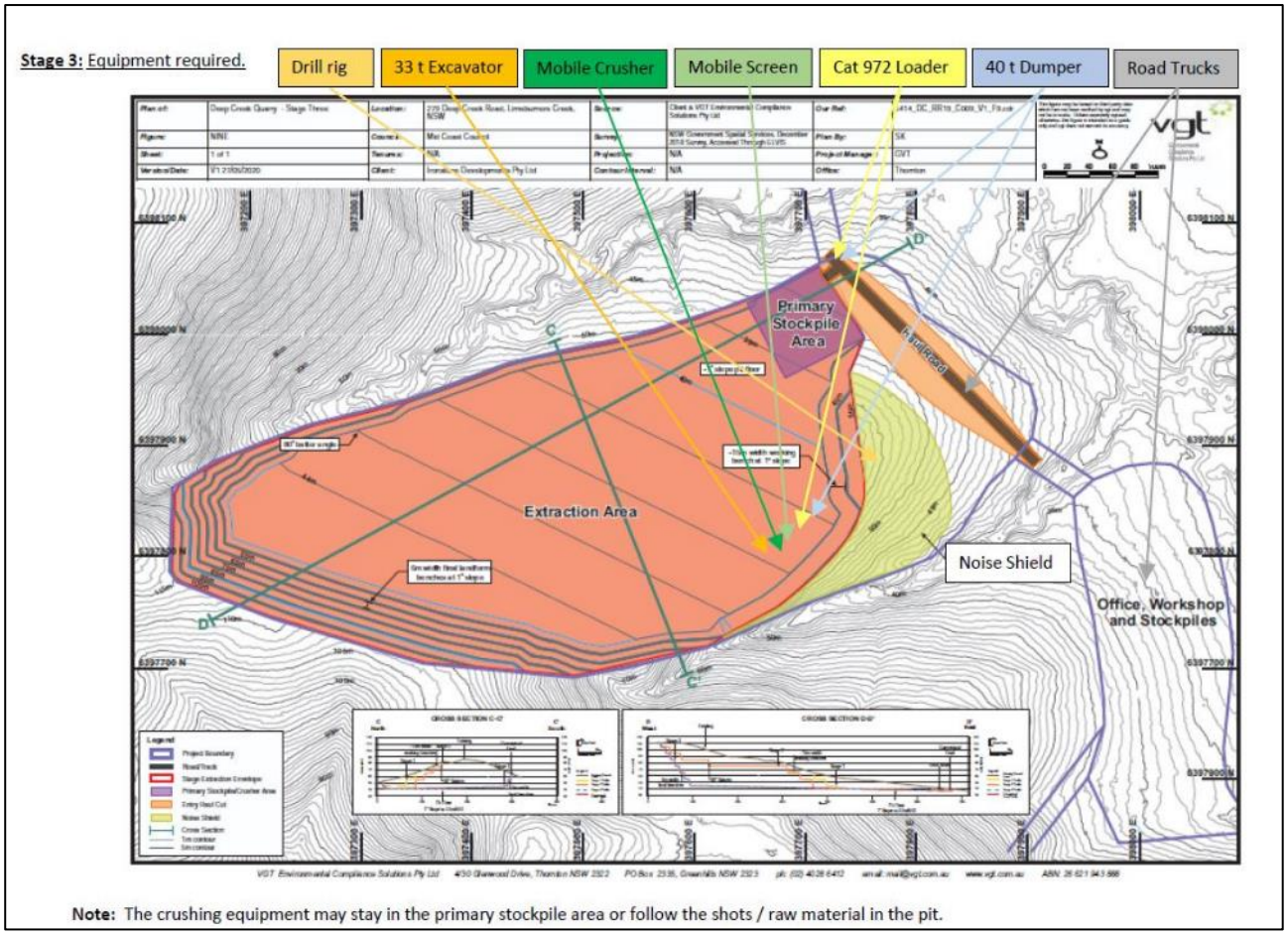


Figure 5: Scenario 3 – Stage 2



Note: The crushing equipment may stay in the primary stockpile area or follow the shots / raw material in the pit.

Figure 6: Scenario 4 – Stage 3

4.2 Noise Sources

The sound power levels of the significant noise-generating equipment used in the modelling of each scenario are listed in **Table 7**.

Table 7

Noise Source Sound Power Levels

Equipment	Number	Use/Activity	Lw, dB(A)	
	500 ktpa		Leq	Lmax
Drill Rig	1	Drilling blast holes (typically used 2-3 days every month)	113	121
Hydraulic Excavator 33t	1	Resource extraction and haul truck loading.	108	113
Front-end Loader (Caterpillar 972K)	1	Haul truck and product truck loading, blending road pavement materials.	110	112
Articulated 40t Haul Truck (Caterpillar 730C or similar)	2	Raw material haulage to processing area.	98	102
Tracked bulldozer (CAT D9)	1	Material handling in extraction area.	108	113
Processing (Twister Trac VS350E)	1	Primary crushing of raw material	113	120
Mobile crusher + screen (Eg Mobicone MCO13 / MS18Z-AD)	1	Secondary crushing and screening of raw material	113	118
Product truck	5*	Hauling product off-site to market	91	115#

* Typical number on-site at any given time.

Impact from truck being loaded.

4.3 Maximum Noise Levels

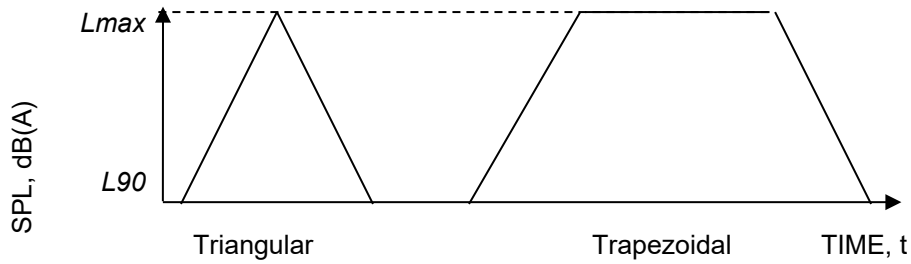
The only activity that would occur between 6:00am and 7:00am is product trucks being loaded and travelling on the Quarry Access Road. Since the maximum noise level from this activity is less than the combined noise level for all operational noise sources, the results of the operation noise impact modelling will be used to inform the necessity of a full quantitative assessment of maximum noise impacts.

4.4 Traffic Noise

Additional traffic noise generated by the Project at residential receivers adjacent to The Bucketts Way will be of a discrete rather than constant nature. There are many methods available for calculating the cumulative noise impact arising from discrete signals of various shapes. The methodology employed in this Section was sourced from the US Environmental Protection Agency document No. 550/9-74-004 *Information on Levels of Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974*.

The document refers to *triangular* and *trapezoidal* time signals, which are illustrated in **Figure 7**. A triangular time signal rises from the background level to a peak noise level and then immediately begins to subside. A triangular time signal is a good approximation of the Sound Pressure Level (SPL) signal of a truck as it passes an observation point. A trapezoidal time signal rises from the background level to a maximum level and sustains that level for a period of time before subsiding. The trapezoidal time signal is a good approximation of the SPL signal of a train as it passes an observation point.

Figure 7: Triangular and trapezoidal noise signals



The value of $L_{eq,T}$ for a series of identical triangular time patterns having a maximum level of L_{max} is given by **Equation 1**.

$$L_{eq},T = L_b + 10\log\left[1 + \frac{ND}{T}\left(\frac{10^{(L\max - Lb)/10} - 1}{2.3} - \frac{\left(L_{\max} - L_b\right)}{10}\right)\right] \quad (1)$$

Where;

- L_b is background noise level, dB(A)
- L_{MAX} is vehicle noise, dB(A)
- T is the time for each group of vehicles (min)
- N is number of vehicle trips
- D is duration of noise of each vehicle (min)

For calculation purposes, Lmax is the maximum vehicle noise at the assessment point(s), and has been based on numerous measurements of quarry truck pass-by noise taken by Spectrum Acoustics at receivers near other quarries in recent years. The background noise level is the level that existed prior to the introduction of the new noise, the L_{A90} level. The assessment period T corresponds to the stated criterion period, that is, 60 minutes.

Between the private access road and the Pacific Highway (where the majority of trucks will travel), there are eight dwellings whose façade is less than 50m from the centre of the nearest travel lane on The Bucketts Way. The village of Limeburners Creek (i.e. off Old Coach Road) is south of the quarry, with the nearest dwelling over 90m from The Bucketts Way. The closest dwelling to The Bucketts Way in this area is 18m from the road. The assessment has evaluated the noise impacts to the closest dwelling, with all other dwellings expected to experience noise levels similar to or lower than the assessed dwelling.

4.5 Blasting and Vibration Assessment

The following sections provide standard equations for predicting blast overpressure and ground vibration levels, sourced from the United States Bureau of Mines.

4.5.1 Blast Overpressure

Unweighted airblast overpressure levels (OP) are predicted from **Equation 2** below.

$$OP = 165 - 24(\log_{10}(D) - 0.3\log_{10}(Q)), \text{ dB} \quad (2)$$

Where; D is distance from the blast to the assessment point (m) and
Q is the weight of explosive per delay (kg).

4.5.2 Blast Vibration

The basic equations for calculation of peak particle vibration (PPV) levels from blasting are as follows:

$$\mathrm{PPV} = 1140\left(\frac{D}{Q^{0.5}}\right)^{-1.6}, \text{ mm/s} \quad \text{(for average ground type)} \tag{3}$$

$$\mathrm{PPV} = 500\left(\frac{D}{Q^{0.5}}\right)^{-1.6}, \text{ mm/s} \quad \text{(for hard rock)} \tag{4}$$

Where; *D* and *Q* are defined as in Equation 1 and 2. Equation 4 has been adopted due to the hard nature of the resource material as no specific site law has been established through trial blasting.

5.0 RESULTS AND DISCUSSION

5.1 Predicted Operational Noise Levels

Noise levels were modelled using Renzo Tonin Associates (RTA) *Environmental Noise Model* v3.06 (ENM) software. Point-to-point calculations were performed for all receivers in Figure 2.

Predicted noise levels for the three modelled scenarios are summarised in **Tables 8** to **11**. Any exceedances of the noise trigger level, if they occur, are highlighted in bold type. Criteria are taken from Table 4.

Receiver R3 and R4a are currently unhabituated with no approved dwelling. Ironstone Developments Pty has a negotiated agreement with these properties. They are included in the tables of results for completion only.

Noise contours are shown in **Appendix B.**

Table 8

Predicted noise levels, dB(A),Leq(15min) - Construction

Receiver	Noise Trigger level	Meteorological conditions			
		Neutral	WNW	NNE	ESE
R1*	45	27	22	<20	20
R2	45	<20	<20	<20	<20
R3*	45	38	38	38	38
R4a*	45	41	**46**	45	41
R4	45	36	37	39	37
R5	45	27	32	31	29
R6	45	26	28	35	26
R7	45	21	30	32	20
R8	45	20	25	30	<20
R9	45	25	25	33	25
R10	45	<20	<20	27	<20
R11	45	<20	<20	29	22
R12	45	<20	<20	26	<20
R13	45	<20	<20	22	<20
R14	45	<20	<20	29	22
R15	45	<20	<20	22	<20
R16	45	<20	<20	27	23
R17	45	<20	<20	24	20
R18	45	<20	<20	24	22
R19	45	<20	<20	<20	<20
R20	45	<20	<20	21	<20
R21	45	<20	<20	<20	<20
R22	45	<20	<20	<20	<20
R23	45	<20	<20	<20	<20
R24	45	<20	<20	<20	21
R25*	45	27	<20	26	36
R26	45	<20	<20	<20	<20
R27	45	<20	<20	<20	<20
R28	45	<20	25	<20	<20
R29	45	28	29	23	28

Receiver	Noise Trigger level	Meteorological conditions			
		Neutral	WNW	NNE	ESE
R30	45	39	38	36	39
R31	45	29	35	28	34
R32	45	40	39	41	40
R33	45	26	32	32	26
R34	45	24	29	29	22
R35	45	22	29	28	<20
R36	45	<20	27	28	<20
R37	45	<20	26	29	<20
R38	45	<20	25	28	<20
R39	45	<20	24	29	<20
R40	45	<20	22	26	<20
R41	45	<20	20	25	<20
R42	45	<20	<20	20	<20
R43	45	<20	<20	<20	<20
R44	45	<20	<20	<20	<20
R45	45	<20	<20	<20	<20
R46	45	<20	<20	<20	<20
R47	45	<20	<20	<20	<20
R48	45	<20	<20	<20	<20
R49	45	<20	<20	<20	<20
R50	45	<20	<20	<20	<20
R51	45	<20	<20	<20	<20
R52	45	<20	<20	<20	<20
R56	45	<20	<20	<20	<20
R57	45	<20	<20	<20	<20
R58	45	<20	<20	<20	21
R59	45	<20	<20	<20	21
R60	45	<20	<20	<20	26
R61	45	<20	<20	<20	<20
R62	45	<20	<20	<20	<20
R63	45	<20	<20	<20	<20
R64	45	<20	<20	<20	<20
R65	45	<20	<20	<20	<20
R66	45	<20	<20	<20	<20
R67	45	<20	<20	<20	<20
R68	45	<20	<20	<20	<20
R69	45	<20	<20	<20	<20
R70	45	<20	<20	<20	<20
R71	45	<20	<20	<20	<20
R72	45	<20	<20	<20	<20
R74	45	<20	<20	<20	<20
R75	45	<20	<20	<20	<20
R76	45	<20	<20	<20	<20
R77	45	<20	<20	<20	<20
R78	45	<20	<20	<20	<20
R80	45	<20	<20	<20	<20
R84	45	<20	<20	<20	<20
R85	45	<20	<20	<20	<20
* No approved dwelling, nominal location selected based on structures present.					

