O’Neil Mine

Noise Impact Assessment

Alcoa of Australia Limited

03 October 2024

→ **The Power of Commitment**

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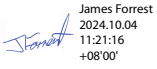
S4	1	A Farhath	B Hillion		J Forrest		03/10/24

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Glossary and abbreviated terms

Term	Description
AS	Australian Standard
Alcoa	Alcoa of Australia Limited
CONCAWE	Conservation of Clean Air and Water in Europe
CMR	Contingency Mine Region
CEO	Chief Executive Officer
dB	Decibel, unit of sound pressure level
dB(A)	Decibel (A-weighted)
dB(L) $_{\text{Linear peak}}$	Decibel (Linear), peak value of measurement period
EPA	Environmental Protection Authority
The Regulations	Environmental Protection (Noise) Regulations 1997
GHD	GHD Pty Ltd
IF	Influencing factor
ISO	International Organisation for Standardization
SPL	Sound pressure level
SWL	Sound power level
L_{Aeq}	Equivalent continuous sound level over A-weighted spectra
L_{A90}	Noise level exceeded for 90 percent of the measurement period over A-weighted spectra
L_{A10}	Noise level exceeded for 10 percent of the measurement period over A-weighted spectra
L_{A1}	Noise level exceeded for one percent of the measurement period over A-weighted spectra
ha	Hectare, unit of surface area
m	Metre, unit of distance
NIA	Noise impact assessment
NSR	Noise sensitive receptor
km	Kilometre, unit of distance
RFI	Request for information
ms	Millisecond, unit of time

Executive summary

Alcoa of Australia Limited (Alcoa) are investigating the opportunities and constraints for expanding the Huntly Bauxite Mine (the Mine) operations into the O'Neil region. The Proposal is located in the Peel Region of Western Australia (WA), approximately 100 km south east of Perth.

This Noise Impact Assessment (NIA) is for the expansion of the Huntly Mine into the O'Neil region. The NIA investigates potential noise impacts that may arise from the construction and operation of the O'Neil mine. Blasting noise and vibration during construction of the O'Neil mine were deemed relatively minor compared to operation and therefore a qualitative construction assessment approach was adopted. A quantitative approach utilising noise modelling was adopted to assess the operation of the O'Neil mine.

Operational noise modelling for O'Neil predicted noise emissions for the O'Neil mine region over its lifespan. From approximately 2026 to 2029, mining operations at Huntly Mine are proposed to expand to O'Neil mine region. Pit clearing, mine development and mining will occur in a phased approach in adjacent zones to start in 2026 and end in 2028. Rehabilitation works will extend from 2028 to 2030.

A review of the proposed zones to be mined each year was undertaken to inform the selection of worst case operational scenarios for modelled purposes. The following worst case years of operation were selected to be modelled:

- Scenario A (2027)
- Scenario B (2028)
- Scenario C (2029).

The worst case condition is qualified by the following:

- Mining activities occur at pit locations closest to the noise sensitive receivers (NSR).
- Mining activities occur at the surface and not at lower depths inside pits.
- Full duty cycle and simultaneous operation of all mobile fleet.
- Wind direction is from source to receptor for each NSR.

The findings of the assessment for the expansion of the Huntly Mine region into the O'Neil mine region are summarised as follows:

- White Horse Hills Campsite (NSR1) has potential for nighttime operational noise exceedance if tonality is present in the mining noise
- NSR1 has potential for audibility of mining activity based on ambient noise survey.
- Under realistic operational conditions , it is expected that noise at all noise sensitive receivers will comply with the noise criteria for all time periods.
    - Mining activities spread out over multiple pit locations instead of at locations closest to the NSR.
    - Mining activities occur lower than natural ground surface due to pit depths.
    - Mobile fleet will not always be simultaneously operating under full load conditions.
    - Wind direction is based on meteorological conditions.
- With operational planning practices, noise compliance can be achieved even under worst case conditions
- Ground borne noise and vibration is expected to be insignificant at the all the nearby NSRs for the proposed O'Neil mine region.

This report is subject to, and must be read in conjunction with, the limitations set out in Section 1 and the assumptions and qualifications contained throughout the report.

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1. Introduction

1.1 Proposal description

Alcoa is investigating the opportunities and constraints for expanding the existing Huntly Bauxite Mine (the Mine) operations within the O'Neil region. Pending approvals, the mining operations at Huntly mine are proposed to expand into O'Neil region from approximately 2026 to 2029. The proposed O'Neil region is located 16 km north east of the town of Dwellingup and 29 km east of the town of Pinjarra.

Alcoa has engaged GHD to prepare supporting technical studies for the O'Neil region.

1.2 Purpose of this report

This Noise Impact Assessment is to explore the expansion of the Huntly Bauxite Mine into the O'Neil region.

1.3 Scope of works

The proposed scope of works for noise modelling and impact assessment for the O'Neil are as follows:

- Define assigned noise levels at selected sensitive receptors and specify relevant airblast criteria and ground vibration criteria.
- Based on available preliminary mine plan for the mine region, establish typical worst case mine operation scenarios for assessment.
- Develop acoustic models under the established typical worst case mining operation scenarios, to generate noise contour plots and predict noise levels at nearby sensitive receptors.
- Undertake modelling predictions for airblast levels and ground vibration levels at nearby sensitive receptors, under the corresponding worst case scenarios, based on *AS 2187.2-2006 - Appendix J – Ground Vibration and Airblast Overpressure.*
- Assess the predicted noise levels, air-blast levels and ground vibration levels against relevant assessment criteria, as well as against baseline noise environment.
- Provide practical mitigation and control recommendations if the exceedances are predicted.
- Prepare draft technical report documenting assessment methodology, modelling predictions, assessment results and relevant mitigation and control recommendations.
- Prepare final technical report based on Alcoa comments on draft report.

1.4 Limitations

This report has been prepared by GHD for Alcoa of Australia Limited and may only be used and relied on by Alcoa of Australia Limited for the purpose agreed between GHD and Alcoa of Australia Limited as set out in Section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Alcoa of Australia Limited arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

2. Proposal background

2.1 Proposal overview

From approximately 2026 to 2029, mining operations at Huntly mine are proposed to expand to the O'Neil mine region. The O'Neil region comprises an area of approximately 10,035 ha. The O'Neil region lies within the Dwellingup State Forest and is surrounded by Monadnocks Conservation Park to the north east and Serpentine National Park to the north west.

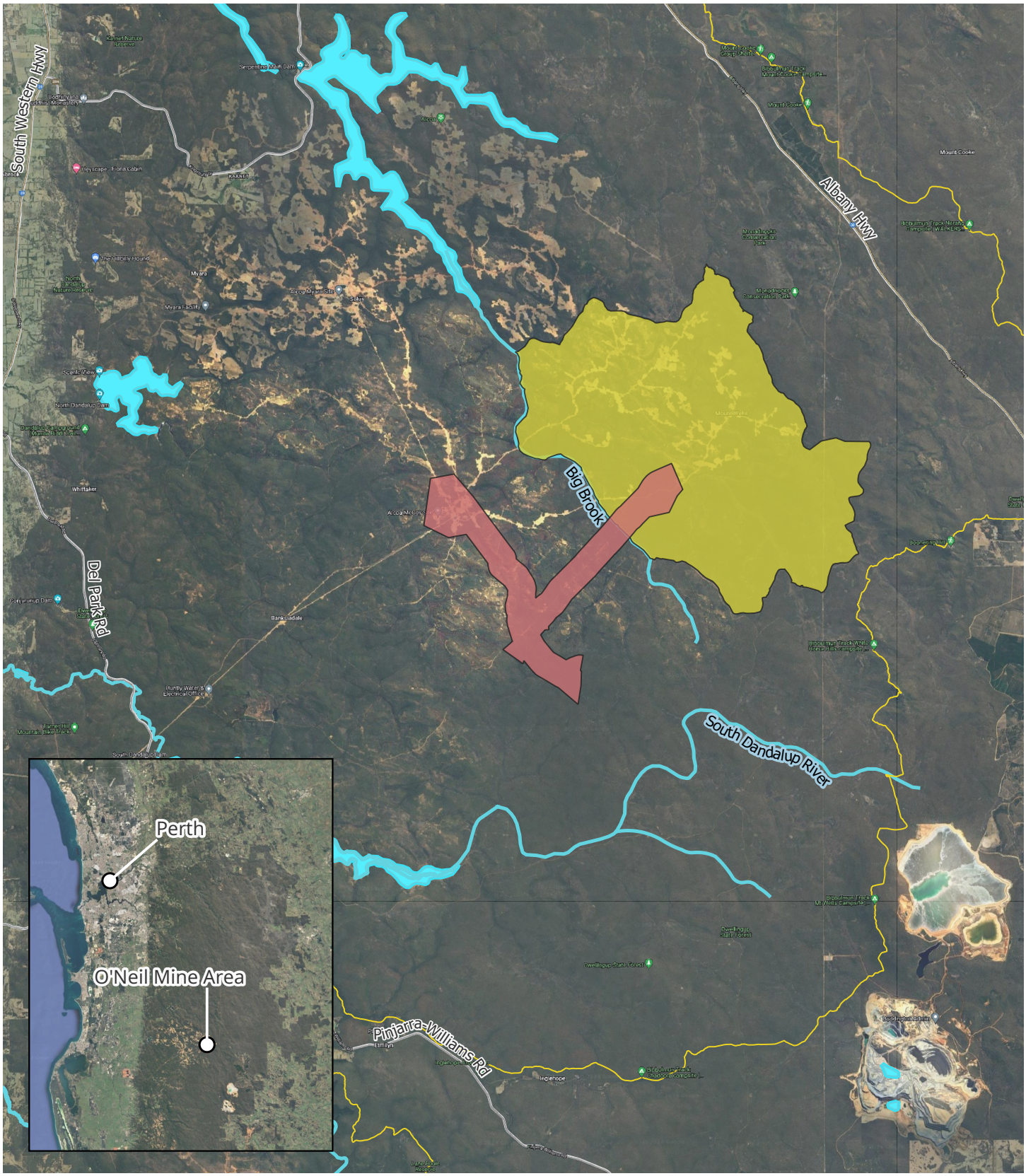
The O'Neil region will require construction of new haul routes. The haul roads will allow for transportation of processed ore from the mine pits to an existing conveyor at Alcoa's McCoy facility.

