Attachment 6

Environmental Assessment Report

GROUNDWORK plus

Bromelton North Quarry Extension

Environmental Assessment Report

Prepared for: Neilsens Quality Gravels Pty Ltd

Date: December 2022

File Reference: 740_620_003

DOCUMENT CONTROL

PROJECT / DETAILS REPORT

Document Title:	Bromelton North Quarry Extension: Environmental Assessment Report
Principal Author:	Y. Dowling
Client:	Neilsens Quality Gravels Pty Ltd
Reference Number:	740_620_003

DOCUMENT STATUS

Issue	Description	Date	Author	Reviewer
0	Environmental Assessment Report	December 2022	Y. Dowling	D. Doolan

DISTRIBUTION RECORD

Recipient	
Neilsens Quality Gravels Pty Ltd	Electronic x 1
Department of Environment and Science	Electronic x 1

GROUNDWORK PLUS
Phone: 1800 GW PLUS (1800 497 587)
Email: info@groundwork.com.au
Website: groundwork.com.au
ABN 13 609 422 791

VIC/TAS
WeWork | Groundwork Plus
Office 21-106
120 Spencer Street, Melbourne
Vic 3000

QLD/NSW
6 Mayneview Street, Milton Qld 4064
PO 1779, Milton BC Qld 4064
Phone: +61 7 3871 0411
Fax: +61 7 3367 3317

Geotechnical Laboratory
Unit 78/109 Leitchs Road, Brendale Qld 4500
Phone: 0417 615 217

SA/WA/NT
2/3 16 Second St, Nuriootpa SA 5355
PO Box 854, Nuriootpa SA 5355
Phone: +61 8 8562 4158

TABLE OF CONTENTS

TABLES

DIAGRAMS

GRAPHS

FIGURES

DRAWINGS

East Pit Extension Drawing No. 740.DRG.398r1

ATTACHMENTS

Attachment 1 Noise Impact Assessment

Attachment 2 Air Quality Assessment

Attachment 3 EMR / CLR Search Results

1 Introduction

1.1 Background

Groundwork Plus Pty Ltd has been engaged by Neilsens Quality Gravels Pty Ltd ('Neilsens') to prepare and submit a Development Application ('DA') to the Office of the Coordinator-General ('Coordinator-General') for a new Material Change of Use – Development Permit for Extractive Industry (Extension and increase in volume) at the existing Bromelton North Quarry located at 291 Sandy Creek Road, Bromelton, properly described as Lot 1 on RP98576 ('herein referred to as the 'site').

The site is located within the Bromelton State Development Area ('Bromelton SDA'), which was declared by the Coordinator-General in 2008 under the *State Development and Public Works Organisation Act 1971*, and the Bromelton Key Resource Area ('KRA') 61.

The purpose of the application is to extend the eastern quarry footprint and increase to the annual extraction volumes to 800,000 tonnes per annum. An illustration of the proposed development is provided in the attached drawing titled **East Pit Extension (Drawing no. 740.DRG.398r1)**. No changes to the other aspects of the operation are proposed (e.g., hours of operation, location of fixed processing plant).

There is an existing Environmental Authority ('EA') authorising the site activities, which comprises the following Prescribed Environmentally Relevant Activities ('ERAs') under the *Environmental Protection Regulation 2019* ('EP Reg'):

- ERA 16 Threshold (2)(b) Extracting, other than by dredging, in a yea, the following quantity of material – more than 100,000 tonnes per year but not more than 1,000,000 tonnes per year; and
- ERA 16 Threshold (3)(b) Screening, in a year, the following quantity of material – more than 100,000 tonnes per year but not more than 1,000,000 tonnes per year.

The purpose of this Environmental Assessment Report ('EAR') is to support the extension of the existing eastern quarry footprint by providing the information necessary to assist the Department of Environmental and Science ('DES') in the assessment of the EA amendment. It must be noted that this EAR considers the Environmental Values ('EVs') and impacts to the extent of the proposed changes to the site activities only, which are the East Pit extension and increase in volumes. It does not retrospectively assess activities authorised under the existing EA.

1.2 Purpose of the EAR

The application requirements for an EA amendment application are outlined in Section 226A of the *Environmental Protection Act* ('EP Act') and include the following:

- An assessment of the likely impact of the proposed activity on the EVs, including:
    - a description of the EVs likely to be affected by the activity.
    - details of any emissions or releases likely to be generated by the activity.
    - a description of the risk and likely magnitude of impacts on the EVs.
    - details of the management practices proposed to be implemented to prevent or minimise adverse impacts.
    - details of how the land the subject of the application will be rehabilitated after each relevant activity ceases.

- A description of the proposed measures for minimising and managing waste generated by each relevant activity.
- Details of any site management plan that relates to the land the subject of the application or any other document relating to the application prescribed under a regulation.

This EAR contains the above-mentioned information to the extent that it relates to the amendments specifically.

1.3 Eligibility Criteria and Standard Conditions

ERA 16 Threshold (2)(b) is not an activity to which an ERA standard applies. Therefore, the eligibility criteria and standard conditions do not apply to the proposed activity and no further assessment of the eligibility criteria or standard conditions has been included in the application material.

1.4 Site Description

The details of the site location are summarised in **Table 1 – Summary of Subject Land**. The location of the site is illustrated in **Figure 1 – Aerial Photo and Cadastre**.

Figure 1 – Aerial Photo and Cadastre

(Figure reprinted from The State of Queensland (2022))

Table 1 – Summary of Subject Land

Address	291 Sandy Creek Road, Bromelton QLD 4285
Access	Sandy Creek Road
Real Property Description	Lot 1 on RP98576
Tenure	Freehold
Lot Area	627.92 hectares
Local Authority	Scenic Rim Regional Council

1.5 Description of Activities

Included as **Diagram 1 – Conceptual On-Site Extractive Operations** is an illustration of the quarry development. The quarry operations comprise of the following basic elements:

- Clearing of vegetation and striping of topsoil and overburden material using mechanical means (i.e. bulldozer or excavator) and stockpiling for incorporation into on-site rehabilitation works where required, or use in constructing stormwater control structures (e.g. perimeter banks).
- Drilling and blasting the exposed underlying rock to a manageable size for the developed quarry benches to the quarry pit or bench below.
- Transferring raw material from the quarry face or pit floor to a designated crushing and screening plant/stockpile hardstand areas using an excavator or front-end loader into off-road haul trucks.
- Crushing and screening the raw material using crushing and screening processing plant(s).
- Stockpiling the final products using a front-end loader and/or off-road haul trucks within designated hardstand areas until required to be loaded into road trucks for transportation off-site for sale.
- Rehabilitating disturbed areas progressively once terminal benches are reached.

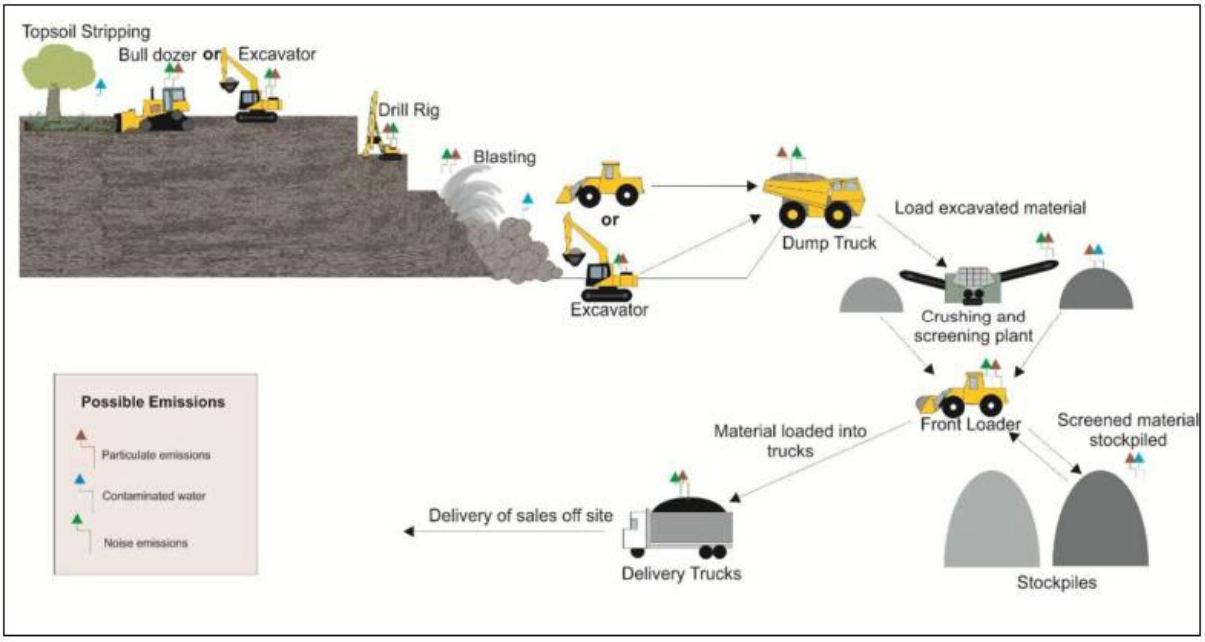


Diagram 1 – Conceptual On-Site Extractive Operations

Operations are supported by a range of ancillary buildings and structures including, but not limited to:

- Site office and amenities block, visitor car park, staff car park and truck parking area(s).
- Weighbridge, workshop and truck wash down facility.
- Security fencing.
- Internal haul and access roads.

1.6 Plant and Equipment

The number of plant and equipment deployed on-site is anticipated to vary from time-to-time to service the project demands. Types of major plant and equipment may include, but not limited to:

- Bulldozer.
- Grader.
- Drill Rig.
- Excavator.
- Off-highway haul trucks.
- Front-end loader.
- Mobile crushing and screening plant.
- Haul road trucks.
- Highway haul trucks.
- Wheel loaders.
- Articulated dump trucks.
- Articulated water cart.
- Service trucks.
- Light vehicles.
- Tractor.
- Forklift.
- Water pumps.
- Bobcat.

Machinery repairs and maintenance will be carried out on-site where practicable within a designated workshop area. Stationary equipment will generally be serviced in the field unless it is practical for the parts to be dismantled and transported to the workshop. Consumables (e.g., tyres, oils and greases) will be supplied by contractors and removed (including associated packaging) for disposal off-site in accordance with the requirements of the prevailing legislation and the local authority on a regular basis.

1.7 Hours of Operation

The hours of operation will generally be:

- 6:00am to 6:00pm Monday to Friday.
- 7.00am to 5:00pm Saturdays.
- Blasting activities only to occur between 9:00am to 5:00pm Monday to Friday, except in an emergency.
- No operations on Sundays or Public Holidays.

1.8 Summary of Proposed Changes

It is proposed to extend the East Pit to access known resources on the land and improve operational efficiencies. The proposed extension will provide additional extraction area, stockpiling and ancillary operations area and stormwater controls. The fixed processing plant and associated stockpiling area will be retained in the centre of the site. No additional buildings or structures are proposed. The existing site office, amenities block, parking areas, weighbridge, workshop and truck wash down facilities and other supporting infrastructure will be retained unchanged.

Extraction activities will continue to occur within the west pit.

It is intended to replace the conditions of the current Consent Order with a new development approval, which will become the relevant land use approval regulating the site in conjunction with the EA.

A comparison of the approved and proposed site layout plans is provided in **Figure 6 – Approved and Proposed Footprint**.

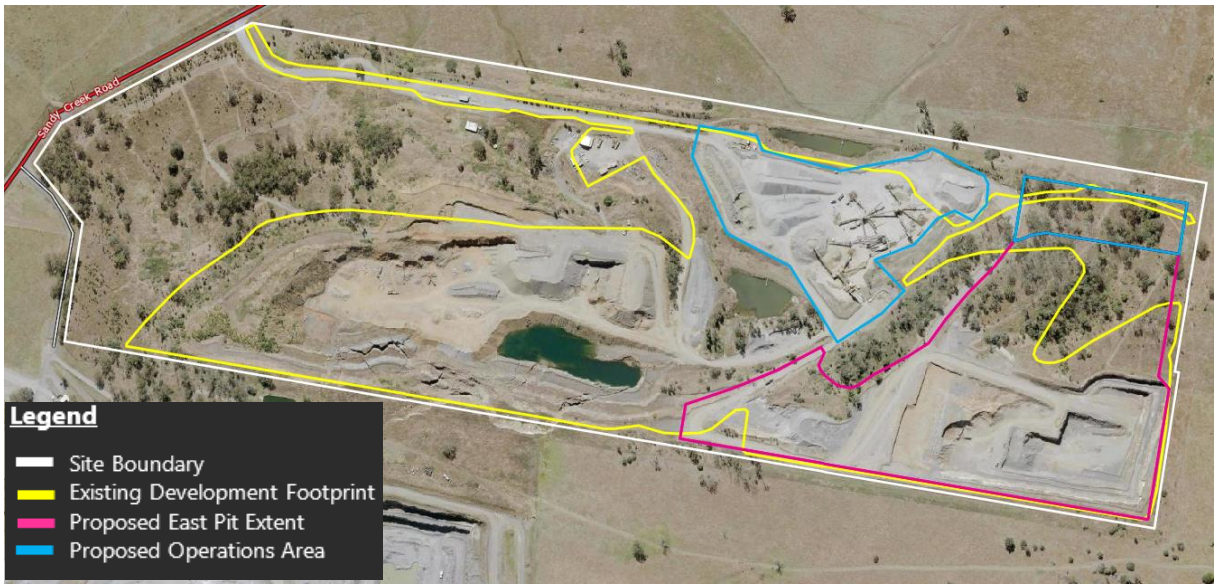


Figure 2 – Existing and Proposed Footprint

Table 2 – Development Attributes (Existing and Proposed) provides a summary of the existing and proposed site activities relevant to the EA amendment.

Table 2 – Development Attributes (Existing and Proposed)

	Approved	**Proposed**
Approval Reference:	P & E Court Consent Order (ref: Appeal No. 3448 of 2003)	To be confirmed
Environmental Authority:	DES Ref: EPPR00540113	-
Environmentally Relevant Activities:	ERA No. 16 – Extractive and Screening Activities, Threshold 2(b) – extracting, other than by dredging, in a year,	No change

	Approved	**Proposed**
	more than 100,000 tonnes but not more than 1,000,000 tonnes ERA No. 16 – Extractive and Screening Activities, Threshold 3(b) – screening, in a year, more than 100,000 tonnes but not more than 1,000,000 tonnes.	
Annual Protection:	400,000tpa	800,000tpa
Hours of Operation:	6:00am to 6:00pm Monday to Friday 7.00am to 5:00pm Saturdays Blasting activities only to occur between 9:00am to 5:00pm Monday to Friday, except in an emergency. No operations on Sundays or Public Holidays	No change Noise and air quality assessments have been undertaken to confirm that the extended operation can continue to achieve the noise and air quality criteria in the existing EA (refer **Attachment 1 – Noise Impact Assessment** and **Attachment 2 – Air Quality Assessment**).

2 Description of Environmental Values

2.1 Regional Context

2.1.1 Land Use

Refer to **Figure 1 – Aerial Photo and Cadastre** for an illustration of the site and surrounding area. The site is a pre-existing extractive industry activity. **Table 3 – Adjacent Land Uses** provides a summary of the land uses surrounding the site.

Table 3 – Adjacent Land Uses

Direction	Land Use
North	Vacant land / agricultural activities
East	Vacant land / agricultural activities
South	Extractive Industry
West	Vacant land / agricultural activities

Bromelton North Quarry is located within the Bromelton SDA, which was declared by the Coordinator-General in 2008 under the *State Development and Public Works Organisation Act 1971*, refer to **Figure 3 – Bromelton SDA Mapping**. New development within the Bromelton SDA is regulated by the Office of the Coordinator-General under the *Development Scheme for the Bromelton State Development Area* , rather than under the framework established by the *Planning Act 2016*.

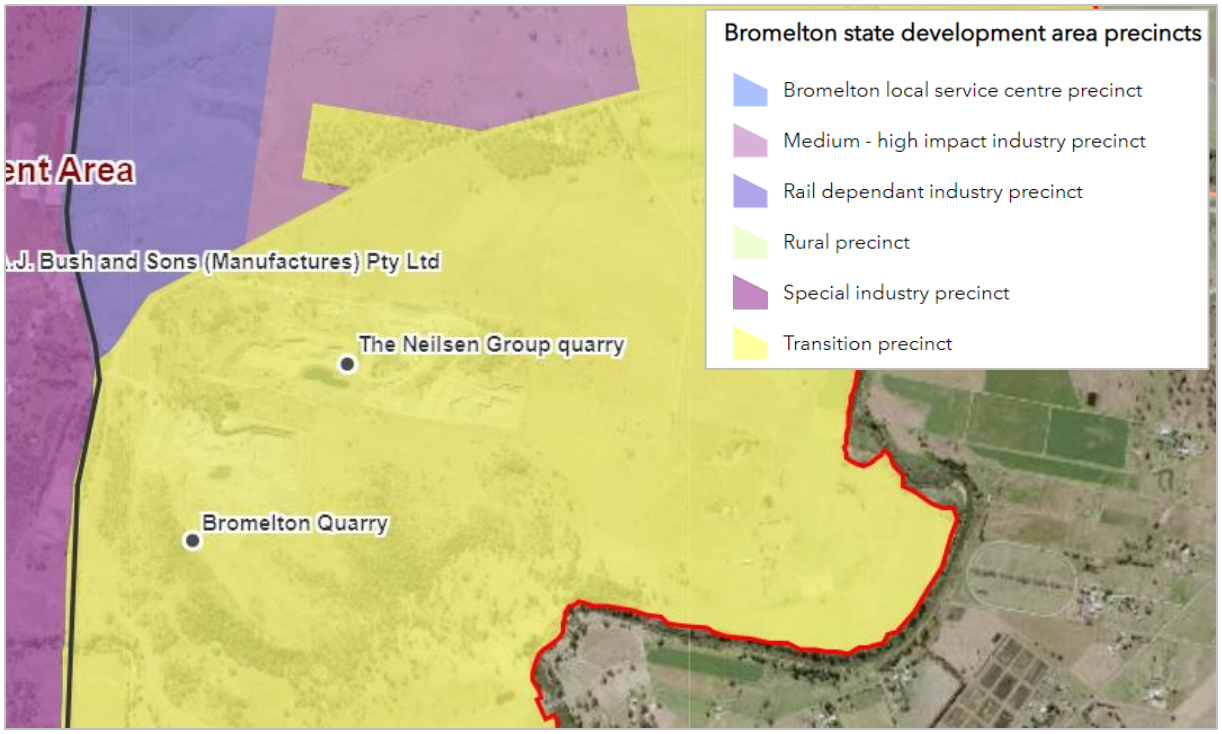


Figure 3 – Bromelton SDA Mapping

(Figure source: State Development, Infrastructure, Local Government and Planning (2022))

The site is also within the Bromelton KRA no. 61, refer to **Figure 4 – Bromelton KRA 61 Mapping**. The State Planning Policy identifies KRA no. 61 as:

> *SIGNIFICANCE:*
>
> *The resource is conveniently situated to supply the Scenic Rim and Logan, Ipswich and Brisbane City markets by either road or rail transport for up to 100 years at the planned rates of extraction. The resource meets the criteria for State significance.*
>
> *SEPARATION AREA:*
>
> *The surrounding country is lower than the resource and is mostly zoned as Rural, thus the 1000 metre separation distance has been adopted. The full 1000 metre separation distance from the resource also applies over the industrial estate on the western side of the railway line, and 700 to 1000 metres over rural land to the north. The separation area is constrained by Rural Residential lots to the southwest, which are less than 1000 metres from the resource. The southwest flank of the hill will partly screen the operations from these Rural Residential lots.*

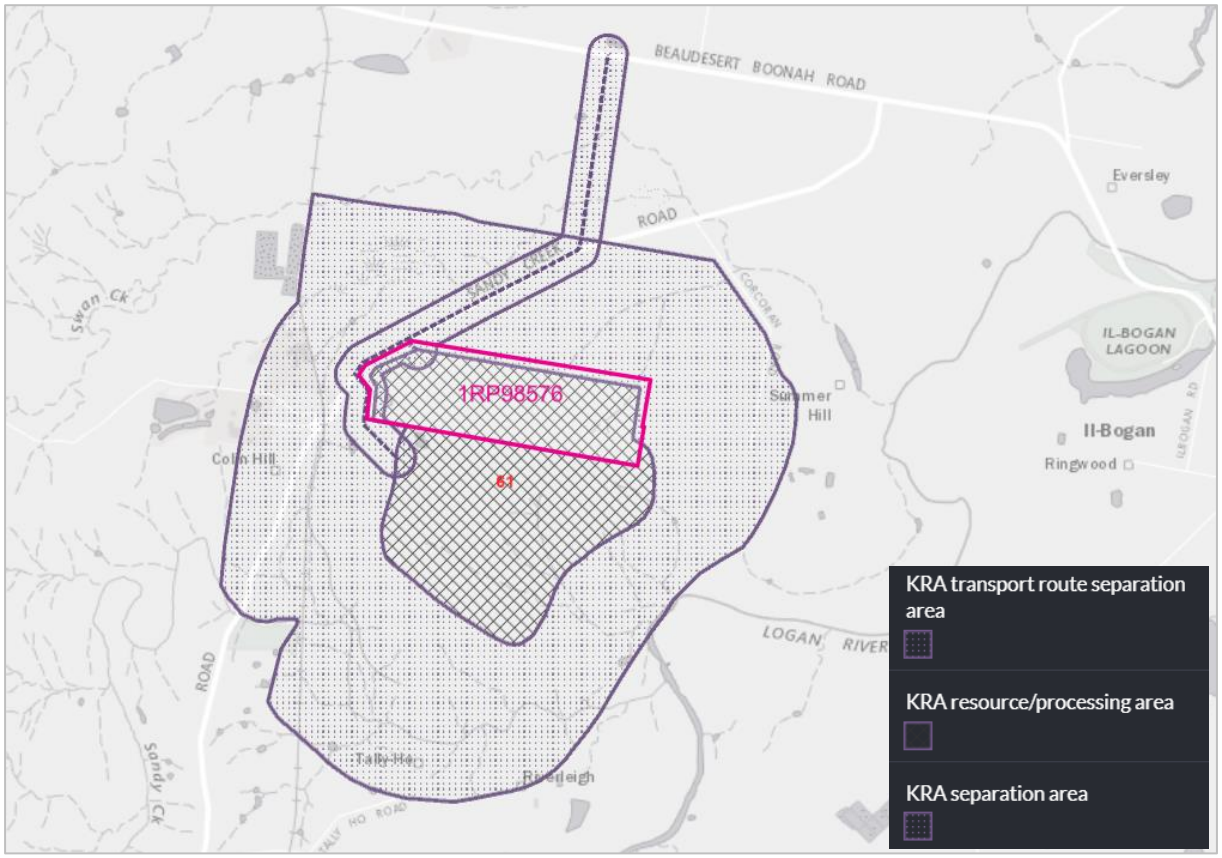


Figure 4 – Bromelton KRA 61 Mapping

(Figure reprinted from The State of Queensland (2022))

2.1.2 Nearest Sensitive Receptors

Sensitive receptors, as defined under Schedule 1 of the *Environmental Protection Policy (Noise) 2019*, are outlined in **Table 4 – Nearby Sensitive Receptors**. A discussion on whether any of these sensitive receptors are in close proximity to the site is provided herein.

Table 4 – Nearby Sensitive Receptors

Sensitive Receptor	Description and Location
Residence	The nearest residence is situated approximately 730 m north of the proposed operations area. There are a total of five residences within 1 km of the site. Further discussion of the nearest receptors (dwellings) is provided in **Section 2.6.1 - Audible Noise** and **Section 2.7 - Air**.
Library and educational institution (including schools, playgrounds, college and university)	St Mary's School is situated in Bromelton, approximately 4.5km east of the proposed extraction area. Beaudesert Public Library is situated approximately 4.5km from the site.
Childcare centre or kindergarten	Edge Early learning Beaudesert is situated in Beaudesert, is situated approximately 4.5km east of the proposed extraction area.
School or playground	St Mary's School is situated in Bromelton, approximately 4.5km east of the proposed extraction area.
Hospital, surgery or other medical institution	The nearest hospital (Beaudesert Hospital) is situated approximately 5.5km east of the proposed extraction area.
Commercial and retail activity	The nearest commercial and retail activities are situated in the township of Beaudesert. Land east of the site is used for animal agriculture, being primarily livestock grazing.
Protected area or critical area	The nearest protected area is the Henderson Reserve Nature Refuge is situated approximately 17.5km north north-east of the site. The nearest National Park is Sarabah National Park approximately 18.5 km south-east of the site Refer to **Figure 5 – Protected Areas and State Forests**.
Marine park	The Moreton Bay Marine Park is situated approximately 80 km north north-east of the site.
Park or garden that is open to the public (whether or not on payment of an amount) for use other than for sport or organised entertainment	Platell Park is situated approximately 1.1 km south-west of the site boundary.