Table 9

Predicted noise levels, dB(A),Leq(15min) – Operations Stage 1

Receiver	Noise Trigger level	Meteorological conditions			
		Neutral	WNW	NNE	ESE
R1*	40	32	28	29	30
R2	40	<20	24	<20	<20
R3*	40	38	39	39	38
R4a*	40	37	39	38	36
R4	40	31	34	35	30
R5	40	24	33	31	28
R6	40	22	25	29	25
R7	40	<20	26	28	<20
R8	40	<20	22	26	<20
R9	40	21	24	27	22
R10	40	<20	<20	25	<20
R11	40	<20	<20	26	<20
R12	40	<20	<20	24	<20
R13	40	<20	<20	21	<20
R14	40	<20	<20	26	<20
R15	40	<20	<20	23	<20
R16	40	<20	<20	26	<20
R17	40	<20	<20	24	<20
R18	40	<20	<20	25	<20
R19	40	<20	<20	23	<20
R20	40	<20	<20	24	<20
R21	40	<20	<20	<20	<20
R22	40	<20	<20	<20	<20
R23	40	<20	<20	<20	21
R24	40	<20	<20	<20	23
R25*	40	30	27	29	40
R26	40	<20	<20	<20	<20
R27	40	<20	<20	<20	<20
R28	40	<20	22	20	<20
R29	40	24	25	20	22
R30	40	32	32	28	32
R31	40	24	30	21	20
R32	40	34	36	36	32
R33	40	25	33	32	23
R34	40	22	30	28	<20
R35	40	21	29	28	<20
R36	40	<20	25	27	<20
R37	40	<20	23	27	<20
R38	40	<20	22	26	<20
R39	40	<20	21	26	<20
R40	40	<20	21	24	<20
R41	40	<20	<20	22	<20
R42	40	<20	<20	21	<20
R43	40	<20	<20	<20	<20
R44	40	<20	<20	<20	<20
R45	40	<20	<20	<20	<20
R46	40	<20	<20	<20	20

Receiver	Noise Trigger level	Meteorological conditions			
		Neutral	WNW	NNE	ESE
R47	40	<20	<20	<20	23
R48	40	<20	<20	<20	23
R49	40	<20	<20	<20	<20
R50	40	<20	<20	<20	<20
R51	40	<20	23	<20	<20
R52	40	<20	26	<20	<20
R56	40	<20	<20	<20	<20
R57	40	<20	<20	<20	<20
R58	40	<20	<20	<20	23
R60	40	<20	<20	<20	27
R61	40	<20	<20	<20	<20
R62	40	<20	<20	<20	<20
R63	40	<20	<20	<20	<20
R64	40	<20	<20	<20	<20
R65	40	<20	<20	<20	<20
R66	40	<20	<20	<20	<20
R67	40	<20	<20	<20	<20
R68	40	<20	<20	<20	<20
R69	40	<20	<20	<20	<20
R70	40	<20	<20	<20	<20
R71	40	<20	<20	<20	<20
R72	40	<20	<20	<20	<20
R74	40	<20	<20	<20	<20
R75	40	<20	<20	<20	<20
R76	40	<20	<20	<20	<20
R77	40	<20	<20	<20	<20
R78	40	<20	<20	<20	<20
R80	40	<20	<20	<20	<20
R84	40	<20	<20	<20	<20
R85	40	<20	<20	<20	<20
* No approved dwelling, nominal location selected based on structures present.					

Table 10

Predicted noise levels, dB(A),Leq(15min) – Operations Stage 2

Receiver	Noise Trigger level	Meteorological conditions			
		Neutral	WNW	NNE	ESE
R1*	40	31	30	30	33
R2	40	22	31	<20	<20
R3*	40	**43**	**48**	43	**40**
R4a*	40	40	**44**	40	38
R4	40	33	39	36	31
R5	40	26	35	33	24
R6	40	25	30	30	24
R7	40	22	31	29	20
R8	40	22	28	28	20
R9	40	24	28	30	23
R10	40	21	25	27	<20
R11	40	22	26	30	21
R12	40	20	24	26	<20
R13	40	<20	21	24	<20

Receiver	Noise Trigger level	Meteorological conditions			
		Neutral	WNW	NNE	ESE
R14	40	30	29	31	22
R15	40	21	23	26	20
R16	40	30	27	32	22
R17	40	30	25	26	21
R18	40	22	25	34	22
R19	40	24	24	30	24
R20	40	21	24	30	21
R21	40	22	21	30	26
R22	40	22	<20	30	33
R23	40	20	<20	24	30
R24	40	20	<20	<20	30
R25*	40	31	28	30	**42**
R26	40	<20	23	<20	<20
R27	40	<20	27	<20	<20
R28	40	<20	30	<20	<20
R29	40	28	33	20	23
R30	40	32	36	28	32
R31	40	24	34	22	20
R32	40	34	39	37	33
R33	40	26	36	32	24
R34	40	23	33	30	21
R35	40	22	32	30	<20
R36	40	<20	31	27	<20
R37	40	21	30	28	<20
R38	40	20	29	27	<20
R39	40	21	28	28	<20
R40	40	<20	27	26	<20
R41	40	<20	25	25	<20
R42	40	25	20	23	21
R43	40	<20	<20	20	<20
R44	40	20	<20	27	25
R45	40	<20	<20	<20	28
R46	40	<20	<20	<20	27
R47	40	<20	<20	<20	29
R48	40	<20	<20	<20	29
R49	40	<20	<20	<20	<20
R50	40	<20	26	<20	<20
R51	40	<20	31	<20	<20
R52	40	<20	31	<20	<20
R56	40	<20	<20	<20	<20
R57	40	<20	<20	<20	<20
R58	40	<20	<20	<20	25
R60	40	<20	<20	<20	30
R61	40	<20	<20	<20	<20
R62	40	<20	<20	<20	<20
R63	40	<20	<20	<20	<20
R64	40	<20	<20	<20	<20
R65	40	<20	<20	<20	<20
R66	40	<20	<20	<20	<20

Receiver	Noise Trigger level	Meteorological conditions			
		Neutral	WNW	NNE	ESE
R67	40	<20	<20	<20	<20
R68	40	<20	<20	<20	<20
R69	40	<20	<20	<20	<20
R70	40	<20	<20	<20	<20
R71	40	<20	24	<20	<20
R72	40	<20	27	<20	<20
R74	40	<20	<20	<20	<20
R75	40	<20	<20	<20	<20
R76	40	<20	<20	<20	<20
R77	40	<20	<20	<20	<20
R78	40	<20	<20	<20	<20
R80	40	<20	20	<20	<20
R84	40	<20	<20	<20	<20
R85	40	<20	<20	<20	<20
* No approved dwelling, nominal location selected based on structures present.					

Table 11

Predicted noise levels, dB(A),Leq(15min) – Operations Stage 3

Receiver	Noise Trigger level	Meteorological conditions			
		Neutral	WNW	NNE	ESE
R1*	40	30	31	28	30
R2	40	22	29	<20	<20
R3*	40	38	**47**	35	35
R4a*	40	37	**44**	39	37
R4	40	32	38	35	30
R5	40	27	37	32	24
R6	40	25	29	30	24
R7	40	23	30	29	21
R8	40	21	25	27	21
R9	40	24	25	30	23
R10	40	<20	23	27	<20
R11	40	<20	21	26	<20
R12	40	<20	20	25	<20
R13	40	<20	<20	23	<20
R14	40	<20	21	26	20
R15	40	<20	<20	25	<20
R16	40	<20	20	26	20
R17	40	<20	<20	25	<20
R18	40	<20	<20	26	20
R19	40	<20	<20	24	23
R20	40	<20	<20	25	<20
R21	40	<20	<20	22	<20
R22	40	<20	<20	<20	<20
R23	40	<20	<20	21	25
R24	40	<20	<20	<20	26
R25*	40	31	28	30	40
R26	40	<20	20	<20	<20
R27	40	<20	22	<20	<20
R28	40	<20	24	<20	<20

Receiver	Noise Trigger level	Meteorological conditions			
		Neutral	WNW	NNE	ESE
R29	40	25	29	20	23
R30	40	32	34	29	32
R31	40	24	31	22	20
R32	40	34	39	36	32
R33	40	27	36	34	25
R34	40	24	35	32	21
R35	40	23	33	31	20
R36	40	20	29	29	<20
R37	40	20	26	28	<20
R38	40	<20	25	27	<20
R39	40	20	24	28	<20
R40	40	<20	26	28	<20
R41	40	<20	24	26	<20
R42	40	<20	<20	25	<20
R43	40	<20	<20	22	<20
R44	40	<20	<20	20	21
R45	40	<20	<20	<20	<20
R46	40	<20	<20	<20	<20
R47	40	<20	<20	<20	23
R48	40	<20	<20	<20	23
R49	40	<20	<20	<20	<20
R50	40	<20	22	<20	<20
R51	40	<20	25	<20	<20
R52	40	<20	27	<20	<20
R56	40	<20	<20	<20	<20
R57	40	<20	<20	<20	<20
R58	40	<20	<20	<20	25
R60	40	<20	<20	<20	28
R61	40	<20	<20	<20	<20
R62	40	<20	<20	<20	<20
R63	40	<20	<20	<20	<20
R64	40	<20	<20	<20	<20
R65	40	<20	<20	<20	<20
R66	40	<20	<20	<20	<20
R67	40	<20	<20	<20	<20
R68	40	<20	<20	<20	<20
R69	40	<20	<20	<20	<20
R70	40	<20	<20	<20	<20
R71	40	<20	20	<20	<20
R72	40	<20	22	<20	<20
R74	40	<20	<20	<20	<20
R75	40	<20	<20	<20	<20
R76	40	<20	<20	<20	<20
R77	40	<20	<20	<20	<20
R78	40	<20	<20	<20	<20
R80	40	<20	20	<20	<20
R84	40	<20	<20	<20	<20
R85	40	<20	<20	<20	<20
* No approved dwelling, nominal location selected based on structures present.					

The results in **Tables 10** to **12** predict noise levels below the project noise trigger level at all assessed receivers with the following exceptions:

Receiver R25: 2dB exceedance under ESE winds during Stage 2, and at, but not exceeding noise criteria during ESE winds in other Stage 1 and 3.

Receiver R3 (associated property): 4-8 dB exceedance under WNW winds from Stage 2 onwards.
Receiver R4a (associated property): 4 dB exceedance under WNW winds from Stage 3 onwards.

Receiver 3, 4, and 4a have agreements in place with Ironstone Developments Pty Ltd accounting for potential noise impacts due to quarrying activity.

5.2 VLAMP Assessment

The DPE's *Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extraction Industry Development* (VLAMP) lists five (5) different levels of noise impact and recommended actions. These impact levels and actions are shown in **Table 12**.

Table 12

VLAMP Noise Categories and Recommended Actions

Noise Category	Project Noise Levels	Recommended action
1. Negligible	0-2 dB(A) above PNTL	Not a discernible noise impact – no action required
2. Marginal	3-5 dB(A) above PNTL and project contributes less than 1 dB at residence	Mechanical ventilation and air conditioning
3. Moderate	3-5 dB(A) above PNTL and project contributes more than 1 dB at residence	Mechanical ventilation, air conditioning and facade upgrade
4. Significant	More than 5 dB(A) above PNTL at residence	Mechanical ventilation, air conditioning and facade upgrade, property acquisition
5. Significant	More than 5 dB(A) above amenity limit over 25% of land area	Property acquisition

The noise impact assessment in Section 5.1 found that none of the assessed receivers (residences) would be impacted under any noise category in Table 12 apart from Receiver R3 as discussed in Section 5.1. Receiver R3 has an agreement with Ironstone Developments Pty Ltd accounting for noise impacts from the quarry.

5.3 Maximum Noise Levels

The predicted worst case noise level of 48 dB(A),Leq(15min) at R3 was based on all sources operating simultaneously. As discussed in Section 4.3 the Lmax sound power level of the night time source (truck loading) is less than the total daytime LAeq sound power and the predicted maximum levels must be lower than 48 dB(A) at all receivers. This is well below the 52 dB(A),Lmax default minimum sleep disturbance noise screening level and no further quantitative assessment is required.

5.4 Off-Site Road Traffic

5.4.1 Traffic Types and Levels

The Applicant anticipates that the bulk of the products would be despatched from the Site using truck and dog trailers of various configurations, i.e. with a capacity of between 32.5t and 37.5t, smaller quantities of products would be despatched by semi-trailers (27.5t to 30t capacity) or rigid trucks (12.5t to 18t capacity).

Traffic levels would vary substantially on a daily basis throughout the life of the Project. For the purposes of this assessment, daily loads despatched would average 55 laden trucks with annual production typically around 500 000 tonnes. A maximum of 25 laden trucks per hour is proposed to account for potential morning traffic peaks, with a daily maximum of 4,000 tonnes per day (approximately 125 laden trucks per day). A worst case of 50 movements per hour was considered in the assessment of potential noise impacts.

5.4.2 Product Transport Routes

All laden trucks departing the quarry would travel eastwards on a private access road from the Quarry to a new intersection on The Bucketts Way. The private access road will be a two-way, two-lane, sealed road that runs east-west perpendicular to, and on the western side of, The Bucketts Way. Unladen trucks travelling to the Site from The Bucketts Way would approach either from northbound or southbound prior to entering the new private access road. It is expected the majority of traffic will approach from and leave to the south (i.e. to access the Pacific Highway).

5.4.3 Traffic Noise Impact Assessment

Based on the maximum annual product despatch rate of 500 000t, the Project would generate on average 55 laden truck movements per day, with 25 laden trucks per hour maximum, or 50 movements, half as arriving empty trucks and half as departing full trucks.

Between the private access road and the Pacific Highway (where the majority of trucks will travel), there are eight dwellings whose façade is less than 50m from the centre of the nearest travel lane on The Bucketts Way. The village of Limeburners Creek (i.e. off Old Coach Road) is south of the quarry, with the nearest dwelling over 90m from The Bucketts Way. The closest dwelling to The Bucketts Way in this area is 18m from the road. The assessment has evaluated the noise impacts to the closest dwelling, with all other dwellings expected to experience noise levels similar to or lower than the assessed dwelling.

Point calculation modelling resulted in a road traffic noise level of 43 dB(A),Leq(1hour) based on a nominal speed of 90km/h. This is significantly below the adopted criterion of 55 dB(A),Leq(1hour).

There is the possibility of additional road traffic generation by the proposed Hillview Quarry, located to the north of DCQ off Maytom's Lane at Booral. The maximum production rate for that quarry would be 1.5Mtpa. Being triple the production rate of DCQ, the maximum morning heavy vehicle numbers would be 5 dB greater than for DCQ, or 48 dB(A),Leq(1hour). The cumulative level of 50 dB(A) at the closest dwelling is 5 dB below the adopted criterion of 55 dB(A).