The O'Neil region is shown in Figure 2.1.

2.2 Mining operations

The proposed O'Neil operations include the following:

- Development of haul roads for long haul ore trucking back to the McCoy facility.
- Mine development (Mining) activities including drilling, logging, clearing and disposal of wood waste.
- Pre-mining (Mine development) activities including drill and blast operations and overburden removal using scrapers and excavators.
- Load and haul mining of bauxite ore involving a mobile equipment fleet of excavators, loaders, haul trucks and dozers.
- Rehabilitation activities using dozers and scrapers for landscaping, pre-ripping, soil return, contour ripping, followed by planting and fertilising.
- Construction of heavy and light vehicle access roads.



Legend

Rivers
Reservoirs
Roads
Bibbulmun Track
O'Neil Area
O'Neil Haul Road (McCoy)

Paper Size ISO A4

0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

Alcoa of Australia Limited

O'Neil Noise Impact Assessment

Site location

Project No. **12565572**
Revision No. **1**
Date. **30/09/2024**

FIGURE 2-1

Document Path: \\ghdnet\ghd\AU\Perth\Projects\61\12565572\Tech\Noise\12565572_Noise_GIS\Noise-working.qgz
Print Date: 30/09/2024

Data Source:Google Earth Imagery 2024.
Created By: afarhath

3. Assessment methodology

This NIA of the proposed Huntly Mine expansion into the O'Neil was completed in accordance with EPA and contemporary guidance to predict noise and vibration impact on surrounding noise sensitive receivers (NSRs). The modelling evaluates potential worst case impacts from the Project and outlines how these impacts can be managed. The assessment was undertaken with consideration to the Regulations which is further referenced in Section 4.

3.1 Approach

3.1.1 Blasting methodology

Blasting noise and vibration, is assessed qualitatively as outlined in Section 8 against the vibration noise and blasting criteria outlined in Sections 4.2 and 4.3.

3.1.2 Operational methodology

The assessment adopted a quantitative approach using noise modelling to assess the operation (which encompasses Mine development, Mining and Rehabilitation) of the O'Neil mining area at multiple mining zones. Alcoa proposes the operation of O'Neil mine to be staged over several years where select zones will be mined each year as shown in Figure 2.1. Once mining has concluded in a particular zone, operations will expand into a new zone. The mining location varies from year to year.

For assessment purposes, GHD focused on determining the worst case noise impact to each of the NSRs for both day and night periods as well as under the worst case meteorological conditions from a noise propagation perspective. These selections and parameters are outlined in Section 6.

4. Noise and vibration criteria

4.1 Operational noise

The Regulations specify maximum allowable external noise levels at noise sensitive, commercial and industrial premises. The Regulations (Regulation 7) define prescribed standards for noise emissions as follows:

7. (1) Noise emitted from any premises or public place when received at other premises –

> *1. Must not cause or significantly contribute to, a level of noise which exceeds the assigned level in respect of noise received at premises of that kind*
>
> *2. Must be free of –*
>
> > *(i) Tonality (e.g. whining or droning)*
> >
> > *(ii) Impulsiveness (e.g. sirens)*
> >
> > *(iii) Modulation (e.g. banging or thumping)*

Furthermore, a *…noise emission is taken to significantly contribute to a level of noise if the noise emission exceeds a value which is 5 dB below the assigned level…*

The assigned levels (Regulation 8) are shown in Table 4.1.

Table 4.1 Assigned noise levels, dB(A)

Type of premise receiving noise	Time of day	Assigned level, dB(A)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area[2]	7.00 am to 7.00 pm Monday to Saturday (Day)	45 + IF	55 + IF	65 + IF
	9.00 am to 7.00 pm Sunday and public holidays (Sunday)	40 + IF	50 + IF	65 + IF
	7.00 pm to 10.00 pm all days (Evening)	40 + IF	50 + IF	55 + IF
	10.00 pm on any day to 7.00 am Monday to Saturday and 9.00 am Sunday and public holidays (Night)	35 + IF	45 + IF	55 + IF
Noise sensitive premises[3]	All hours	60	75	80
Commercial premises	All hours	60	75	80
Industrial and utility premises other than those in the Kwinana Industrial Area	All hours	65	80	90

Notes:

1. IF = influencing factor
2. Noise sensitive areas that are classified as highly sensitive areas include a building, or a part of a building, on the premises that is used for a noise sensitive purpose and any other part of the premises within 15 metres of that building or that part of the building.
3. Any other areas located further than 15 metres from a building and directly associated with a noise sensitive use.

Tonality, impulsiveness and modulation are defined in Regulation 9. Noise is to be taken to be free of these characteristics if:

> *(a) The characteristics cannot be reasonably and practicably removed by techniques other than attenuating the overall level of noise emission.*
>
> *(b) The noise emission complies with the standard after the adjustments of* Table 4.2 *are made to the noise emission as measured at the point of reception.*

Table 4.2 Adjustment for intrusive or dominant noise characteristics, dB[1]

Tonality[2]	Impulsiveness[3]	Modulation[3]
+5	+10	+5

Notes:

1. Adjustment applies where noise emission is not music
2. Adjustments are cumulative to a maximum of 15 dB
3. Any area other than highly sensitive area

Assigned noise levels in Table 4.1 have been set differently for noise sensitive, commercial and industrial and utility premises. For noise sensitive premises an influencing factor (IF) is incorporated into the assigned noise levels. IF depends on land use zonings within circles of 100 m and 450 m radius from the noise receptor, including:

- Proportion of industrial land use zonings
- Proportion of commercial zonings, and
- Presence of major (more than 15,000 vehicles per day) or secondary (6000 to 15,000 vehicles per day) roads.

For this assessment it has been assumed that IF will be zero for all noise sensitive premises surrounding the Project, as they are more than 450 m from any industrial or commercial premises or major road. For noise sensitive residences, the time of day also affects the assigned levels. The Regulations define three types of assigned noise levels:

- L_{A10} assigned noise level which is not to be exceeded for more than 10 percent of the time
- L_{A1} assigned noise level which is not to be exceeded for more than one percent of the time, and
- L_{Amax} assigned noise level means a noise level which is not to be exceeded at any time.

The L_{A10} noise limit is the most significant for this assessment as this is most representative of continuous noise emissions.

An important impact on Regulation 7 assigned noise levels as per Table 4.1, is when the noise sensitive receptor location is already affected by industrial noise from an external factor outside the Project. In this case, there is a requirement for new noise sources that are introduced to the area to comply with a noise limit that is set 5 dB(A) below the assigned noise levels at this noise sensitive receptor (DWER, 2021).

4.2 Blasting noise

The Regulations state that airblast levels resulting from blasting on any premises or public place received at any other premises must not exceed the following limits.

Table 4.3 Blasting noise guide values as per Regulation 11 in the Regulations

Time period	Time	Construction noise requirements
Daytime	7:00 am to 6:00 pm on any day which is not a Sunday or a public holiday	– 125 dB(L) $_{Linear, peak}$ for any blast, and – 120 dB(L) $_{Linear, peak}$ for nine in any ten consecutive blasts, regardless of the interval between blasts.
Sunday and public holidays	7:00 am to 6:00 pm on Sunday or a public holiday	– 120 dB(L) $_{Linear, peak}$ for any blast, and – 115 dB(L) $_{Linear, peak}$ for nine in any ten consecutive blasts, regardless of the interval between blasts.
Out of hours	6:00 pm to 7:00 am on any day which is not a Sunday or a public holiday	– 90 dB(L) $_{Linear, peak}$ at any other premises, and – The only exception is that explosives which have previously been placed and primed may be fired if necessary to meet a safety requirement of the Department of Minerals and Energy (DME), in which case the levels must meet those given above for daytime and weekend blasting, for the time when the blast was scheduled to be fired.

Furthermore, the Regulations give guidance on peak sound levels dB(L) $_{Linear, peak}$ for blasting noise, whereby:

- Monday to Friday Daytime level: 125 dB(L) Linear, peak
- Sunday and public holiday Daytime level: 120 dB(L) Linear, peak

4.3 Blasting vibration

For blasting vibration, the following limits minimise risk to any premises nearby.

Table 4.4 Blasting vibration guide values as per AS 2187.2-2006

Time period	Time	Blasting requirements
Daytime	7:00 am to 6:00 pm on any day which is not a Sunday or a public holiday	– No vibration level resulting from blasting on any premises or public place, when received at any other premises, may exceed a peak particle velocity of 10 mm/s. – The vibration levels for 9 in any 10 consecutive blasts (regardless of the interval between blasts) on any premises or public place, when received at any other premises, must not exceed 5.0 mm/s.
Out of hours	6:00 pm and 7:00 am on any day which is not a Sunday or a public holiday	– No vibration level resulting from blasting on any premises or public place, when received at any other premises, may exceed a peak particle velocity of 1.0 mm/s. – The vibration levels for 9 in any 10 consecutive blasts (regardless of the interval between blasts) on any premises or public place, when received at any other premises, must not exceed 0.5 mm/s.

5. Existing environment

5.1 Site description

The Huntly Bauxite Mine lies within Jarrah forest of the Darling Plateau, approximately 70 km south east of Perth. Specifically, the O'Neil mining region is located to the south-east of existing McCoy mine region, which retains operating mine facilities. The O'Neil region is surrounded by Monadnocks Conservation Park to the north east and Serpentine National Park further to the north west.

5.2 Ambient noise environment

An ambient noise survey was conducted by GHD in the summer months of December 2023 and January 2024. The survey was captured in *12565572-00000-EN-RPT-010_1* (GHD, 2024). The main outcomes are detailed as follows:

- Ambient noise levels representative of rural area at NSR1 and NSR3, noting at NSR2 the noise levels did not drop below 28 dB, L_{A90} during the measurement period.
- Low frequency noise that is likely from nearby gold mine at NSR2 is present on most days and is sometimes audible in the daytime. This was determined via a combination of listening back to audio files and audio spectrograph visual assessment (GHD, 2024).
- Higher background noise levels are observed during the evening time, in comparison with the daytime for all locations (NSR1, NSR2 and NSR3) – this is likely attributable to insects and birds as the spectrographs do not exhibit typical characteristics associated with industrial noise for these time periods (GHD, 2024).
- Due to the baseline noise survey outcome which is the presence of industrial noise at NSR2 during the daytime, the noise criteria will be 5 dB below the assigned level for that time of the day for all days of the week including Sundays and Public Holidays.