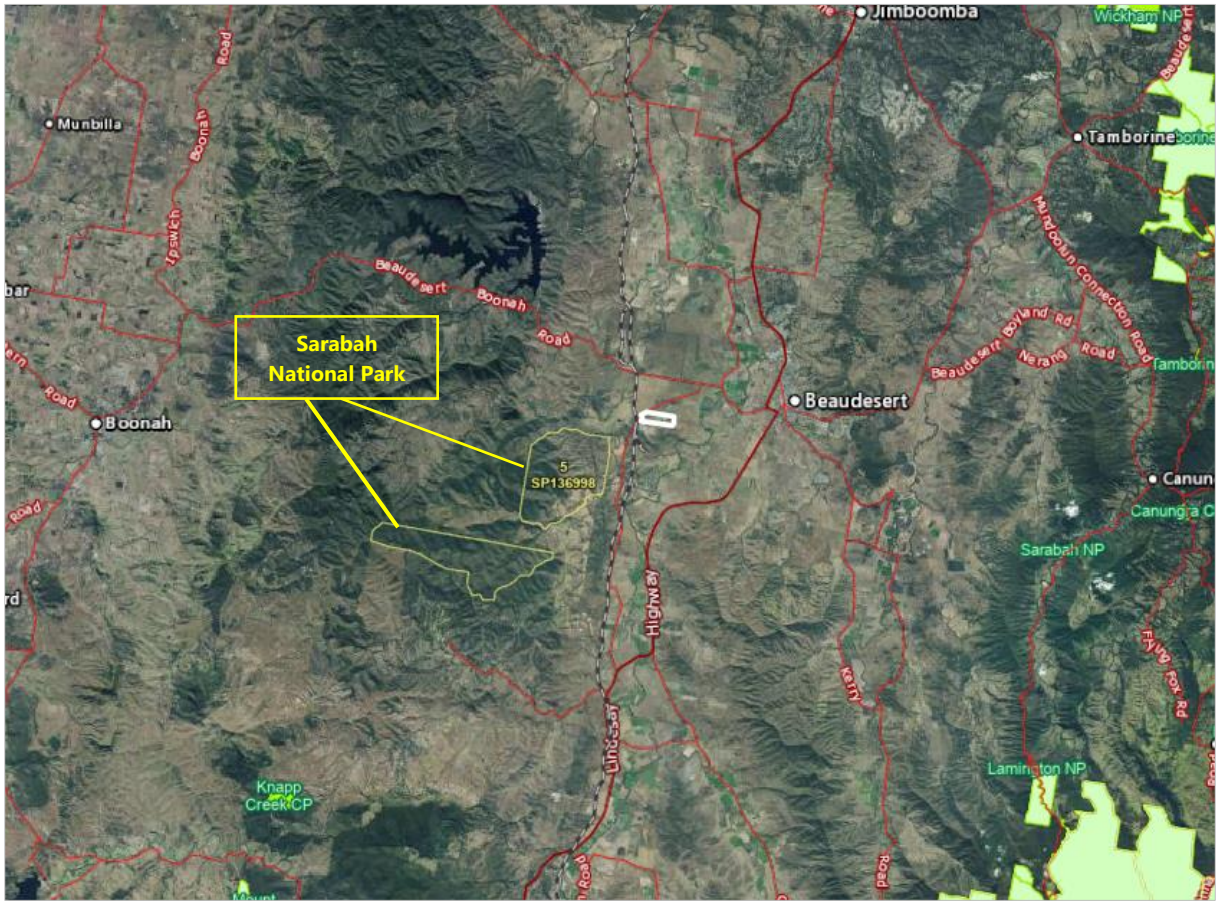


Figure 5 – Protected Areas and State Forests

(Figure reprinted from The State of Queensland (2022))

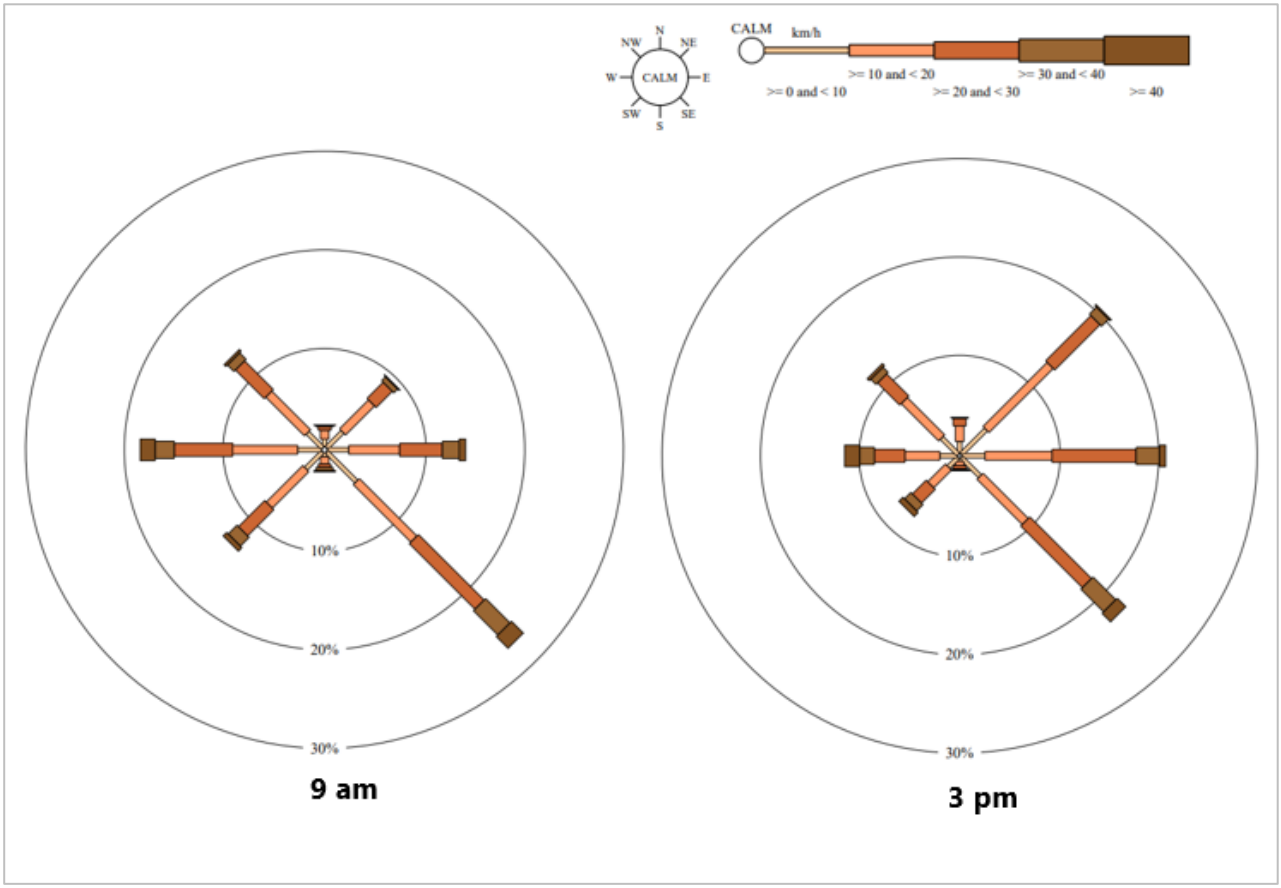
2.1.3 Regional Climate

A summary of the regional climate data sourced from the Bureau of Meteorology ('BoM') is provided in **Table 5 – Regional Climatic Statistics.** As shown in **Table 5**, the annual mean rainfall for this locality 911.1mm and majority of rain falls between December and March. There is no recent available wind data in proximity to the site. The nearest station with complete 9am and 3 pm wind data is the Mount Tamborine, Fern Street Station (Station 040197); however, collection of wind data at this location ceased in 1978. Wind speed and direction data is presented in **Table 5** and graphically as **Graph 1 – Wind Roses and Annual Speed and Direction 9am vs 3pm**. Wind data presented below is therefore indicative only.

Table 5 – Regional Climatic Statistics

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Rainfall (mm)													
Mean	145.0	118.9	143.6	42.0	63.6	43.1	30.1	28.4	33.3	78.4	81.4	126.5	911.1
Temperature (°C)													
Mean min.	19.3	19.1	17.9	14.0	9.9	7.5	6.2	6.5	10.0	13.1	16.2	18.2	13.2
Mean max.	31.4	30.6	29.2	27.0	24.2	21.7	21.6	23.4	26.3	28.2	30.0	30.7	27.0
Wind Speed (km/h)													
Mean 9am wind speed	21.0	20.4	20.7	20.1	19.4	21.4	23.1	21.7	23.1	22.7	20.8	19.4	21.2
Mean 3pm wind speed	21.7	21.0	20.7	19.4	18.8	20.7	22.1	22.1	23.6	23.4	22.8	20.6	21.4

Source:
Rainfall and Temperature data from Beaudesert Drumley Street Station No.: 040983
Wind data from Mount Tamborine, Fern Street Station 040197



Graph 1 – Wind Roses and Annual Speed and Direction 9am vs 3pm

(Reprinted and adapted from BoM (2021)

2.2 Land

2.2.1 Remnant Vegetation

The site is predominantly mapped as comprising of Category X – non remnant vegetation for the purpose of the *Vegetation Management Act 1999* ('VMA'). As show in **Figure 6 – Remnant Vegetation Mapping** a portion of the East Pit extension contains Category C – regrowth vegetation containing an endangered Regional Ecosystem (which is also identified as Essential Habitat) as summarised in **Table 6 – RE Description within Extension Area**.

Clearing of Category C regrowth vegetation for the purpose of extractive industry within a Key Resource Area is exempt clearing work pursuant to Schedule 21 of the *Planning Regulation 2017*. As such, further consideration of this vegetation is not relevant to this EAR.

Land to the west of the extension area is mapped as comprising Category B – remnant vegetation containing endangered RE; however, Neilsens do not intend to carry out any clearing within the mapped area from that authorised under the existing site approvals.

Table 6 – RE Description within Extension Area

RE	VMA Status	Short Description
Category C Regrowth Vegetation		
12.8.24	Endangered	*Corymbia citriodora* subsp. variegata, *Eucalyptus crebra* +/- E. moluccana open forest. Occurs on Cainozoic igneous rocks especially lower slopes of rhyolite and trachyte hills (e.g., Moogerah Peaks). Structure category: mid-dense.

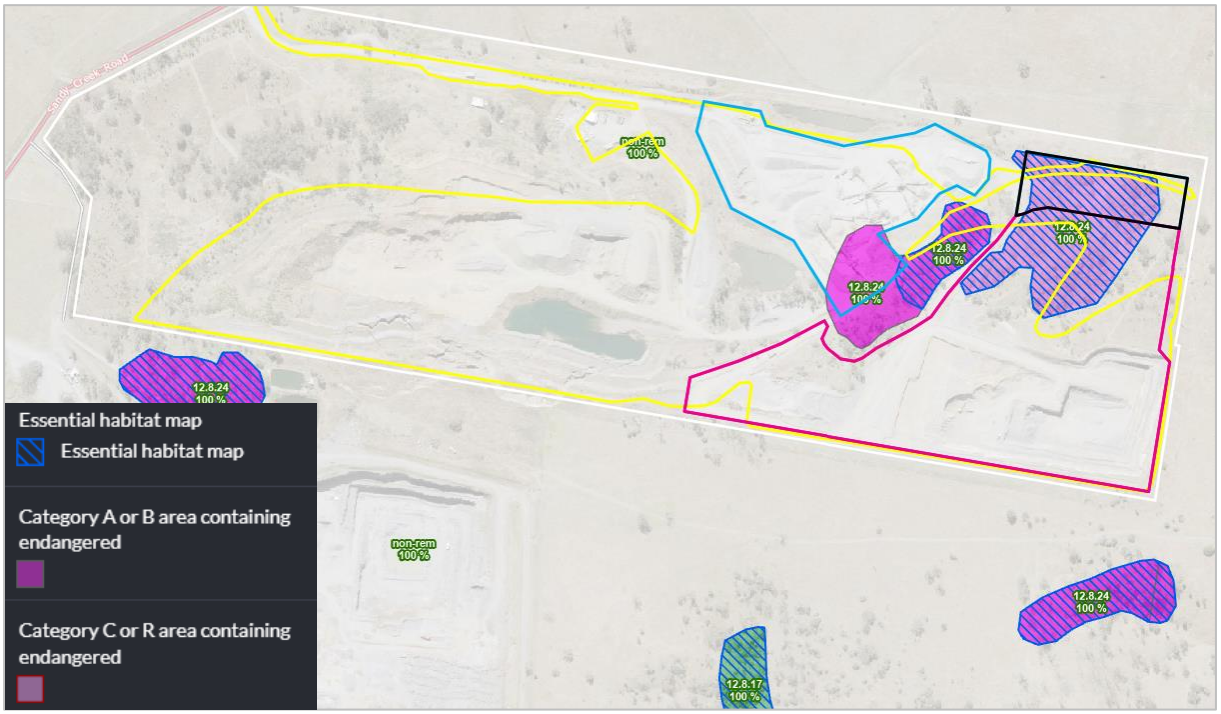


Figure 6 – Remnant Vegetation Mapping

(Figure reprinted from The State of Queensland (2022))

2.2.2 Koala Habitat

The proposed extension area contains core koala habitat but is not identified in a priority koala habitat area. Clearing of koala habitat for the purpose of extractive industry within a Key Resource Area would generally be assessable under Schedule 10, Part 10, Division 4, Subdivision 1 of the *Planning Act 2016*. However, as the development is proposed within a State development area the clearing falls under the definition of 'exempt development' in Schedule 24. As such, further consideration of this vegetation is not relevant to this EAR.

2.2.3 Flora Survey Trigger Mapping

The site is not mapped as containing any High Risk Areas on the Flora Survey Trigger Mapping, refer **Figure 7 – Flora Survey Trigger Mapping** and as a result a flora survey for the purpose of the *Nature Conservation Act 1999* ('NCA') is not triggered.

Figure 7 – Flora Survey Trigger Mapping

(Figure reprinted from *Protected Plants Flora Survey Trigger Map* (DES 2022))

2.2.4 Matters of State Environmental Significance

Figure 8 – MSES Mapping provides an illustration of the areas mapped as Matters of State Environmental Significance ('MSES') within the proposed extension area. These include:

- MSES regulated vegetation [category C- endangered or of concern]
- MSES regulated vegetation [essential habitat]
- MSES regulated vegetation [defined watercourse]
- MSES wildlife habitat [SEQ koala habitat - core].

In accordance with the Department's *Information sheet: Exemptions – where offsets cannot be required* (DES 2020), Category C regrowth vegetation is not a prescribed matter for the purpose of the *Environmental Offsets Act 2014*. The above-mentioned MSES regulated vegetation [essential habitat], MSES regulated vegetation [category C- endangered or of concern]and MSES regulated vegetation [defined watercourse] are understood to be solely associated with the Category C regrowth vegetation. As previously outlined, clearing for the purpose of extractive industry within a KRA is exempt clearing work pursuant to Schedule 21 of the *Planning Regulation 2017*.

The above-mentioned clearing of core koala habitat, which is the same matter identified as MSES wildlife habitat [SEQ koala habitat - core], is exempted development where development occurs in a State development area. As such, further consideration of this vegetation is not relevant to this EAR.

Further consideration of MSES associated is therefore not relevant to this EAR.

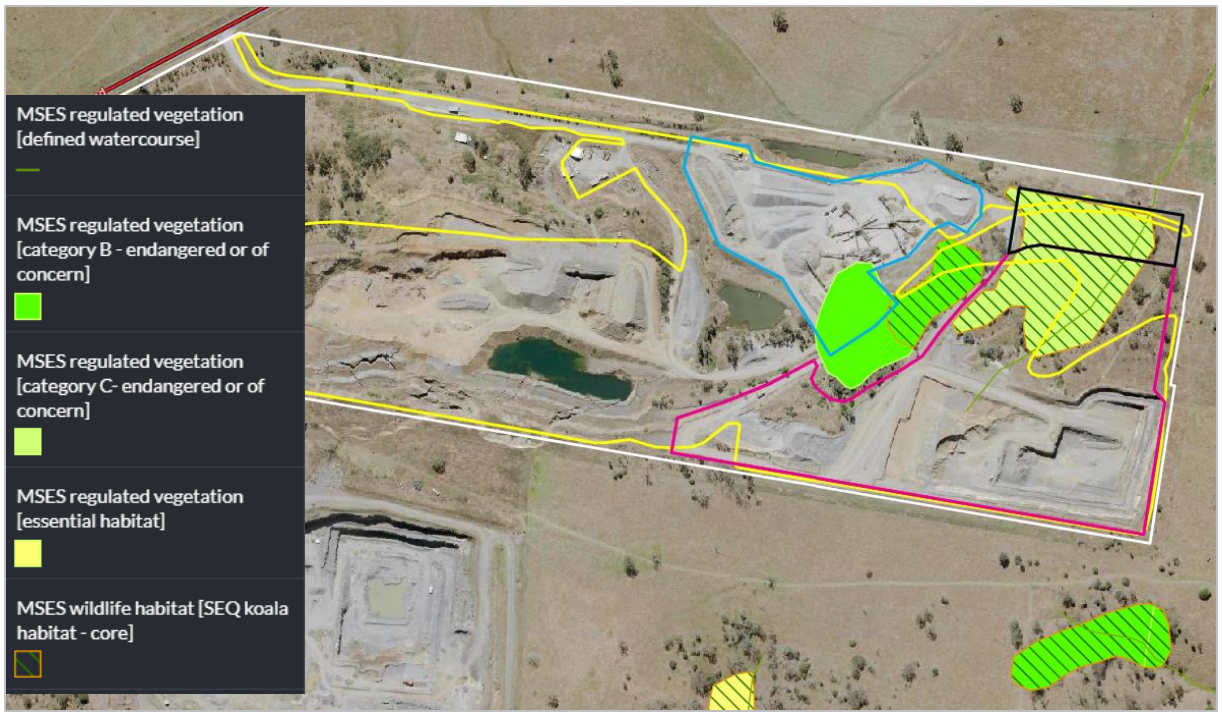


Figure 8 – MSES Mapping

(Figure reprinted from The State of Queensland (2022))

2.2.5 Topography

Elevations range between 80m AHD at the lowest point along the northern border of the site, to approximately 140m AHD in the south-western portion, refer to **Figure 9 – Contour Mapping**.

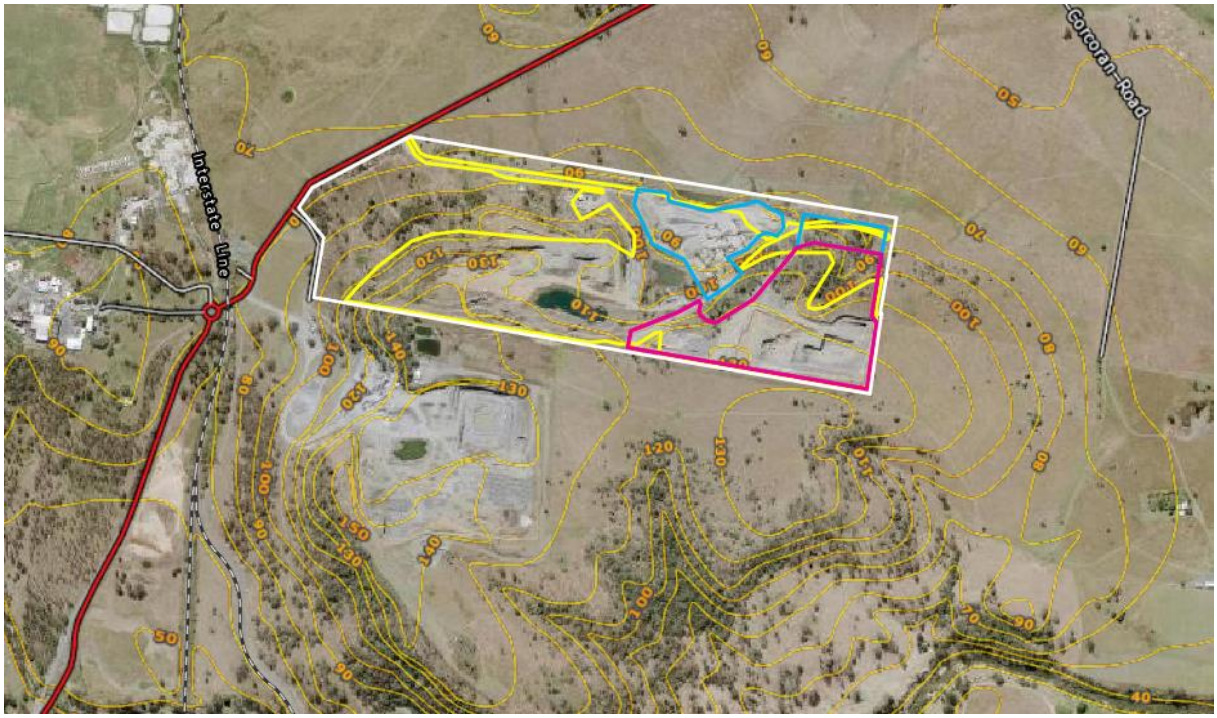


Figure 9 – Contour Mapping

(Figure reprinted from The State of Queensland (2022))

2.2.6 Geology

The Ipswich Geological Sheet (1:100 000) shows the site and surrounds comprises Tertiary basalt flows overlying sediments of the Jurassic Walloon Coal measures and extensive quaternary alluvium associated with the Logan River and tributaries. The geology of Bromelton North Quarry consists generally of a residual soil profile which overlies a weathered basalt zone of between 2m and 15m thickness, which in turn overlies the slightly weathered to unweathered basement basalt rock units. The most abundant rock type in the current workings is a dark grey to black basaltic tertiary flow. The geological structure varies noticeably around the deposit.

2.2.7 Contaminated Land

A review of search results of the Environmental Management Register ('EMR') and Contaminated Land Register ('CLR') has confirmed that the site is not currently listed on either the EMR or CLR. A copy of the search results is included as **Attachment 3 – EMR / CLR Search Results**.

2.2.8 Acid Sulphate Soil

Review of the Acid Sulfate Soils ('ASS') mapping (The State of Queensland 2022) has confirmed that the site is not located within, or near, an area where ASS have previously been identified, or within a prospective land zone containing ASS. Elevations are typically at or above 72 m AHD at the site, and therefore the site is not anticipated to be subject to ASS.

2.3 Water

2.3.1 Watercourses

The site is situated approximately 700 m east of the Logan River. An ephemeral gully (Stream Order 1) traverses the East Pit extension area, draining in a northerly direction towards Swan Creek, approximately 860 m downstream of the site boundary. Swan Creek, which is a tributary for the Logan River, has been dammed at several locations downstream of the site prior to the confluence with the Logan River. Refer to **Figure 10 – State Watercourse Mapping** for an illustration of the local watercourse mapping.

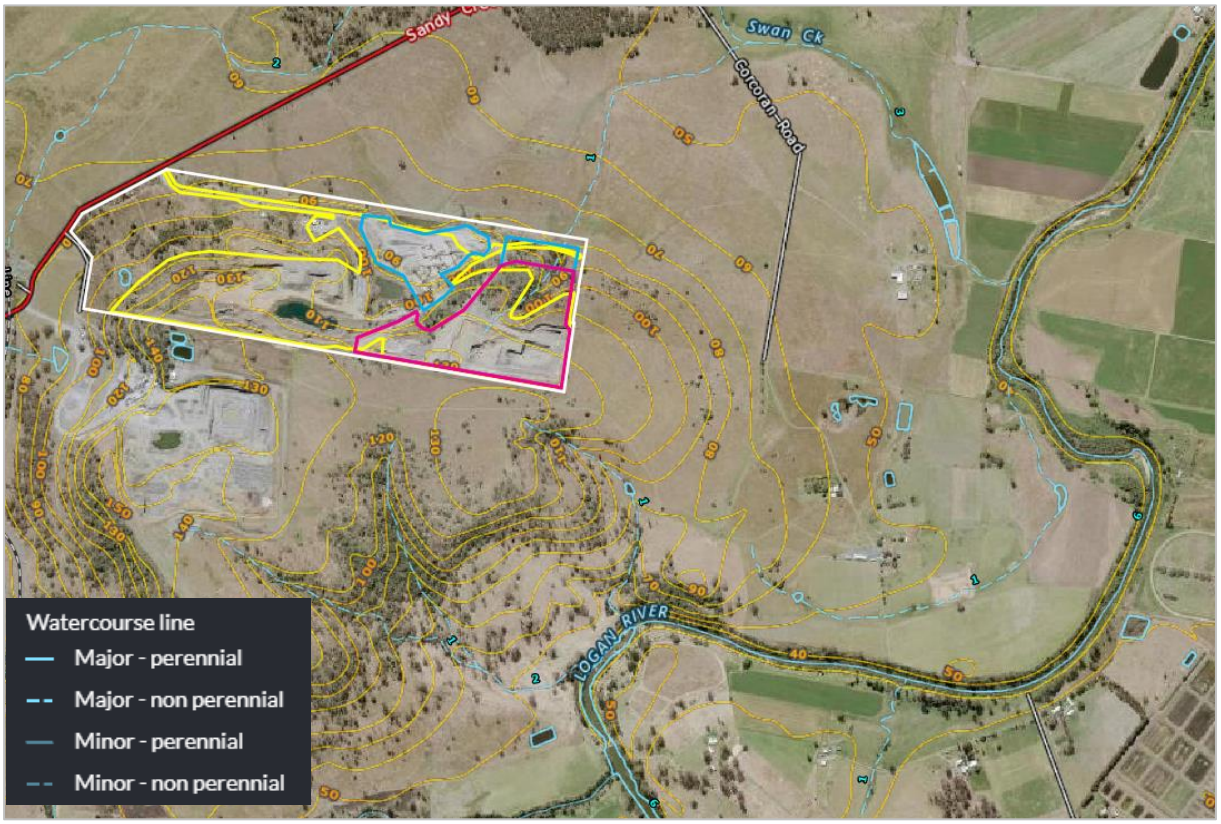


Figure 10 – State Watercourse Mapping

(Figure reprinted from The State of Queensland (2022))

2.3.2 Water Quality Objectives and Environmental Values

The site is located on the border of the Western Logan River and Upper Eastern Logan River sub-catchments of the Logan River Basin (Basin 145). The water type for the site is identified as Lowland Streams (categorised as lowland freshwaters). Schedule 1 of the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* ('EPP Water'), provides environmental values and Water Quality Objectives ('WQOs') for the Logan River Basin through the *Logan River Environmental Values and Water Quality Objectives* (DERM 2010). WQOs are summarised in **Table 7 – Water Quality Objectives: Logan River Freshwaters**.