5.5 Blasting and Vibration Assessment

Predicted blast overpressure and ground vibration levels at the nearest residential receivers in each direction from the Site are shown in **Table 13**. Calculations are based on charge weights (Maximum Instantaneous Charge weight, [MIC]) of a nominal 60kg and a likely maximum value of 80kg.

Table 13

Predicted Blast Impacts

Receiver	Distance (m)[a]	Criterion		MIC = 60 kg		MIC = 80 kg	
		PPV[b]	OP[c]	PPV	OP	PPV	OP
R19 (south)	1020	5	115	0.2	102	0.3	103
R22 (west)	1680	5	115	0.1	97	0.1	98
R24 (north)	1370	5	115	0.1	99	0.2	100
R3 (east)	500	5	115	0.6	109	0.8	110

[a] Distance from receiver to closest point of extraction area.
[b] Peak vertical ground vibration, mm/s.
[c] Blast overpressure, dB.

The results in **Table 13** confirm that blast vibration and overpressure levels will be below the 5% exceedance criteria at the assessed residential receivers. A maximum of 5% of blasts per year can exceed these criteria as discussed in Section 3.7.1.

6.0 MANAGEMENT AND MONITORING

A Noise Management Plan (NMP) should be developed for the quarry prior to the commencement of construction, it is recommended that at a minimum the NMP should include:

- A noise monitoring program, including:
  - Noise monitoring on commencement of construction and on a quarterly basis for at least the first year of operation to determine compliance with the noise criteria and to inform any further noise mitigation works, should the need arise. Monitoring locations would include R6 and/or R19 and R25.
- Management controls to minimise noise impacts, including:
  - Relevant best practice noise management practices.
  - Ensuring plant and equipment used onsite are generally consistent with the sound power levels used in this noise modelling assessment.
  - The location of plant and equipment relative to bunding and screens is generally consistent with this noise modelling assessment.
- Response protocols in the event of a monitored exceedance or noise complaint and implementation of reasonable feasible mitigation measures where criteria is exceeded.

A Blast Management Plan should be developed prior to undertaking blasting onsite, the Blast Management Plan should include vibration monitoring protocols for each blast and response protocols in the event of any exceedance of blast vibration criteria.

7.0 SEARS REQUIREMENTS

Table 14 details where the report assessment contained in the SEARs have been addressed in this report.

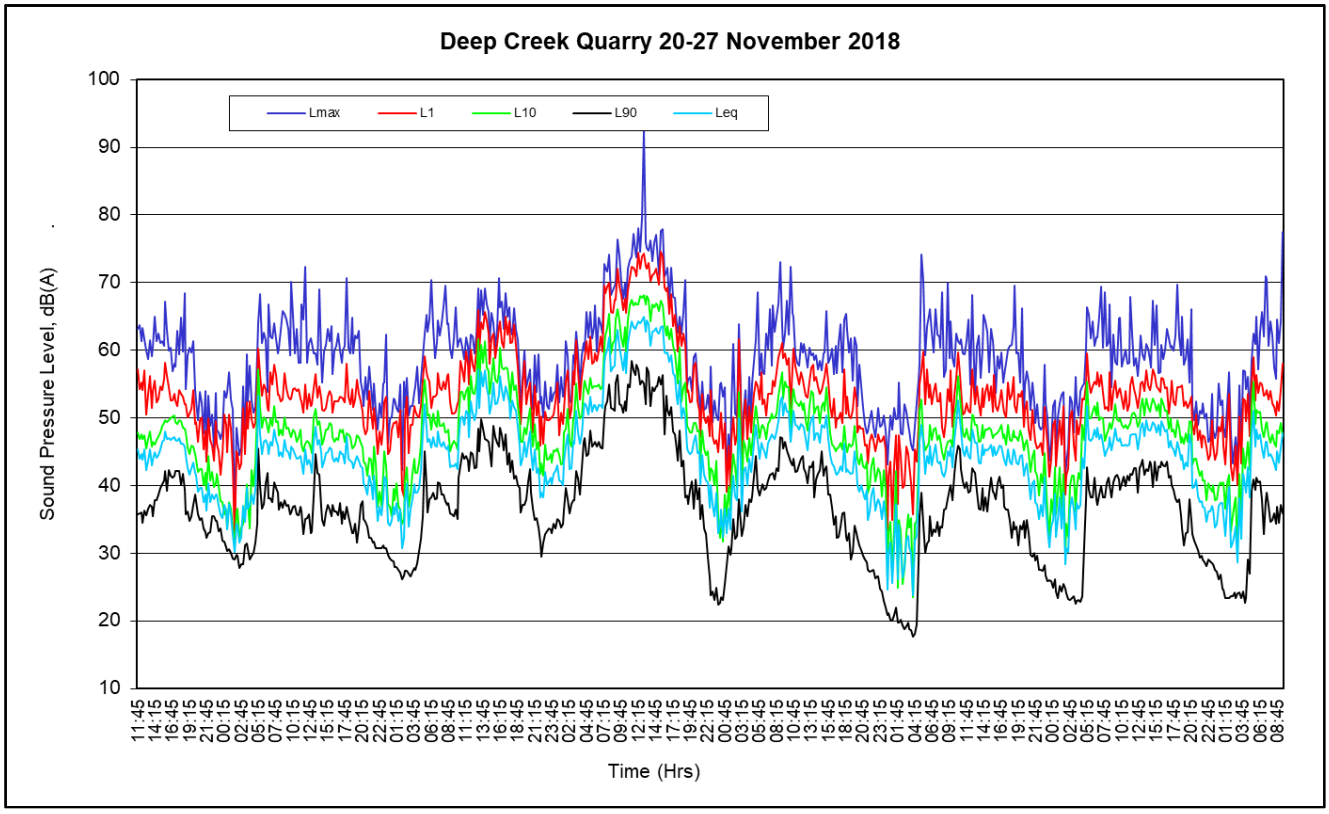
Table 14

Coverage of SEARs and Additional Matters

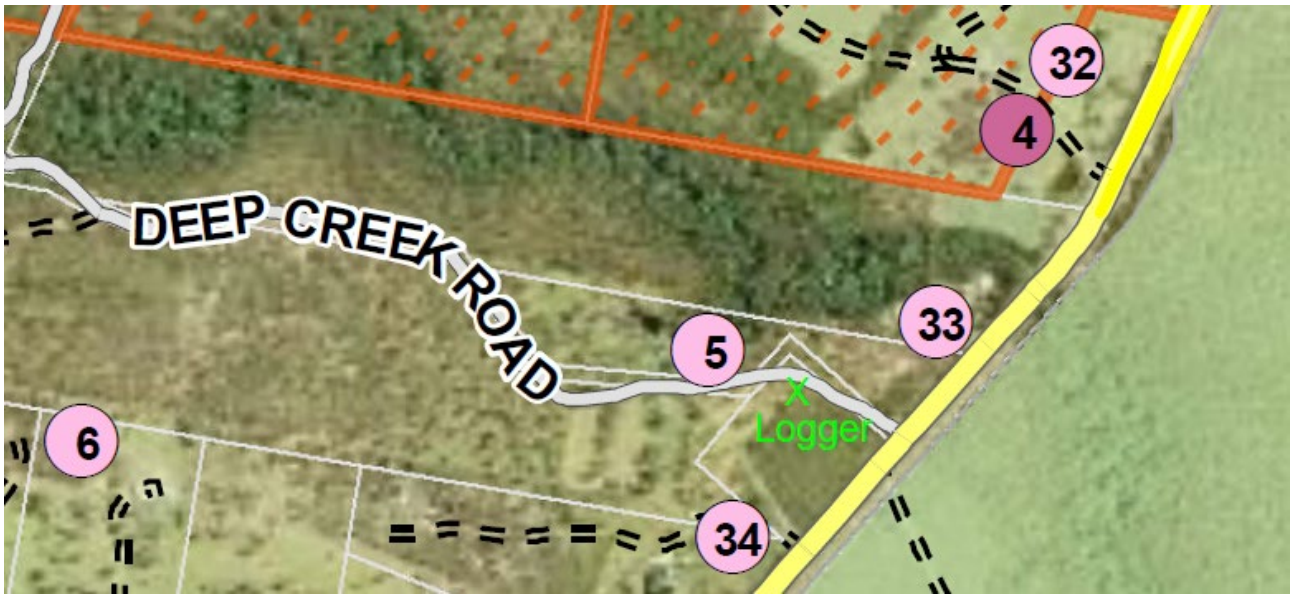
Government Agency	Paraphrased Requirement	Relevant Section(s)
DPIE	Detailed assessment of construction noise – Interim Construction Noise Guideline (DECC, 2009)	3.5, 5.1
	Detailed assessment of operational noise – NSW Noise Policy for Industry (NPI)	3.3, 4.1, 5.1
	Detailed assessment of offsite transport noise – NSW Road Noise Policy (DECCW, 2011)	3.6, 4.5, 5.5
	Consider Voluntary Land Acquisition and Management Policy (VLAMP)	5.3
	Proposed blasting hours, frequency and methods	4.6
	Detailed blast assessment – Australian and New Zealand Environment Council (ANZEC)	5.6
	Reasonable and feasible mitigation measures	1.1
	Monitoring and management measures	6.0

APPENDIX A

NOISE DATA CHART

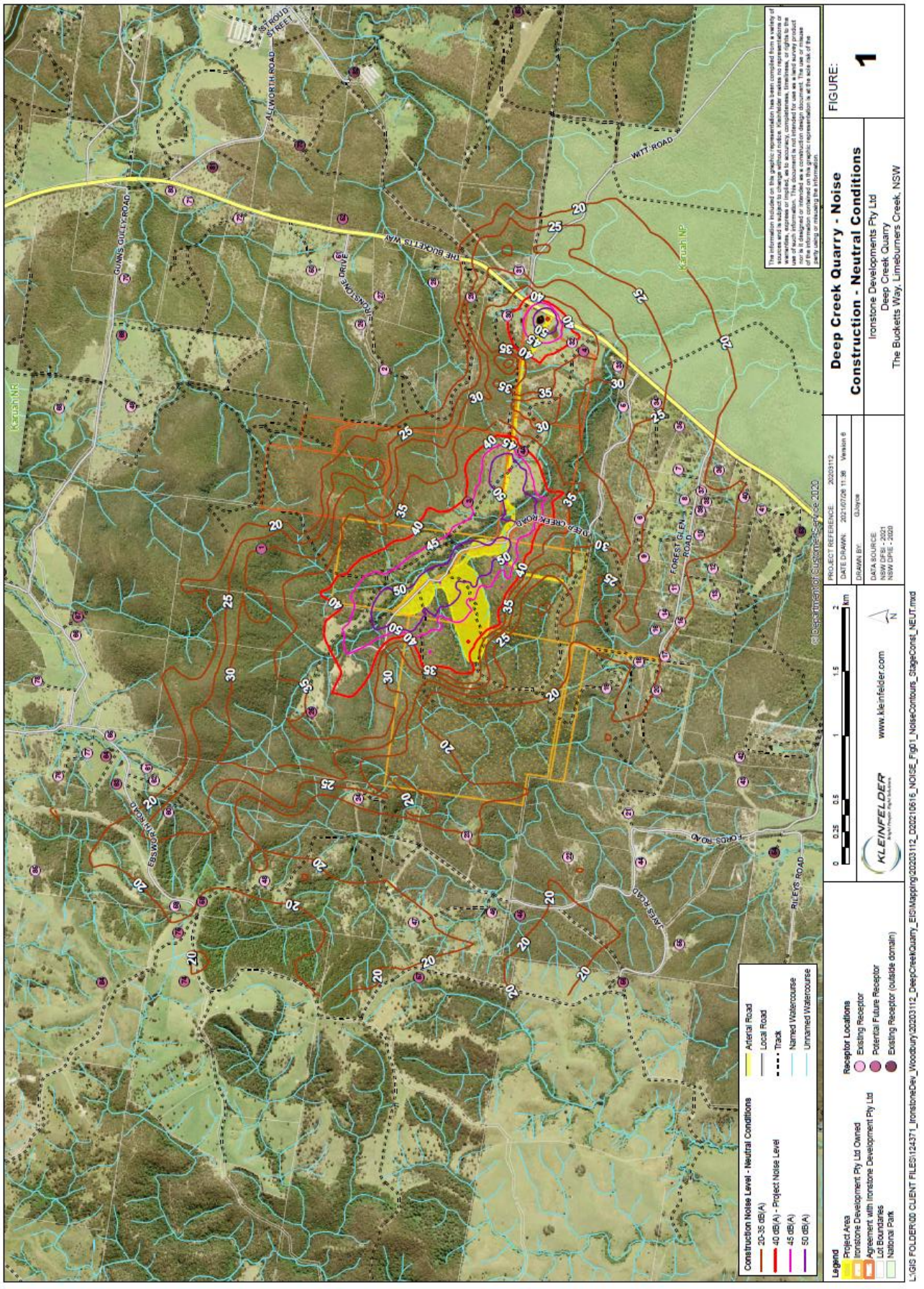


The Noise Logger was positioned just off Deep Creek Road, approximately 150m from The Bucketts Way. The logger was placed and collected by Neil Pennington of Spectrum Acoustics, at approximately the location shown below:



APPENDIX B

NOISE CONTOURS


Deep Creek Quarry - Noise
Construction - Neutral Conditions
Ironstone Developments Pty Ltd
Deep Creek Quarry
The Bucketts Way, Limeburners Creek, NSW
FIGURE:
1
PROJECT REFERENCE: 20203112
DATE DRAWN: 2021/07/26 11:36
Version 6
DRAWN BY: GJoyce
DATA SOURCE
NSW DFSI - 2021
NSW DPIE - 2020
KLEINFELDER
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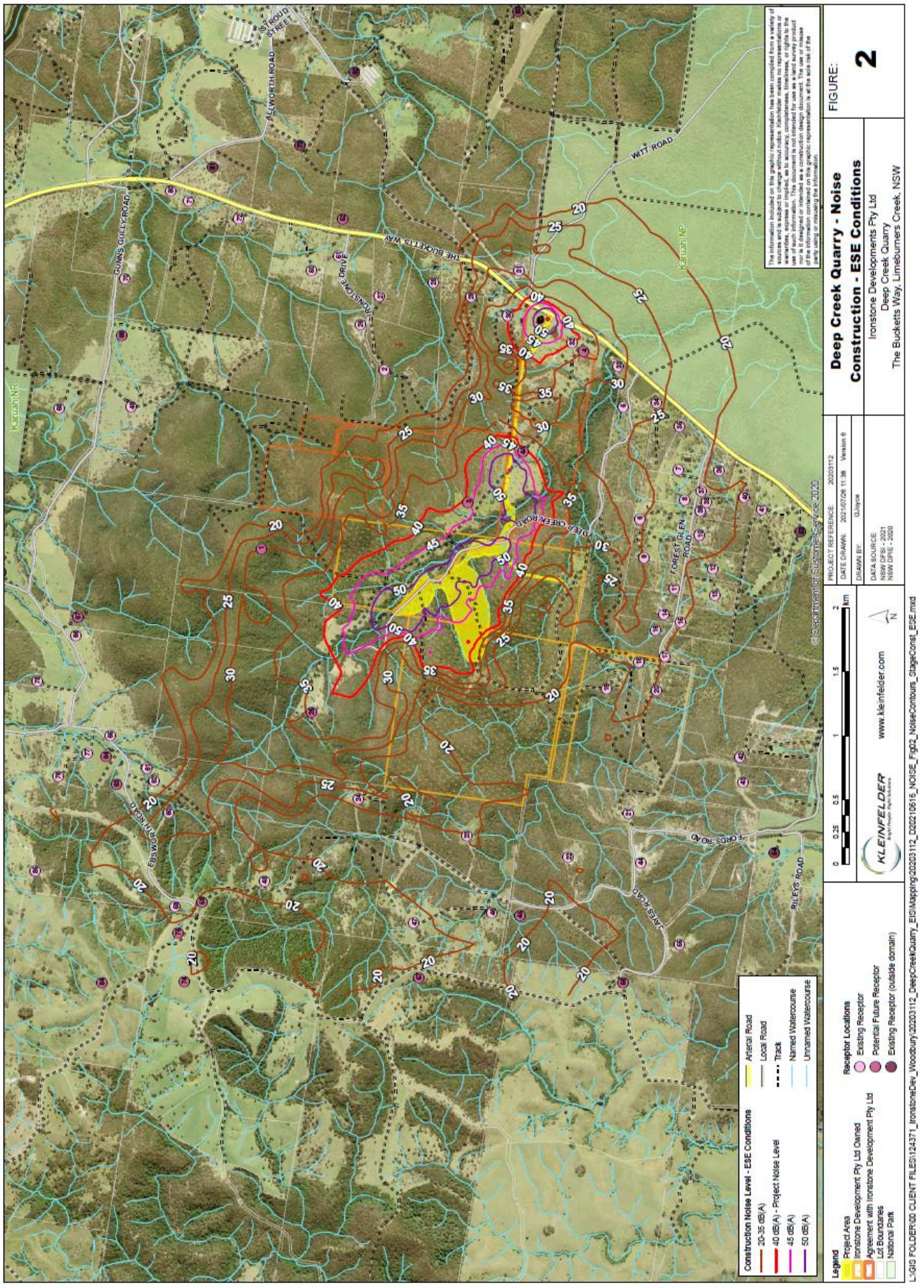
Km
Legend
Project Area
Ironstone Development Pty Ltd Owned
Agreement with Ironstone Development Pty Ltd
Lot Boundaries
National Park
Receptor Locations
Existing Receptor
Potential Future Receptor
Existing Receptor (outside domain)
Construction Noise Level - Neutral Conditions
20-35 dB(A)
40 dB(A) - Project Noise Level
45 dB(A)
50 dB(A)
Arterial Road
Local Road
Track
Named Watercourse
Unnamed Watercourse
WITT ROAD
ALLWORTH ROAD
GLENS GULLY ROAD
THE BUCKETTS WAY
BONES DRIVE
DEEP CREEK ROAD
FOREST GLEN ROAD
RILEYS ROAD
KAMILAROI HIGHWAY
Karuah NP
L:\GIS FOLDER\00 CLIENT FILES\1124371_IronstoneDev_Woodbury\20203112_DeepCreekQuarry_EIS\Mapping\20203112_D20210616_NOISE_Fig01_NoiseContours_StageConst_NEUT.mxd


Deep Creek Quarry - Noise
Construction - ESE Conditions
Ironstone Developments Pty Ltd
Deep Creek Quarry
The Bucketts Way, Limeburners Creek, NSW
FIGURE:
2
Construction Noise Level - ESE Conditions
20-35 dB(A)
40 dB(A) - Project Noise Level
45 dB(A)
50 dB(A)
Arterial Road
Local Road
Track
Named Watercourse
Unnamed Watercourse
Legend
Project Area
Ironstone Development Pty Ltd Owned
Agreement with Ironstone Development Pty Ltd
Lot Boundaries
National Park
Receptor Locations
Existing Receptor
Potential Future Receptor
Existing Receptor (outside domain)
PROJECT REFERENCE: 20203112
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DRAWN BY: GJoyce
DATA SOURCE
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NSW DPIE - 2020
KLEINFELDER
www.kleinfelder.com
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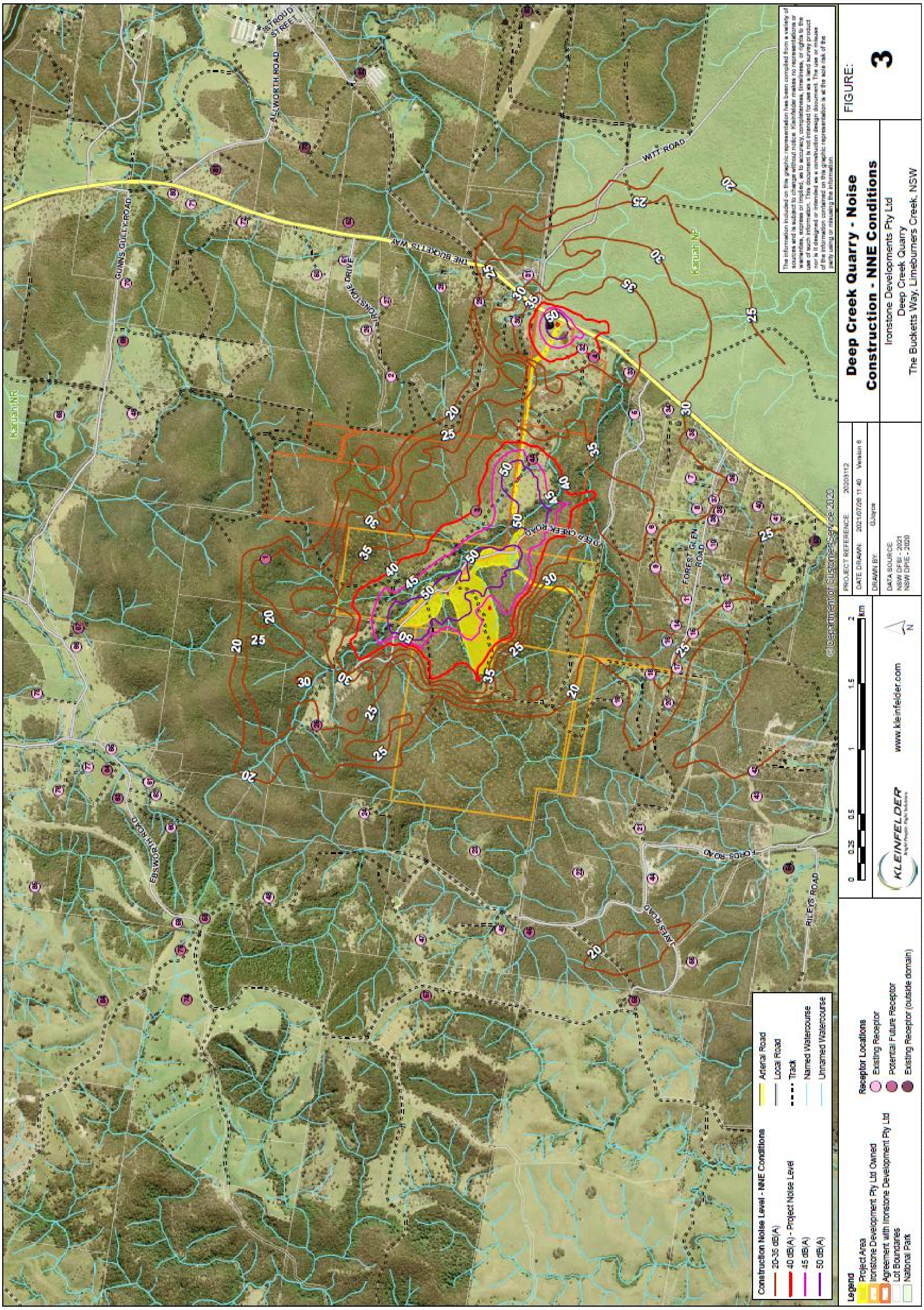
Deep Creek Quarry - Noise
Construction - NNE Conditions
Ironstone Developments Pty Ltd
Deep Creek Quarry
The Bucketts Way, Limeburners Creek, NSW
FIGURE:
3
PROJECT REFERENCE: 20203112
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DRAWN BY: GJoyce
DATA SOURCE: NSW DFSI - 2021 NSW DPIE - 2020
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KLEINFELDER
Construction Noise Level - NNE Conditions
20-35 dB(A)
40 dB(A) - Project Noise Level
45 dB(A)
50 dB(A)
Arterial Road
Local Road
Track
Named Watercourse
Unnamed Watercourse
Legend
Project Area
Ironstone Development Pty Ltd Owned
Agreement with Ironstone Development Pty Ltd
Lot Boundaries
National Park
Receptor Locations
Existing Receptor
Potential Future Receptor
Existing Receptor (outside domain)
THE BUCKETTS WAY
DEEP CREEK ROAD
FOREST GLEN ROAD
WITT ROAD
GUNNS GULLY ROAD
ALLWORTH ROAD
STROUD STREET
IRONSTONE DRIVE
EBSWORTH ROAD
RILEYS ROAD
FORDS ROAD
Karuah NP
Karuah NR
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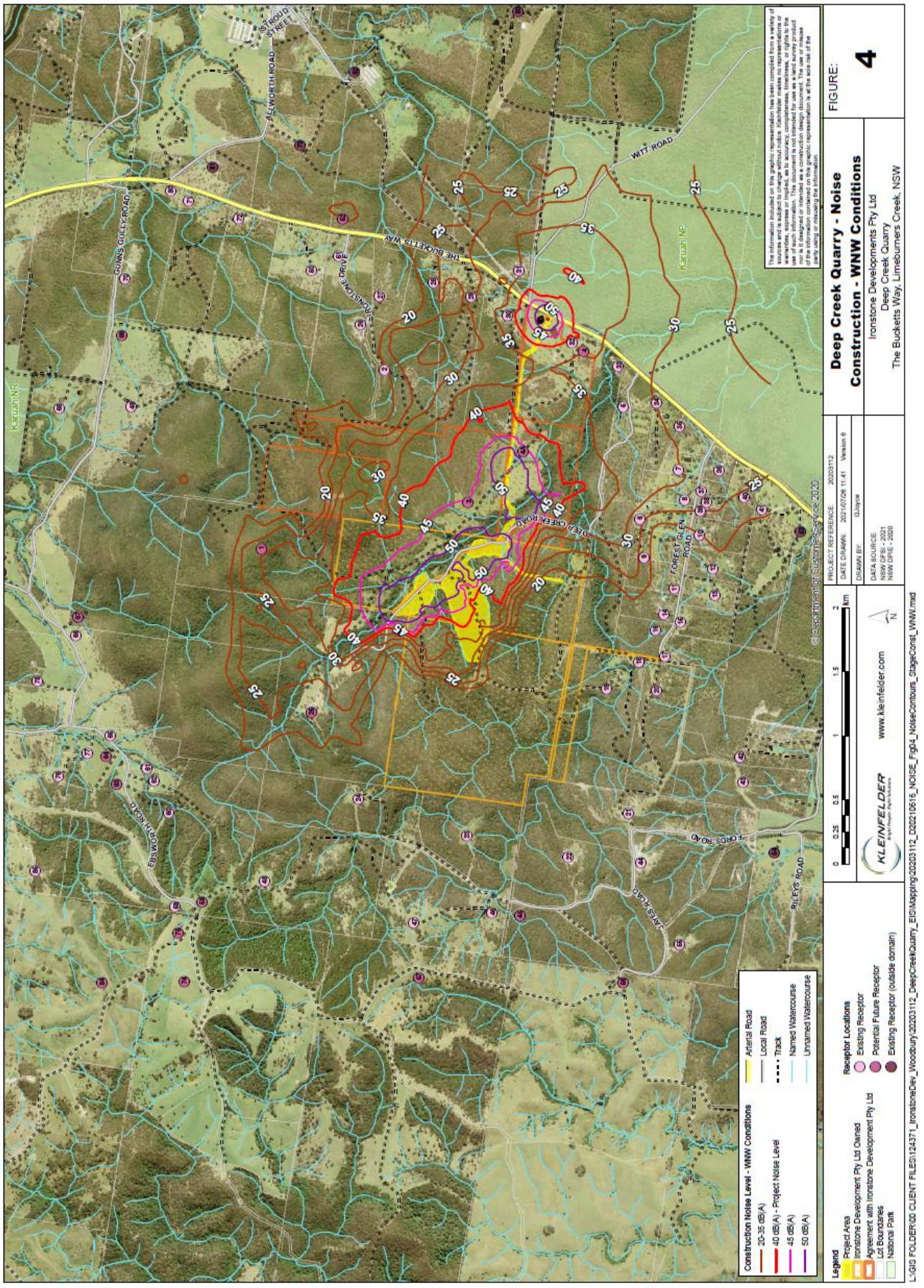
Deep Creek Quarry - Noise
Construction - WNW Conditions
Ironstone Developments Pty Ltd
Deep Creek Quarry
The Bucketts Way, Limeburners Creek, NSW
FIGURE:
4
Construction Noise Level - WNW Conditions
20-35 dB(A)
40 dB(A) - Project Noise Level
45 dB(A)
50 dB(A)
Arterial Road
Local Road
Track
Named Watercourse
Unnamed Watercourse
Legend
Project Area
Ironstone Development Pty Ltd Owned
Agreement with Ironstone Development Pty Ltd
Lot Boundaries
National Park
Receptor Locations
Existing Receptor
Potential Future Receptor
Existing Receptor (outside domain)
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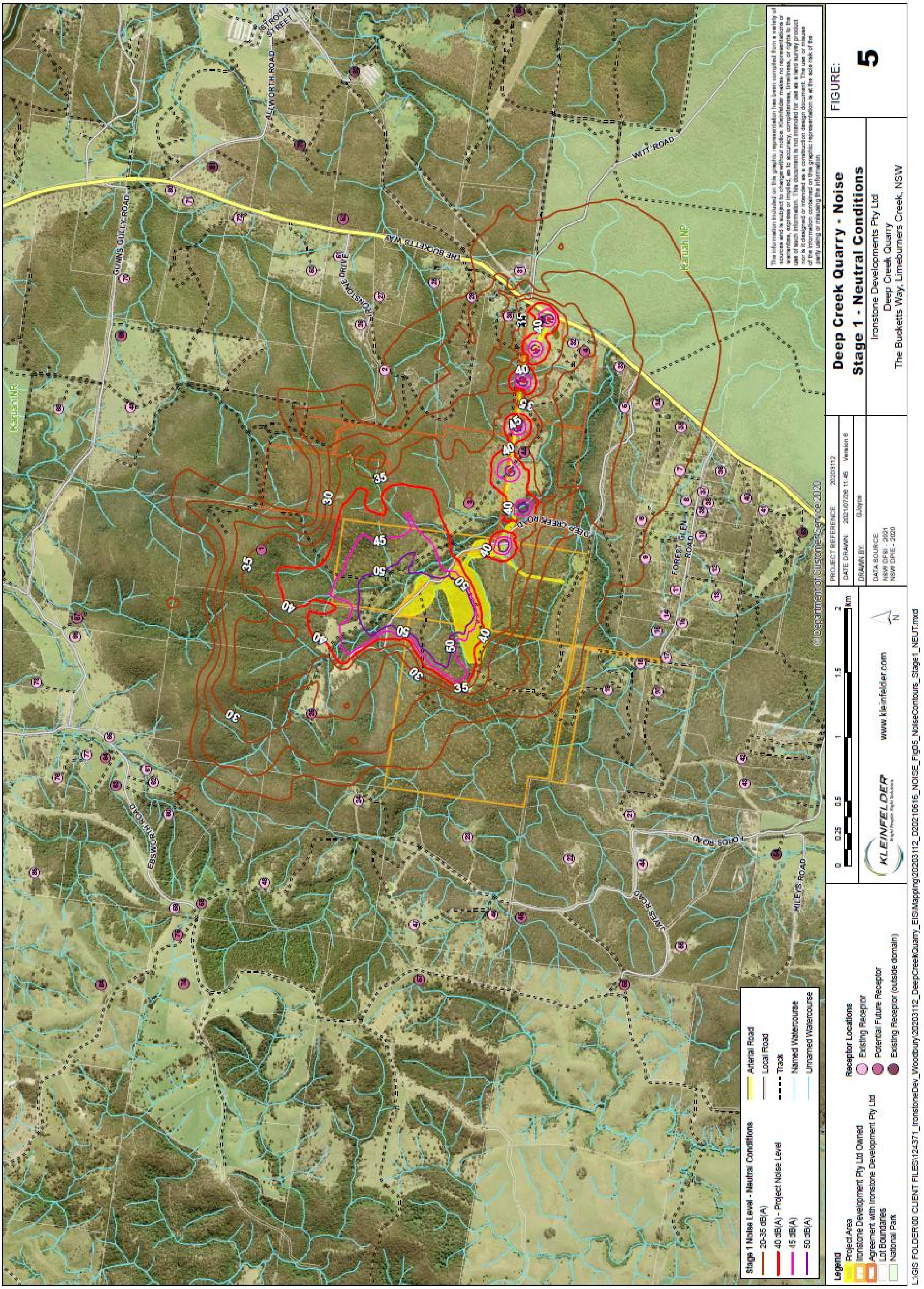
WITT ROAD
ALLWORTH ROAD
ST ROUD STREET
GUNNS GULLY ROAD
THE BUCKETTS WAY
FORSTER DRIVE
DEEP CREEK ROAD
FOREST GLEN ROAD
COMBS ROAD
RILEYS ROAD
Karuah NP
Karuah NP