Table 5.1 Overview of noise levels captured in noise survey

Location	Description	Sound pressure level , dB(A)					
		Day L_{A90} Range	Day Typical L_{A90}	Evening L_{A90} Range	Evening Typical L_{A90}	Night L_{A90} Range	Night Typical L_{A90}
NSR1	White Horse Hills Campsite	21 - 37	29	33 - 45	41	20 - 44	35
NSR2	Mount Wells Campsite	31 - 39	28	31 - 49	35	28 - 36	29
NSR3	Bibbulmun Nerang Campsite	23 - 33	32	27 - 42	39	23 - 34	29

5.3 Sensitive receptor

NSRs have been selected as per what has previously been identified for Holyoake East (Wood, 2023) and are consistent with the noise monitoring locations. As the identified NSRs are remote, with no commercial or industrial zones as well as lack of any major roads, there is no influencing factors to be applied as outlined in the Regulations.

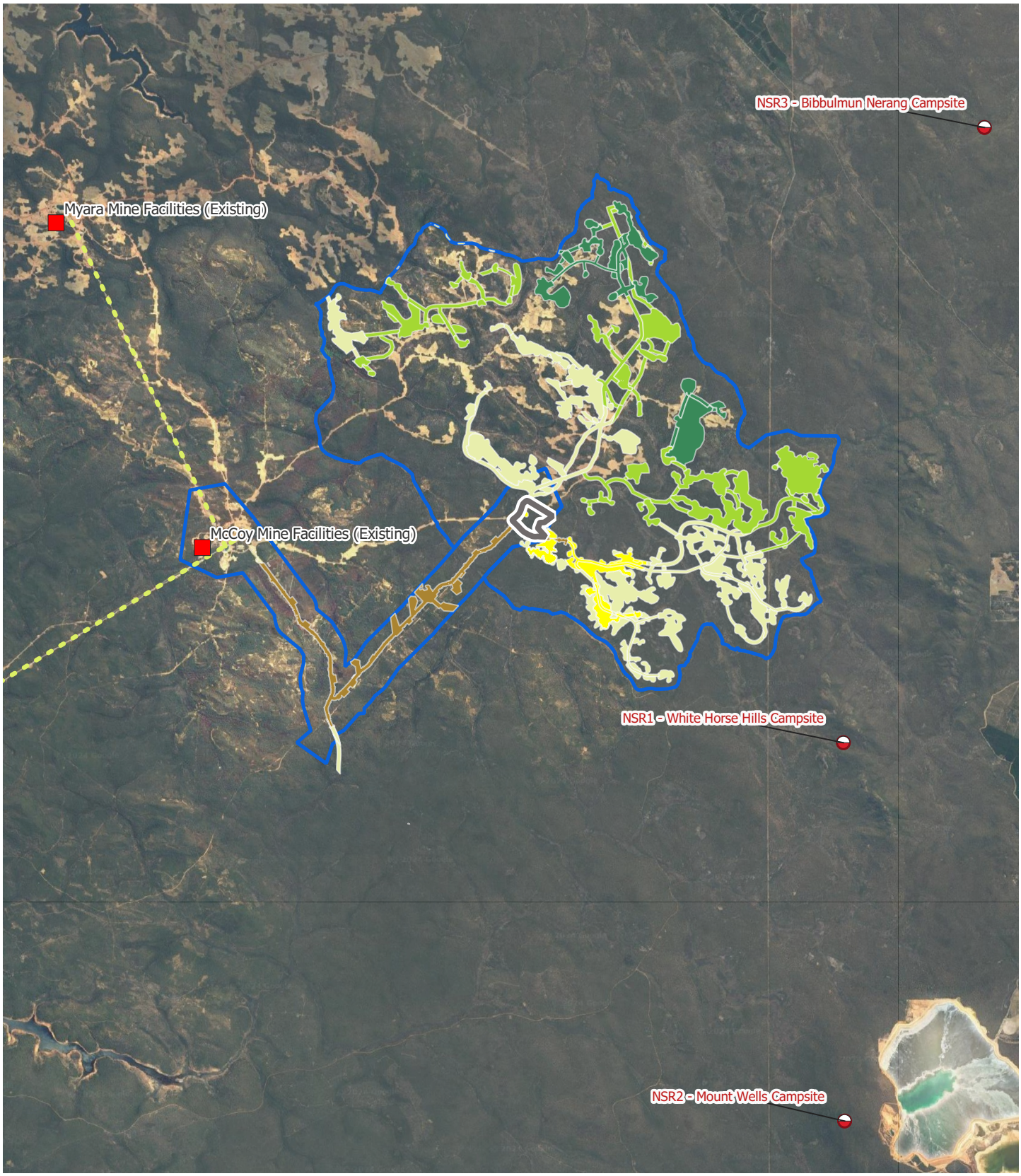
Table 5.2 Noise sensitive receptors and assigned noise levels

ID	Description	Approximate distance to Site	Coordinates (Easting, Northing)	Assigned noise levels L_{A10}		
				Day	Out of hours / Sundays and Public Holidays	Night
NSR1	White Horse Hills Campsite	3000 m	437719.00 m E, 6391882.00 m S	45	40	35
NSR2	Mount Wells Campsite	7500 m	437752.00 m E, 6381857.00 m S	40[1]	35[1]	35[2]
NSR3	Bibbulmun Nerang Campsite	9000 m	441458.00 m E, 6408184.00 m S	45	40	35

Notes:

1. Note noise criteria is 5 dB below assigned levels to account for the potential cumulative impact from industry in the area during the daytime period
2. Note in the absence of evidence of industrial noise during the nighttime as per Section 4 the noise criteria matches the assigned noise level for that time period

Sensitive receptor locations are further detailed in Figure 5.1.



Legend

- O'Neil Mining Area
- Existing mine facilities - Huntly mine
- O'Neil facilities
- Noise sensitive receptors
- Existing conveyor

Mining zones
- 2024
- 2025
- 2026
- 2027
- 2028

Paper Size ISO A4

0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

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O'Neil Noise Impact Assessment

Noise sensitive receptors

Project No. **12565572**
Revision No. **1**
Date. **30/09/2024**

FIGURE 5-1

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Print Date: 30/09/2024

Data Source:Google Earth Imagery 2024.
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6. Operational noise modelling methodology

6.1 Modelling assumptions

For assessment purposes, Mine development has been considered to utilise the same equipment fleet as Rehabilitation. There are also two operating units for both Mining and Rehabilitation/Mine development that operate concurrently in different pits from each other. For example, when Mining is occurring in the 2026 zone, there are two units (A and B) operating within this zone. And when Rehabilitation/Mine development is occurring in the 2027 zones, there are two units (C and D) operating within this zone.

For conservatism, the following is assumed:

- All mining operations occur simultaneously at full duty cycle.
- It is assumed that the terrain is on flat and open natural ground contours. Even though it is expected that mining pit depth could have varied average depth, it has been conservatively assumed that mining will occur at the surface level at all years.

Table 6.1 O'Neil mine operation equipment and locations

Equipment type	Number of equipment			
	Mining		Mine development / Rehabilitation	
Mobile fleet	Unit A	Unit B	Unit C	Unit D
Excavators (250T)	2x in pit	1x in pit	-	-
Haul trucks moving (190T) [1]	12x from pit to McCoy	12x from pit to McCoy		
Haul trucks idle (190T)	1x idle in pit	1x idle in pit	-	-
Haul trucks high-idle (190T)	1x high idle at McCoy	1x high idle at McCoy	-	-
Dozer	1x in pit	1x in pit	2x	1x
Scrapers	-	-	2x	3x
Excavators for soil & overburden removal	-	-	3x	2x
Watercarts	3x in pit	2x in pit	-	-
Graders	1x in pit	1x in pit	-	-
Loader type A	1x high idle in pit	-	-	-
Loader type B	-	1x high idle in pit	-	-
Fixed plant				
Diesel generator (0.6 MW)	1x at the O'Neil facilities			
Secondary sizer	1x at McCoy			
Crusher 260	1x at McCoy			
Apron feeder	1x at McCoy			
Discharge conveyor	1x at McCoy			
Hopper	1x at McCoy			
Vibrating screen	1x at McCoy			

Notes:

1. Total number of moving haul trucks between McCoy and O'Neil is 24 as per email received (received 29th July 2024)
2. Blast drills not considered in the operational modelling as per RFI-007 (received 5th December 2023) but impact of blasting is taken into account in Section 8.

Furthermore, the model does not include noise emissions from any other sources besides what has been highlighted in Table 6.1. Noise emissions from existing mining and industrial activities in the vicinity of the Project, as well as any road traffic, aircraft, fauna and domestic sources have been excluded from the modelling.

6.2 Noise modelling scenarios

The noise impact on each NSR depend on the geographic location of the NSR with respect to the mining activities. The worst case scenario in terms of schedule of activities was determined using the Alcoa-provided mining schedule (RFI-11 received 26th June 2024) along with Figure 2.1. This is summarised in Table 6.2.

Table 6.2 Operational modelling noise scenarios

Scenario ID	Representative year	Mining activities	Fixed plant and long haul activities	Most affected receptor(s)
-[1]	2025	Haul road construction	Haul road clearing and construction	-
-[1]	2026	Mine development in 2026 pits	Fixed plant construction activities start; long haul ore trucking continues	-
A	2027	Mine development in 2027 pits Mining in 2026 pits	Fixed plant construction activities continue; long haul ore trucking continues	NSR1, NSR2
B	2028	Rehabilitation in 2026 pits Mining in 2027 pits Mine development in 2028 pits	Fixed plant construction activities continue; long haul ore trucking continues	NSR1, NSR3
C	2029	Rehabilitation in 2027 pits Mining in 2028 pits	Fixed plant construction activities continue; long haul ore trucking continues	NSR3
-[1]	2030	Rehabilitation in 2028 pits	Fixed plant construction activities continue; long haul ore trucking continues	-

Notes:
1. Scenarios marked with "-" have been considered but have not been presented in this report as they do not represent worst case from a noise emissions perspective.