Table 7 – Water Quality Objectives: Logan River Freshwaters

Quality Characteristic	WQO*
Turbidity	< 10 NTU
Suspended Solids	< 6 mg/L
Chlorophyll-a	< 5 µg/L
Total Nitrogen (N)	< 500 µg/L
Oxidised N	< 60 µg/L
Ammonia N	< 20 µg/L
Organic N	< 420 µg/L
Total Phosphorous (P)	< 50 µg/L
Filterable Reactive P	< 20 µg/L
Dissolved Oxygen	85 – 110 % Saturation (20^{th}->80^{th} percentile)
pH	6.5 – 8.0
Conductivity	780 µS/cm

2.3.3 Flooding

The site is not mapped as being subject to flooding in accordance with State mapping, or the Flood Hazard Overlay mapping provided by Scenic Rim Regional Council.

2.4 Wetlands

The site is not mapped as containing any VMA Wetlands, High Ecological Significance ('HSES') Wetlands or Wetland Protection Areas. The nearest mapped wetland is Il Bogan Lagoon, situated 2.2 km east of the site refer to **Figure 11 – Wetland Mapping**; however, this wetland is not downstream of the site and is separated from the site by the Logan River and extensive agricultural lands.

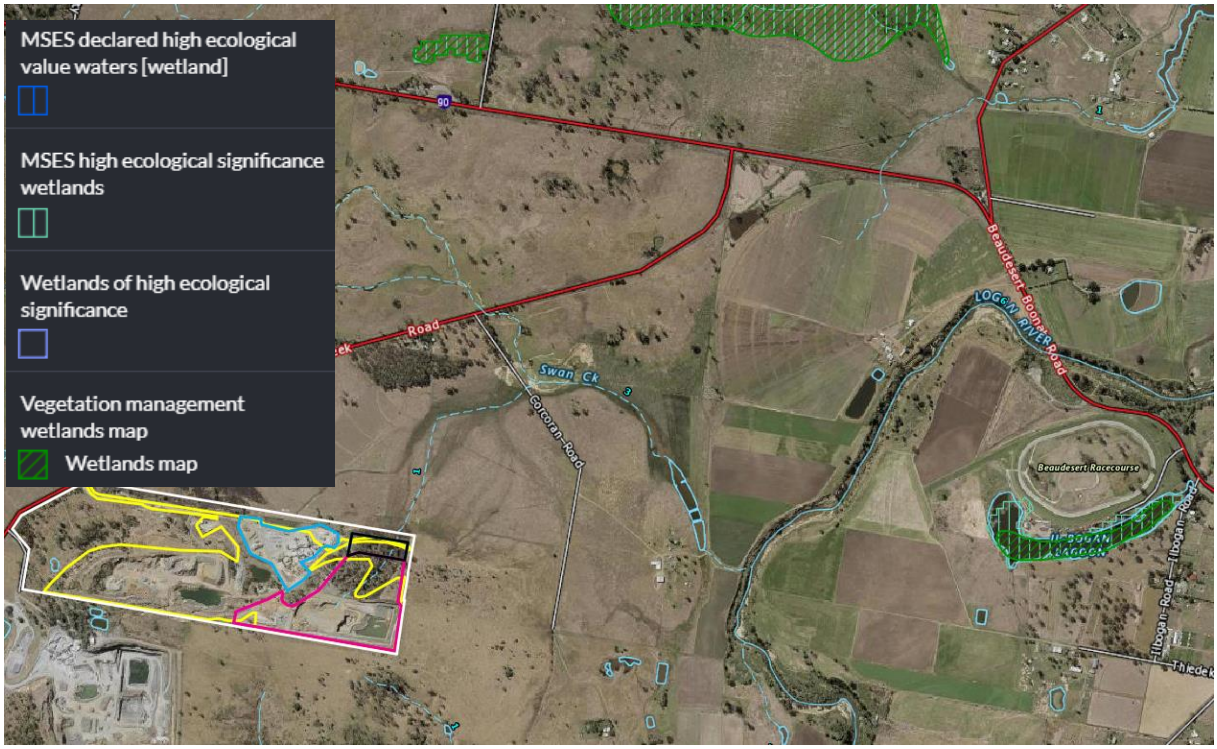


Figure 11 – Wetland Mapping

(Figure reprinted from The State of Queensland (2022))

2.5 Groundwater

Based on State records, one bore was formerly situated within the site boundary (RN 152663) and one bore was situated south of the site adjacent to the East P(RN 152664); however, these have since been recorded as abandoned and destroyed, and groundwater data for these bores is limited and has therefore been excluded from this EAR.

Local groundwater information has been sourced for other bores within a 2 km radius centred on the site as shown in **Figure 12 – Local Registered Groundwater Bore Locations**. Only existing bore facilities and those with groundwater depth data have been referenced. The details for these bore locations are summarised in **Table 8 – Registered Bore Groundwater Summary**. It must be noted that available bore records for the area are primarily situated in alluvium, which differs to the basaltic rock type at the site. Salinity levels of groundwater in the locality based on available data (bores RN 169358 and RM 169251 in the Walloon Coal Measure) is 3125 µS/cm to 4,800 µS/cm).

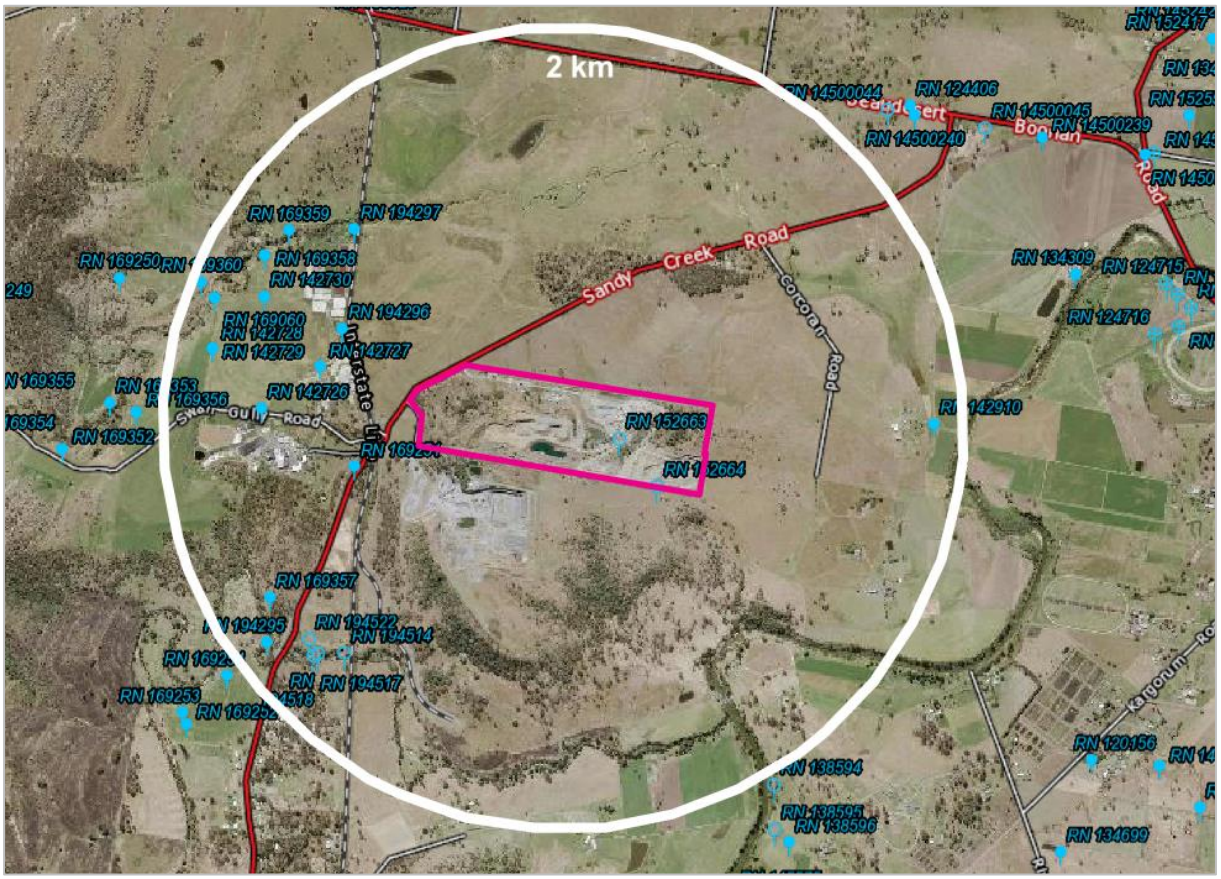


Figure 12 – Local Registered Groundwater Bore Locations

(Figure reprinted from The State of Queensland (2022))

Table 8 – Registered Bore Groundwater Summary

Reg No.	Lat / Long	Geology	Date	Top of Aquifer BGL (SWL)	Estimated Groundwater Depth (mAHD)^
142727	-27.99132844, 152.9257198	Logan River Alluvium	11-Feb-11	10 m	68
142728	-27.99053096, 152.9202186	Logan River Alluvium	9-Feb-11	10 m	69
142729	-27.99053096, 152.9202186	Logan River Alluvium	10-Feb-11	10 m	69
142730	-27.98819439, 152.9228643	Logan River Alluvium	9-Feb-11	9 m	69
142910	-27.99393687, 152.9570735	Logan River Alluvium	23-Jan-03	1.5 m	48.5
169357	-28.00175356, 152.9231496	Sandy Creek Alluvium	21-Oct-15	7 m (SWL -6.5 m)	49
169358	-27.98633478, 152.922886	Walloon Coal Measures (Sandstone)	20-Oct-15	12 m (SWL - 9 m)	63
169359	-27.98521608, 152.9241173	Walloon Coal Measures (Sandstone)	21-Oct-15	9 m	65

Reg No.	Lat / Long	Geology	Date	Top of Aquifer BGL (SWL)	Estimated Groundwater Depth (mAHD)^
				(SWL -8 m)	
169360	-27.98753355, 152.9196309	Walloon Coal Measures (Sandstone)	21-Oct-15	11 m (SWL – 9 m)	65
169060	-27.98824174, 152.9203248	Quaternary Clay	3-Jul-15	6 m (SWL – 4 m)	69
169251	-27.99585205, 152.927466	Walloon Coal Measures (Coal)	18-Aug-15	38 m (SWL – 10 m)	44

Notes:
BGL = Below Ground Level
SWL = Standing Water Level
*Based on elevation of bore, subtracting SWL
^Estimated by subtracting top of aquifer depth from approximate bore elevation at ground surface.

Initial quarry development indicates the development is likely to reach a floor of 88 m AHD. Thereby not extending to estimated groundwater levels based on the above.

Figure 13 – GDE Mapping provides an illustration of the Groundwater Dependent Ecosystem ('GDE') mapping at the site. The site is mapped under The State of Queensland (2022) as containing the following 'Potential Groundwater Dependent Ecosystem':

GDE Name: Low rainfall &/or low-capacity permeable rocks (basalts) (rule set SEQ_RS_03)
Temporal Nature: Intermittent
Aquifer Type: Unconfined
Aquifer Geology: Unconsolidated sedimentary
TDS: <1500 mg/L
pH: Unknown

The GDE is identified as being situated in the Tertiary basalts rock over which the site is situated.

Figure 13 – GDE Mapping

(Figure reprinted from The State of Queensland (2022))

2.6 Noise

2.6.1 Audible Noise

Assured Environmental ('AE') was engaged by Neilsens to prepare an assessment of potential noise impacts, with the findings presented in the report titled *Bromelton North Quarry - Noise Impact Assessment* (AE 2022a) included as **Attachment 1 – Noise Impact Assessment**. The following provides excerpts from the Noise Impact Assessment to provide a concise summary of the outcomes. Please refer to the full text attached for further details.

A total of 20 noise sensitive receptors were considered by AE for the purpose of the noise modelling exercise as illustrated in **Figure 14 – Sensitive Receptors**. AE carried out background noise monitoring from 12 to 20 October 2022 at one location (referred to as ML1, shown in **Figure 15 – Noise Monitoring Location**) to quantify background noise levels at the identified sensitive receptors.

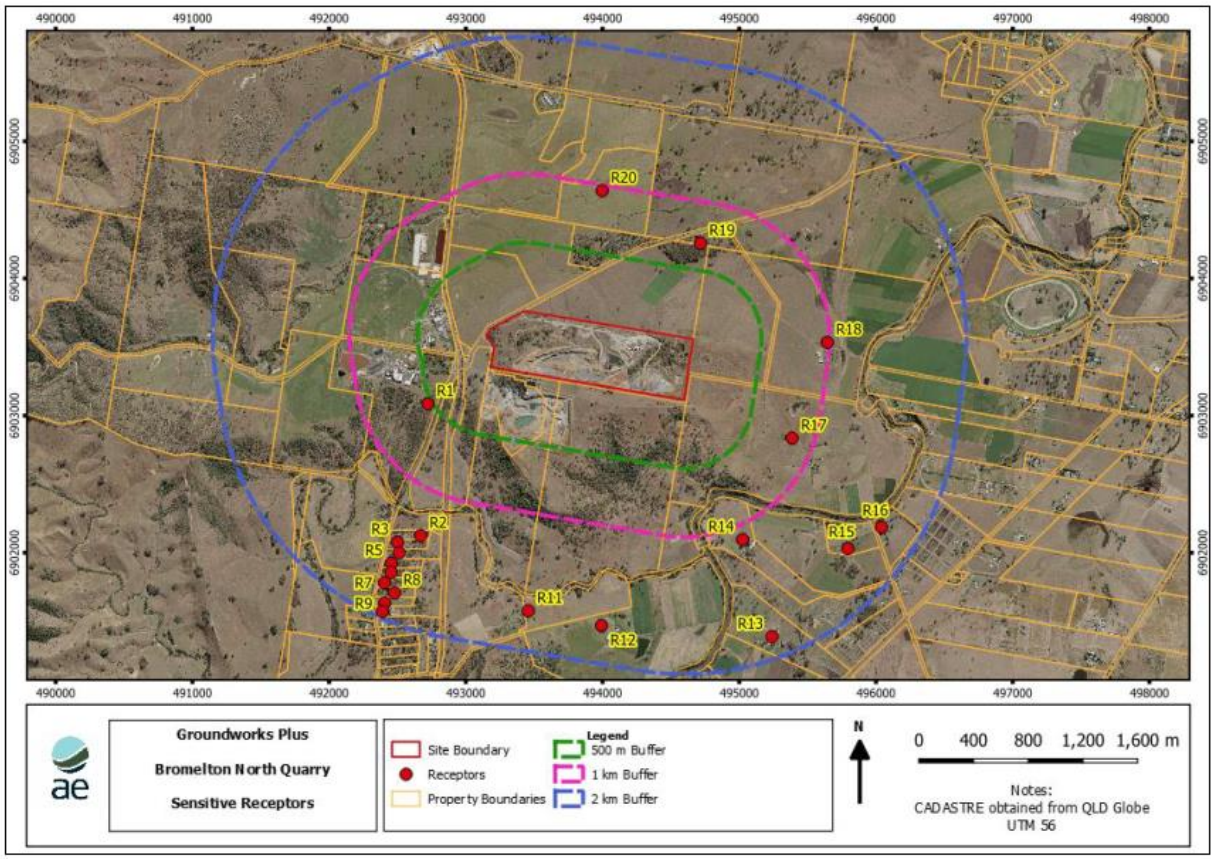


Figure 14 – Sensitive Receptors
(Figure reprinted from the *Bromelton North Quarry - Noise Impact Assessment* (Assured Environmental 2022a))

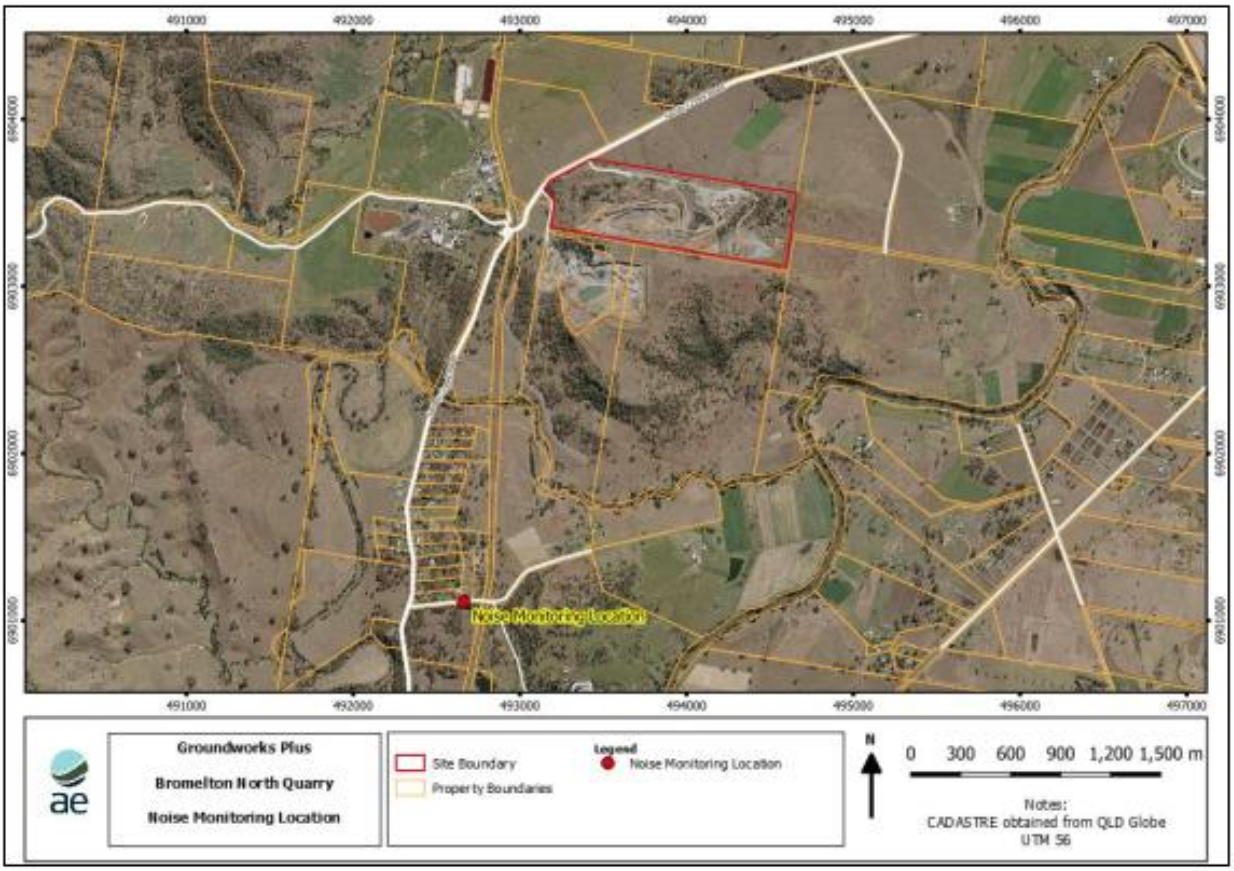


Figure 15 – Noise Monitoring Location
(Figure reprinted from the *Bromelton North Quarry - Noise Impact Assessment* (Assured Environmental 2022a))

Results of the background noise monitoring are presented in **Table 9 – Summary of Noise Monitoring Results**. AE noted that four hours over the monitoring period were affected by high wind speeds and/or rain and therefore data collected during weather affected observation periods were excluded in accordance with the provisions of the *Noise Measurement Manual* (DES 2020). In addition, data influenced by insect noise was removed from the results.

Table 9 – Summary of Noise Monitoring Results

Location	Period	L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	RBL[2]
ML1	Day (7am to 6pm)	97	64	48	35	56	32
	Evening (6pm to 10pm)	88	57	47	32	52	29
	Night (10pm to 7am)	94	55	45	32	52	29

Table notes:

1. Table reprinted from the *Bromelton North Quarry - Noise Impact Assessment* (Assured Environmental 2022a)
2. Rating Background Noise Level (RBL)

For the purpose of determining potential noise impacts, AE adopted the default noise limits which were established through a collaborative review between Cement, Concrete and Aggregates Australia ('CCAA') and the Department of Environment and Heritage Protection ('EHP'). The default noise limits are specified in the *CCAA Guideline – Assessment and Control of Environmental Noise Emission from Quarries – Queensland* (CCAA 2015). The limiting L_{AMax} criteria was identified by AE as the EPP (Noise) acoustic

quality objectives ('AQO'). **Table 10 – Summary of Applicable Noise Criteria at Sensitive Receptors** provides an overview of the noise criteria adopted by AE for the purpose of their assessment.

Table 10 – Summary of Applicable Noise Criteria at Sensitive Receptors

Criteria Parameter	Receptors	$L_{Aeq,T}$			Night L_{AMax}
		Day	Evening	Night	
EPP (Noise) AQO	All Sensitive Receptors	50	42	37	65
CCAA Element 1 Limits	All Sensitive Receptors	45	35	30	-
a) In accordance with Schedule I of the Environmental Authority, LA10 adj, T has been taken as approximately equivalent to LAmax adj, T.					

Table reprinted from the *Bromelton North Quarry - Noise Impact Assessment* (Assured Environmental 2022a)

AE attended the site on 28 October and 4 November 2022 to carry out noise measurements in relation to the following primary nose sources:

- Truck movements and truck unloading activities.
- External plant (fixed and mobile).
- Pit activities.
- Crushing activities.

A summary of the sound pressure level measurements is provided in *Table 15: Sound Power Levels* of **Attachment 1 – Noise Impact Assessment**.

Following collection of the relevant background data and consideration of noise criteria, AE determined the predicted noise from the future quarrying activities. The results indicated that, with the exception of R19 and R20, compliance with the relevant criteria can be achieved at all sensitive receptors. The cause of the one exceedance at these locations during the night-time period was determined to be operation of the Trio Crusher and Metso Crusher. To mitigate noise impacts at R19 and R20, AE recommended the application of a 1.6 m high U-shaped barrier on the platform to shield these receptors. The outcomes of the predicted noise levels for the future quarrying operations with the application of this measure are presented in **Table 11 – Maximum Predicted Results – Future Quarry Activities with Mitigation**, indicating that with the barrier installed, compliance with the adopted criteria at all time periods. Please note that modelling outputs were not generated for the Evening (E) period as the site will not be operational during this time period.

Table 11 – Maximum Predicted Results – Future Quarry Activities with Mitigation

ID	Predicted Operational Noise Levels (dB L_{Aeq})				Criteria Levels (dB L_{Aeq})			
	D	E	N	L_{AMax}	D	E	N	L_{AMax}
R01	18	-	<10	<10	45	35	30	65
R02	<10	-	<10	<10	45	35	30	65
R03	<10	-	<10	<10	45	35	30	65
R04	<10	-	<10	<10	45	35	30	65
R05	<10	-	<10	<10	45	35	30	65
R06	<10	-	<10	<10	45	35	30	65
R07	<10	-	<10	<10	45	35	30	65
R08	<10	-	<10	<10	45	35	30	65

ID	Predicted Operational Noise Levels (dB L_{Aeq})				Criteria Levels (dB L_{Aeq})			
	D	E	N	L_{AMax}	D	E	N	L_{AMax}
R09	<10	-	<10	<10	45	35	30	65
R10	<10	-	<10	<10	45	35	30	65
R11	11	-	<10	<10	45	35	30	65
R12	13	-	<10	<10	45	35	30	65
R13	<10	-	<10	<10	45	35	30	65
R14	16	-	<10	<10	45	35	30	65
R15	<10	-	<10	<10	45	35	30	65
R16	<10	-	<10	<10	45	35	30	65
R17	20	-	10	10	45	35	30	65
R18	27	-	16	15	45	35	30	65
R19	40	-	30	30	45	35	30	65
R20	38	-	28	28	45	35	30	65

Table notes:
Table reprinted and adapted from the *Bromelton North Quarry - Noise Impact Assessment* (Assured Environmental 2022a)
D = Day, E = Evening, N = Night.