Deep Creek Quarry - Noise
Stage 1 - Neutral Conditions
Ironstone Developments Pty Ltd
Deep Creek Quarry
The Bucketts Way, Limeburners Creek, NSW
FIGURE:
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PROJECT REFERENCE: 20203112
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DATA SOURCE:
NSW DFSI - 2021
NSW DPIE - 2020
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KLEINFELDER
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© Department of Customer Service 2020
Stage 1 Noise Level - Neutral Conditions
20-35 dB(A)
40 dB(A) - Project Noise Level
45 dB(A)
50 dB(A)
Arterial Road
Local Road
Track
Named Watercourse
Unnamed Watercourse
Legend
Project Area
Ironstone Development Pty Ltd Owned
Agreement with Ironstone Development Pty Ltd
Lot Boundaries
National Park
Receptor Locations
Existing Receptor
Potential Future Receptor
Existing Receptor (outside domain)
THE BUCKETTS WAY
DEEP CREEK ROAD
IRONSTONE DRIVE
GUNNS GULLY ROAD
ALLWORTH ROAD
STROUD STREET
WITT ROAD
FOREST GLEN ROAD
EBSWORTH ROAD
RILEYS ROAD
FORDS ROAD
Karuah NP
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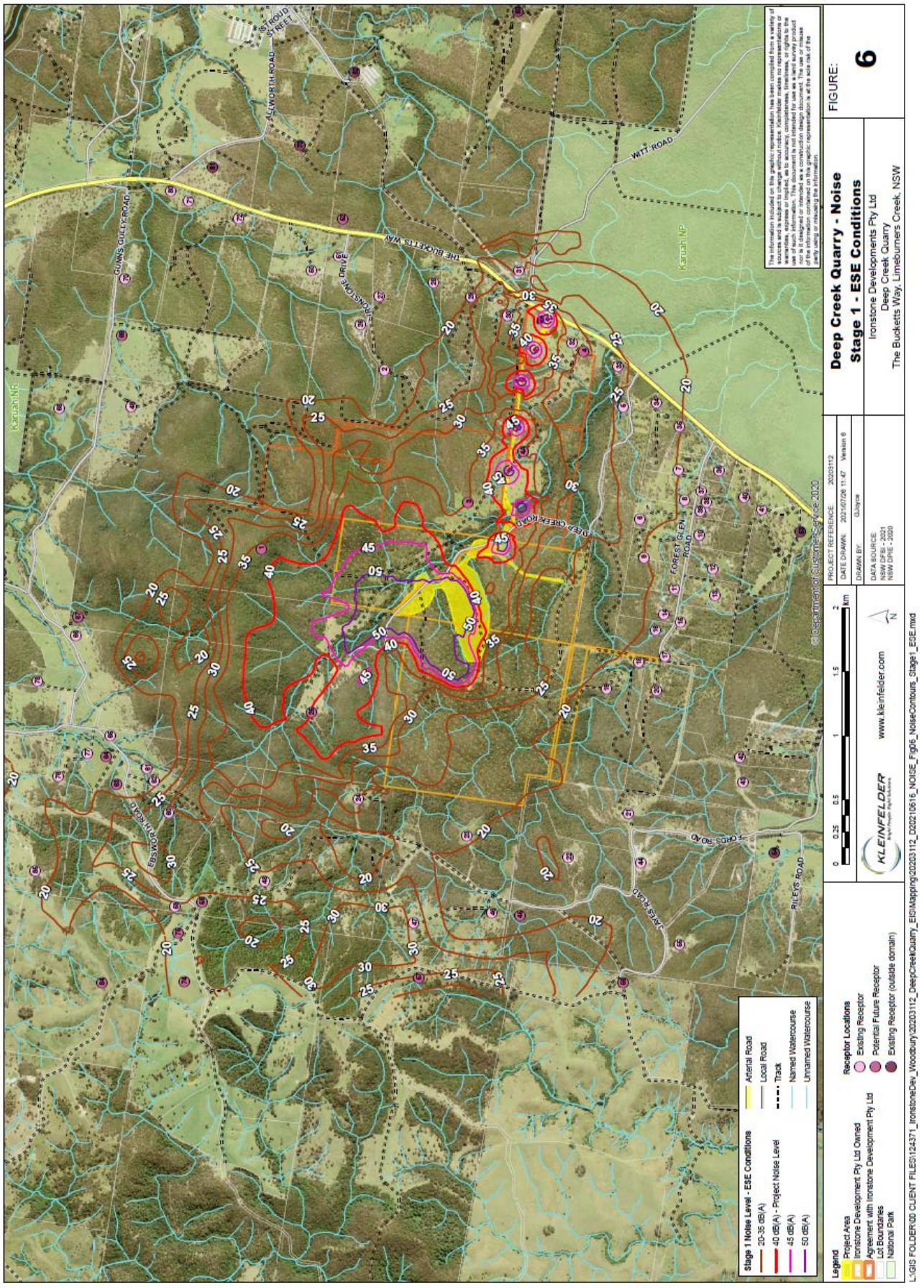
Deep Creek Quarry - Noise
Stage 1 - ESE Conditions
Ironstone Developments Pty Ltd
Deep Creek Quarry
The Bucketts Way, Limeburners Creek, NSW
FIGURE:
6
Stage 1 Noise Level - ESE Conditions
20-35 dB(A)
40 dB(A) - Project Noise Level
45 dB(A)
50 dB(A)
Arterial Road
Local Road
Track
Named Watercourse
Unnamed Watercourse
Receptor Locations
Existing Receptor
Potential Future Receptor
Existing Receptor (outside domain)
Legend
Project Area
Ironstone Development Pty Ltd Owned
Agreement with Ironstone Development Pty Ltd
Lot Boundaries
National Park
PROJECT REFERENCE: 20203112
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DATA SOURCE
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NSW DPIE - 2020
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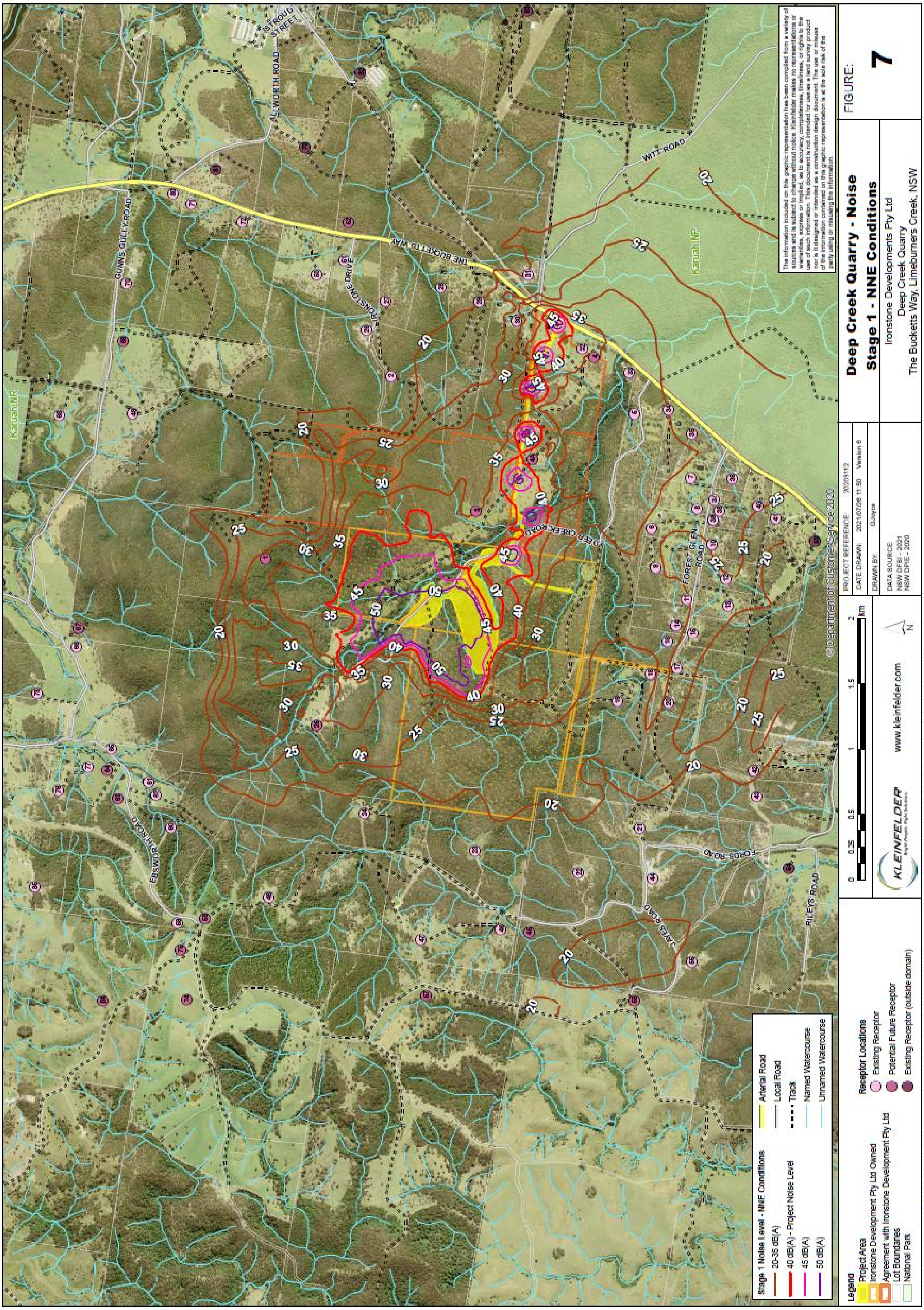
Deep Creek Quarry - Noise
Stage 1 - NNE Conditions
Ironstone Developments Pty Ltd
Deep Creek Quarry
The Bucketts Way, Limeburners Creek, NSW
FIGURE:
7
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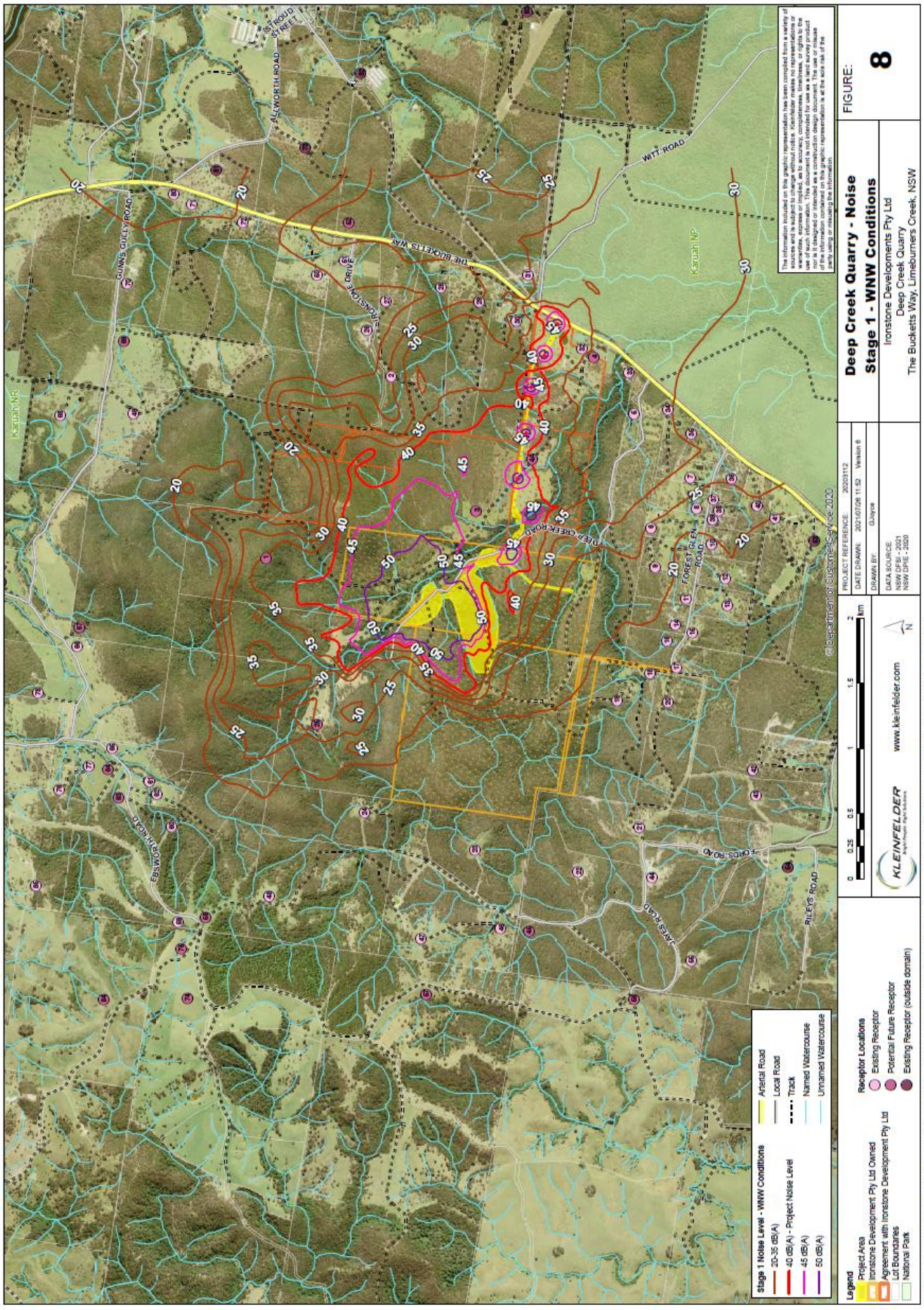
Legend
Project Area
Ironstone Development Pty Ltd Owned
Agreement with Ironstone Development Pty Ltd
Lot Boundaries
National Park
Stage 1 Noise Level - NNE Conditions
20-35 dB(A)
40 dB(A) - Project Noise Level
45 dB(A)
50 dB(A)
Arterial Road
Local Road
Track
Named Watercourse
Unnamed Watercourse
Receptor Locations
Existing Receptor
Potential Future Receptor
Existing Receptor (outside domain)
THE BUCKETTS WAY
WITT ROAD
DEEP CREEK ROAD
FOREST GLEN ROAD
GUNNS GULLY ROAD
ALLWORTH ROAD
STROUD STREET
IRONSTONE DRIVE
EBSWORTH ROAD
RILEYS ROAD
FORDS ROAD
Karuah NP
Karuah NR
© Department of Customer Service 2020