For the noise modelling, there are several acoustic parameters to base the assessment upon, based on the nature of the type and duration of noise sources present.

– L_{Amax} is the (A-weighted) maximum root-mean squared (RMS) noise level predicted.
– L_{A1} is the (A-weighted) noise level exceeded for one percent of the operational period.
– L_{A10} is the (A-weighted) noise level exceeded for 10 percent of the operational period.

L_{A10} will be the acoustic parameter chosen for this assessment because complying with L_{A10} implies complying with L_{A1} and L_{Amax} parameters due to it being the most conservative parameter over the range of noise sources present.

6.3 Operational noise sources

The operational noise source details for modelling are shown in Table 6.3.

Table 6.3 Operational noise sources for O'Neil

Equipment type	SWL, dB(A)	Octave band sound power level, (dB)									Height, m	Modelled type	No. of operational units assumed[1]
		31.5Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz			
Excavators (250T)	116	106	115	122	113	114	111	107	100	96	1.5	Point	3
Haul Trucks (190T) Drive-by	120	110	112	119	118	119	115	111	106	99	1.5	Line	24[3]
Haul Trucks (190T) Idle	107	110	119	104	101	102	103	100	91	82	1.5	Point	2[3]
Haul Trucks (190T) High-Idle	121	107	111	118	118	120	115	112	107	101	1.5	Point	2[3]
Dozer	116	115	120	124	118	115	108	103	96	88	1.5	Point	5
Scrapers	108	108	117	116	112	110	108	102	97	108	1.5	Point	5
Excavators for soil & overburden removal	115	116	108	117	116	112	110	108	102	97	1.5	Point	5
Water Carts	122	112	118	124	121	121	115	113	106	100	1.5	Point	5
Graders	111	102	107	113	110	109	105	103	95	93	1.5	Point	2
Loader Type A	113	100	111	122	109	110	108	105	95	90	1.5	Point	1
Loader Type B	116	101	110	121	115	116	110	106	101	94	1.5	Point	1
Secondary Sizer	114	119	121	120	117	111	107	104	100	89	1.5	Point	1
Diesel Generator (0.6 MW)	105	-	85	92	96	97	98	98	97	98	1.5	Point	1
McCoy Crusher	110	89	97	104	109	103	105	104	98	91	3	Point	1
Hopper	95	-	85	86	88	88	91	88	84	78	3	Point	1
Apron Feeder	104	93	97	95	99	101	99	97	92	85	3	Point	1
Vibrating Screen	87	57	72	82	84	84	83	79	73	65	2	Point	1
Discharge conveyor	102	101	103	105	100	101	97	93	85	79	3	Point	1

Notes:

1. Number of units of equipment are based on 89% availability and 85% utilisation
2. Blast drills are assessed in Section 8
3. 24 moving haul trucks are modelled as a line source between O'Neil mining pits and McCoy for all scenarios, where idle haul truck sources indicate loading or unloading haul trucks that have temporarily stopped

6.4 Software package

SoundPLAN 9.0 is a computer program for the calculation, assessment, and prognosis of noise propagation. SoundPLAN calculates environmental noise propagation according to CONCAWE and other algorithms. Propagation calculations take into account sound intensity losses due to geometrical spreading, terrain effects, atmospheric absorption and ground absorption The CONCAWE algorithm also takes into account the presence of wind conditions, such as 'downwind' conditions, which are favourable to sound propagation. As a result, predicted received noise levels are expected to represent a worst case scenario, due to the distances involved between source and receptors, enhancement of noise due to weather is expected to have an effect on the closest sensitive receptor locations.

The algorithms used in this model account for the following physical features:

- Geometrical divergence
- Atmospheric absorption
- Ground effect
- Screening by obstacles
- Reflections.

6.5 Meteorological and geographical conditions

In assessing meteorological conditions, the CONCAWE method has been applied instead of ISO 9613-2 weather correction. Modelling results are based on available information provided and should only be used as a guide for comparative purposes. The noise model inputs and assumptions for the operational assessment of the Project are worst case default (according to the WA DWER Draft Guidelines 2021) and provided in Table 6.4.

Table 6.4 Noise modelling parameters

Variable	Parameter used	
Prediction algorithm	CONCAWE prediction algorithm	
Ground absorption coefficient G = 0 is for hard, reflective ground G = 1 is for soft, porous ground	G = 0.6 (based on vegetated land or sand)	
Receptor heights	1.5 m above ground.	
Terrain	Three-dimensional terrain has been used in the model. Ground contours were used based on the dataset provided by Alcoa: 1 m data 'DEM01m_MGA94.tif' (received from Alcoa May 2022) For the remainder of the area 5 m ground contours were sourced from: 5 m data – retrieved from Elvis Elevation and Depth Foundation Spatial Data	
Shielding	Shielding from site structures, such as buildings and noise walls have been considered in the model.	
Order of reflection	2	
Proposed layout	The noise model developed for this assessment was based on the mine pit shape files provided by Alcoa. 'Huntly_Clearing_Approval_ONeil_06062024_GDA94.shp" (June 2024)	
Meteorological Scenario	Day	Night
Temperature	20°C	15°C
Relative Humidity	50%	50%
Wind Speed [1]	4 m/s	3 m/s

Variable	Parameter used	
Pasquill Stability	E	F

Notes:

1. The wind direction considered in the noise model is from source to receptor as this constitutes worst case form a noise emissions perspective.

7. Noise modelling results

For daytime activities, the most stringent assigned level will be during Sundays and public holidays. The most stringent criteria overall; however, is the nighttime assigned level.

The predicted noise levels are presented for each receptor for each relevant scenarios in Table 7.1, and have been compared with the noise criteria to determine compliance.

As can be seen from Table 7.1, the predicted noise levels are expected to comply with the noise criteria at all receptors. The highest predicted noise level is at NSR1 during the nighttime. Results highlighted in yellow denote a risk of non-compliance when tonality is considered (tonality attracts a 5 dB correction as per Regulation 9), whereas results highlighted in green denote compliance.

Table 7.1 Noise modelling results

Noise sensitive receptors	Daytime (Sunday and Public Holidays)[1]				Nighttime			
	Noise Criteria	Predicted noise level, dB L_{A10}			Noise Criteria	Predicted noise level, dB L_{A10}		
		A (2027)	B (2028)	C (2029)		A (2027)	B (2028)	C (2029)
White Horse Hills Campsite (NSR1)	40 dB(A)	32	31	28	35 dB(A)	32	32	29
Mount Wells Campsite (NSR2)	35 dB(A)[2]	20	21	20	35 dB(A)	21	22	21
Bibbulmun Nerang Campsite (NSR3)	40 dB(A)	17	21	21	35 dB(A)	18	22	22

Notes:
1. Sunday and Public Holiday daytime is used as it is the worst case condition.
2. As evidenced in the baseline noise monitoring survey, industrial noise is already present during the daytime at NSR2 therefore new sources of noise are to comply with s noise criteria which 5dB(A) below the assigned level (i.e. 35 dB(A) during Sunday daytime an public holiday daytime

The modelled noise contours for each scenario are presented in Appendix A:

- Figure A-1: Scenario A L_{A10} daytime noise contours
- Figure A-2: Scenario A L_{A10} nighttime noise contours
- Figure A-3: Scenario B L_{A10} daytime noise contours
- Figure A-4: Scenario B L_{A10} nighttime noise contours
- Figure A-5: Scenario C L_{A10} daytime noise contours
- Figure A-6: Scenario C L_{A10} nighttime noise contours.

7.1 Noise impact compliance assessment

The modelling results presented in Table 7.1 show that the predicted noise levels are expected to comply with the noise criteria under worst case weather conditions at NSR 2 and 3 at all times of the day and night, including during Sundays and public holidays.

However, for NSR1 (White Horse Hills Campsite) there is a risk of non-compliance (+2 dB) during the nighttime period (Scenarios A and B) should tonality be evident in the received noise (i.e. compliance is expected if tonality is not evident at each receptor).

The following sections outline how compliance can be achieved.

7.1.1 Tonality assessment

It is possible that some of the mobile equipment (mainly haul trucks) may exhibit tonality at some of the receptors. However, this tonality may not always be evident at the receptor for the following reasons:

- Tonality may not exceed the ambient noise at the NSRs at all times.

- Overall tonality will be reduced via masking of specific tonal components from one equipment to another.
- The level of noise emissions and tonality from items of mobile equipment will vary depending on their locations (i.e. changing heights, depths and lateral position to NSRs).
- The severity and pitch of the tonality from mobile equipment is dependent on operating conditions (i.e. heat, operating load etc.).

With the above reasons in consideration, prediction of tonality at the NSRs from the mobile equipment fleet is difficult, especially when the mining operations are several kilometres from the receptors as is the case in this assessment.

The noise contours are presented in Appendix A and show that there is potential of non-compliance of +1 to +3 dB L_{A10} during the nighttime at NSR1 for two of three operation scenarios modelled.

7.1.2 Conservatism of the worst case noise model

7.1.2.1 Weather conditions

The worst case weather conditions are the default meteorological conditions stipulated in the WA DWER Draft Guideline Assessment of Environmental Noise Emissions. It is expected that the most frequent occurrence of default weather conditions will occur in the cooler periods of the year.

7.1.2.2 Mining activities

The modelling scenarios assessed assume that all noise-generating activities occur simultaneously at full duty cycle, and that all mining activities occur at the pit surface. Hence, it is expected that these worst case assumptions have additional significant margins of conservativism in terms of noise modelling predictions compared with realistic activities within the pit areas.

7.1.2.3 Impact of conservatism to predicted results

Table 7.1 presents the predicted noise levels incorporating the following worst case conditions:

- For each scenario, noise sources were located at the pit closest to the nearest NSR for each mining area under consideration, which is very conservative approach from noise propagation perspective.
- Full duty cycle and simultaneous operation of all mobile fleet. In reality, the equipment load will fluctuate through the day and instances of all equipment being under full load simultaneously are highly unlikely.
- Mining activities occur at the surface and not at lower depths inside pits. This is quite conservative, because mining equipment, relative position to nearby ground contours, will fluctuate throughout the day with equipment being shielded at times and exposed at other times.
- Wind direction from source to receptor for each NSR (i.e. downwind conditions). This constitutes worst case from a noise propagation point of view. In reality, there will times where the wind conditions are not downwind, and there could be significant period of times where downwind conditions are not present.