2.6.2 Airblast Overpressure and Vibration

As part of the Noise Impact Assessment, AE carried out an assessment of ground vibration and air overpressure impacts associated with the proposed development, the findings of which are presented in **Attachment 1 – Noise Impact Assessment**. The following provides excerpts from the Noise Impact Assessment to provide a concise summary of the blasting impact assessment outcomes. Please refer to the full text attached for further details.

AE assessed blast impacts in accordance with the methods specified in Australian Standard (AS) *2187.2-2006 Explosives – Storage and use – Use of Explosive* (Standards Australia 2006). Predicted ground vibration levels (measured as Peak Particle Velocity ('PPV')) for the future quarrying activities are presented in **Table 12 – Predicted Ground Vibration from Blasting using Typical MIC**. The results indicate that compliance with the relevant ground vibration limits can be achieved at all receptors using a typical mass charge (maximum instantaneous charge = MIC) of 98.77 kg. AE also calculated PPV results using an MIC of 600 kg, which was found to still maintain compliance at all receptor locations.

Table 12 – Predicted Ground Vibration from Blasting using Typical MIC

Receptor	Distance from Site Boundary (m)	K^2	β^3	Typical Q^4 (kg)	Predicted PPV (mm/s)	Criteria (mm/s)	Compliant
R01	1400	1041	1.6	98.77	0.38	10	Y
R02	1850	1041	1.6	98.77	0.24	10	Y
R03	2020	1041	1.6	98.77	0.21	10	Y
R04	2130	1041	1.6	98.77	0.19	10	Y
R05	2170	1041	1.6	98.77	0.19	10	Y
R06	2200	1041	1.6	98.77	0.18	10	Y

Receptor	Distance from Site Boundary (m)	K[2]	β[3]	Typical Q[4] (kg)	Predicted PPV (mm/s)	Criteria (mm/s)	Compliant
R07	2250	1041	1.6	98.77	0.18	10	Y
R08	2270	1041	1.6	98.77	0.18	10	Y
R09	2350	1041	1.6	98.77	0.17	10	Y
R10	2400	1041	1.6	98.77	0.16	10	Y
R11	1750	1041	1.6	98.77	0.27	10	Y
R12	1100	1041	1.6	98.77	0.56	10	Y
R13	2100	1041	1.6	98.77	0.20	10	Y
R14	1100	1041	1.6	98.77	0.56	10	Y
R15	1610	1041	1.6	98.77	0.30	10	Y
R16	1720	1041	1.6	98.77	0.27	10	Y
R17	830	1041	1.6	98.77	0.88	10	Y
R18	1000	1041	1.6	98.77	0.65	10	Y
R19	720	1041	1.6	98.77	1.10	10	Y
R20	1130	1041	1.6	98.77	0.53	10	Y

Table notes:

1. Table reprinted from the *Bromelton North Quarry - Noise Impact Assessment* (Assured Environmental 2022a)
2. K = site constant (1041) determined from historical blasting data for the site as noted in the Bromelton North Quarry: Blast Management Plan (Groundwork Plus 2022).
3. β = site constant (1.6) as noted in the Bromelton North Quarry: Blast Management Plan (Groundwork Plus 2022).
4. Q = explosives mass charge (kg)

Predicted overpressure levels (measured as dB (linear peak) ('dB(Z)')) for the future quarrying activities are presented in **Table 13 – Predicted Blast Overpressure using Typical MIC**. An exceedance of the criteria was observed at R19; however, this exceedance can be resolved reduction of the MIC to 89 kg.

Table 13 – Predicted Blast Overpressure using Typical MIC

Receptor	Distance from Site Boundary (m)	Ka[2]	a[3]	Typical Q[4] (kg)	Predicted Overpressure (dB(Z)))	Criteria (dB(Z))	Compliant
R01	1400	20	-1.45	98.77	108.0	115	Y
R02	1850	20	-1.45	98.77	104.5	115	Y
R03	2020	20	-1.45	98.77	103.4	115	Y
R04	2130	20	-1.45	98.77	102.8	115	Y
R05	2170	20	-1.45	98.77	102.5	115	Y
R06	2200	20	-1.45	98.77	102.4	115	Y
R07	2250	20	-1.45	98.77	102.1	115	Y
R08	2270	20	-1.45	98.77	102.0	115	Y
R09	2350	20	-1.45	98.77	101.5	115	Y
R10	2400	20	-1.45	98.77	101.3	115	Y

Receptor	Distance from Site Boundary (m)	Ka[2]	a[3]	Typical Q[4] (kg)	Predicted Overpressure (dB(Z)))	Criteria (dB(Z))	Compliant
R11	1750	20	-1.45	98.77	105.2	115	Y
R12	1100	20	-1.45	98.77	111.1	115	Y
R13	2100	20	-1.45	98.77	102.9	115	Y
R14	1100	20	-1.45	98.77	111.1	115	Y
R15	1610	20	-1.45	98.77	106.3	115	Y
R16	1720	20	-1.45	98.77	105.5	115	Y
R17	830	20	-1.45	98.77	114.6	115	Y
R18	1000	20	-1.45	98.77	112.3	115	Y
R19	720	20	-1.45	98.77	115.4	115	N
R20	1130	20	-1.45	98.77	110.7	115	Y

Table notes:

1. Table reprinted from the *Bromelton North Quarry - Noise Impact Assessment* (Assured Environmental 2022a)
2. Ka = site constant of 20.
3. a = site exponent.
4. Q = explosives mass charge (kg)

2.7 Air

AE was engaged by Neilsens to prepare an assessment of potential air quality impacts, with the findings presented in the report titled *Bromelton North Quarry – Air Quality Assessment* (AE 2022b) included as **Attachment 2 – Air Quality Assessment**. The following provides excerpts from the Air Quality Assessment to provide a concise summary of the outcomes. Please refer to the full text attached for further details. The air quality assessment was based on the sensitive receptors identified in the Noise Impact Assessment (refer to **Figure 14 – Sensitive Receptors**).

Neilsens carry out dust deposition monitoring on and ongoing monthly basis at the site at two locations as shown in **Figure 16 – Bromelton Deposited Dust Monitoring Locations**. The average deposited dust data from location NBDG5 was used by AE (2022b) to determine the relevant background concentration for the purpose of the assessment as summarised in **Table 14 – Adopted Background Monitoring Data for TSP and Deposited Dust**. NBDG7 data was not considered due to possible influence from the adjacent Bromelton Quarry.

To determine a representative value for the Total Suspended Particle (TSP) background data, AE calculated the PM_{10} using the 2015 data sourced from the Department's Flinders View air monitoring station. The calculated background value is summarised in **Table 14 – Adopted Background Monitoring Data for TSP and Deposited Dust**. $PM_{2.5}$ background values were sourced from 2021 data sourced from the Flinders View air monitoring station.

Table 14 – Adopted Background Monitoring Data for TSP and Deposited Dust

Pollutant	Time Period	Concentration	Source
TSP	Annual	29.0 µg/m^3	Calculated from PM_{10} for 2015
Deposited Dust	Month	44 mg/m^2/day	Average from NBDG5 Monitoring data
PM_{10}	24-hour	Refer Table 9 of **Attachment 2 – Air Quality Assessment**	Flinders View for 2015
	Annual		
$PM_{2.5}$	24-hour	6.5 µg/m3	Flinders View for 2021
	Annual	5.9 µg/m^3	

Table notes: Table reprinted and adapted from the *Bromelton North Quarry – Air Quality Assessment* (Assured Environmental 2022b)

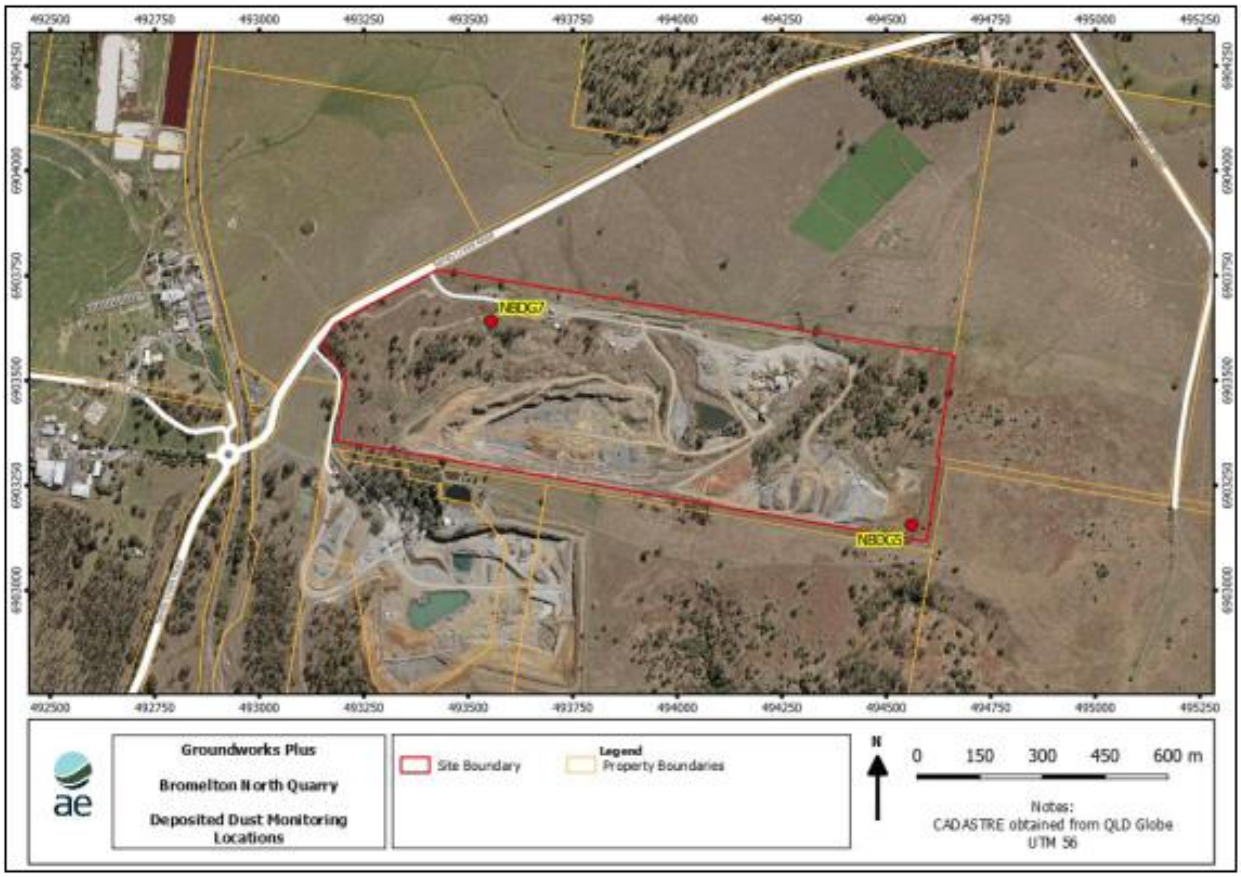


Figure 16 – Bromelton Deposited Dust Monitoring Locations

(Figure reprinted from the Bromelton North Quarry – Air Quality Assessment (AE 2022b)

For the purpose of the air quality assessment, AE (2022b, p .34) considered the following air emissions sources:

- Drilling and Blasting
- Processing (screening, primary and tertiary crushing)
- Material transfers (loading / unloading / miscellaneous)
- Vehicle movements (light and heavy) on internal haul roads
- Wind erosion from stockpiles and exposed areas.

The maximum predicted ground level concentrations at the sensitive receptors determined by AE are presented in **Table 15 – Summary of Maximum Predicted Ground Level Concentrations at Sensitive Receptors from Subject Site**. The outcomes of the modelling indicated that the predicted concentrations will comply at all sensitive receptors and at the site boundary.

Table 15 – Summary of Maximum Predicted Ground Level Concentrations at Sensitive Receptors from Subject Site

Pollutant	Averaging Period	Maximum Predicted GLC at Sensitive Receptors (µg/m^3)	Criteria (µg/m^3)
TSP	Annual	3.3	90
PM_{10}	24 Hours	19.0	50
	Annual	3.6	25
$PM_{2.5}$	24 Hours	2.5	25
	Annual	0.5	8
Deposited Dust	Month	4.6	120 mg/m^2/day

3 Potential Environmental Impacts and Risks

3.1 Purpose of Assessment

The purpose of this assessment is to determine the extent to which the proposed site activities will achieve the environmental objective and performance outcomes nominated in Schedule 8, Part 3, Division 1 of the EP Reg. A risk-based approach has been utilised, with source activities and potential impacts to environmental values utilised to determine the management strategies, if required, to mitigate these impacts to ensure the performance outcomes can be achieved.

3.2 Risk Assessment Methodology

This risk assessment methodology has been adopted from the process for risk management as set out in Clause 6 of the AS ISO 31000:2018 Risk management - Guidelines (Standards Australia Limited 2018). The risk assessment follows the following process:

- Risk Identification (source activity and potential impact).
- Risk Analysis (risk level = likelihood x consequence).
- Risk Evaluation (commentary on risk).

The risk treatment outlines the controls / management measures that can be implemented to reduce the level of risk to as low as reasonably possible.

The risk analysis qualitatively estimates the level of risk based on the likelihood of an environmental impact or event occurring (**Table 16 – Definitions of Likelihood**), and the consequences of the occurrence (**Table 17 – Definitions of Consequence**).

Table 16 – Definitions of Likelihood

Rating	Descriptor	Score
Rare	May occur only in exceptional circumstances	1
Unlikely	Could occur but doubtful	2
Possible	Might occur at some time in the future	3
Likely	Will probably occur	4
Almost Certain	Is expected to occur in most circumstances	5

Table 17 – Definitions of Consequence

Rating	Descriptor	Score
Negligible	Impacts not requiring any treatment or management action	1
Minor	Nuisance or insignificant environmental harm requiring minor management action	2
Moderate	Serious environmental impacts, readily manageable at low cost	3

Rating	Descriptor	Score
Major	Substantial environmental impacts, manageable but at considerable cost and some disruption	4
Severe	Severe environmental impacts with major consequent disruption and heavy cost	5

The consequence and likelihood scores are plotted on the risk vs consequence matrix (**Table 18 – Risk Assessment Matrix**) and the final risk level assigned is a product of the likelihood and consequence scores, which equals the magnitude of the impacts. The higher the risk score, the higher the priority is for management.

Table 18 – Risk Assessment Matrix

Likelihood		Consequence				
		Negligible	**Minor**	**Moderate**	**Major**	**Severe**
		1	**2**	**3**	**4**	**5**
Almost Certain	**5**	5 Medium	10 High	15 High	20 Very High	25 Very High
Likely	**4**	4 Low	8 Medium	12 High	16 High	20 Very High
Possible	**3**	3 Low	6 Medium	9 Medium	12 High	15 High
Unlikely	**2**	2 Low	4 Low	6 Medium	8 Medium	10 High
Rare	**1**	1 Low	2 Low	3 Low	4 Low	5 Medium

Table 19 – Indicative Management Option for Each Risk Assessment Rating describes the possible actions required for each risk assessment rating.

Table 19 – Indicative Management Option for Each Risk Assessment Rating

Risk Rating	Risk Rating Scores	Indicative Management Option
Very High	**17 – 25**	Manage by implementing site management and emergency procedures, plant design controls and regular monitoring.
High	**10 – 16**	Manage by implementing site management procedures, specific monitoring and may require some operation/plant design controls.
Medium	**5 – 9**	Manage by implementing specific monitoring or response procedures.
Low	**1 – 4**	Manage by routine procedures, unlikely to need specific application of resources.

3.3 Inherent and Residual Environmental Risk Assessment

Activities associated with the activity which have the potential to cause environmental harm and/or nuisance and the potential impacts have been identified and tabulated in **Table 20 – Operational Assessment of Environmental Risk**. **Table 20** also includes the inherent risk of the impacts occurring, and the residual risk following implementation of management strategies.

An Environment Management Plan ('EMP') (Doc ref. 740_610_018_R3) has been developed for the site to manage potential environmental impacts, and these documents are referenced where relevant in the risk assessment provided in **Table 20.**

Table 20 – Operational Assessment of Environmental Risk

Environmental Objective [1]	**Performance Outcome**	**Source Activity**	**Potential Impact**	**Inherent Risk Rating** [2]	**Control / Management Measures**	**Residual Risk Rating** [3]
AIR						
The activity will be operated in a way that protects the EVs of air.	• Fugitive emissions of contaminants from storage, handling and processing of materials and transporting materials within the site are prevented or minimised. • Contingency measures will prevent or minimise adverse effects on the environment from unplanned emissions and shut down and start up emissions of contaminants to air. • Releases of contaminants to the atmosphere for dispersion will be managed to prevent or minimise adverse effects on environmental values.	• Clearing of vegetation and topsoil / overburden ahead of the extraction activity. • Stockpiling of topsoil and overburden. • Drilling and blasting activities. • Extraction and handling of raw materials (e.g., transfer of materials, processing, blending, stockpiling, transportation). • Vehicle movements on unsealed roads and access tracks. • Wind erosion on exposed surfaces and stockpiles.	Emission of dust to air impacting nearby sensitive receptors.	3 x 3 = 9 (**Medium**)	In the absence of control measures, potential incidents associated with air emissions impacting nearby sensitive receptors is scored medium due to the setting of the site a rural locality with limited nearby receptors. As identified by AE (2022b), the site is able to comply with relevant air quality limits at all sensitive receptors identified during all time periods provided control measures are implemented (refer to **Section 2.7 - Air**). AE (2022b) recommended the following site-specific control measures to manage air quality impacts at the site: <u>Work Areas / Trafficable Areas:</u> • *Limit high dust generating activities (vehicle movements) to periods of favourable weather conditions.* • *The dry stacking will have a high moisture content which will minimise emissions; if visual surveillance indicates dust generation water the dry stacking where operations are occurring.* • *Dampen down (approx. rate of 2 litres/m²/hour) the internal haul roads by water spraying when visual surveillance indicates excessive dust generation.* • *Restrict vehicle movements to designated routes to the extent practicable.* • *Enforce speed limits on internal roads.* • *Maintain road surfaces in good condition.* • *Prevent and clean up any spillages or dust accumulation on driveways or sealed roads.* <u>Processing Plant</u> • *Use shielding and/or windbreaks where possible.* • *Maintain equipment in accordance with the original equipment manufacturers' specifications.* • *Water or use foam-based products when dust from the crushing area is visibly dispersing towards the north.* <u>Stockpiles</u> • *Limit the height of any stockpiles to <6m, where practicable.* • *Regularly water stockpiles to keep down dust emissions if visual surveillance indicates excessive dust generation.* Section 4.1 - Air Quality Management Plan of the site's EMP provides measures to minimise and/or prevent potential for air quality impacts inclusive of the above site-specific measures. In addition, condition PMA001 (A1) of the *Model Operating Conditions ERA 16—Extractive and screening activities* ('MOC') (DES 2019a) if applied to the EA would provide for regulation of air emissions associated with the site activities.	2 x 2 = 4 (**Low**)

Environmental Objective [1]	Performance Outcome	Source Activity	Potential Impact	Inherent Risk Rating [2]	Control / Management Measures	Residual Risk Rating [3]
					Provided that Neilsens implement the management measures outlined in the EMP, and observe the EA requirements, the environmental objective for 'Air' is likely to be achieved. Residual risk is scored low as the likelihood of an incident occurring, and its consequences, are reduced through the implementation of control measures.	
WATER						
The activity will be operated in a way that protects the EVs of water.	• The storage and handling of contaminants will include effective means of secondary containment to prevent or minimise releases to the environment from spillage or leaks. • Contingency measures will prevent or minimise adverse effects on the environment due to unplanned releases or discharges of contaminants to water. • The activity will be managed so that stormwater contaminated by the activity that may cause an adverse effect on an environmental value will not leave the site without prior treatment. • The disturbance of any acid sulfate soil, or potential acid sulfate soil, will be managed to prevent or minimise adverse effects on environmental values. • Any discharge to water or a watercourse or wetland will be managed so that there will be no adverse effects due to the altering of existing flow regimes for water or a watercourse or wetland. • The activity will be managed so that adverse effects on environmental values are prevented or minimised.	• Clearing of vegetation and topsoil. • Stockpiling of topsoil and overburden. • Extraction and handling of raw materials (e.g., transfer of materials, processing, blending, stockpiling, transportation).	Release of contaminated water to the receiving environment.	4 x 3 = 12 (**High**)	Stormwater runoff will interact with disturbed areas created through the development of site. A minor non-perennial watercourse is mapped as traversing land to the north of the proposed extension area. In the absence of any control measures, potential risk of impacts to receiving waters is conservatively scored high. the site. However, the current site activities provide the precedent for how the extension area will be managed to ensure that release of contaminates to waters will be mitigated. To manage potential impacts to waters from the proposed extraction area, a Water Quality Management Plan has been incorporated in Section 4.2 of the site's EMP. In addition, a Stormwater Management Plan has been prepared for the proposed development, refer to *Attachment 2 – Stormwater Management Plan Drawing* of the EMP. Provided that the management measures outlined in the EMP are implemented, and the EA conditions complied with, the environmental objective for 'Water' is likely to be achieved. The residual risk score is reduced to medium based on a possible likelihood and a moderate consequence which can be management in accordance with the measures in the EMP. The site is not located within, or near, an area where ASS have previously been identified, or within a prospective land zone containing ASS. Elevations are typically at or above 72 mAHD at the site; therefore, presence of ASS is very unlikely, and no management measures are considered necessary.	2 x 3 = 6 (**Medium**)

Environmental Objective [1]	Performance Outcome	Source Activity	Potential Impact	Inherent Risk Rating [2]	Control / Management Measures	Residual Risk Rating [3]
WETLANDS						
The activity will be operated in a way that protects the environmental values of wetlands.	The activity will be managed in a way that prevents or minimises adverse effects on wetlands.	• Clearing of vegetation and topsoil. • Stockpiling of topsoil and overburden. • Extraction and handling of raw materials (e.g., transfer of materials, processing, blending, stockpiling, transportation).	Release of contaminants to, or physical damage of, nearby wetlands.	1 x 2 = 2 (**Low**)	The site is not mapped as containing any VMA or HES Wetlands; therefore, direct impacts to wetlands are unlikely. The nearest mapped wetland is situated approximately 2.2 km east of the site, separated from the site by the Logan River and extensive agricultural land. This wetland is not within the Logan River and is therefore not downstream of the site. Low inherent risks are able to be managed by routine procedures and are unlikely to need specific application of resources. The residual risk is unchanged and remains low.	1 x 2 = 2 (**Low**)
GROUNDWATER						
The activity will be operated in a way that protects the environmental values of groundwater and any associated surface ecological systems.	The activity will be managed to prevent or minimise adverse effects on groundwater or any associated surface ecological systems.	Extraction of raw materials.	Impacts to groundwater quality or quantity.	3 x 3 = 9 (**Medium**)	Based on publicly available groundwater bore data, extraction within the East Pit is not anticipated to intercept the estimated groundwater level (refer **Section 2.5 - Groundwater**). Unmitigated, the potential for indirect impacts through release of contaminants which have the potential to be transported to groundwaters is scored medium, based on a possible likelihood. The Water Quality Management Plan (Section 4.2 of the EMP) include measures for capture and treatment of surface waters that may interact with potential contaminants at the site that could impact groundwater. The EMP also includes a Hydrocarbon and Chemical Management Plan that provides measures for management of other potential groundwater contaminants, refer to Section 4.3 of the EMP. In addition, it is understood that extraction will be undertaken so as to not intercept groundwater within the extraction areas. In addition, 'Water' for the purpose of the MOC is taken to include groundwater; therefore, the application of the conditions contained in the MOC will regulate impacts to groundwater. Provided Neilsens implement the EMP and observe the requirements of the EA, potential for indirect impacts to groundwater will be reduced, and the residual risk is reduced to a lower score based on a decreased likelihood of an event occurring. The risk is reduced to a lower score however remains medium, which will require ongoing management through the implementation of the EMP.	2 x 3 = 6 (**Medium**)
			Impacts to GDEs.	2 x 2 = 4 (**Low**)	The proposed extension is overlain by land mapped as moderate confidence derived DGE (subterranean cave ecosystem GDE). As previously noted, top of aquifer was generally recorded between approximately 44 m AHD and 69 m AHD based on publicly available groundwater bore data. Depth of extraction within the extension	2 x 2 = 4 (**Low**)