Deep Creek Quarry - Noise
Stage 1 - WNW Conditions
Ironstone Developments Pty Ltd
Deep Creek Quarry
The Bucketts Way, Limeburners Creek, NSW
FIGURE:
8
Legend
Project Area
Ironstone Development Pty Ltd Owned
Agreement with Ironstone Development Pty Ltd
Lot Boundaries
National Park
Receptor Locations
Existing Receptor
Potential Future Receptor
Existing Receptor (outside domain)
Stage 1 Noise Level - WNW Conditions
20-35 dB(A)
40 dB(A) - Project Noise Level
45 dB(A)
50 dB(A)
Arterial Road
Local Road
Track
Named Watercourse
Unnamed Watercourse
PROJECT REFERENCE: 20203112
DATE DRAWN: 2021/07/26 11:52 Version 6
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NSW DPE - 2020
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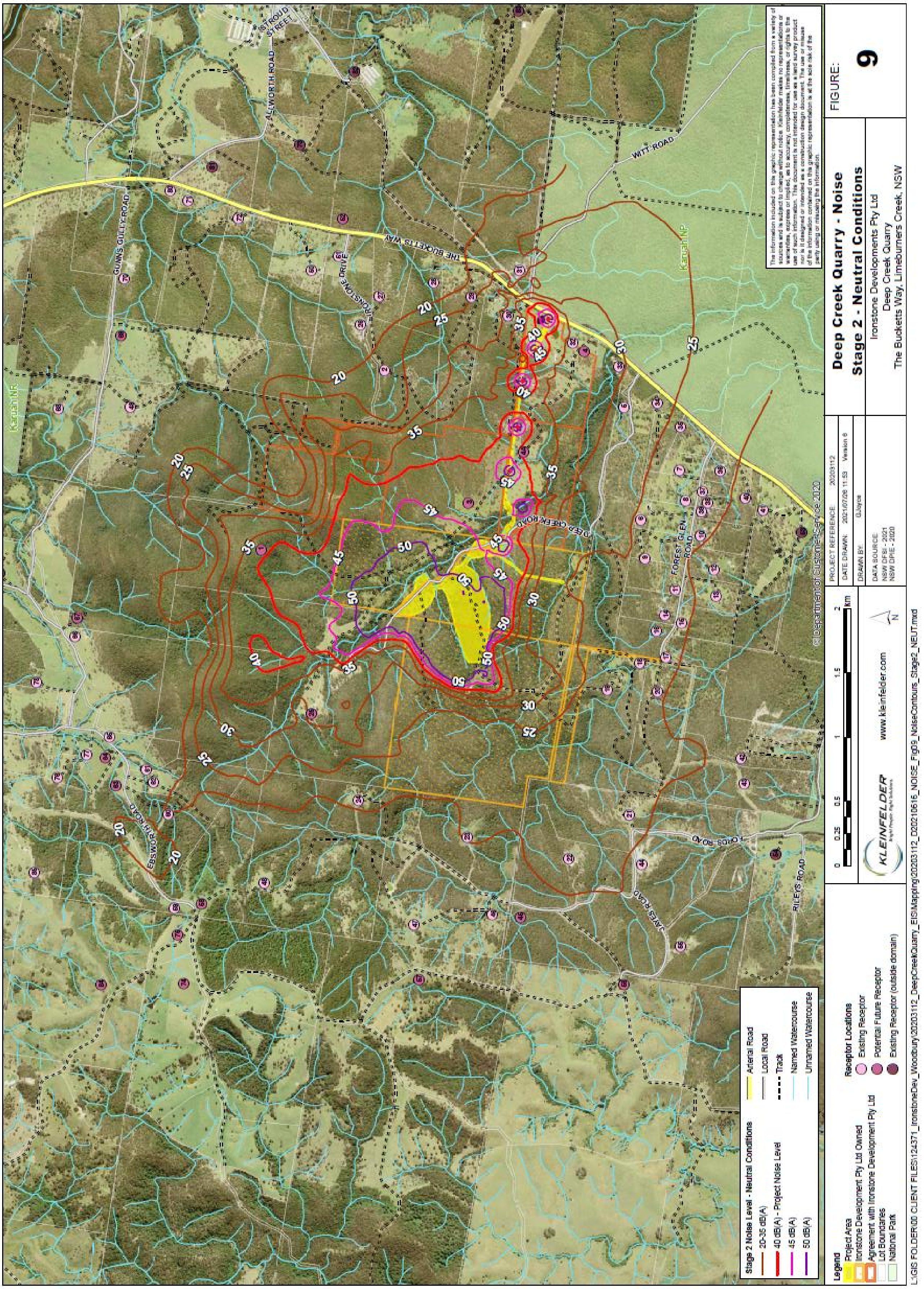
Deep Creek Quarry - Noise
Stage 2 - Neutral Conditions
Ironstone Developments Pty Ltd
Deep Creek Quarry
The Bucketts Way, Limeburners Creek, NSW
FIGURE:
9
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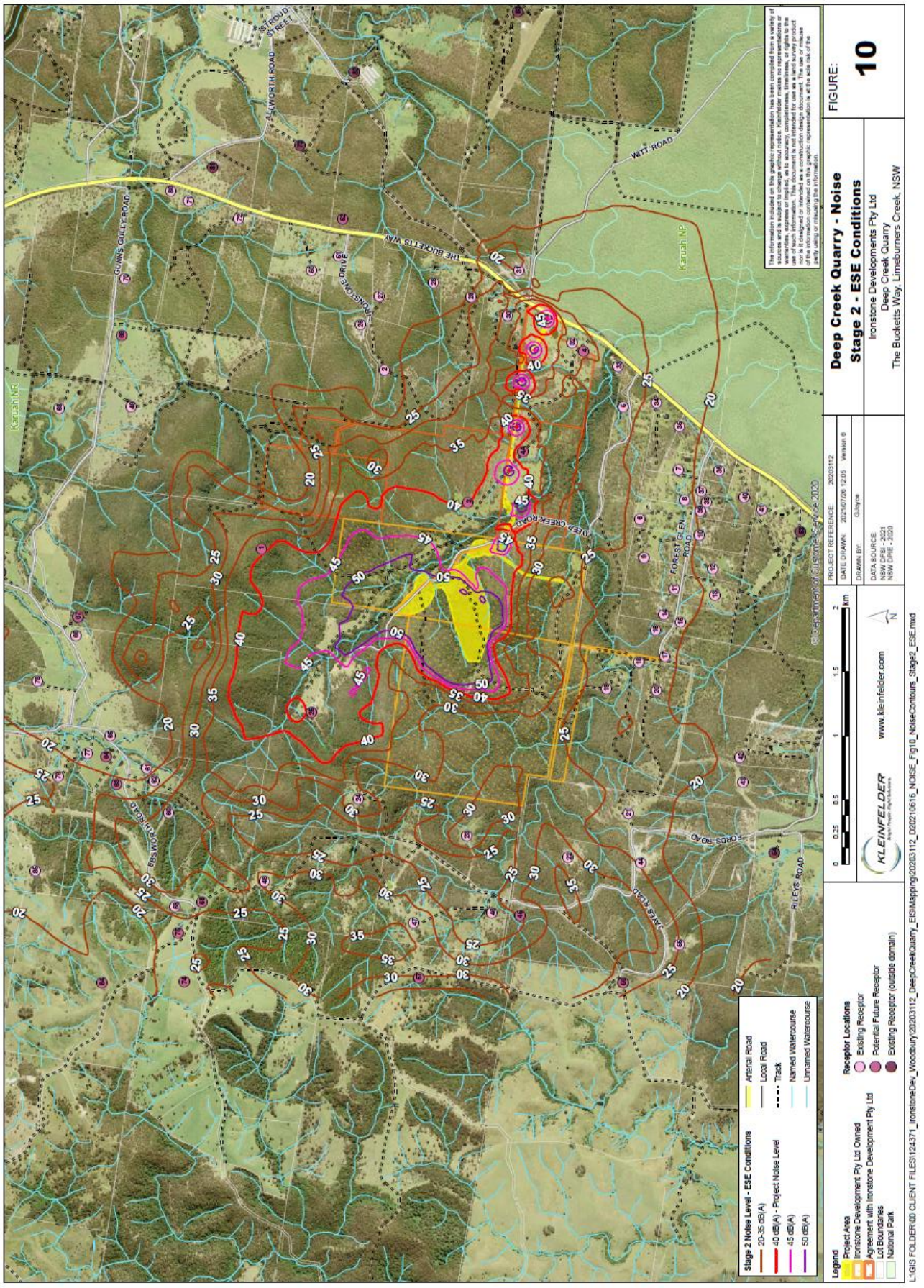
KLEINFELDER
Stage 2 Noise Level - Neutral Conditions
20-35 dB(A)
40 dB(A) - Project Noise Level
45 dB(A)
50 dB(A)
Arterial Road
Local Road
Track
Named Watercourse
Unnamed Watercourse
Legend
Project Area
Ironstone Development Pty Ltd Owned
Agreement with Ironstone Development Pty Ltd
Lot Boundaries
National Park
Receptor Locations
Existing Receptor
Potential Future Receptor
Existing Receptor (outside domain)
THE BUCKETTS WAY
DEEP CREEK ROAD
WITT ROAD
ALLWORTH ROAD
STROUD STREET
GUNNS GULLY ROAD
IRONSTONE DRIVE
FOREST GLEN ROAD
EBSWORTH ROAD
RILEYS ROAD
FORDS ROAD
DAYES ROAD
Karuah NP
© Department of Customer Service 2020