Under operational conditions which constitute more realistic conditions, it is predicted that:

- if noise sources are not at the pit which is nearest to the relevant NSR based on modelling, the predicted noise will reduce by 3 dB or more at for both day and night scenarios.
- Outside of downwind conditions, modelling shows a 2 dB or more reduction in noise levels for both day and night scenarios.

Hence, for realistic operational conditions, it is expected that predicted noise level will comply with the noise criteria at all NSRs at all times.

At times that worst case conditions may be present, it is expected that with the implementation of operational planning practices, even where mining activity may occur closest to the pit edges of NSRs, noise compliance can be achieved at all NSRs at all periods of the day. Operational noise management is discussed in Section 10.

7.1.3 Audibility assessment

The audibility of mining noise at the NSRs depends on the ambient baseline levels, the weather conditions and the tonal content of the noise. These are factors that are difficult to predict given the large distances involved.

A conservative and simplified approach to assess the audibility is proposed based on 30 dB(A) (i.e. 5 dB below nighttime noise criteria).

Based on the noise modelling results in Table 7.1 , NSR1 mining noise from O'Neil is predicted to have the potential to be audible under the worst case scenario at nighttime.

However, audibility is reduced when weather conditions are expected to be less conducive for noise propagation (i.e. other than worst case weather conditions). Furthermore, mining noise is assessed as audible if the predicted noise level values protrude above the ambient monitoring data by more than 3 dB as a person typically does not detect a change in noise levels below 2 to 3 dB (David Bies, 2018).

Additionally, from the ambient noise monitoring survey highlighted in Table 5.1, the audibility of mining noise is likely to be masked by typical ambient noise levels at the NSR1 location of 29 dB(A) during the day and 35 dB(A) during the night.

8. Blasting noise and vibration assessment

8.1 Blasting noise

Blast noise data from Alcoa's existing Huntly mine operations in the Myara region was collected by Wood in previous assessments to derive an empirical assessment criterion based on current operational practices. O'Neil is expected to employ blast noise criteria and blast methodology that is similar to that currently practiced in Myara.

Table 8.1 Blast noise at distances from Alcoa's existing Huntly Mine operations in the Myara Region (Wood, 2023)

Monitor	Distance from blast centre, m	Maximum instantaneous charge mass, kg	Measured peak noise level $dB(L)_{Linear, peak}$
Blast 1			
1	1390	9 kg per hole, 762 holes	117
2	2780		107
3	5560		92
Blast 2			
1	1090	7 kg per hole, 40 holes	116
2	2180		107
3	4360		99

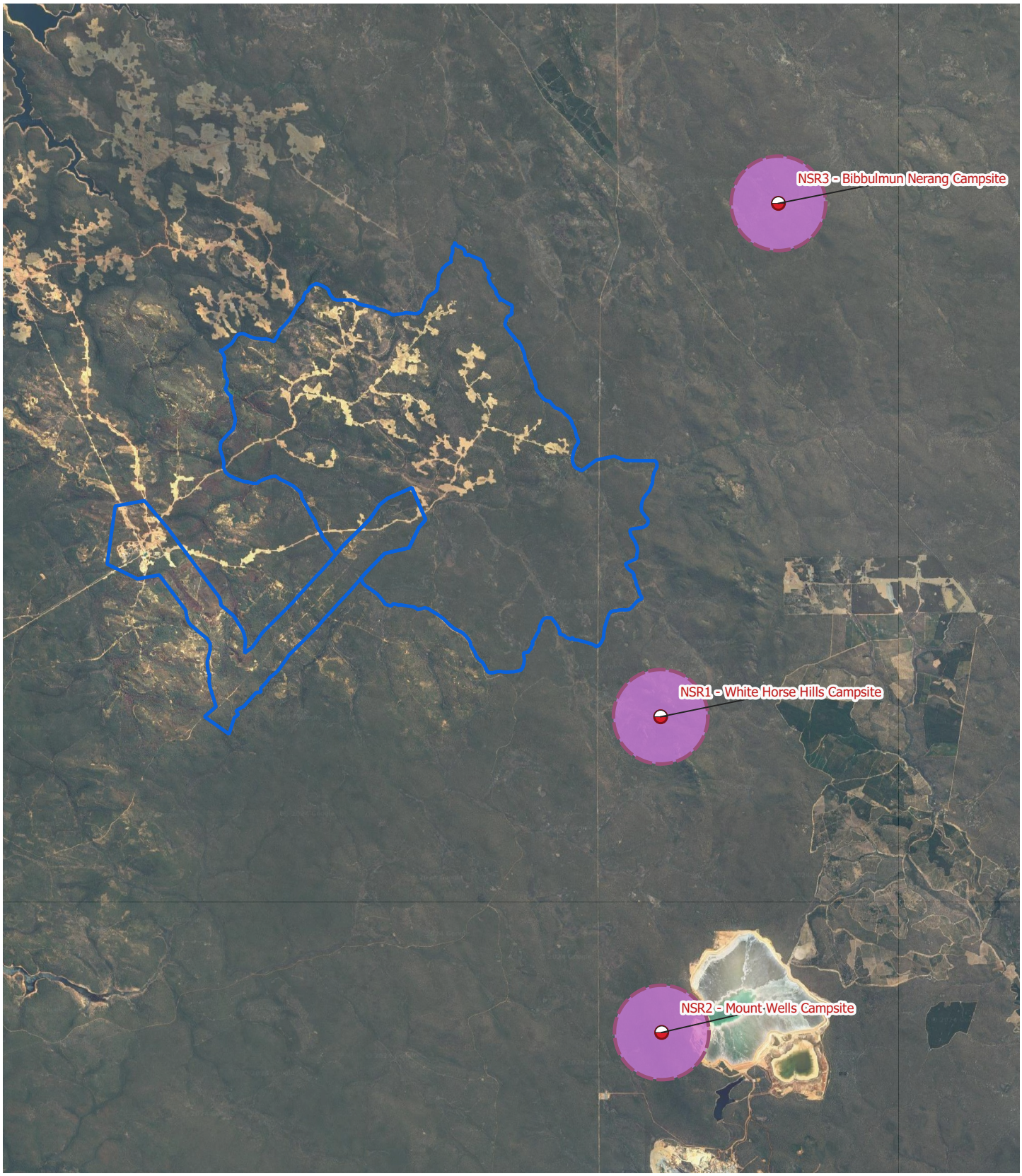
Based on this data, the noise criteria of 120 $dB(L)_{Linear, peak}$ is expected to be at approximately 1,200 m from the blast centre. It is not expected that there will be any exceedances at the NSRs due to the large distances from the nearest NSR (NSR1) to mine site (>2000 m). This has been visualised in Figure 8.1.

8.2 Blasting vibration

The calculated distances for ground borne vibration levels to attenuate to below 5 mm/s are 212 m and 188 m for a 9 kg and 7 kg charge masses, respectively. It is not likely the safety exclusion zone for a blasting event will exceed these distances from the blast centre. Therefore, ground borne vibration is expected to be insignificant at the all the nearby NSRs for the proposed region.

Table 8.2 Calculated distance for ground vibration to attenuate levels below 5 mm/s criteria.

Blast ID	Maximum instantaneous charge mass (8 ms detonation window)	Distance to attenuate below 5 mm/s (Safety exclusion zone)
Blast 1	9 kg	212 m
Blast 2	7 kg	188 m



Legend

Proposed mining region for O'Neil | Noise sensitive receptors | 1200m blasting noise radius

Paper Size ISO A4

0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

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O'Neil Noise Impact Assessment

Blast zones peak noise level assessment

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FIGURE 8-1

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9. Construction noise management

Construction activities should be performed in accordance with the Regulations. Under the Regulations, various construction noise requirements apply for daytime construction and out of hours construction as outlined in the table below.

Table 9.1 Construction noise criteria

Time period	Time	Construction noise requirements
Daytime construction	7:00 am and 7:00 pm on any day which is not a Sunday or a public holiday	No specific construction noise criteria. However, construction noise should be kept as low as practicable. This is provided that: – The construction work is carried out in with respected to control of noise as outlined in Section 6 of AS 2436-1981 “Guide to Noise Control on Construction, Maintenance and Demolition Sites”. – The equipment used for the construction works is the quietest that is reasonably available. – The CEO may request a construction noise management plan to be submitted for the construction work at any point of time.
Out of hours construction	7:00 pm and 7:00 am on any day which is not a Sunday or a public holiday	Construction noise should, as far as practicable, meet the assigned noise levels outlined in Regulation 8 in the Regulations. This is provided that: – The construction work is carried out in with respected to control of noise as outlined in Section 6 of AS 2436-1981 “Guide to Noise Control on Construction, Maintenance and Demolition Sites”. – The equipment used for the construction works is the quietest that is reasonably available. Furthermore, out of hours construction works may require the following are undertaken if excessive noise is expected: – The contractor must advise all nearby occupants of the work to be done at least 24 hours before it commences. – The contractor must show that it was reasonably necessary for the work to be done out of hours. – The contractor must submit to the CEO a noise management plan at least seven days before the work starts, and the plan must be approved by the CEO. – The noise management plan must include details of: • Need for the work to be done out of hours • Types of activity which could be noisy • Predictions of noise levels • Control measures for noise and vibration • Monitoring of noise and vibration • Complaint response