Environmental Objective [1]	Performance Outcome	Source Activity	Potential Impact	Inherent Risk Rating [2]	Control / Management Measures	Residual Risk Rating [3]
					area is anticipated to be around RL 88 and therefore impacts to subterranean GDEs are not anticipated.	
NOISE						
The activity will be operated in a way that protects the EVs of the acoustic environment.	The release of sound to the environment from the activity is managed so that adverse effects on EVs including health and wellbeing and sensitive ecosystems are prevented or minimised.	• Clearing of vegetation and topsoil / overburden ahead of the extraction activity. • Stripping and stockpiling of topsoil, subsoils and overburden. • Extraction and handling of materials (e.g., transfer of materials, stockpiling, transportation). • Screening and processing of the materials. • Vehicle movements on unsealed roads and access tracks. • Plant and equipment use, including reverse beepers. • Radio / UHF use. • Alarms.	Noise nuisance for nearby noise sensitive receptors.	4 x 3 = 12 (**High**)	In accordance with the AE (2022a) noise impact assessment, in the absence of any noise management measures for the Trio and Metso Crusher, there is potential for noise impacts during the night-time period at receptors R19 and R20 (refer to **Section 2.6.1 - Audible Noise**). If the site were to operate in the absence of controls for the crushers during the night-time period, inherent risk of impacts is conservatively scored high. However, in line with the AE (2022a) assessment, it is proposed to apply a 1.6 m high U-shaped barrier on the platform to shield these receptors from potential noise impacts. Application of this treatment results in the site achieving compliance with the relevant noise criteria during all time periods. Section 4.4 - Noise Management Plan of the site's EMP contains additional control measures to minimise noise emissions from the site activities. Provided that Neilsens implement control measures for potential noise impacts as outlined in the EMP, and observe the EA requirements, the environmental objective for 'Noise' is likely to be achieved. Residual risk is reduced to low as the likelihood and consequence of an incident involving noise nuisance is reduced through the implementation of the above measures. Medium risks can effectively be managed through ongoing application of control measures such as those outlined in the EMP.	3 x 2 = 6 (**Medium**)
		• Blasting activities.	Air overpressure and ground vibration impacts causing disturbance for sensitive receptors.	4 x 3 = 12 (**High**)	Blasting will be required at the site to fragment materials for processing. Blasting inherent can cause elevated ground vibration and air overpressure levels when carried out in an uncontrolled manner. Inherent risk is conservatively scored high in the absence of controls. The results of the vibration assessment completed by AE (2022b) determined that compliance with the relevant ground vibration limits can be achieved at all receptors using a typical mass charge (maximum instantaneous charge = MIC) of 98.77 kg (and up to an MIC of 600 kg). Predicted overpressure levels (measured as dB (linear peak) ('dB(Z)')) for the future quarrying activities determined by AE (2022b) determined an exceedance of the criteria at R19 when an MIC of 98.77 kg is used; however, this exceedance is resolved reduction of the MIC to 89 kg.	3 x 2 = 6 (**Medium**)

Environmental Objective [1]	Performance Outcome	Source Activity	Potential Impact	Inherent Risk Rating [2]	Control / Management Measures	Residual Risk Rating [3]
					In addition, Section 4.5 – Blast Management Plan of the EMP has been prepared to provide measures to minimise potential impacts associated with blasting at the site. Through control of MIC and implementation of the control measures referenced in the EMP, the likelihood of potential impacts from blasting can be reduced, resulting in a reduced residual risk of medium which can be managed through application of ongoing controls.	
WASTE						
Any waste generated, transported, or received as part of carrying out the activity is managed in a way that protects all environmental values.	Waste generated, transported or received is managed in accordance with the waste and resource management hierarchy in the *Waste Reduction and Recycling Act 2011*. If waste is disposed of, it is disposed of in a way that prevents or minimises adverse effects on environmental values.	Vegetation clearing. Storage and disposal of residual waste (i.e., general, and regulated waste).	Improper disposal of wastes.	3 x 3 = 9 (**Medium**)	Types of waste that may be generated at the quarry include, but are not necessarily limited to, the following: • Regulated wastes (e.g., batteries, oil filters, waste oil/hydrocarbons and containers, oil/water emulsions and tyres). • Scrap metal and used or faulty parts and equipment. • General waste such as food waste, packaging, and consumables. • Green waste. In the absence of control measures, potential for impacts associated with improper disposal of wastes is inherently scored medium. The Waste Management Plan included as Section 4.6 of the EMP details measures for management of waste at the site, with reference to the requirements of the *Waste Reduction and Recycling Act 2011* ('WRR Act'). Condition PMG038 (WS1) of the MOC (DES 2019a) if applied to the EA would enable regulation of impacts associated with waste. Provided Neilsens implement the measures outlined in the EMP, and comply with the requirements of the EA, the residual risk of a potential incident involving waste is reduced, and the environmental objective for 'Waste' is likely to be achieved.	2 x 2 = 4 (**Low**)
LAND						
The activity is operated in a way that protects the environmental values of land including soils, subsoils, landforms and associated flora and fauna.	• The activity will be managed to prevent or minimise adverse effects on the environmental values of land due to unplanned releases or discharges, including spills and leaks of contaminants. • The application of water or waste to the land is sustainable and is managed to prevent or minimise adverse effects on the composition or structure of soils and subsoils.	Handling of chemicals and fuels on-site (e.g., refuelling of mobile plant).	Release of hydrocarbons and fuels to land.	3 x 3 = 9 (**Medium**)	The extension area is not expected to accommodate areas for storage of hydrocarbons or chemicals. In the absence of controls, the inherent risk of handling fuels and chemicals is high due to an increased likelihood of potential release if handling and storage activities are unmanaged. This A Hydrocarbon and Chemical Management Plan has been incorporated into the EMP (refer to Section 4.3) which provides management measures for handling and storage of hydrocarbons and chemicals to reduce the potential impacts to land associated with spills and/or leaks. Common Condition (DES 2019b) can also be applied, which states: *PCG012 (G6) - Chemicals and fuels in containers of greater than 15 litres must be stored within a secondary containment system.*	2 x 2 = 4 (**Low**)

Environmental Objective [1]	Performance Outcome	Source Activity	Potential Impact	Inherent Risk Rating [2]	Control / Management Measures	Residual Risk Rating [3]
					Provided Neilsens implements the measures outlined in the EMP and observes the EA requirements, the residual risk is reduced to a lower level as the likelihood and consequence of an incident occurring is reduced through the implementation of the management measures outlined in the EMP. The residual risk is scored medium, and ongoing management in accordance with the EMP will be required to ensure risk is as low as reasonably possible. The environmental objective for 'Land' can be achieved through application of the nominated controls.	
The activity is operated in a way that protects the environmental values of land including soils, subsoils, landforms and associated flora and fauna.	Activities that disturb land, soils, subsoils, landforms and associated flora and fauna will be managed in a way that prevents or minimises adverse effects on the EVs of land.	Clearing of vegetation ahead of extraction.	Unauthorised impacts to protected species as a result of site activities.	2 x 2 = 4 (**Low**)	As summarised in **Section 2.2.1 - Remnant Vegetation** and **Section 2.2.2 - Koala Habitat**, clearing mapped vegetation is exempt from further assessment under the Planning Act framework. On the basis of these exemptions, it is considered that activities within the East Pit have an inherent low risk of unauthorised impacts to regrowth vegetation. To further mitigate potential impacts to adjacent areas of mapped remnant vegetation, the operational areas are to be demarcated prior to clearing. Provided all clearing occurs within the designated operational limits, impacts to adjacent areas of vegetation will be avoided. Land to the west of the extension area is mapped as comprising Category B – remnant vegetation containing endangered RE; however, Neilsens do not intend to carry out any clearing within the mapped area from that authorised under the existing site approvals. A low inherent risk requires no application of specific management measures and residual risk remains low. The environmental objective for 'Land' is therefore achieved.	2 x 2 = 4 (**Low**)
The activity is operated in a way that protects the environmental values of land including soils, subsoils, landforms and associated flora and fauna.	Areas disturbed will be rehabilitated or restored to achieve sites that are— • safe to humans and wildlife; and • non-polluting; and • stable; and • able to sustain an appropriate land use after rehabilitation or restoration.	Post-closure implementation and management of the site rehabilitation.	Failure to achieve rehabilitation milestones in disturbance areas at the cessation of the activities.	3 x 4 = 12 (**High**)	In the absence of management measures to assist in site rehabilitation, landforms created through the extraction activities have the potential to impact upon environmental values of the surrounding areas following cessation of the extractive industry activities. Inclusion of the conditions PML004 (L2) and PML005 (L3) of the MOC (DES 2019a) will enable regulation of rehabilitation for the proposed extraction area. The EMP includes a Rehabilitation Management Plan (refer to Section 4.6 of the EMP). Provided that Neilsens implement the EMP, and observe the EA requirements, the environmental objectives for 'Land' are likely to be achieved. Residual risk is reduced to a lower level as the likelihood of failure of final rehabilitated landforms is reduced through the implementation of these measures. With future planning and implementation of successful rehabilitation, the likelihood of failure is reduced; however, the consequence remains the same, which result in a residual risk rating of medium.	2 x 3 = 6 (**Medium**)

Notes:

1. Environmental Objectives and Performance Outcomes have been reprinted from Schedule 8, Part 3, Division 1 of the EP Reg
2. "Inherent risk" is the level of risk that exists if the impacts go unmitigated.
3. "Residual risk" is the risk that remains after implementation of the proposed control / management measures.

4 Concluding Remarks

The EAR has been prepared to address the EA application requirements as outlined in Section 125 of the EP Act.

The highest level of residual risk has been calculated as medium. Ongoing management of the site will be required in accordance with the management measures provided in the site's EMP, and through compliance with the EA conditions, to ensure that the potential risk associated with environmental impacts identified is reduced to as low as reasonably possible.

The EMP have been developed to provide written procedures regarding the measures for the management of potential environmental impacts from the site activities, with reference to the risk assessment provided in **Table 20 – Operational Assessment of Environmental Risk**. In addition, it is proposed that the MOC (DES 2019a) and Common Conditions (DES 2019b) are applied to enable regulation of environmental impacts.

References

AE (Assured Environmental), (2022a). *Bromelton North Quarry - Noise Impact Assessment*

AE (Assured Environmental), (2022b). *Bromelton North Quarry – Air Quality Assessment*

Bureau of Meteorology (2022). *Climate Data Online*. Accessed October 2022 via http://www.bom.gov.au/climate/data/

CCAA (Cement, Concrete & Aggregates Australia), (2015). *CCAA Guideline – Assessment and Control of Environmental Noise Emission from Quarries – Queensland*. Accessed 26 November 2022 via https://www.ccaa.com.au/common/Uploaded%20files/CCAA/Industry%20Guidelines/CCAA%20Extractive%20Noise%20Reduction%20LR%20MAY15.pdf

DES (Department of Environment and Science, (2019a). *Model operating conditions—ERA 16—Extractive and screening activities.* Accessed 8 December 2022 via https://environment.des.qld.gov.au/__data/assets/pdf_file/0026/89144/pr-co-extraction-and-screening.pdf

DES (Department of Environment and Science, (2019b). *Common conditions: Prescribed environmentally relevant activities.* Accessed 8 December 2022 via https://environment.des.qld.gov.au/__data/assets/pdf_file/0030/89841/pr-co-common-conditions-prescribed-eras.pdf

DES (Department of Environment and Science). (2020). *Noise Measurement Manual.* Accessed June 28 November 2022 via https://environment.des.qld.gov.au/licences-permits/pdf/noise-measurement-manual-em1107.pdf

DES, (Department of Environment and Science). (2022). *Queensland Environmental Offsets Policy*. Accessed 23 November 2022 via https://environment.des.qld.gov.au/__data/assets/pdf_file/0022/266062/offsets-policyv1-12.pdf

DERM (Department of Environment and Resource Management), (2010). *Logan River Environmental Values and Water Quality Objectives.* Accessed 25 November 2022 via https://environment.des.qld.gov.au/__data/assets/pdf_file/0031/87583/logan-river-ev-2010.pdf

EHP, (Department of Environment and Heritage Protection), (2016). *Planning for Noise Control*.

SDILGP (State Development, Infrastructure, Local Government and Planning), (2021). *KRA Reports and Maps: Key Resource Area reports and maps 41 to 80.* Accessed 4 October 2022 via https://dsdmipprd.blob.core.windows.net/general/key-resource-area-reports-and-maps-41-to-80.pdf

SDILGP, (2022). *Bromelton State Development Area.* Accessed 4 October 2022 via https://dsdmipprd.blob.core.windows.net/general/key-resource-area-reports-and-maps-41-to-80.pdf

Standards Australia. (2006). *AS 2187.2-Explosives - Storage and use - Use of explosives*. Standards Australia: Sydney, NSW.

Standards Australia (2018). *ISO 31000:2018 Risk management – Guidelines.* Standards Australia: Sydney, NSW

The State of Queensland, (2022). *Queensland Globe*. Accessed via https://qldglobe.information.qld.gov.au/

DRAWINGS

GROUNDWORK plus

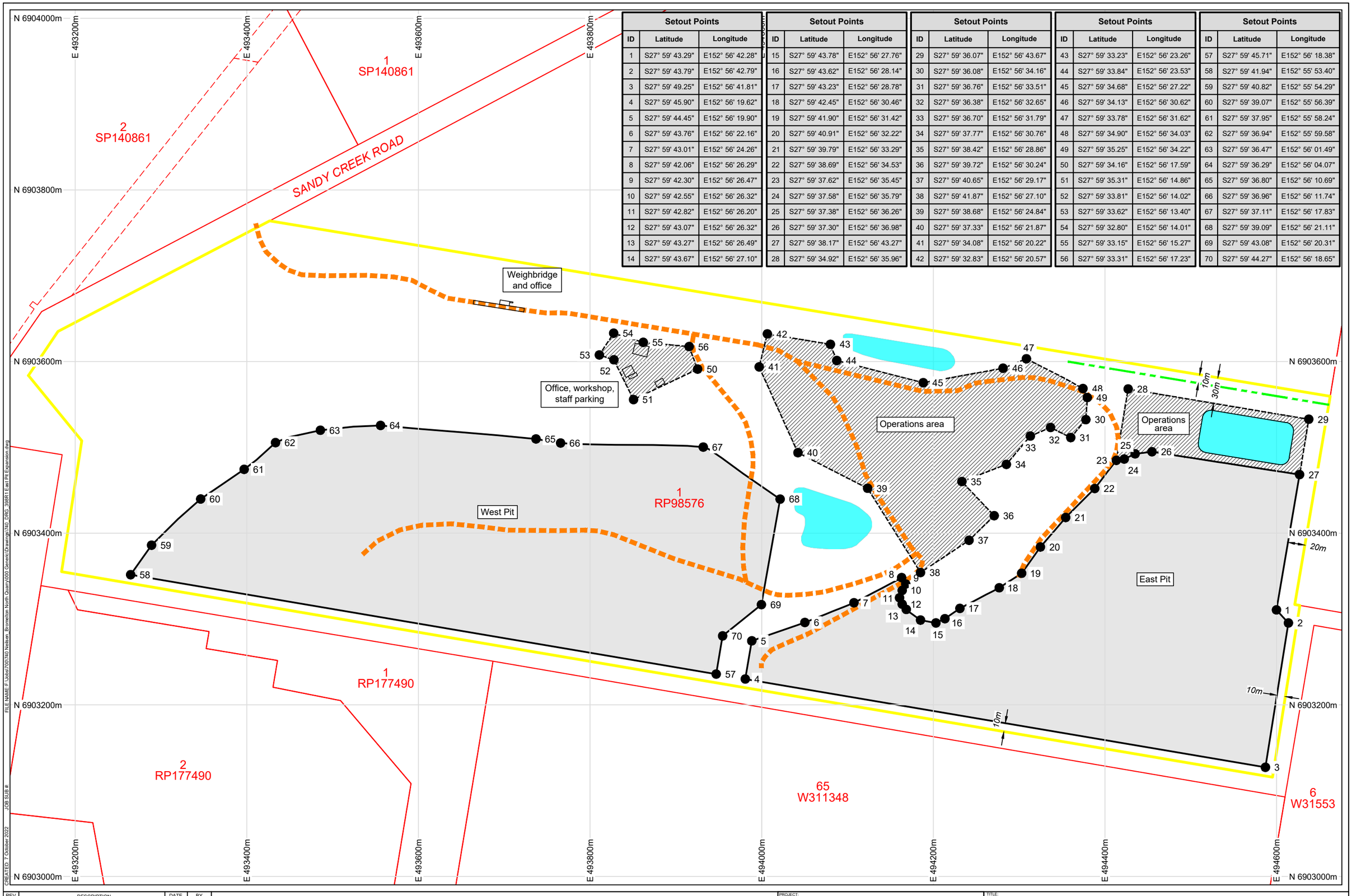
Setout Points		
ID	Latitude	Longitude
1	S27° 59' 43.29"	E152° 56' 42.28"
2	S27° 59' 43.79"	E152° 56' 42.79"
3	S27° 59' 49.25"	E152° 56' 41.81"
4	S27° 59' 45.90"	E152° 56' 19.62"
5	S27° 59' 44.45"	E152° 56' 19.90"
6	S27° 59' 43.76"	E152° 56' 22.16"
7	S27° 59' 43.01"	E152° 56' 24.26"
8	S27° 59' 42.06"	E152° 56' 26.29"
9	S27° 59' 42.30"	E152° 56' 26.47"
10	S27° 59' 42.55"	E152° 56' 26.32"
11	S27° 59' 42.82"	E152° 56' 26.20"
12	S27° 59' 43.07"	E152° 56' 26.32"
13	S27° 59' 43.27"	E152° 56' 26.49"
14	S27° 59' 43.67"	E152° 56' 27.10"

Setout Points		
ID	Latitude	Longitude
15	S27° 59' 43.78"	E152° 56' 27.76"
16	S27° 59' 43.62"	E152° 56' 28.14"
17	S27° 59' 43.23"	E152° 56' 28.78"
18	S27° 59' 42.45"	E152° 56' 30.46"
19	S27° 59' 41.90"	E152° 56' 31.42"
20	S27° 59' 40.91"	E152° 56' 32.22"
21	S27° 59' 39.79"	E152° 56' 33.29"
22	S27° 59' 38.69"	E152° 56' 34.53"
23	S27° 59' 37.62"	E152° 56' 35.45"
24	S27° 59' 37.58"	E152° 56' 35.79"
25	S27° 59' 37.38"	E152° 56' 36.26"
26	S27° 59' 37.30"	E152° 56' 36.98"
27	S27° 59' 38.17"	E152° 56' 43.27"
28	S27° 59' 34.92"	E152° 56' 35.96"

Setout Points		
ID	Latitude	Longitude
29	S27° 59' 36.07"	E152° 56' 43.67"
30	S27° 59' 36.08"	E152° 56' 34.16"
31	S27° 59' 36.76"	E152° 56' 33.51"
32	S27° 59' 36.38"	E152° 56' 32.65"
33	S27° 59' 36.70"	E152° 56' 31.79"
34	S27° 59' 37.77"	E152° 56' 30.76"
35	S27° 59' 38.42"	E152° 56' 28.86"
36	S27° 59' 39.72"	E152° 56' 30.24"
37	S27° 59' 40.65"	E152° 56' 29.17"
38	S27° 59' 41.87"	E152° 56' 27.10"
39	S27° 59' 38.68"	E152° 56' 24.84"
40	S27° 59' 37.33"	E152° 56' 21.87"
41	S27° 59' 34.08"	E152° 56' 20.22"
42	S27° 59' 32.83"	E152° 56' 20.57"

Setout Points		
ID	Latitude	Longitude
43	S27° 59' 33.23"	E152° 56' 23.26"
44	S27° 59' 33.84"	E152° 56' 23.53"
45	S27° 59' 34.68"	E152° 56' 27.22"
46	S27° 59' 34.13"	E152° 56' 30.62"
47	S27° 59' 33.78"	E152° 56' 31.62"
48	S27° 59' 34.90"	E152° 56' 34.03"
49	S27° 59' 35.25"	E152° 56' 34.22"
50	S27° 59' 34.16"	E152° 56' 17.59"
51	S27° 59' 35.31"	E152° 56' 14.86"
52	S27° 59' 33.81"	E152° 56' 14.02"
53	S27° 59' 33.62"	E152° 56' 13.40"
54	S27° 59' 32.80"	E152° 56' 14.01"
55	S27° 59' 33.15"	E152° 56' 15.27"
56	S27° 59' 33.31"	E152° 56' 17.23"

Setout Points		
ID	Latitude	Longitude
57	S27° 59' 45.71"	E152° 56' 18.38"
58	S27° 59' 41.94"	E152° 55' 53.40"
59	S27° 59' 40.82"	E152° 55' 54.29"
60	S27° 59' 39.07"	E152° 55' 56.39"
61	S27° 59' 37.95"	E152° 55' 58.24"
62	S27° 59' 36.94"	E152° 55' 59.58"
63	S27° 59' 36.47"	E152° 56' 01.49"
64	S27° 59' 36.29"	E152° 56' 04.07"
65	S27° 59' 36.80"	E152° 56' 10.69"
66	S27° 59' 36.96"	E152° 56' 11.74"
67	S27° 59' 37.11"	E152° 56' 17.83"
68	S27° 59' 39.09"	E152° 56' 21.11"
69	S27° 59' 43.08"	E152° 56' 20.31"
70	S27° 59' 44.27"	E152° 56' 18.65"



REV	DESCRIPTION	DATE	BY
1	Pit avoids remnant vegetation	04/10/22	MR

Data Sources:
Photography: Groundwork Plus RPA Survey, Captured 2022-07-26
Topography:
Cadastre: © The State of Queensland (DNRME) 2022
Ecosystem:
Other: Background Photography: © The State of Queensland (DNRME) 2019

Legend:
- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Proposed Extraction Boundary
- Water Storage / Sediment Basin
- Operations Area Boundary
- Internal Haul Road
- Vegetation Buffer

PROJECT: Bromelton North

CLIENT: Neilsens Quality Gravels Pty Ltd

TITLE: East Pit Expansion

GROUNDWORK plus
PH: +61 7 3871 0411
WWW.GROUNDWORK.COM.AU

SCALE: 1:4,000 When Printed On A3 — 0 — 80m
DRAWING NUMBER: 740.DRG.398
REVISION: 1
DATE: 7 October 2022 DRAWN: MR
PRINTED: 7 October 2022 CHECKED: MB
DATUM: HORIZONTAL / VERTICAL / ZONE
MGA / AHD / 56

FILE NAME: F:\Jobs\7000\740 Neilsen Bromelton North Quarry\000 Generic\Drawings\740_DRG_398R1 East Pit Expansion.dwg
JOB SUB #
CREATED: 7 October 2022

ATTACHMENTS

GROUNDWORK plus

Attachment 1

Noise Impact Assessment

BROMELTON NORTH QUARRY - NOISE IMPACT ASSESSMENT

Project ID: 14565

9/12/2022

Release: R1

Prepared For:

Groundwork Plus

Assured Environmental

DOCUMENT CONTROL PAGE

Project Title: BROMELTON NORTH QUARRY - NOISE IMPACT ASSESSMENT

Project Reference ID: 14565

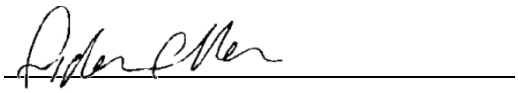
Report Prepared by:

Assured Environmental
Unit 7, 142 Tennyson Memorial Avenue
Tennyson, QLD, 4105

Report Prepared for:

Groundwork Plus
6 Mayneview Street
Milton, QLD, 4066

Author: Michelle Clifton



Reviewer: Aiden Allen

Table 1: History of Revisions

Revision	Date	Issued to	Changes
R0	24/11/2022	M. Benham	Initial Release
R1	9/12/2022	M. Benham	Comments

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

GLOSSARY

A-Weighting	A response provided by an electronic circuit which modifies sound in such a way that the resulting level is similar to that perceived by the human ear.
Background Noise	Noise level at a given location and time measured in the absence of any alleged noise nuisance sources. Typically, represented by the L_{A90} noise statistic.
Calibrator	An instrument used to carry out 'field calibrations' before and after monitoring to ensure the sound level meter does not drift.
dB (decibel)	This is the scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and the reference pressure (0.00002 N/m^2).
dB(A) or dBA	This is a measure of the overall noise level of sound across the audible spectrum with a frequency weighting (i.e., 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Fast Time Weighting	Sound level meters apply a time-smoothing function to the measured sound. Fast time weighting has an exponential smoothing time constant of 125 milliseconds.
Free-field	Refers to a sound pressure level determined at a point away from reflective surfaces other than the ground with no significant contribution due to sound from other reflective surfaces; generally, as measured outside and away from buildings.
L_{Aeq}	This is the equivalent steady sound level in dB(A) containing the same acoustic energy as the actual fluctuating sound level over the given period. Noise levels often fluctuate over a wide range with time. Therefore, when a noise varies over time, the LAeq is the equivalent continuous sound which would contain the same sound energy as the time varying sound. Many studies show that human reaction to level-varying sounds tends to relate closer to the LAeq noise level than any other descriptor.
L_{Amax}	The A-weighted, maximum, sound level. It should be noted that maximum noise levels are not peak levels.
L_{Amin}	The A-weighted, minimum, sound level.