Deep Creek Quarry - Noise
Stage 2 - ESE Conditions
Ironstone Developments Pty Ltd
Deep Creek Quarry
The Bucketts Way, Limeburners Creek, NSW
FIGURE:
10
Stage 2 Noise Level - ESE Conditions
20-35 dB(A)
40 dB(A) - Project Noise Level
45 dB(A)
50 dB(A)
Arterial Road
Local Road
Track
Named Watercourse
Unnamed Watercourse
Legend
Project Area
Ironstone Development Pty Ltd Owned
Agreement with Ironstone Development Pty Ltd
Lot Boundaries
National Park
Receptor Locations
Existing Receptor
Potential Future Receptor
Existing Receptor (outside domain)
PROJECT REFERENCE: 20203112
DATE DRAWN: 2021/07/26 12:05 Version 6
DRAWN BY: Gloyne
DATA SOURCE
NSW DFSI - 2021
NSW DPE - 2020
KLEINFELDER
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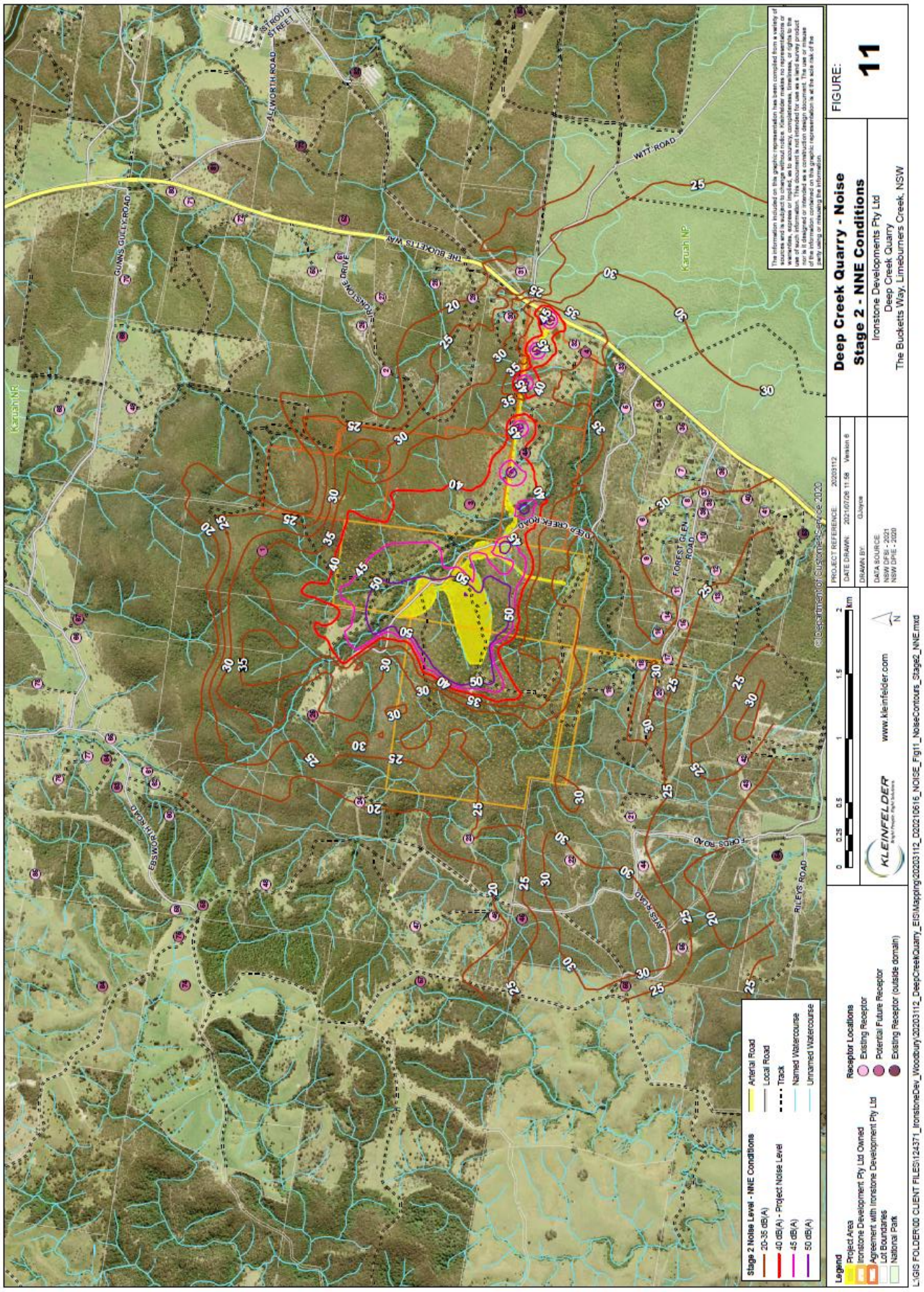
Deep Creek Quarry - Noise
Stage 2 - NNE Conditions
Ironstone Developments Pty Ltd
Deep Creek Quarry
The Bucketts Way, Limeburners Creek, NSW
FIGURE:
11
Stage 2 Noise Level - NNE Conditions
20-35 dB(A)
40 dB(A) - Project Noise Level
45 dB(A)
50 dB(A)
Arterial Road
Local Road
Track
Named Watercourse
Unnamed Watercourse
Legend
Project Area
Ironstone Development Pty Ltd Owned
Agreement with Ironstone Development Pty Ltd
Lot Boundaries
National Park
Receptor Locations
Existing Receptor
Potential Future Receptor
Existing Receptor (outside domain)
DATA SOURCE
NSW DFSI - 2021
NSW DPE - 2020
PROJECT REFERENCE: 20203112
DATE DRAWN: 2021/07/26 11:58 Version 6
DRAWN BY: GJoyce
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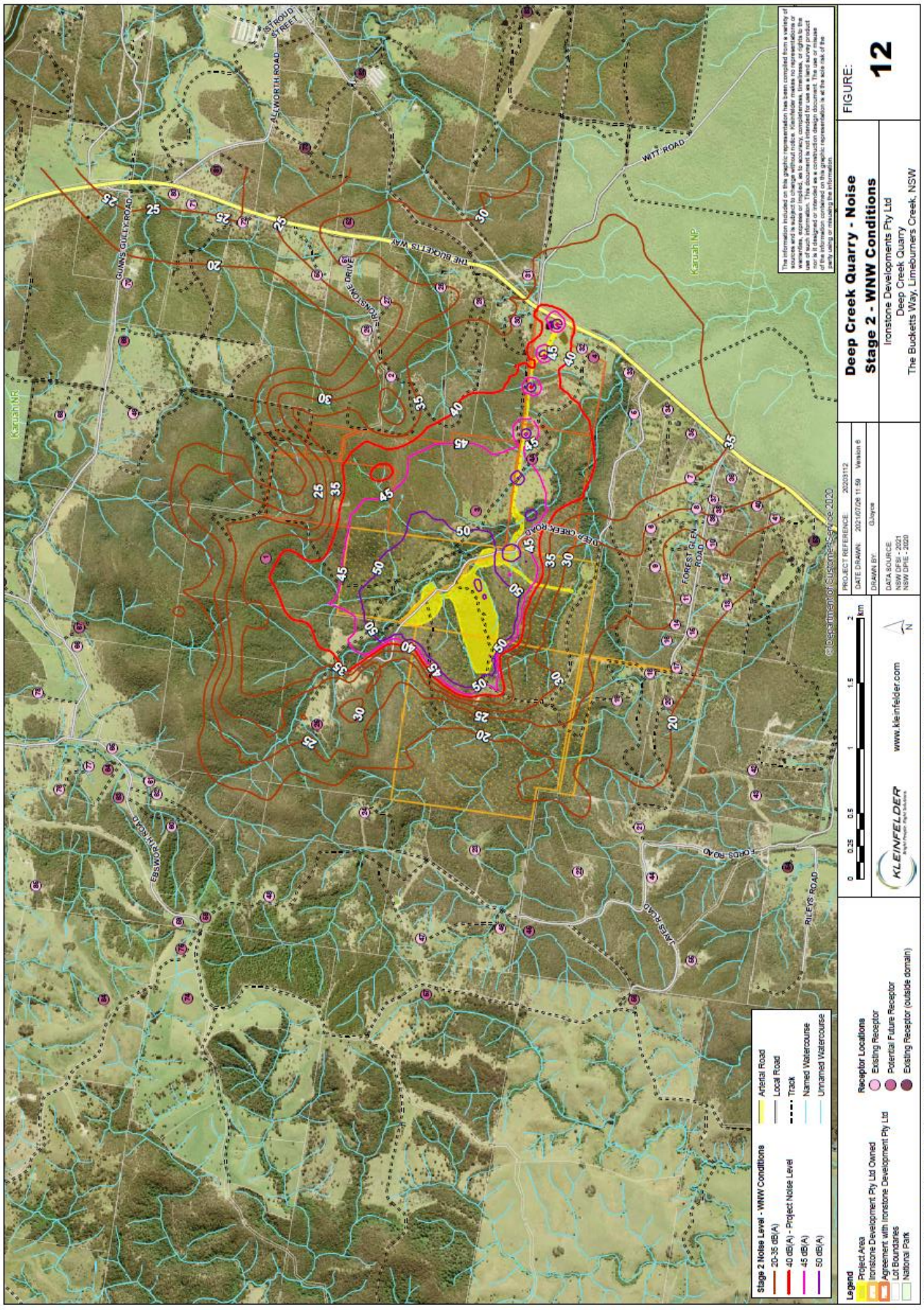
Deep Creek Quarry - Noise
Stage 2 - WNW Conditions
Ironstone Developments Pty Ltd
Deep Creek Quarry
The Bucketts Way, Limeburners Creek, NSW
FIGURE:
12
Stage 2 Noise Level - WNW Conditions
20-35 dB(A)
40 dB(A) - Project Noise Level
45 dB(A)
50 dB(A)
Arterial Road
Local Road
Track
Named Watercourse
Unnamed Watercourse
Legend
Project Area
Ironstone Development Pty Ltd Owned
Agreement with Ironstone Development Pty Ltd
Lot Boundaries
National Park
Receptor Locations
Existing Receptor
Potential Future Receptor
Existing Receptor (outside domain)
PROJECT REFERENCE: 20203112
DATE DRAWN: 2021/07/26 11:59 Version 6
DRAWN BY: GJoyce
DATA SOURCE
NSW DFSI - 2021
NSW DPIE - 2020
KLEINFELDER
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Km
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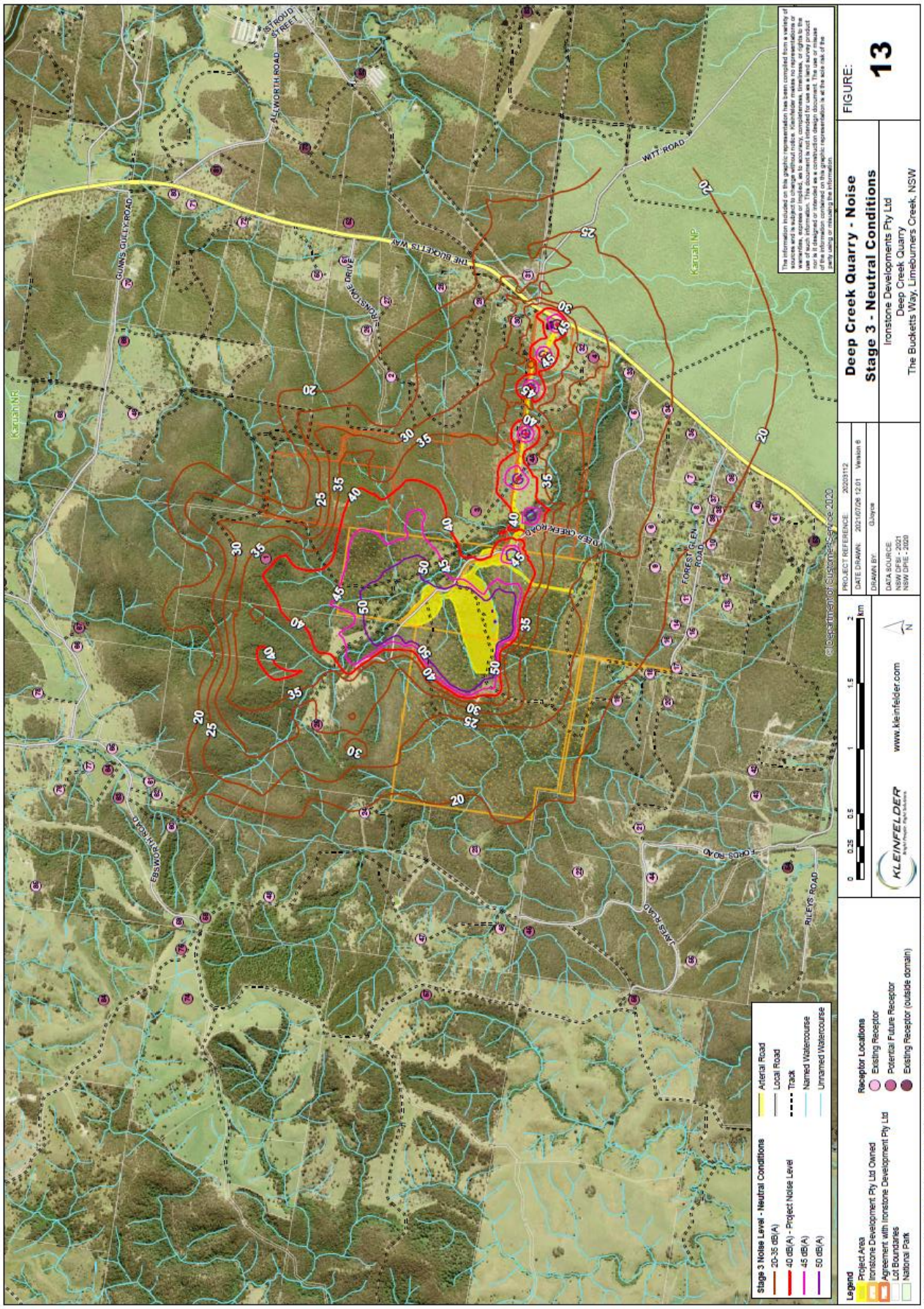
Deep Creek Quarry - Noise
Stage 3 - Neutral Conditions
Ironstone Developments Pty Ltd
Deep Creek Quarry
The Bucketts Way, Limeburners Creek, NSW
FIGURE:
13
KLEINFELDER
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Stage 3 Noise Level - Neutral Conditions
20-35 dB(A)
40 dB(A) - Project Noise Level
45 dB(A)
50 dB(A)
Arterial Road
Local Road
Track
Named Watercourse
Unnamed Watercourse
Receptor Locations
Existing Receptor
Potential Future Receptor
Existing Receptor (outside domain)
Project Area
Ironstone Development Pty Ltd Owned
Agreement with Ironstone Development Pty Ltd
Lot Boundaries
National Park
DATA SOURCE
NSW DFSI - 2021
NSW DPIE - 2020
DRAWN BY
DATE DRAWN
PROJECT REFERENCE
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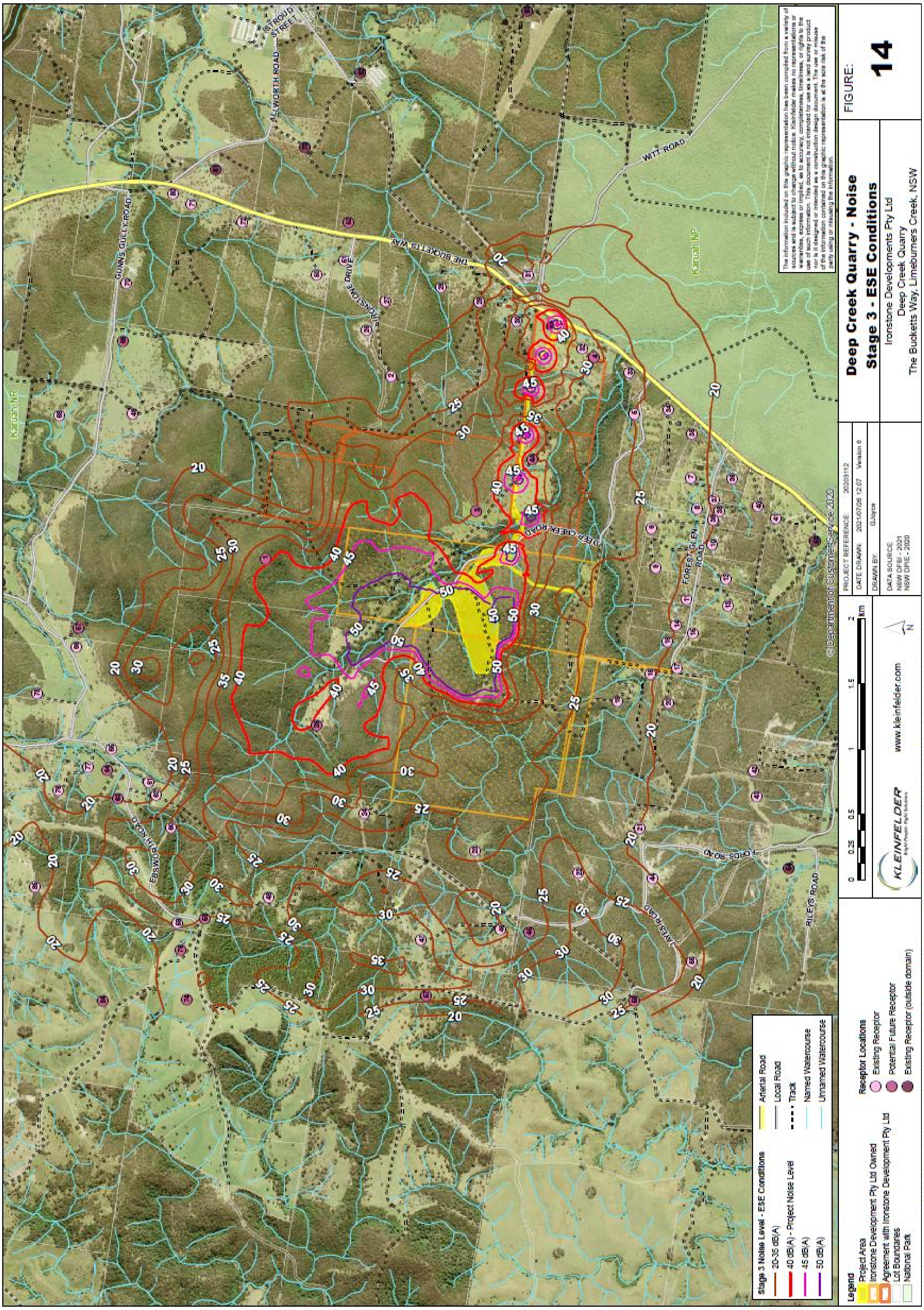
Deep Creek Quarry - Noise
Stage 3 - ESE Conditions
Ironstone Developments Pty Ltd
Deep Creek Quarry
The Bucketts Way, Limeburners Creek, NSW
FIGURE:
14
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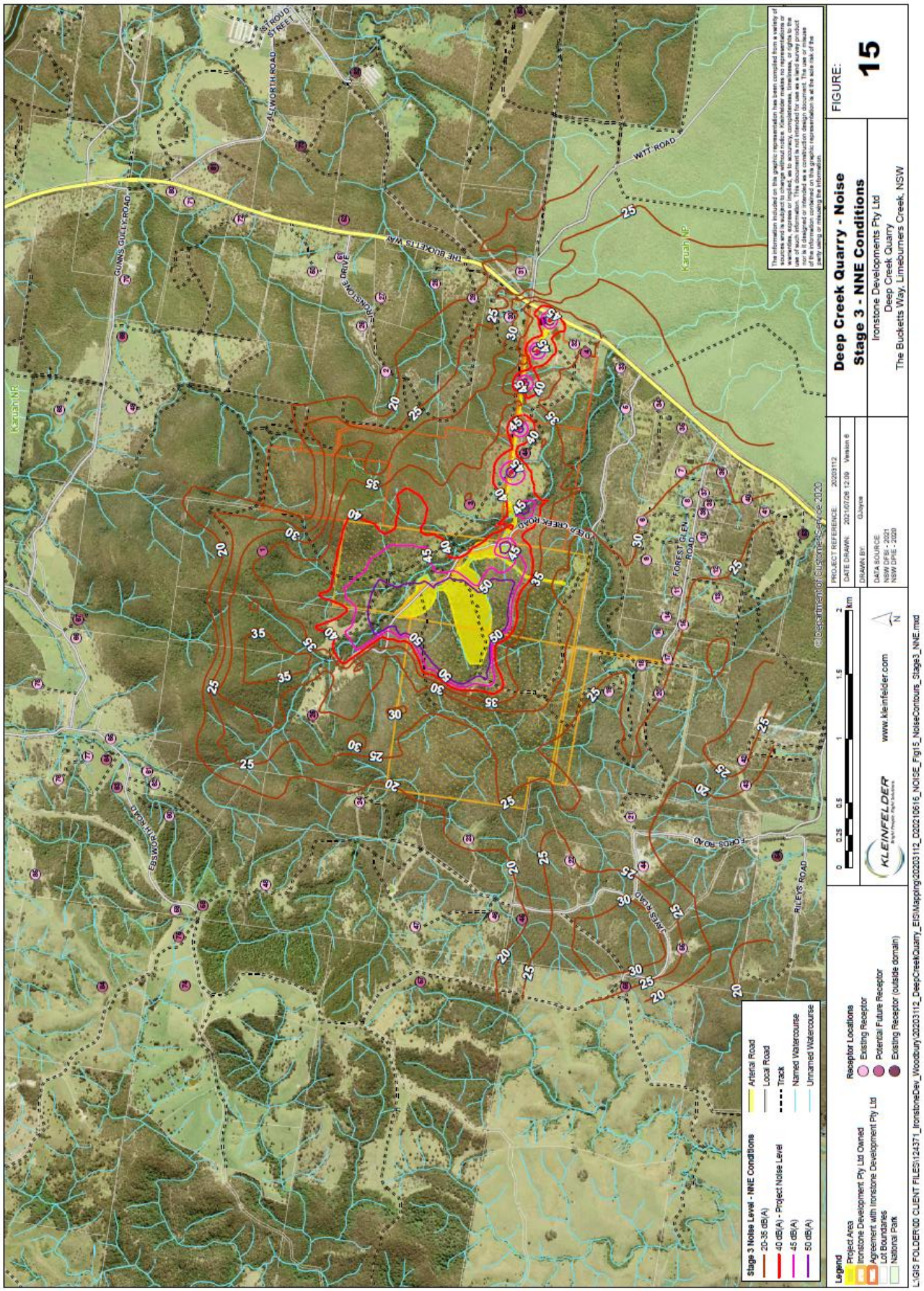
KLEINFELDER
Legend
Project Area
Ironstone Development Pty Ltd Owned
Agreement with Ironstone Development Pty Ltd
Lot Boundaries
National Park
Stage 3 Noise Level - ESE Conditions
20-35 dB(A)
40 dB(A) - Project Noise Level
45 dB(A)
50 dB(A)
Arterial Road
Local Road
Track
Named Watercourse
Unnamed Watercourse
Receptor Locations
Existing Receptor
Potential Future Receptor
Existing Receptor (outside domain)
THE BUCKETTS WAY
WITT ROAD
DEEP CREEK ROAD
IRONSTONE DRIVE
GUNNS GULLY ROAD
ALLWORTH ROAD
STROUD STREET
FOREST GLEN ROAD
EBSWORTH ROAD
RILEYS ROAD
FORDS ROAD
Karuah NP
Karuah NR