10. Operational noise management

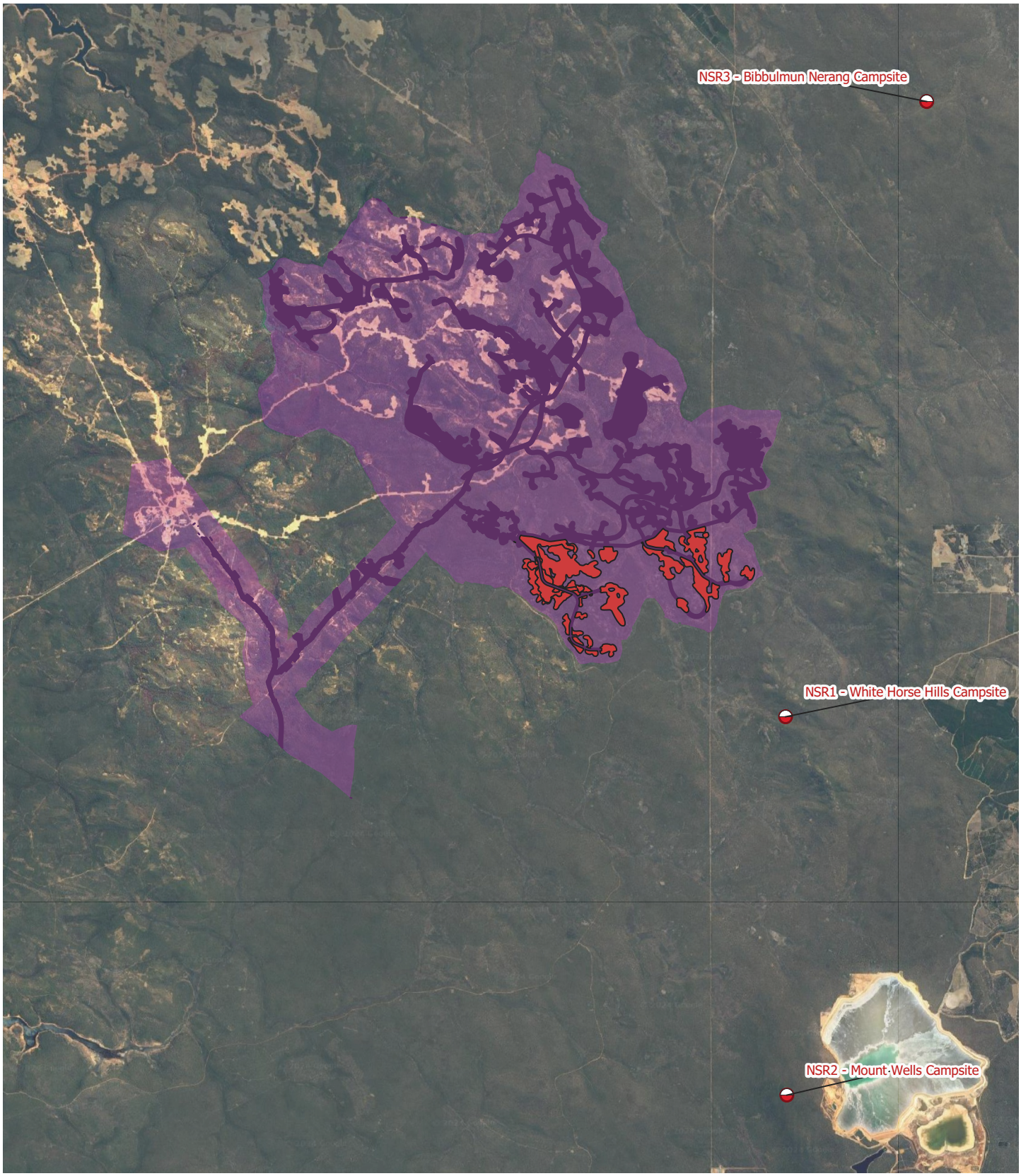
Worst case operational conditions may be present due to the factors below, which are further elaborated in Section 7.1.2.3.

- Mining activities occur at pit locations closest to the NSR.
- Mining activities occur at the surface and not at lower depths inside pits.
- Full duty cycle and simultaneous operation of all mobile fleet.
- Wind direction from source to receptor for each NSR (i.e. downwind conditions).

Whilst these conditions are unlikely to occur simultaneously, it is still a possibility. Hence, operation noise management strategies should be in place in order for compliance of noise level at all receptors. This is especially true for NSR1, where the presence of tonality is expected to cause non-compliance in the nighttime.

In order to reduce the likelihood of non-compliance, it is recommended that mining operations do not take place at the pit locations highlighted in Figure 10.1 during the night time period (i.e. Monday to Sunday 7am-7pm, Sundays and public holidays 9am-7pm).

It is predicted that excluding these pits from the mining operations at nighttime will reduce the received noise level at the NSR1 by at least 3 dB. This will significantly reduce likelihood of non-compliance due to possible tonality of the noise received at NSRs.



Legend

- O'Neil mine region
- Noise sensitive receptors
- O'Neil mine pits and haul
- Exclusion zone for nighttime operations

Paper Size ISO A4

0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

N

GHD

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O'Neil Noise Impact Assessment

Operational noise mitigation - Mining exclusion zones (Night time)

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FIGURE 10.1

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11. Conclusion

The NIA for the expansion of the Huntly Mine into the O'Neil region investigated potential noise impacts from the construction and operation of the proposed O'Neil mine. Construction noise, including blasting noise and vibration, was deemed minor compared to operational noise, leading to a qualitative assessment approach for construction and a quantitative noise modelling approach for operation. Noise modelling for worst case operational conditions was conducted for the following scenarios:

- Scenario A (Mining in 2026 pits, Mine development in 2027 pits).
- Scenario B (Rehabilitation in 2026 pits, Mining in 2027 pits, Mine development in 2028 pits).
- Scenario C (Rehabilitation in 2027 pits, Mining in 2028 pits).

The assessment findings indicate potential for nighttime operational noise exceedance at White Horse Hills Campsite (NSR1) if tonality is present in the mining noise. However, mining noise is unlikely to be audible if it is lower than 3 dB below the relatively high levels of ambient noise in the area.

Notwithstanding the above, under realistic operational conditions, all NSRs are expected to comply with noise criteria at all periods of the day. With operational planning practices such as those detailed in Section 10 of this report, noise compliance can be achieved even under worst case conditions.

Ground borne noise and vibration are expected to be insignificant at all nearby NSRs for the proposed O'Neil mine region.

12. References

CONCAWE. (1981). *the propagation of noise from petroleum and petrochemical complexes to neighbouring communities .*
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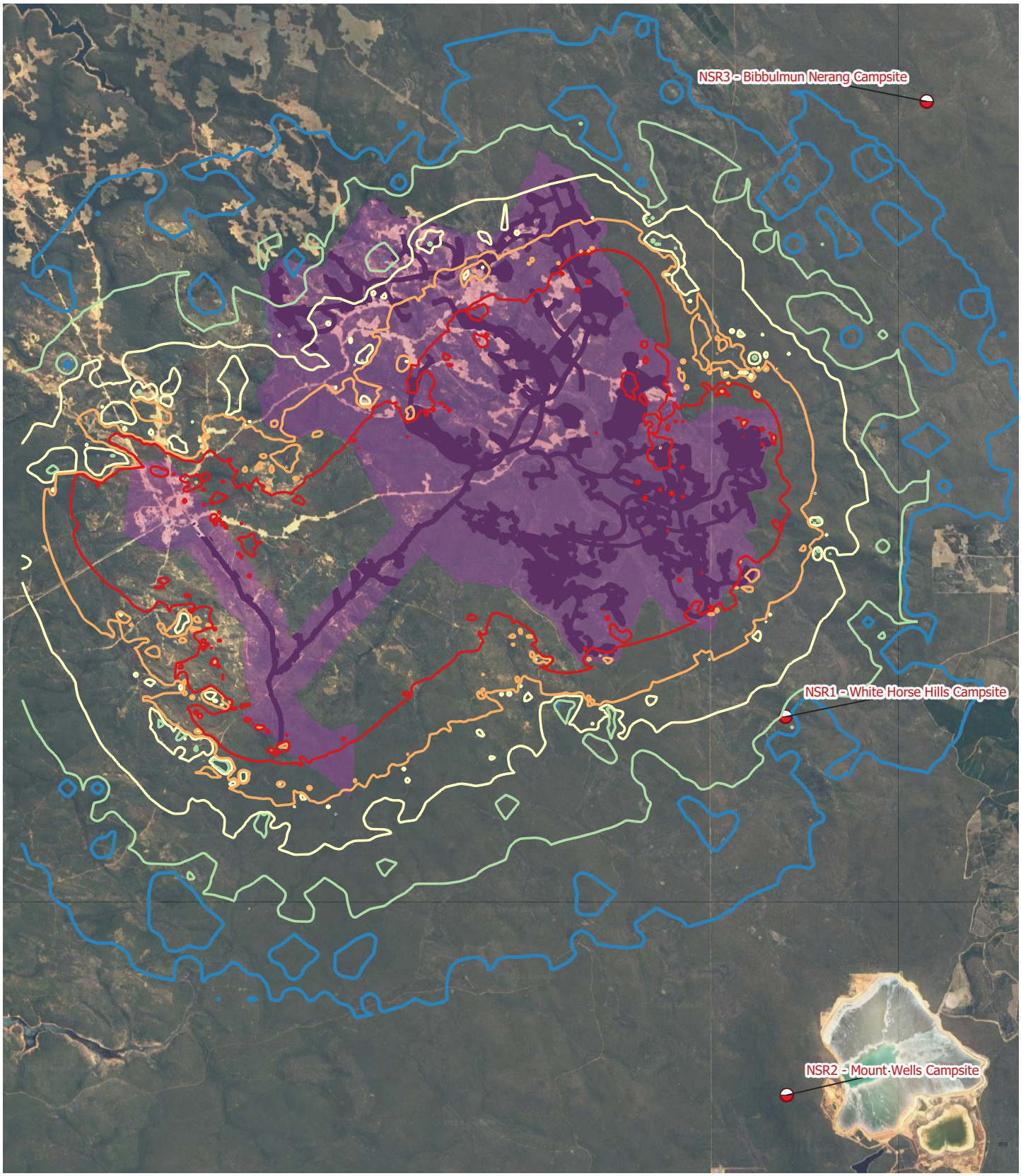
Appendix A

Noise contour maps



Legend

Predicted noise level, dB(A)
25
30
35
40
45
O'Neil mine region
Noise sensitive receptors
O'Neil mine pits and haul

Paper Size ISO A4
0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

N

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O'Neil Noise Impact Assessment