ABBREVIATIONS

AHD	Australian Height Datum
DES	Department of Environment and Science
EA	Environmental Authority
EPP(Noise)	Environmental Protection (Noise) Policy 2019
ERA	Environmentally Relevant Activities
Mtpa	Million tonnes per annum
SDAP	State Development Assessment Provisions
SDRC	Southern Downs Regional Council
SLM	Sound Level Meter
tpa	Tonnes per annum

1 INTRODUCTION

1.1 Background

The Neilsens Group (Neilsens) operate the hard rock quarry known as Bromelton North Quarry, (Subject Site). Bromelton North Quarry is operated pursuant to Consent Order for Material Change of Use – Development Permit for Extractive Industry (ref: 3448 of 2003) granted on 23 June 2004. The Consent Order allows for extraction of 400,000 tonnes per annum of material from the site.

The operation holds an Environmental Authority (EA) EPPR0054113 for the extraction and screening of between 100,000 to 1,000,000 tonnes of material per annum.

Neilsens propose to increase the extraction rate to 800,000 tonnes per annum and extend the east pit footprint. It is not proposed to change the approved hours of operation or location of fixed plant, and equipment.

1.2 Scope of Assessment

Assured Environmental (AE) was appointed by Groundwork Plus to undertake a noise and vibration impact assessment from the increase in extraction and screening from 400,000 tpa to 800,000 tpa.

In undertaking the assessment, reference has also been made to the following regulations and guidelines:

- Environmental Protection Act 1994;
- Environmental Protection Regulation 2019;
- Environmental Protection (Noise) Policy 2019; and
- Application requirements for activities with noise impacts (DES, 2021); and
- Noise Measurement Manual (NMM) (DES, 2019).

In accordance with the requirements of the above guidelines, computational modelling and first principle calculations have been undertaken to assess the potential for adverse amenity and health impacts as a result of the proposed development.

1.3 This Report

This report summarises the methodology, results, and conclusions of the noise and vibration assessment.

2 DESCRIPTION OF ENVIRONMENTAL VALUES

2.1 Location

The Subject Site is located at Sandy Creek Road, Bromelton, on Lot 1 on RP98576. The Site is approximately 5 km south west of Beaudesert and has a total site area of approximately 62 hectares. The site is located in the Transition Precinct of the Bromelton State Development Area, in which extractive industry is an expected land use. The Subject Site and the adjacent quarry are classified as a Key Resource Area (KRA 61), which is a planning tool designed to protect resources from being rendered inaccessible by urban expansion.

The existing setting is dominated by agricultural land used for cropping and grazing purposes interspersed with clusters of rural residential land. Other non-rural activities occur within proximity of the site, including an adjacent extractive industry use to the south and energy facility to the west.

2.2 Receptors

There are five sensitive receptors within 1 km of the Subject Site and 20 sensitive receptors within 2 km. The receptors within 2 km of the Subject Site are listed in Table 2 and have been identified as shown in Figure 2.

The nearest sensitive receptor, R1 is a single dwelling located approximately 558 metres south west of the Subject Site boundary. The quarry workings will retain a ridgeline to the south, which will topographically screen the operations from receptors to the south-east and south-west.

Table 2: Modelled Sensitive Receptors

ID	Location (UTM Zone 56)		Elevation (m)	Land use
	Easting	Northing		
R1	492722	6903088	89	Residential
R2	492669	6902126	61	Residential
R3	492499	6902079	66	Residential
R4	492511	6902002	68	Residential
R5	492453	6901925	73	Residential
R6	492452	6901859	73	Residential
R7	492404	6901783	75	Residential
R8	492477	6901708	73	Residential
R9	492405	6901635	81	Residential
R10	492389	6901573	85	Residential
R11	493456	6901579	64	Residential
R12	493992	6901471	68	Residential
R13	495239	6901390	57	Residential
R14	495024	6902098	55	Residential
R15	495795	6902032	57	Residential
R16	496042	6902189	49	Residential
R17	495388	6902837	61	Residential
R18	495644	6903536	54	Residential
R19	494717	6904259	60	Residential
R20	493997	6904642	60	Residential

2.3 Terrain

Figure 3 illustrates the local topography, as obtained from a combination of Lidar data at 10 m resolution. The terrain of the local area is undulating to hilly varying from approximately 30 m to 170 m AHD within 1 km radius of the Subject Site.

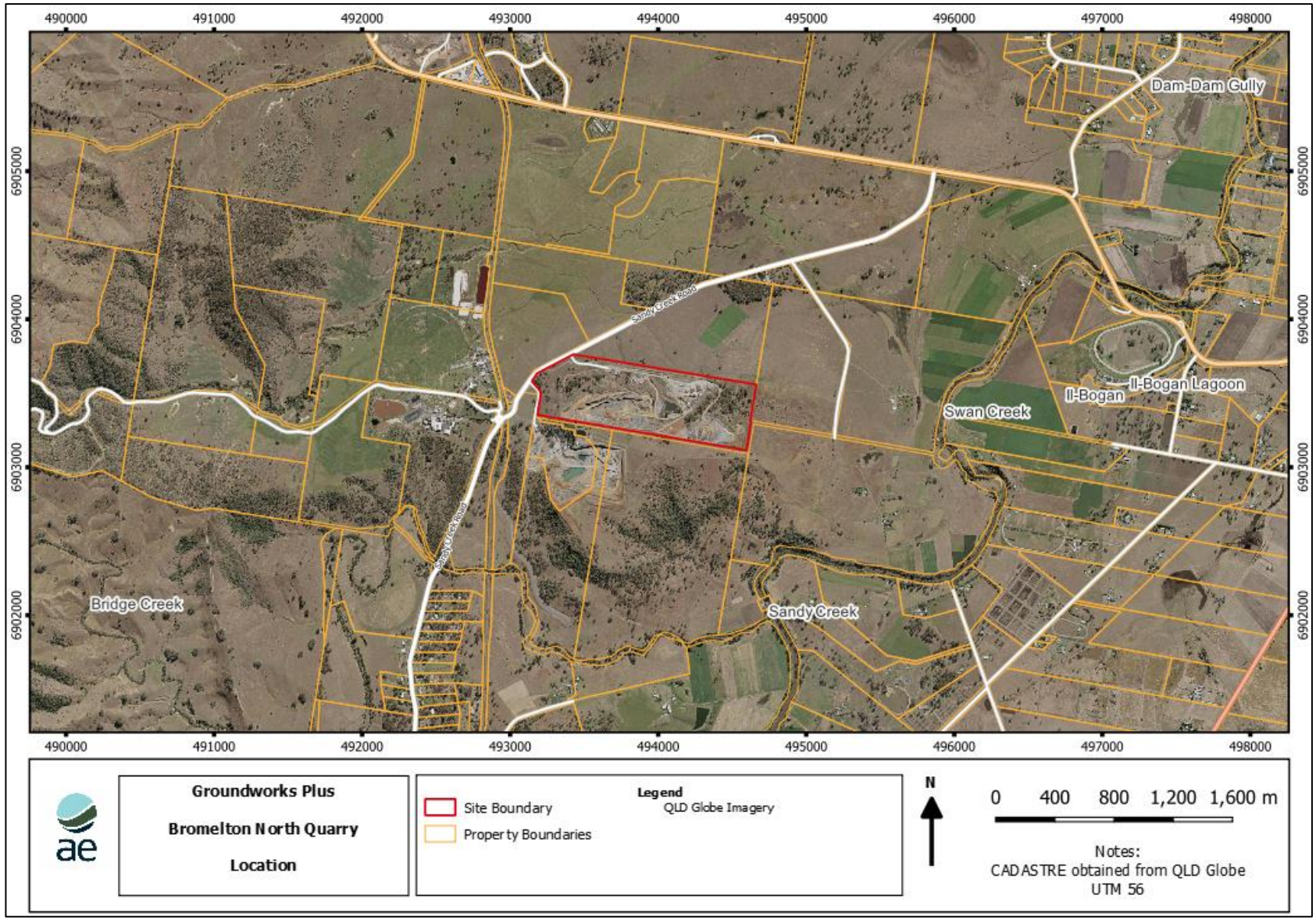


Figure 1: Site Location

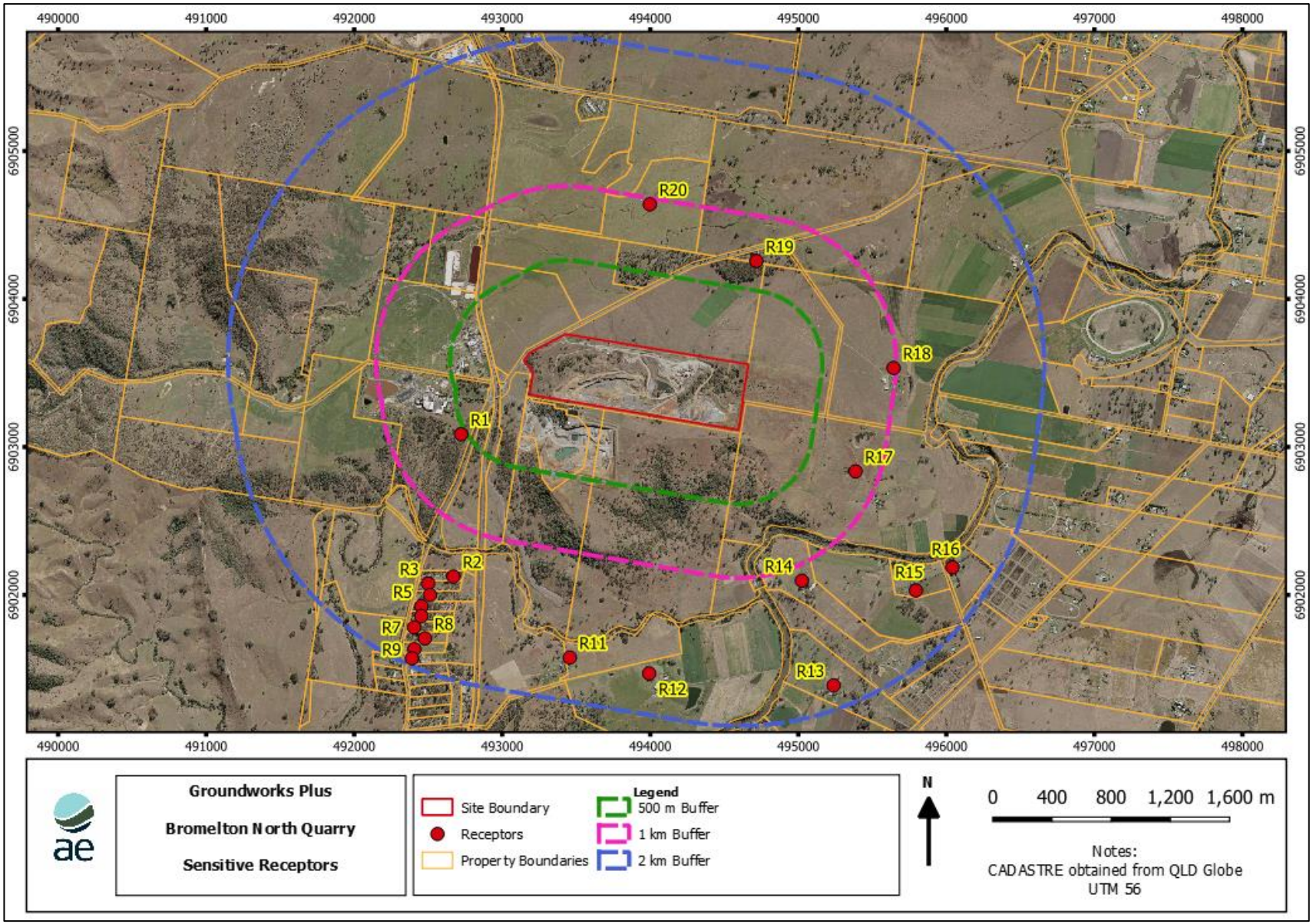


Figure 2: Sensitive Receptors

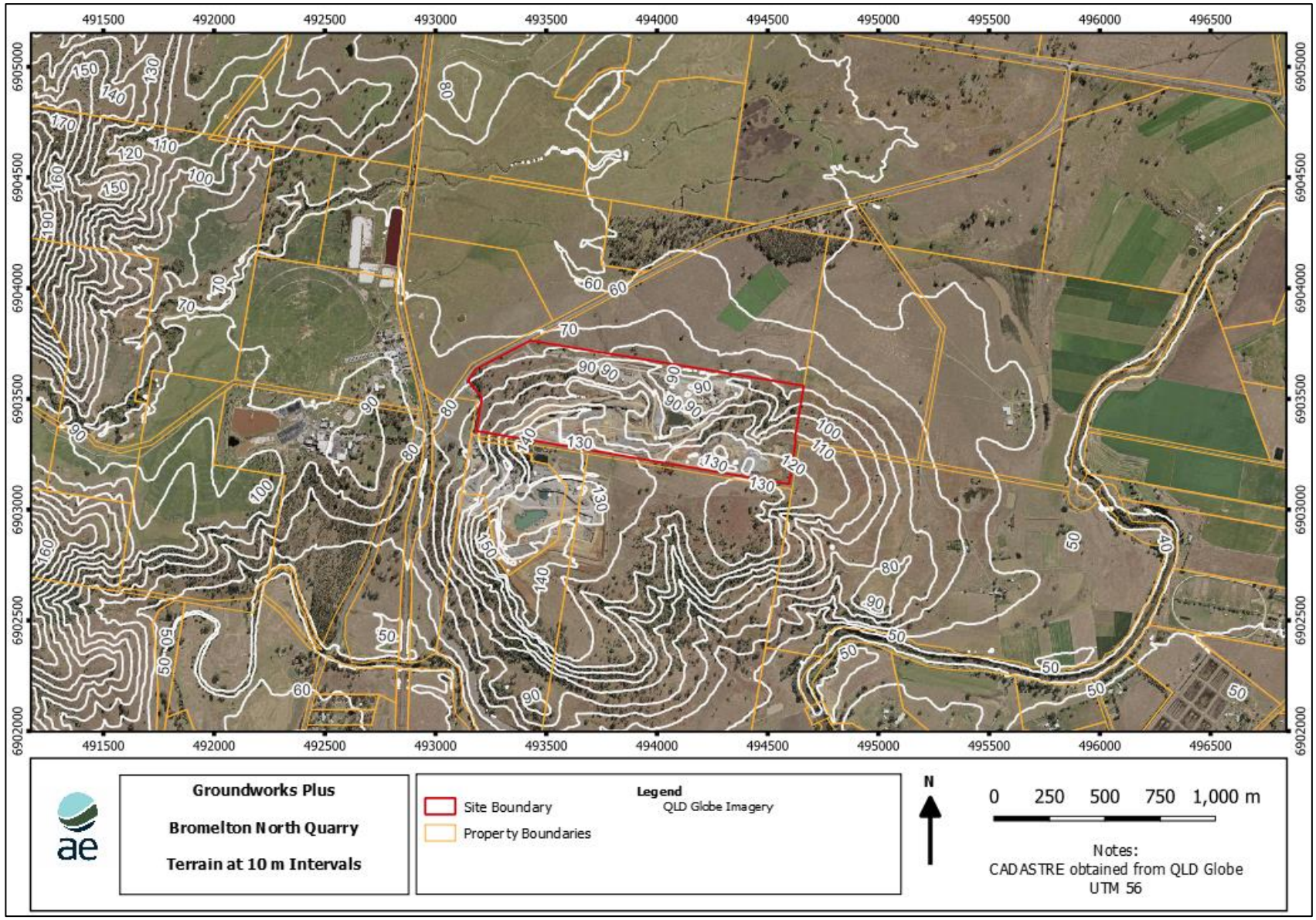


Figure 3: Surrounding Topography at 10 m Intervals (Extracted from LiDAR Data)

3 QUARRY OPERATIONS

3.1 Overview

Neilsens operate the hard rock quarry known as Bromelton North Quarry, (Subject Site). The quarry operates under:

- Consent Order for Material Change of Use – Development Permit for Extractive Industry (ref: 3448 of 2003) granted on 23 June 2004;
- Environmental Authority EPPR00540113 (EA), issued by the Department of Environment and Science (DES), authorising the following Environmentally Relevant Activities (ERAs):
    - ERA Threshold 16 (2)(b) - Extractive and screening activities - extracting, other than by dredging more than 100,000 but not more than 1,000,000 tonnes of material in a year.
    - ERA Threshold (3)(b) - Extractive and screening activities - screening more than 100,000 but not more than 1,000,000 tonnes of material in a year.

3.2 Current Consent Conditions

Conditions of Environmental Authority EPPR00540113 (effective 12 August 2020) issued by the Department of Environment and Science provides specific requirements relating to emissions of noise from the activity as summarised in Table 3

Table 3: Conditions Relevant to Noise (EPPR00540113)

<table>
<tr><th>Condition number</th><th>Condition</th></tr>
<tr><td>Noise</td><td></td></tr>
<tr><td>N1</td><td>In the event of a complaint about noise that constitutes intrusive noise being made to the administering authority, that the administering authority considers is not frivolous or vexatious, then the emission of noise from the premises to which this environmental authority relates must not result in levels greater than those specified in Table 1 – Noise Limits.
Table 1 – Noise Limits
<table>
<tr><th></th><th>7am–6pm</th><th>6pm–10pm</th><th>10pm–7am</th></tr>
<tr><td></td><td colspan="3">Noise measured at the sensitive place</td></tr>
<tr><td>LAmax, adj, T</td><td>Background noise level plus 5 dB(A)</td><td>Background noise level plus 5 dB(A)</td><td>Background noise level plus 3 dB(A)</td></tr>
<tr><td></td><td colspan="3">Noise measured at the commercial place</td></tr>
<tr><td>LAmax, adj, T</td><td>Background noise level plus 10 dB(A)</td><td>Background noise level plus 10 dB(A)</td><td>Background noise level plus 8 dB(A)</td></tr>
</table></td></tr>
<tr><td>N2</td><td>All blasting must be carried out in a proper manner by a competent person in accordance with best practice environmental management to minimise the likelihood of adverse effects being caused by the impact of airblast overpressure and ground borne vibrations on sensitive premises and people living in or using the surrounding area.</td></tr>
<tr><td>N3</td><td>Blasting activities must be carried out in such a manner that if blasting noise should propagate to a noise-sensitive place, then</td></tr>
</table>

Condition number	Condition
	(i) the blast overpressure must be not more than 115 dB (linear peak) for four (4) out of five (5) consecutive blasts; and (ii) the ground vibration must be: • for vibrations of more than 35 Hz-not more than twenty-five (25) millimetres per second ground vibration, peak particle velocity; and • for vibrations of not more than 35 Hz-not more than 10 (10) millimetres per second ground vibration, peak particle velocity.
N4	The ground-borne vibration transducer (or array) must be attached to a mass of at least 30kg to ensure good coupling with the ground where the blast site and measurement site cannot be shown to be on the same underlying strata. The mass shall be buried so that its upper most surface is at the same level as the ground surface.
N5	The ground-borne vibration transducer (or array) must be placed at a distance of at least the longest dimension of the foundations of a noise-affected building or structure away from such building or structure between that building or structure and the site of the blasting.

There are three points to make about Condition N1.

Firstly, the noise parameter $L_{Amax\ adj,\ T}$ is considered equivalent to $L_{A10\ adj,\ T}$. The noise level metric that has been set for determining the acceptable level of noise emission is the $L_{A10\ adj}$ noise level parameter. This is defined as the A-weighted sound pressure level adjusted for tonal character and impulsiveness of the sound that is exceeded for 10% of the measurement period (typically 15 minutes) using fast response. In practice, there are some difficulties in both (i) accurately measuring emitted quarry noise using this parameter and (ii) accurately predicting emitted noise levels using this parameter.

Recognising these difficulties, in recent years the State has been adopting the more readily measured and predicted $L_{Aeq\ adj,T}$ noise level parameter. $L_{Aeq,\ adj\ T}$ is defined as the adjusted A-weighted equivalent continuous sound pressure level measured on fast response, adjusted for tonality and impulsiveness, during the time period T, where T is measured for a period no less than 15-minutes when the activity is causing a steady state noise, and no shorter than one hour when the approved activity is causing an intermittent noise.

If the noise source is generating steady-state noise, there will generally be no significant difference between the resultant $L_{A10\ adj,T}$ value and the resultant $L_{Aeq\ adj,T}$ noise level value when each is measured concurrently over the same measurement time period, T. Rather, and putting aside any contribution from extraneous noise sources, the differences in the resultant values measured using each parameter will be due to fluctuations in wind speed and direction.

Secondly, while it is possible to logarithmically add the $L_{Aeq,T}$ noise level generated by one source, i.e., quarry noise in this instance, and the $L_{Aeq,T}$ noise level generated by one source, i.e. road traffic noise, to generate a resultant $L_{Aeq,T}$ or $L_{Aeq\ adj,T}$ noise level generated by both sources, it is not technically correct to attempt the same process using $L_{A10,T}$ values.

In these circumstances and recognising there is likely to be a small difference between the $L_{A10,T}$ at source and the $L_{Aeq,T}$ noise level at source it is appropriate to predict quarry noise levels using the $L_{Aeq,T}$ noise level parameter after making an appropriate adjustment to account for the likely difference between the two noise level parameters. In this way, and adopting unchanging atmospheric conditions, e.g., unvarying wind speed and direction, the resultant

predicted $L_{Aeq,T}$ noise level after adjustment will be an appropriate surrogate for the $L_{A10,T}$ noise level which cannot be predicted.

Additionally, the assessment of background plus 5 dB(A) is consistent with the current approach of assessing noise impacts from development. Table 4 presents the noise limits as derived from Condition N1 from the noise monitoring data outlined in Section 4.

Table 4: Environmental Authority Condition N1 Noise Limits

Monitoring Location	Receptors	Day	Evening	Night
NML1	Sensitive Place	32 + 5 = 37	29 + 5 = 34	29 + 3 = 32
	Commercial Place	32 + 10 = 42	29 + 10 = 39	29 + 8 = 37

3.3 Current Operations

The existing quarry operation provides for extraction, processing, stockpiling, ancillary operations area, and stormwater controls over 5 stages. The current operation generally aligns with the approved Stage 4 layout, avoiding mapped remnant vegetation between the east and west pits.

Material is processed using a crushing and screening plant located in the central sector of the quarry. The primary bin tipping platform is approximately 15 metres above the plant and stockpile pad whilst the remainder of the plant (screens and secondary and tertiary crushers) are located on a pad north of the primary bin tipping platform. This processing plant produces a wide range of quality quarried products.

The quarry component of the operation comprises two pits. The quarrying process begins with removal of overburden material and excavation at the quarry face and/or floor using various heavy machinery (excavators, bulldozers, and wheeled loaders).

Fragmented material is transported from the pit floor to the onsite processing area (referred to as the crushing floor) using dump trucks traversing a haul road up and out of the pit to the feeder dump point above the crushing floor.

The crushing floor comprises of an array (or train) of equipment including a feeder, crushers, and impactors as well as numerous conveyors and screens. This crushing floor is a permanent fixture and the range, and the type of material being processed, and its required sizing dictate the number of crushers, conveyors and screens used at any point in time.

It is important to note that not all crushing plant is operated simultaneously; the number of crushers and screens operating is dependent on client contracts. Once crushed and screened, the final product is then loaded again into dump trucks and transported along haul roads to stockpiles awaiting sale or further processing (i.e., aggregate coating). Upon sale, the final product is loaded at its stockpile into trucks of multiple sizes for transportation offsite.

3.4 Proposed Operations

The proposed development is for an increase to the scale and intensity of the existing hard rock extraction operation by:

- Extending the eastern quarry footprint north; and

- Increasing the extraction rate to 800,000 tpa.

The east pit has been designed to avoid clearing of remnant vegetation. It is not proposed to alter other aspects of the existing operation such as hours of operation or location of fixed plant and equipment. This development application is intended to replace the conditions of the Consent Order.

The fixed processing plant and associated stockpiling area will be retained in the centre of the site. No additional buildings or structures are proposed, including the site office, amenities block, parking areas, weighbridge, workshop, and truck wash down facilities.

3.5 Comparison of Operations

Table 5 provides a comparison of the current approved existing activities and future proposed modification activities as part of the increase in production.