Deep Creek Quarry - Noise
Stage 3 - NNE Conditions
Ironstone Developments Pty Ltd
Deep Creek Quarry
The Bucketts Way, Limeburners Creek, NSW
FIGURE:
15
Stage 3 Noise Level - NNE Conditions
20-35 dB(A)
40 dB(A) - Project Noise Level
45 dB(A)
50 dB(A)
Arterial Road
Local Road
Track
Named Watercourse
Unnamed Watercourse
Legend
Project Area
Ironstone Development Pty Ltd Owned
Agreement with Ironstone Development Pty Ltd
Lot Boundaries
National Park
Receptor Locations
Existing Receptor
Potential Future Receptor
Existing Receptor (outside domain)
DATA SOURCE:
NSW DFSI - 2021
NSW DPE - 2020
PROJECT REFERENCE: 20200112
DATE DRAWN: 2021/07/26 12:09 Version 6
DRAWN BY: GJoyce
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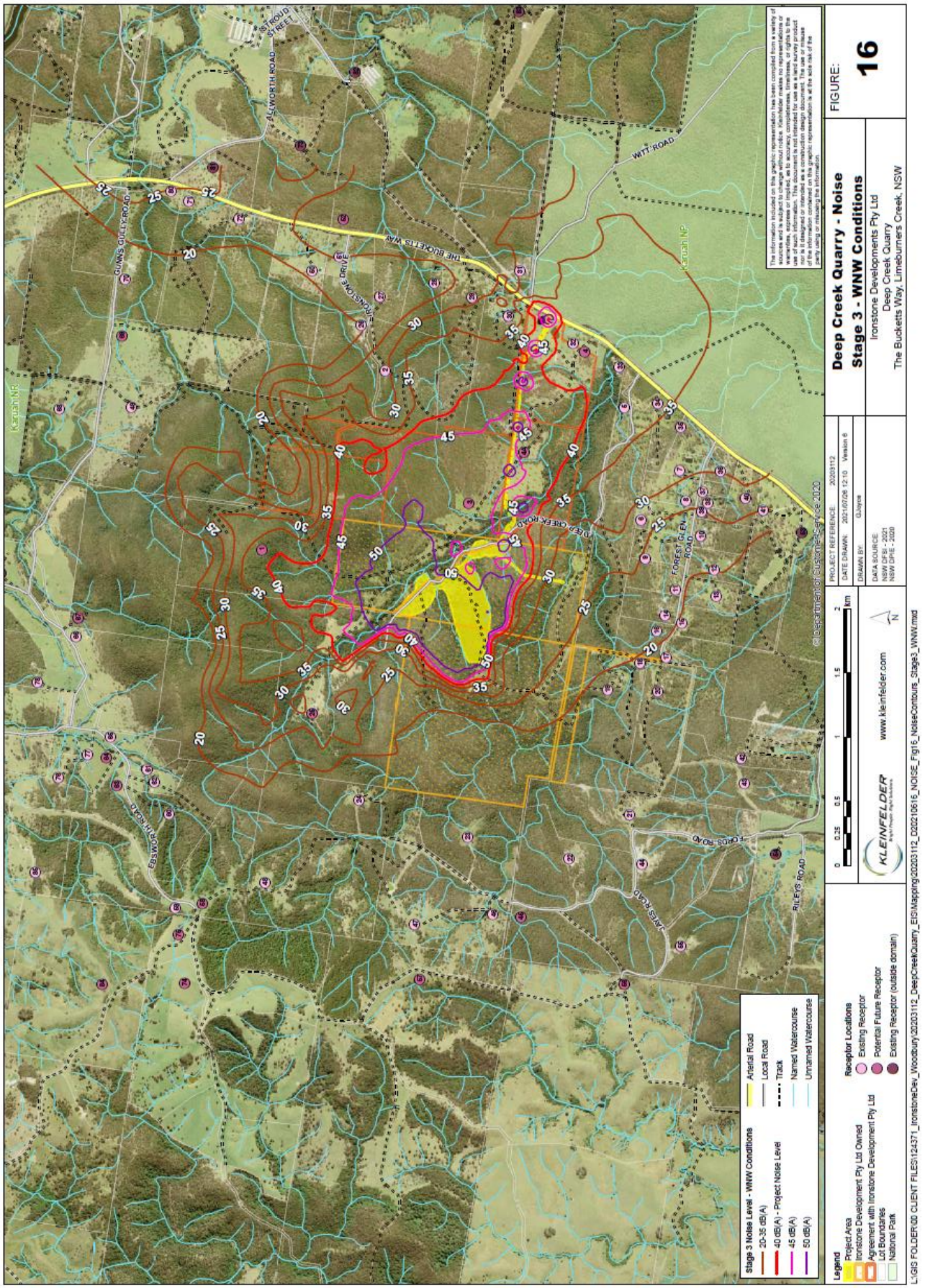
Deep Creek Quarry - Noise
Stage 3 - WNW Conditions
Ironstone Developments Pty Ltd
Deep Creek Quarry
The Bucketts Way, Limeburners Creek, NSW
FIGURE:
16
Stage 3 Noise Level - WNW Conditions
20-35 dB(A)
40 dB(A) - Project Noise Level
45 dB(A)
50 dB(A)
Arterial Road
Local Road
Track
Named Watercourse
Unnamed Watercourse
Legend
Project Area
Ironstone Development Pty Ltd Owned
Agreement with Ironstone Development Pty Ltd
Lot Boundaries
National Park
Receptor Locations
Existing Receptor
Potential Future Receptor
Existing Receptor (outside domain)
DATA SOURCE
NSW DFSI - 2021
NSW DPIE - 2020
PROJECT REFERENCE: 20203112
DATE DRAWN: 2021/07/26 12:10 Version 6
DRAWN BY: GJoyce
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