Scenario A L_{A10} day time noise contours

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FIGURE A-1

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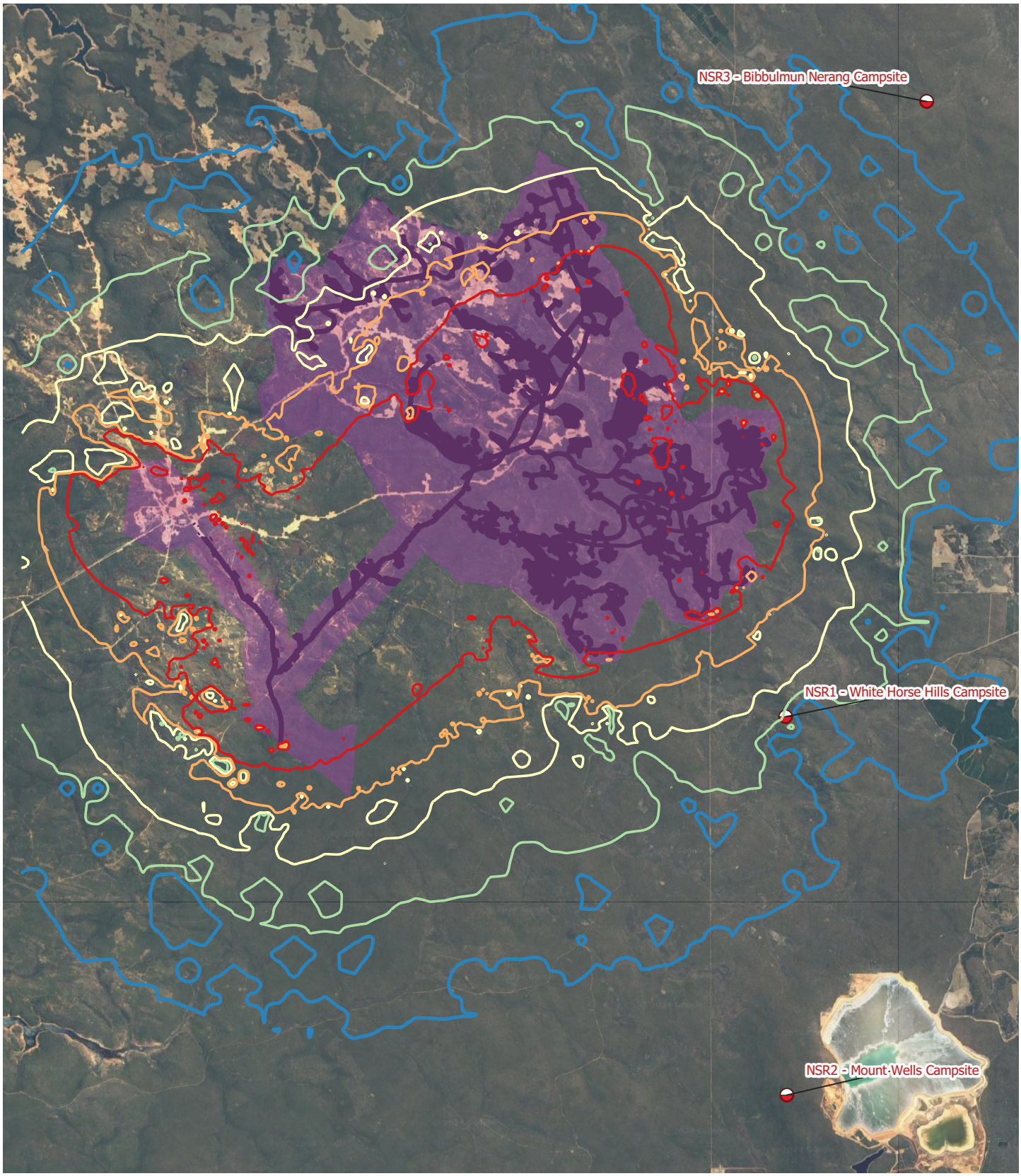

Legend

Predicted noise level, dB(A)
25
30
35
40
45
O'Neil mine region
Noise sensitive receptors
O'Neil mine pits and haul

Paper Size ISO A4
0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

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O'Neil Noise Impact Assessment

Scenario A L_{A10} night time noise contours

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FIGURE A-2

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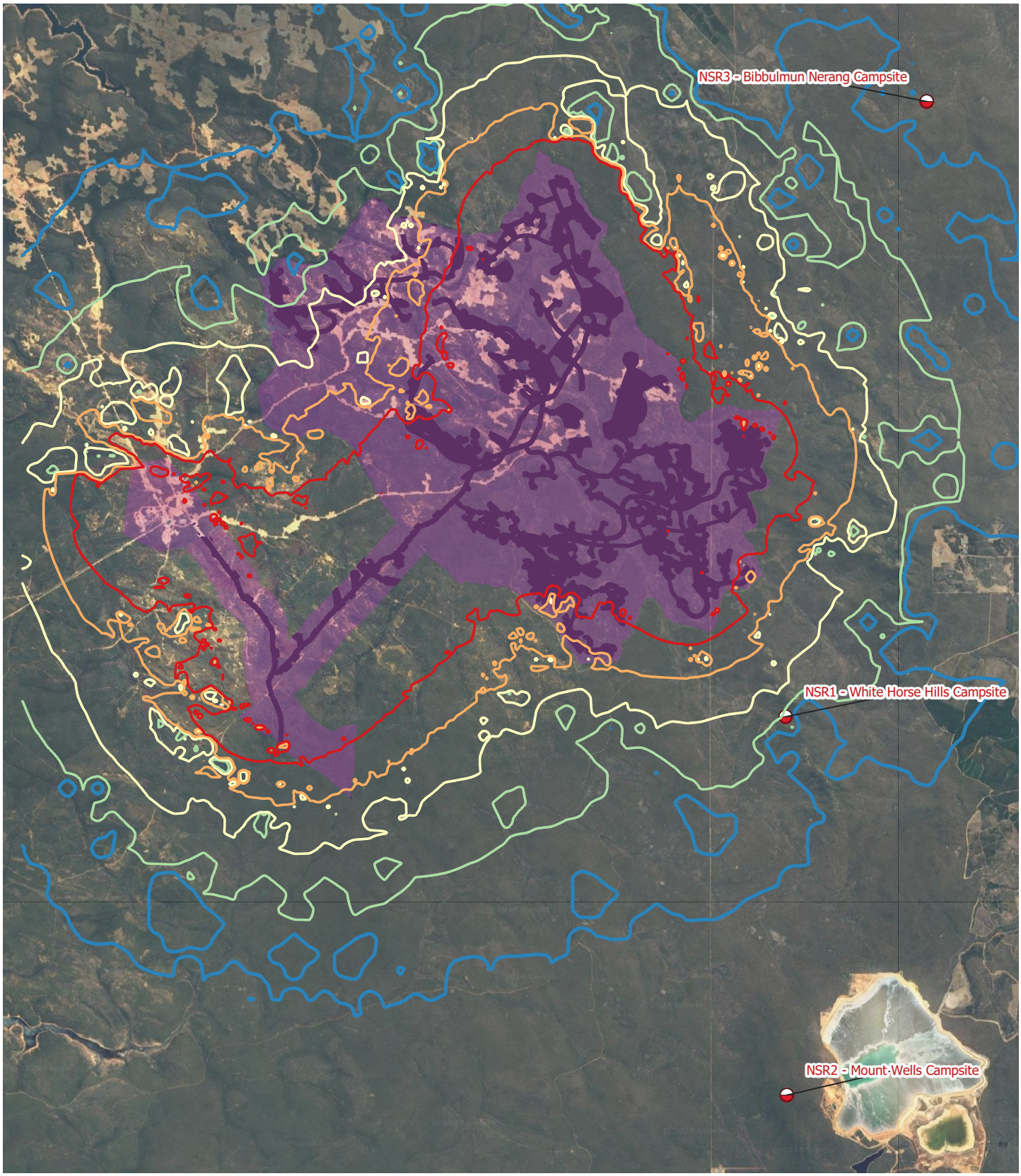

Legend

Predicted noise level, dB(A)
25
30
35
40
45
O'Neil mine region
Noise sensitive receptors
O'Neil mine pits and haul

Paper Size ISO A4
0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

N

GHD

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O'Neil Noise Impact Assessment

Scenario B L_{A10} day time noise contours

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FIGURE A-3

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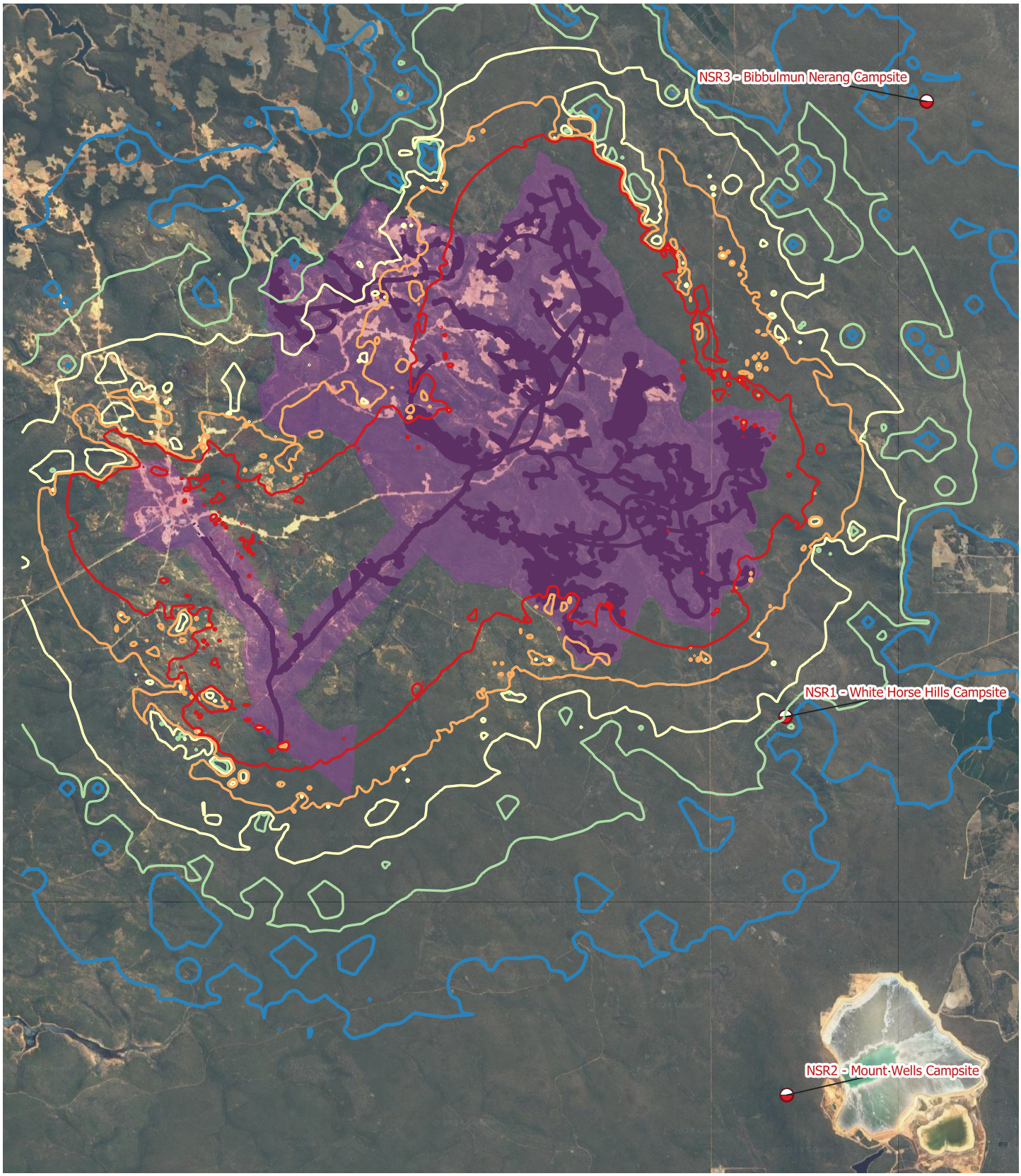