Table 5: Comparison of Activities

Aspect	Current Activities	Proposed Activities
Land Use	Approval granted for an extractive industry and associated processing and crushing and grinding.	Continued use of existing west pit and extension to east pit.
Quarry footprint	As per Figure 5 (Stage 4 of approved plans)and Figure 4	Primarily focused on the East Pit (80%) with some minor extraction in the West Pit (20%)
Approved Hours of operation	06:00 to 18:00 Monday to Friday. 07:00 – 17:00 Saturday No operation on Sundays or Public Holidays	N/A – no change proposed.
Production and Transportation limits	Up to 400,000 tpa from the site. Daily maximum generally 4,000 tpd	Up to 800,000 tpa from the site. Daily maximum generally 4,000 tpd
Extraction method	Extraction by blast and drill.	N/A – no change proposed.
Site infrastructure and plant	Drilling, blasting, and extraction in quarry pit	No change to the operations in the quarry pit.
	Primary, secondary, and tertiary crushing and screening facilities on crushing floor	No change to the crushing/ screening facilities on crushing floor
Product transport method and access	Via truck to Sandy Creek Road	N/A – no change proposed.
Truck Movements	Average daily truck dispatches based on current payloads (9% trucks/ 86% truck and dog and 5% B-double): • 43 truckloads per day • 85 movements per day Staff vehicles: • 10 movements per peak hour (start and end of shift)	Average daily truck dispatches based on current payloads (9% trucks/ 86% truck and dog and 5% B-double): • 78 truckloads per day • 156 movements per day Staff vehicles: • 10 movements per peak hour (start and end of shift)
Blasting	Typically, 12 blasts per year	Expected 24 blasts per year
Blasting hours	09:00 to 17:00 Monday to Friday	N/A – no change proposed.

Aspect	Current Activities	Proposed Activities
Equipment	Refer to Section 3.3.	N/A – no change proposed. Increased extraction and processing based on increasing efficiency

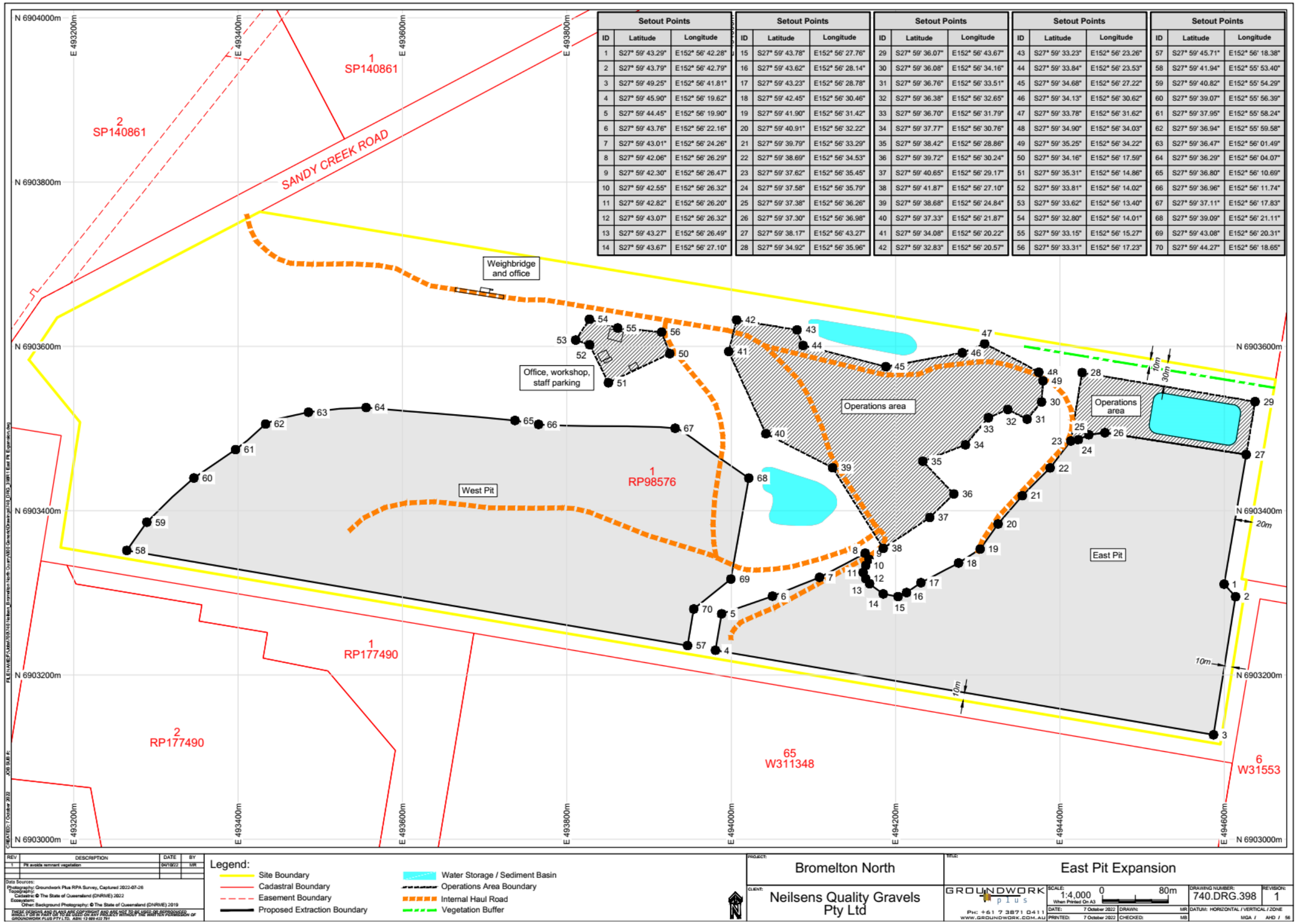


Figure 4: Proposed East Pit Extension

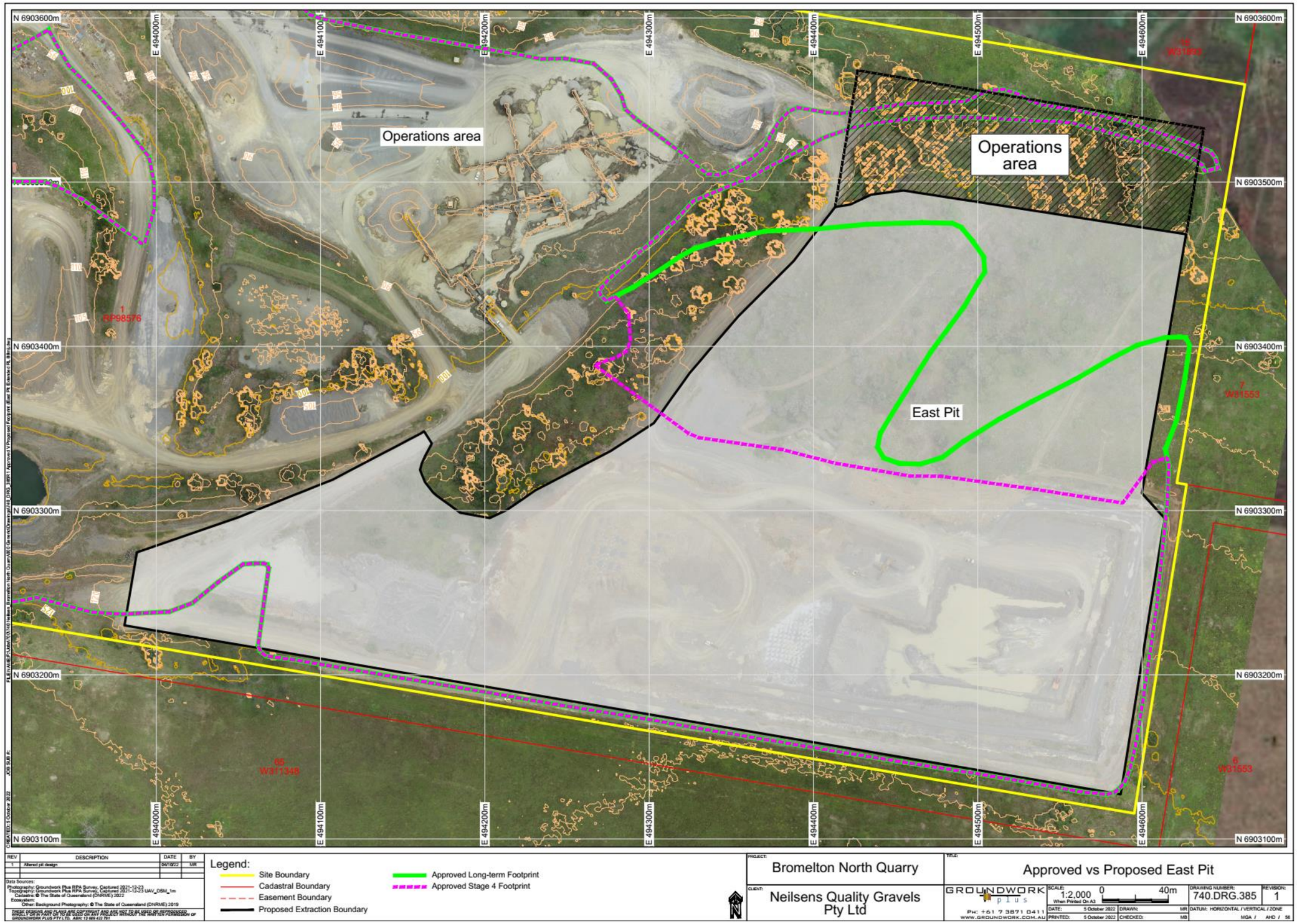


Figure 5: Approved and Proposed Footprint of East Pit

4 EXISTING NOISE ENVIRONMENT

4.1 Existing Sources of Noise

The existing acoustic environment in the area is influenced by traffic along Sandy Creek Road. Additional noise sources include birds and wind through vegetation at receptors.

4.2 Baseline Noise Monitoring

Background noise monitoring was undertaken from 12 to 20 October 2022 at one location in order to quantify the background noise levels at nearby sensitive receptors. The noise monitoring location (ML1) information is presented in Appendix A. Neither the Subject Site nor the adjacent quarry were audible at the monitoring location. The noise monitoring location is presented in Figure 6.

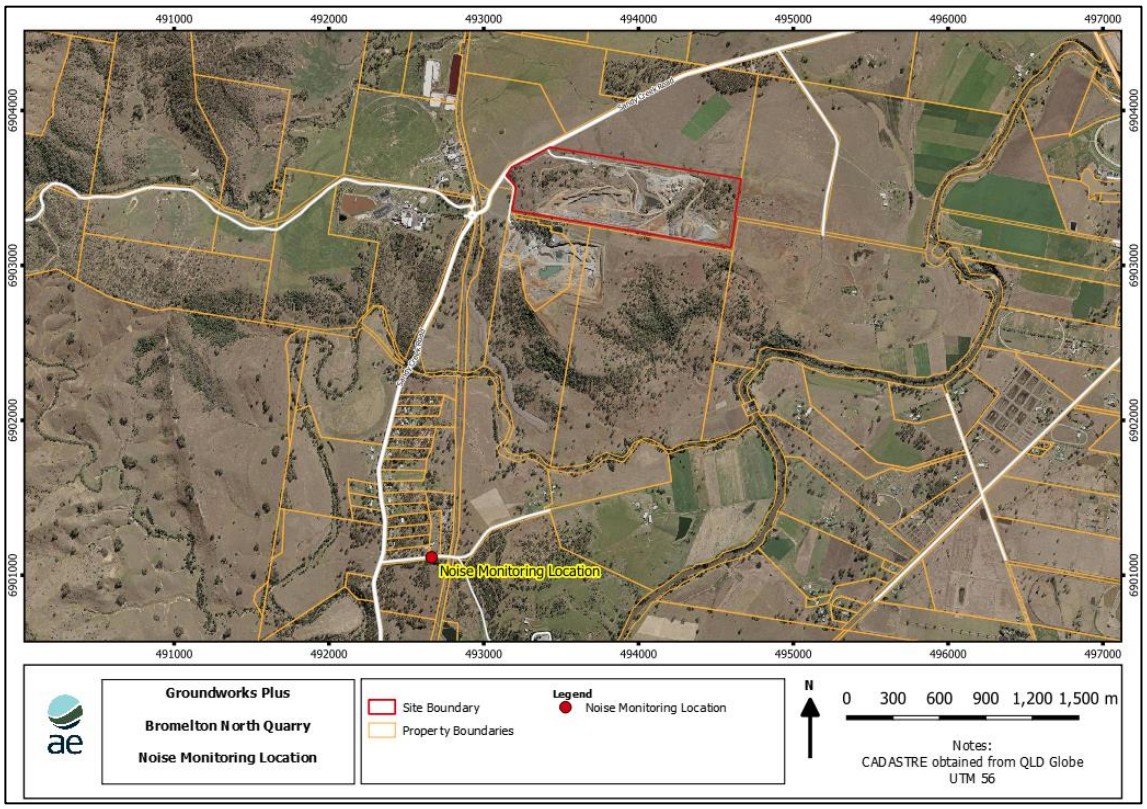


Figure 6: Monitoring Location

Noise measurements were undertaken in accordance with the requirements of Australian Standard AS 1055-2018 *'Acoustics – Description and measurement of environmental noise'*. One sound level meter (SLM) was used for the continuous monitoring. The SLM was situated in a free-field position and a data logging time of 15 minutes was adopted. The microphone was positioned at a height of 1.2 metres above ground level and fitted with a windshield throughout the measurements. The serial numbers and calibration information for the instruments as well as daily measurement data and time histories are presented in Appendix A.

Noise monitoring has a potential to be affected by rainfall and wind speeds above 5 m/s. A review of meteorological data from the DES Josephville, found that there were four hours affected by high wind speeds and/or rain during the monitoring period (7 days). To avoid

weather-related bias, and in accordance with the Noise Measurement Manual noise data collected during the weather-affected periods are not considered in analysis.

A review of the 1/3 octave spectrum for each measurement has identified that during some evenings and night time periods, the monitoring data was influenced by insects. These frequencies have been removed from the analysis. Table 6 below provides a summary of noise levels of each period for a variety of statistical noise parameters with both the weather and insect affected data removed.

Table 6: Summary of Noise Monitoring Results

Location	Period	L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	RBL
ML 1	Day (7 am to 6 pm)	97	64	48	35	56	32
	Evening (6 pm to 10 pm)	88	57	47	32	52	29
	Night (10 pm to 7 am)	94	55	45	32	52	29

It can be seen from Table 6 that the rated background noise levels are typical for the monitoring location setting (i.e., rural). Detailed noise monitoring analysis is presented in Appendix A.

5 REGULATORY REQUIREMENTS

5.1 Overview

This Section reviews the applicable criteria taking into consideration the following:

- Scenic Rim Regional Council Planning Scheme;
- State Development Code 22;
- Bromelton State Development Area Development Scheme;
- Environmental Protection (Noise) Policy 2019; and
- Cement Concrete & Aggregates Australia (CCAA) *Assessment and Control of Environmental Noise Emission from Quarries – Queensland.*

5.2 Scenic Rim Regional Council

The site is located within the Scenic Rim Regional Council Area. The Scenic Rim Planning Scheme includes assessment benchmarks relating to noise within the Extractive Industry Code (PO13) as provided in Table 7.

Table 7: Scenic Rim Regional Council Extractive Industry Code Acceptable Outcomes

Performance Outcomes	Acceptance Outcomes
Environmental management requirements for the Extractive industry are properly identified in an Environmental Management Plan prepared by a suitably qualified person and submitted to Council that demonstrates appropriate management practices to protect environmental standards, by addressing the following: (1) Air quality; (2) Stormwater; (3) Noise; (4) Waste; (5) Water quality including erosion and sedimentation control; (6) Stream bed and bank stability; (7) Landscape and rehabilitation; (8) Workplace procedures; (9) Emergency and hazard procedures; (10) Flora and fauna protection; and (11) Auditing and review.	AO13 No acceptable outcome is prescribed.

5.3 State Code 22: Environmentally Relevant Activities

The State Development Assessment Provisions (SDAP) provide assessment benchmarks for an Environmental Relevant Activity (ERA). A development should demonstrate compliance with the relevant provisions in table 22.2.2 of the code, which summarised in Table 8.

Table 8: State Code 22 Performance Conditions

Performance Outcome	Acceptable Outcome
PO1 Development is suitably located and designed to avoid or mitigate environmental harm to the acoustic environment	AO1.1 Development meets the acoustic quality objectives for sensitive receptors identified in the Environmental Protection (Noise) Policy 2019.

5.4 Bromelton SDA Development Scheme

The Subject Site is located within the Transition Precinct of the Bromelton State Development Area. Section 2.5.4 Emissions details the requirements a development within the SDA area must achieve:

- (1) Development is designed to avoid or minimise:
    - (a) adverse impacts from air, noise and other emissions that will affect the health and safety, wellbeing and amenity of communities and individuals and
    - (b) conflicts arising from (but not limited to), spray drift, odour, noise, dust, light spill, smoke, or ash emissions with sensitive and/or incompatible land uses
- (2) Development supports the achievement of the relevant acoustic and air quality objectives of the Environmental Protection (Noise) Policy 2008 and the Environmental Protection (Air) Policy 2008.
- (3) Development with high levels of emissions is to, in accordance with current best practice, avoid adverse impacts on the cumulative air quality1 of the Bromelton air shed.

The Environmental Protection (Noise) Policy 2008 has been superseded by Environmental Protection (Noise) Policy 2019.

5.5 Cement Concrete & Aggregates Australia

The Guideline Assessment and Control of Environmental Noise Emission from Quarries - Queensland (CCAA, 2015) presents the strategy to be adopted to control environmental noise emission from Queensland quarries. The noise control strategy comprises three elements for setting the appropriate limit for the acceptable level of noise emission from any particular quarry.

The three elements are:

- Adoption of default noise limits based on time of day, with a 45 dBA limit during the day time period.
- Adoption of site-specific noise limits where the default limits are not appropriate
- Adoption of Industry Best Practice Noise Control.

Table 9 presents the Element 1 (Default) noise levels for quarries in Queensland.

Table 9: Element 1 Schedule of Acceptable Noise Levels

Day	Period	Noise level at a noise sensitive place measured as the equivalent continuous sound pressure level ($L_{Aeq\ adj,T}$)
Monday to Saturday	07:00 – 18:00 hours	45 dB(A)
	18:00 – 22:00 hours	35 dB(A)
	22:00 – 07:00 hours	30 dB(A)
Sundays and Public Holidays	08:00 – 18:00 hours	40 dB(A) Emergency maintenance only
All other times	-	Not audible

5.6 Environmental Protection (Noise) Policy

The EPP (Noise) provides acoustic quality objectives for a range of receptors with respect to the potential impact of an activity upon on the health and well-being and biodiversity of the receptors. Specifically, the objectives are intended to enhance or protect the following environmental values:

- The qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystem.
- The qualities of the acoustic environment that are conducive to human health and wellbeing, including by ensuring a suitable acoustic environment for individuals to do any of the following:
    - sleep
    - study or learn
    - be involved in recreation, including relaxation and conversation.
- The qualities of the acoustic environment that are conducive to protecting the amenity of the community.

Table 10 presents a summary of the acoustic quality objectives applicable to the receptors surrounding the Project.

Table 10: EPP(Noise) Schedule 1 Acoustic Quality Objectives

Sensitive receptor	Time of day	Acoustic quality objectives (measured at the receptor) *dB(A)*			Environmental value
		$L_{Aeq,adj,1hr}$	$L_{A10,adj,1hr}$	$L_{A1,adj,1hr}$	
Residence (for outdoors)	daytime and evening	50	55	65	health and wellbeing
Residence (for indoors)	daytime and evening	35	40	45	health and wellbeing
	night-time	30 (37)	35 (42)	40 (47)	health and wellbeing (ability to sleep)

Sensitive receptor	Time of day	Acoustic quality objectives (measured at the receptor) *dB(A)*			Environmental value
		$L_{Aeq,adj,1hr}$	$L_{A10,adj,1hr}$	$L_{A1,adj,1hr}$	
Commercial and retail activity (for indoors)	When the activity is open for business	45 (52)	-	-	health and wellbeing (ability to converse)
Protected area or critical area	-	the level of noise that preserves the amenity of the existing area or place			-

Note: Brackets ( ) denote the external noise criteria assuming a 7 dB(A) façade transmission loss.

The EPP(Noise) provides amenity objectives which do not take into consideration the surrounding environment, which could be sensitive to any increase in noise environment. The EPP(Noise) explanatory note states:

> *The acoustic quality objectives are considered in assessment processes and help inform the decision-making process, including any conditions that may be placed on approvals for environmentally relevant activities. The acoustic quality objectives are not individual point source emission standards but are total levels of noise in the surrounding environment. They assist to inform what the point source acoustic emission level as a condition of approval for a particular activity at a site may be.*
>
> *It is not intended that, as part of achieving the acoustic quality objectives, any part of the existing acoustic environment be allowed to deteriorate. That means in using this policy for making decisions including under the Environmental Protection Act 1994, the acoustic quality objectives should not be seen as a noise limit without consideration of whether the acoustic environment is being allowed to deteriorate due to an existing acoustic environment that is better than the acoustic quality objective.*

The Acoustic Quality Objectives from the EPP(Noise) are shown in Table 11.

Table 11: EPP(Noise) 2019 Acoustic Quality Objectives

Receiver Type	Receptors	$L_{Aeq,adj,1\ hr}$ dB(A)			$L_{A1,\ adj,\ 1\ hr}$ dB(A)
		Day	Evening	Night	Night
Residential Dwellings	All receptors	50	42	37	65

Note: Assuming 7 dB(A) façade transmission loss is accounted for

In addition to the above acoustic quality objectives, the EPP (Noise) 2019 requires that, where reasonable to do so, background creep should be prevented or minimised [Section 9(2)(b)]. While specific noise limits to achieve this outcome are not provided in the EPP (Noise) 2019, reference is made to the previous objectives provided in the now repealed EPP (Noise) 2008 as follows:

(a) for noise that is continuous noise measured by $L_{A90,T}$—more than nil dB(A) greater than the existing acoustic environment measured by $L_{A90,T}$; or

(b) for noise that varies over time measured by $L_{Aeq,adj,T}$—more than 5 dB(A) greater than the existing acoustic environment measured by $L_{A90,T}$.

Given that there are no future industries expected in the local area, the control of background creep is not applicable to this assessment.

5.7 Summary of Criteria

For this project, the limiting L_{AMax} criteria is the EPP(Noise) acoustic quality objectives. For the L_{Aeq}, the Element 1 (default) values in the CCAA guidelines are applied.

Table 12: Summary of Applicable Noise Criteria at Sensitive Receptors

Criteria Parameter	Receptors	$L_{Aeq,T}$			Night L_{Amax}
		Day	Evening	Night	
EPP AQO (Table 10)	All Sensitive Receptors	50	42	37	65
CCAA Element 1 Limits (Table 9)	All Sensitive Receptors	45	35	30	-

a) In accordance with Schedule 1 of the Environmental Authority, $L_{A10\ adj,\ T}$ has been taken as approximately equivalent to $L_{Amax\ adj,\ T}$.

6 NOISE ASSESSMENT METHODOLOGY

6.1 Software

For the purposes of predicting impacts associated with noise emissions from the Subject Site on nearby sensitive receptors, noise modelling of the sources was completed using the proprietary software CadnaA (version 2022 build 189.5221) developed by DataKustik. CadnaA incorporates the influence of meteorology, terrain, ground type and air absorption in addition to source characteristics to predict noise impacts at receptor locations.

6.2 Meteorology

Noise levels were predicted using the CONCAWE propagation methodology, which incorporates the influence of meteorological conditions on the propagation of noise through the atmosphere. The modelled meteorological parameters shown in Table 13 were selected to predict the worst-case noise levels at all receptors during all seasons and all time periods.

Table 13: Model Parameters

Parameter	Day (Noise-Enhancing)	Evening (Noise-Enhancing)	Night (Noise-Enhancing)
Temperature (night)	20°C	10°C	10°C
Relative Humidity	75%	75%	75%
Wind Speed (m/s)	3.0	3.0	2.0
Stability Class	D	D	F
Wind Direction:	Worst Case	Worst Case	Worst Case

6.3 Model Configuration

Table 14 summarises the model configuration used for the modelling.

Table 14: Model Configuration

Parameter	Approach
Standards	CONCAWE
Time Periods	Day (07:00 – 18:00 hours) Evening (18:00 – 22:00 hours) Night (22:00 – 07:00 hours)
Digital Terrain	LIDAR data at 1 m intervals. Triangulation calculation applied.
Ground Absorption	Default absorption for hard surface. Aerial mapping used to include soft ground.

7 NOISE ASSESSMENT

7.1 Scenario Assessed

As detailed in Section 3, there isn't much difference from current and future operations other than the expansion of the eastern pit. There are no additional equipment or mobile plant. As such, only the proposed peak scenario will be assessed.

7.2 Noise Sources

The main noise sources from the proposed change in operations are primarily:

- Truck movements and truck unloading activities;
- External plant (fixed and mobile);
- Pit activities; and
- Crushing activities.

AE carried out a site visit to measure noise from mobile plant and other equipment on 28 October 2022 and 4 November 2022. For safety reasons, noise measurements of mobile plant were not undertaken. Data for these noise sources were obtained from Assured Environmental's sound power level database which includes a number of measurements from quarries and extraction activities.

During two site visits in October and November 2022, sound pressure level measurements of the crushing activities were obtained. In addition, a measurement at the boundary of the crushing floor was obtained for the purposes of validating the crushing activities in the noise model. The measured noise level was 82.5 dB(A) and the predicted noise level at the measurement location was 81.4 dB(A). As the difference (-1.1 dB(A)) between the measurement and prediction noise level were <2 dB(A), the model is considered to be suitable.

Table 15 provides a summary of the noise sources adopted for this assessment and the operational details of each source.