Legend

Predicted noise level, dB(A)
25
30
35
40
45
O'Neil mine region
Noise sensitive receptors
O'Neil mine pits and haul

Paper Size ISO A4
0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

N

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O'Neil Noise Impact Assessment

Scenario B L_{A10} night time noise contours

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FIGURE A-4

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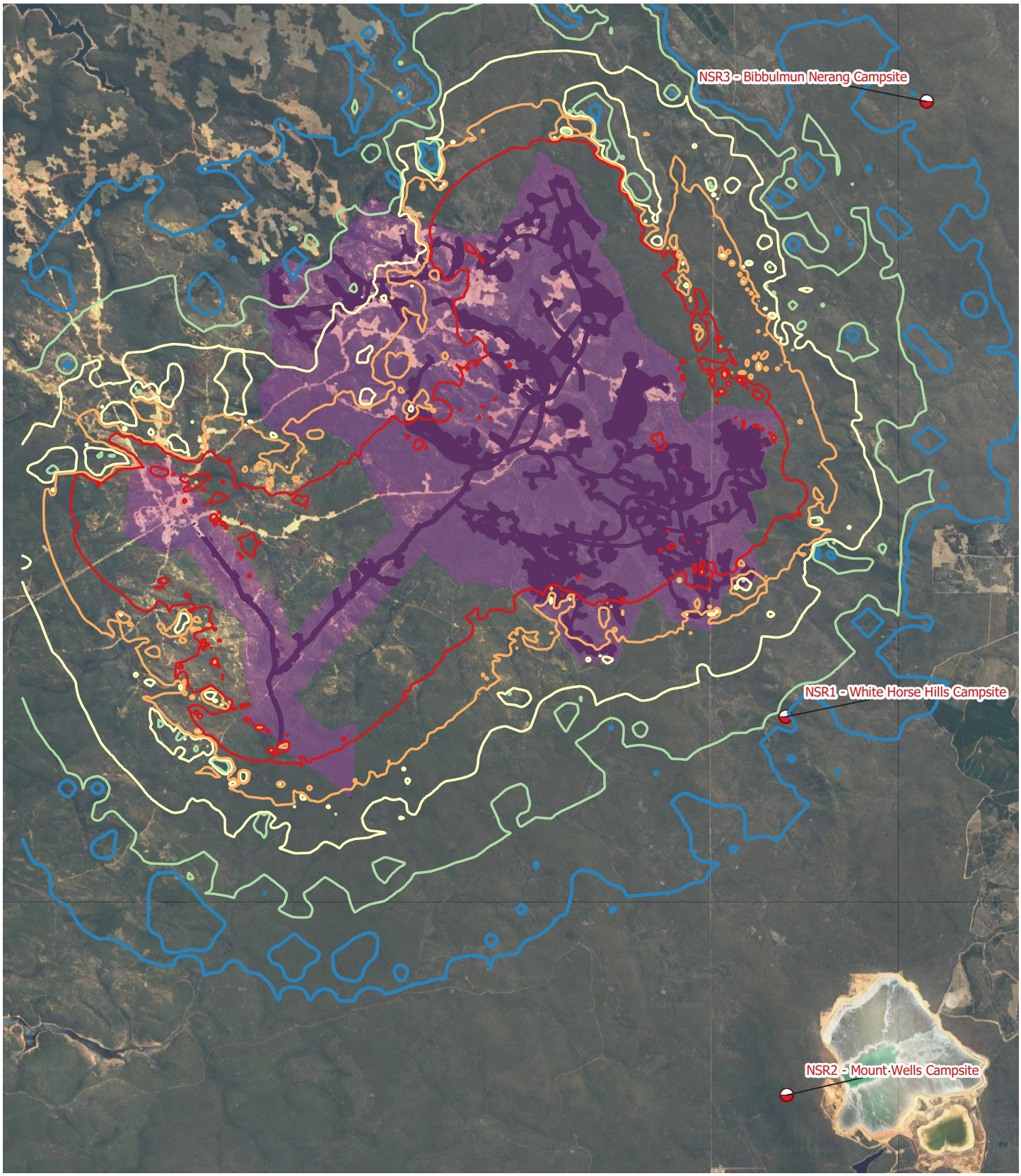

Legend

Predicted noise level, dB(A)
25
30
35
40
45
O'Neil mine region
Noise sensitive receptors
O'Neil mine pits and haul

Paper Size ISO A4
0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

N

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O'Neil Noise Impact Assessment

Scenario C L_{A10} day time noise contours

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FIGURE A-5

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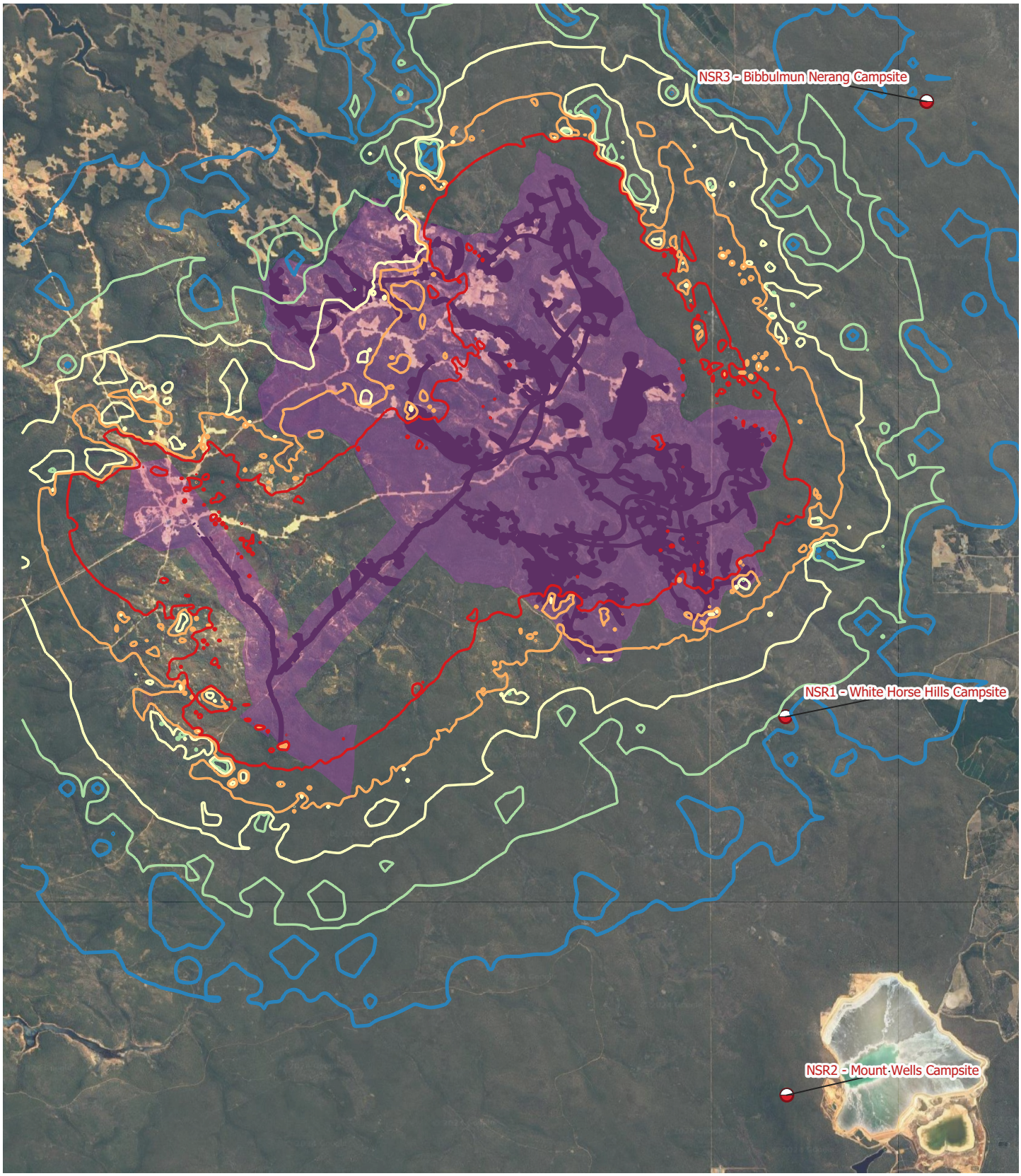

Legend

Predicted noise level, dB(A)
25
30
35
40
45
O'Neil mine region
Noise sensitive receptors
O'Neil mine pits and haul

Paper Size ISO A4
0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

N

GHD

Alcoa of Australia Limited

O'Neil Noise Impact Assessment

Scenario C L_{A10} night time noise contours

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Date. **30/09/2024**

FIGURE A-6

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The Power of Commitment