7.3 Modelling Assumptions

The following assumptions have been applied to the noise model:

- All noise sources operating 100% of any 15-minute period;
- All vehicles will follow the internal haul roads;
- Stockpile heights and locations based on site observations and recent drone contours;
- Internal haul roads vehicle movements are based on daily peak production; and
- Rock drills have been represented as operating at elevated and exposed locations. Drilling at lower and less topographically exposed benches and pit locations throughout the majority of the quarry life will result in reduced noise exposure at surrounding sensitive receptors compared to the results presented in this report; and
- All sources occur between 06:00 – 18:00 hours except drilling which only operates between the hours of 07:00 – 18:00.

Table 15: Sound Power Levels

Activity	Noise Source	Qty	Height above Ground Level (m)	Sound Power Level (dB(A) (Excluding Corrections)		Corrections Applied (tonality, low frequency, impulsiveness)	Operating Hours	Acoustical Usage (%)
				L_{Aeq}	L_{Amax}			
Processing Plant	Vibrating Feeder and Jaw Crusher [a)]	1	6	118	125	+5 dB	06:00 – 18:00	100%
	Trio Cone Crusher and Horizontal Screen [a)]	1	5	115	118	+5 dB	06:00 – 18:00	100%
	Cone Crusher and Horizontal Screen [a)]	2	8	114	116	+5 dB	06:00 – 18:00	100%
	Screen [a)]	3	6	107	108	-	06:00 – 18:00	100%
Drilling	Rock Drill	1	1.5	118	128	+5 dB	07:00 – 18:00	100%
Mobile Plant	Excavator	3	2	106	113	+5 dB	06:00 – 18:00	100%
	FEL	3	2	106	111	-	06:00 – 18:00	100%
	Dump Truck	4	2	109	118	+5 dB	06:00 – 18:00	100%
	Water Cart	1 /hr	2	109	115	+5 dB	06:00 – 18:00	100%
Haulage	Truck idling (weighbridge – in and out)	14/hr	2.5	97	98	-	06:00 – 18:00	1.4 mins per vehicle
	Truck and dog (unladen)	7/hr	2.5	102	108	+5 dB	06:00 – 18:00	100%
	Truck and dog (laden)	7/hr	2.5	102	108	-	06:00 – 18:00	100%
	Truck Exhaust	14/hr	3.5	94	98	-	06:00 – 18:00	100%
	Loading trucks	7/hr	2	109	117	-	06:00 – 18:00	100%
	Truck Unloading at ROM Pad	6/hr	3	115	122	+5 dB	06:00 – 18:00	100%
Office	AC Unit	4	1	70	72	-	06:00 – 18:00	100%
	Staff Vehicles	10	1.0	77	80	-	06:00 – 18:00	100%
	Car door slam	10	1.0	-	94	-	06:00 – 18:00	5%

a) Includes all auxiliary equipment (conveyors, conveyor motors etc). Measured at site

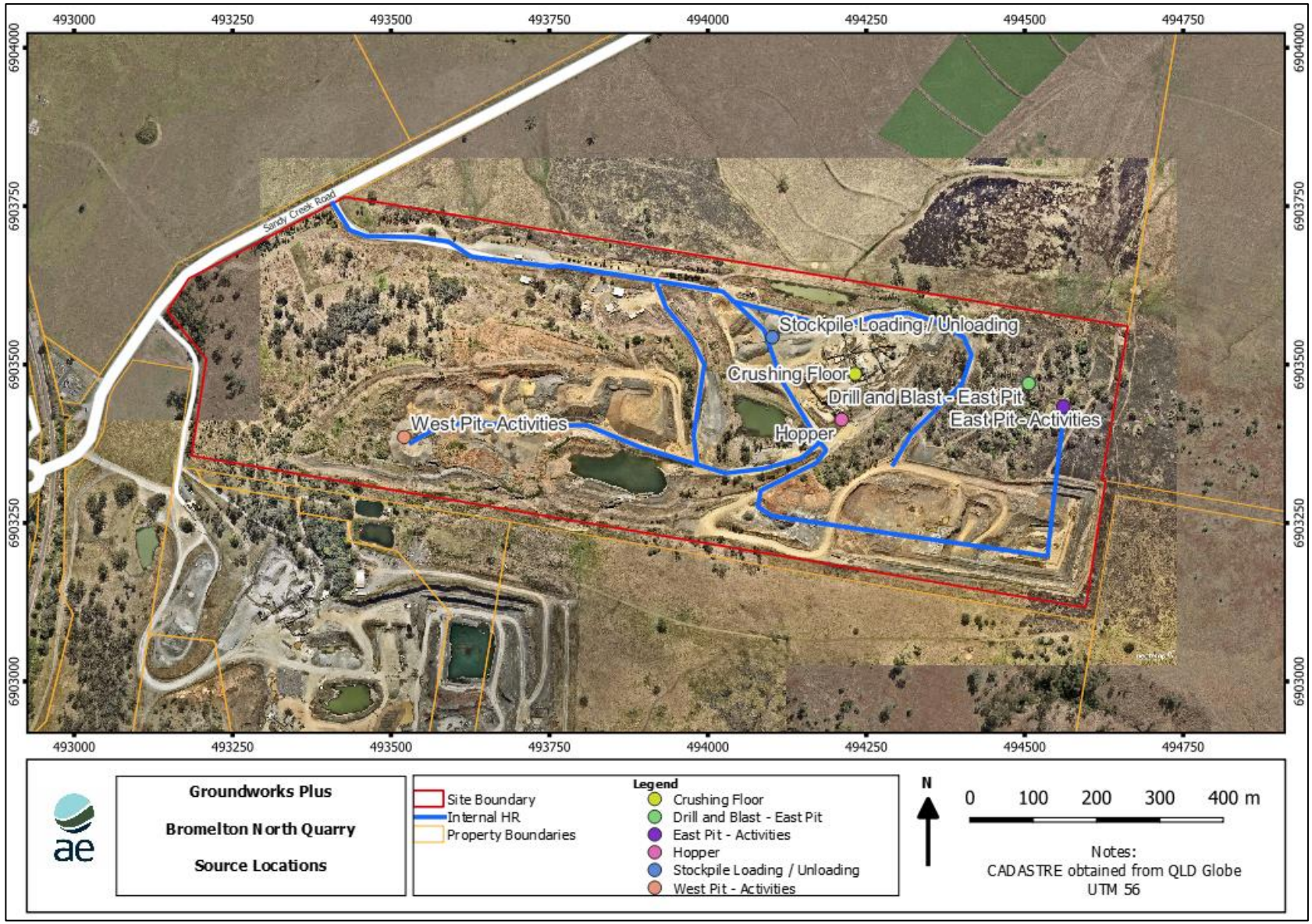


Figure 7: Modelled Source Location for Bromelton North Quarry

8 PREDICTED NOISE LEVELS

8.1 Overview

Criteria used for this assessment is the CCAA Element 1 noise limits as discussed in Section 5. This Section presents the predicted noise levels for future operations and Appendix C provides contour noise levels.

8.2 Future Activities

The current and future hours limit operations within the hours of 06:00 – 18:00 hours, being day time and night time periods.

Table 16 provides the current and future hours limit operations within the hours of 6am and 6pm, being day (D) and night (N) time periods. The results show that all receptors comply with assessment criteria except receptors R19 and R20 for the night time period (i.e., 22:00 – 07:00), which are located north of the Subject Site and are visible from the crushing area.

Table 16: Maximum Predicted Results – Future Quarry Activities

ID	Predicted Operational Noise Levels (dB L_{Aeq})				Criteria Levels (dB L_{Aeq})				Exceedence (dB(A))			
	D	E	N	L_{AMax}	D	E	N	L_{AMax}	D	E	N	L_{AMax}
R01	18	-	<10	<10	45	35	30	65	-	-	-	-
R02	<10	-	<10	<10	45	35	30	65	-	-	-	-
R03	<10	-	<10	<10	45	35	30	65	-	-	-	-
R04	<10	-	<10	<10	45	35	30	65	-	-	-	-
R05	<10	-	<10	<10	45	35	30	65	-	-	-	-
R06	<10	-	<10	<10	45	35	30	65	-	-	-	-
R07	<10	-	<10	<10	45	35	30	65	-	-	-	-
R08	<10	-	<10	<10	45	35	30	65	-	-	-	-
R09	<10	-	<10	<10	45	35	30	65	-	-	-	-
R10	<10	-	<10	<10	45	35	30	65	-	-	-	-
R11	11	-	<10	<10	45	35	30	65	-	-	-	-
R12	13	-	<10	<10	45	35	30	65	-	-	-	-
R13	<10	-	<10	<10	45	35	30	65	-	-	-	-
R14	16	-	<10	<10	45	35	30	65	-	-	-	-
R15	<10	-	<10	<10	45	35	30	65	-	-	-	-
R16	<10	-	<10	<10	45	35	30	65	-	-	-	-
R17	20	-	10	10	45	35	30	65	-	-	-	-
R18	27	-	16	15	45	35	30	65	-	-	-	-
R19	40	-	31	31	45	35	30	65	-	-	1	-
R20	41	-	31	33	45	35	30	65	-	-	1	-

A review of the causes of the exceedences have identified that during the night time, the two highest noise levels at both R19 and R20 are the Trio Crusher and Metso Crusher.

8.3 Mitigation

Detailed noise measurements and modelling of the Trio cone crusher identified this source as the highest contributor to the predicted exceedences at R19 and R20. Onsite observations confirmed there is a 1.5 m high bund to the north of the quarry boundary, which provides noise mitigation for low level sources (i.e., truck movements), however the Trio cone crusher is elevated on a platform.

There are two forms of mitigation:

- Cease operation of the trio crusher during the night-time period (i.e., 06:00 – 07:00 hours); or
- Install a barrier as detailed below.

Based on observations, it is recommended that a 1.6 m high (with the top of the panel being at RL 95 m), U-shaped barrier is installed on the platform to protect the receptors to the north of the Subject Site, as shown in Figure 8. Discussions with Bromelton North Quarry has identified the platform can bare the weight of the selected panels.

The proposed acoustic panels are a Sonata 75 mm thick panels as detailed in Appendix B.

Figure 8: Location of Noise Panels on Trio Cone Crusher Platform

Table 17 provides the predicted noise for the future quarry activities for day (D) and night (N) periods. The results show that all receptors comply with the assessment criteria as detailed in Table 12 when the acoustic panels are installed on the Trio cone crusher platform.

Table 17: Maximum Predicted Results – Future Quarry Activities with Mitigation

ID	Predicted Operational Noise Levels (dB L_{Aeq})				Criteria Levels (dB L_{Aeq})				Exceedence (dB(A))			
	D	E	N	L_{AMax}	D	E	N	L_{AMax}	D	E	N	L_{AMax}
R01	18	-	<10	<10	45	35	30	65	-	-	-	-
R02	<10	-	<10	<10	45	35	30	65	-	-	-	-
R03	<10	-	<10	<10	45	35	30	65	-	-	-	-
R04	<10	-	<10	<10	45	35	30	65	-	-	-	-
R05	<10	-	<10	<10	45	35	30	65	-	-	-	-
R06	<10	-	<10	<10	45	35	30	65	-	-	-	-
R07	<10	-	<10	<10	45	35	30	65	-	-	-	-
R08	<10	-	<10	<10	45	35	30	65	-	-	-	-
R09	<10	-	<10	<10	45	35	30	65	-	-	-	-
R10	<10	-	<10	<10	45	35	30	65	-	-	-	-
R11	11	-	<10	<10	45	35	30	65	-	-	-	-
R12	13	-	<10	<10	45	35	30	65	-	-	-	-
R13	<10	-	<10	<10	45	35	30	65	-	-	-	-
R14	16	-	<10	<10	45	35	30	65	-	-	-	-
R15	<10	-	<10	<10	45	35	30	65	-	-	-	-
R16	<10	-	<10	<10	45	35	30	65	-	-	-	-
R17	20	-	10	10	45	35	30	65	-	-	-	-
R18	27	-	16	15	45	35	30	65	-	-	-	-
R19	40	-	30	30	45	35	30	65	-	-	-	-
R20	38	-	28	28	45	35	30	65	-	-	-	-

9 VIBRATION ASSESSMENT

9.1 Introduction

An assessment of the potential for vibration impacts has been undertaken to determine potential impacts as a result of vibration generated by plant and equipment during quarry operation. In particular, the assessment has considered the potential for impacts on both human comfort and structural damage for the nearest residence to the quarry.

9.2 Vibration Assessment Criteria

For blasting, the existing environmental authority EPPR0005410113 provides the following criteria as outlined in Table 18.

Table 18: Blasting Noise Limits (EPPR0005410113)

Blasting Criteria	Blasting Limits
Airblast overpressure	115 dB (Linear) Peak for 4 out of 5 consecutive blasts
Ground vibration peak particle velocity	• for vibrations of more than 35 Hz-not more than twenty-five (25) millimetres per second ground vibration, peak particle velocity; and • for vibrations of not more than 35 Hz-not more than ten (10) millimetres per second ground vibration, peak particle velocity

It is not recommended or expected that the Blasting Conditions in the EA would need to change as a result of the proposed modification to the Development Consent.

9.3 Assessment of Vibration Impacts

9.3.1 Assessment of Impacts – Site Specific Information

A review of the Blast Management Plan[a] identified a typical maximum instantaneous charge of 98 kg and a site constant of K = 1041.

9.3.2 Assessment of Impacts – Ground Vibration from Blasting

Ground vibration levels have been estimated using the following equation from AS 2187.2-2006 *"Explosives - Storage and use - Use of explosives"*:

$$V = K_g \left(\frac{R}{Q^{1/2}}\right)^{-B}$$

Where:

V = ground vibration as PPV (mm/s)

[a] Groundwork Plus (2022). *Bromelton North Quarry - Blast Management Plan*. Document reference 740_410_002 dated June 2022.

Q = explosives mass charge (kg)

R = distance from charge (m)

K_g = site constant (1041)[a)]

B = site constant (1.6) [a)]

Table 19 presents the predicted ground vibration levels (PPV) at each receptor using typical mass charge of 98.77 kg. It can be seen from Table 19 that compliance is achieved at all sensitive receptors. Additional calculations have identified that an MIC of 600 kg would still achieve compliance at all sensitive receptors.

It should be noted however that the impacts of blasting are dependent on-site specific factors including the blast management techniques, ground conditions and geological stratum types and locations. Given this, monitoring of the blasts should also be undertaken at the nearest sensitive receptor in accordance with the EA and Blast Management Plan.

Table 19: Predicted Ground Vibration from Blasting using Typical MIC

Predicted Ground Vibration from Blasting using Typical MIC							
Receptor	Distance from Site Boundary (m)	K	β	Typical Q (kg)	Predicted PPV (mm/s)	Criteria (mm/s)	Compliant
R1	1400	1041	1.6	98.77	0.38	10	Y
R2	1850	1041	1.6	98.77	0.24	10	Y
R3	2020	1041	1.6	98.77	0.21	10	Y
R4	2130	1041	1.6	98.77	0.19	10	Y
R5	2170	1041	1.6	98.77	0.19	10	Y
R6	2200	1041	1.6	98.77	0.18	10	Y
R7	2250	1041	1.6	98.77	0.18	10	Y
R8	2270	1041	1.6	98.77	0.18	10	Y
R9	2350	1041	1.6	98.77	0.17	10	Y
R10	2400	1041	1.6	98.77	0.16	10	Y
R11	1750	1041	1.6	98.77	0.27	10	Y
R12	1100	1041	1.6	98.77	0.56	10	Y
R13	2100	1041	1.6	98.77	0.20	10	Y
R14	1100	1041	1.6	98.77	0.56	10	Y
R15	1610	1041	1.6	98.77	0.30	10	Y
R16	1720	1041	1.6	98.77	0.27	10	Y
R17	830	1041	1.6	98.77	0.88	10	Y
R18	1000	1041	1.6	98.77	0.65	10	Y
R19	720	1041	1.6	98.77	1.10	10	Y
R20	1130	1041	1.6	98.77	0.53	10	Y

9.3.3 Assessment of Impacts – Blast Overpressure

Airblast levels have been estimated using the following equation from AS 2187.2-2006, *"Explosives - Storage and use - Use of explosives"*:

$$P = K_a \left(\frac{R}{Q^{1/3}}\right)^a$$

Where:

P = pressure (kPa)

Q = explosives mass charge (kg)

R = distance from charge (m)

K_a = site constant (10 – 100)

A = site exponent (-1.45)

Applying a site constant (K_a) of 20, the predicted over blast pressure at each receptor is presented in Table 20. It can be seen that receptor R19 exceeds the 115 dB(Z). If the MIC is reduced to 89 kg, the predicted over blast pressure is 115 dB(Z) at receptor R19; therefore, it is expected to comply with the assessment criteria.

Monitoring of the blasts should be undertaken at the nearest sensitive receptor in accordance with the EA and Blast Management Plan. Monitoring data will provide more accurate data in relation to the site constant when the pit extends closest to R19.

Table 20: Predicted Blast Overpressure using Typical MIC

Predicted Ground Vibration from Blasting using Typical MIC							
Receptor	Distance from Site Boundary (m)	Ka	a	Typical Q (kg)	Predicted Over-Pressure (dB(Z))	Criteria (dB(Z))	Compliant
R1	1400	20	-1.45	98.77	108.0	115	Y
R2	1850	20	-1.45	98.77	104.5	115	Y
R3	2020	20	-1.45	98.77	103.4	115	Y
R4	2130	20	-1.45	98.77	102.8	115	Y
R5	2170	20	-1.45	98.77	102.5	115	Y
R6	2200	20	-1.45	98.77	102.4	115	Y
R7	2250	20	-1.45	98.77	102.1	115	Y
R8	2270	20	-1.45	98.77	102.0	115	Y
R9	2350	20	-1.45	98.77	101.5	115	Y
R10	2400	20	-1.45	98.77	101.3	115	Y
R11	1750	20	-1.45	98.77	105.2	115	Y
R12	1100	20	-1.45	98.77	111.1	115	Y
R13	2100	20	-1.45	98.77	102.9	115	Y
R14	1100	20	-1.45	98.77	111.1	115	Y

Predicted Ground Vibration from Blasting using Typical MIC							
Receptor	Distance from Site Boundary (m)	Ka	a	Typical Q (kg)	Predicted Over-Pressure (dB(Z))	Criteria (dB(Z))	Compliant
R15	1610	20	-1.45	98.77	106.3	115	Y
R16	1720	20	-1.45	98.77	105.5	115	Y
R17	830	20	-1.45	98.77	114.6	115	Y
R18	1000	20	-1.45	98.77	112.3	115	Y
R19	720	20	-1.45	98.77	115.4	115	N
R20	1130	20	-1.45	98.77	110.7	115	Y

10 CONCLUSIONS

Neilsens propose to increase the extraction rate to 800,000 tonnes per annum and extend the east pit footprint. It is not proposed to change the approved hours of operation or location of fixed plant, and equipment.

A noise impact assessment has been undertaken to demonstrate that the expansion of the quarry will not have adverse effects on surrounding receptors. The assessment has been conducted in accordance with Department of Environment & Science (DES) *Guideline - Application requirements for activities with impacts to noise*.

Predictive noise modelling has been undertaken for the site to assess the potential impacts of noise emission from quarry operations and traffic generation. The results of the predictive noise modelling have determined that compliance with the adopted noise criteria is expected to be achieved if the mitigation discussed in Section 9 is implemented.

A blasting vibration assessment has predicted over blast pressure at each receptor is achieve with a MIC of 89 kg whilst ground vibration is also predicted to comply with the assessment criteria with an MIC of 98 kg.

APPENDIX A: BACKGROUND NOISE MONITORING

Table 21: ML1 - Site Details

Site Details: NML 1	
Coordinates:	-28.015153 "S, 152.925362"E
Start / End Date	12 October 2022 at 13:50 hours to 20 October 2022 at 10:35 hours
Logger Details	Norsonic 139 (serial number – 1392800) Next Laboratory Calibration Due: 05/01/2023
Calibration Details	Pulsar 106 (serial number 70394) Start / End Calibration Level: 94.0 dB(A) / 94.4 dB(A) Next Laboratory Calibration Due: 29/08/2023
Measurement Details:	Fast/ A-weighting / 15-min duration / 1.2 m microphone height / Free field position
Weather Details	DES Josephville weather station indicated during the monitoring period 4 hours was affected by rainfall or wind.
On-site Observations:	Located along Flood Lane. Dominant noise sources were wind through vegetation, birdsong, and traffic on Sandy Creek Road and air conditioning.

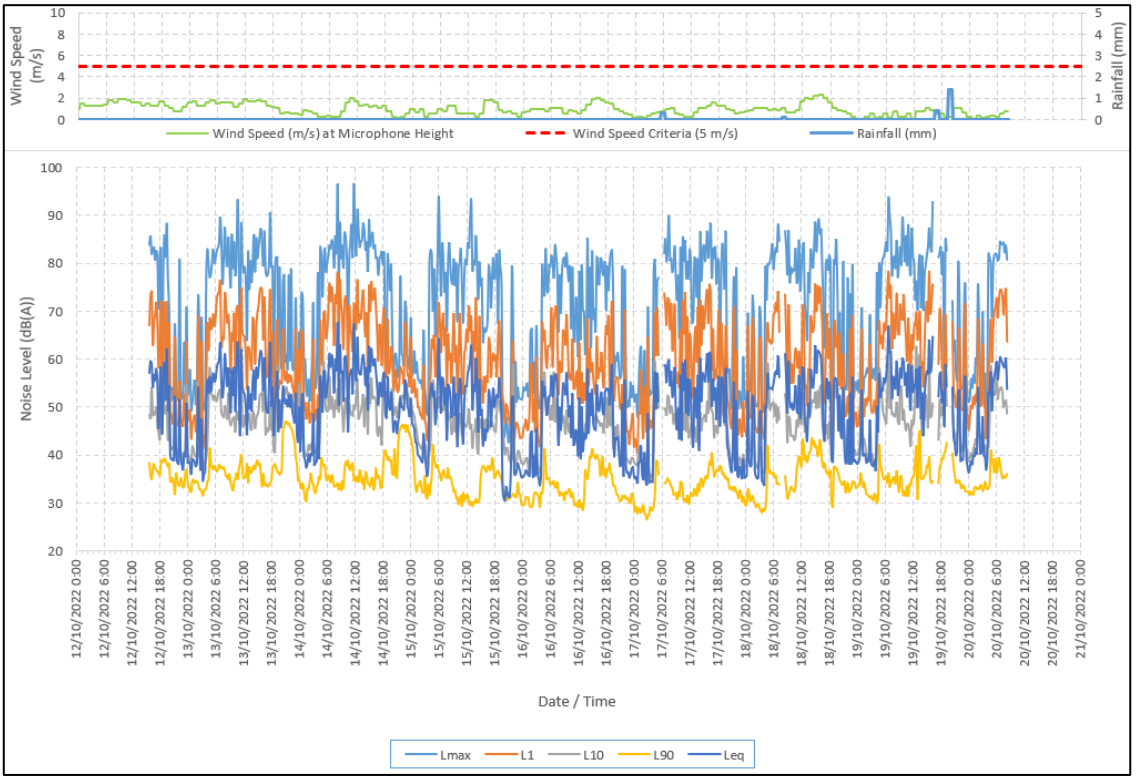


Table 22: ML1 - Noise Monitoring Results

Date	Period	L_{max}	L_1	L_{10}	L_{90}	L_{eq}	minL_{90}, 1-hour	Median L_{eq}, 1-hour
12/10/2022	Day	-	-	-	-	-	-	-
	Evening	88.2	57.9	46.0	36.6	54.4	34.3	51.8
	Night	84.2	55.8	44.2	33.5	52.2	30.3	46.1
13/10/2022	Day	93.2	65.7	48.6	36.0	57.3	33.6	57.7
	Evening	81.3	57.5	50.0	35.1	51.8	33.4	51.2
	Night	83.6	57.1	46.9	33.5	52.3	31.2	50.2
14/10/2022	Day	96.5	68.8	49.8	35.0	59.6	33.0	58.8
	Evening	82.1	59.1	50.9	30.2	51.8	28.6	51.0
	Night	93.9	56.7	47.9	33.3	52.6	31.0	51.5
15/10/2022	Day	92.9	61.0	46.2	33.4	53.9	30.0	52.9
	Evening	82.3	54.7	44.1	32.0	49.5	29.4	49.0
	Night	83.0	52.7	43.1	31.9	48.7	29.1	40.7
16/10/2022	Day	85.1	58.7	46.5	34.1	51.4	29.7	51.3
	Evening	82.6	57.0	44.7	29.2	51.2	26.9	49.1
	Night	85.0	51.9	41.2	29.5	50.2	27.0	43.0
17/10/2022	Day	89.8	64.3	47.6	33.7	55.8	30.9	55.6
	Evening	86.3	56.8	45.3	30.7	52.2	28.2	51.8
	Night	84.0	55.1	42.8	31.1	50.8	28.1	47.5
18/10/2022	Day	89.1	63.3	48.0	37.8	56.4	32.6	55.6
	Evening	84.8	57.0	47.3	32.0	51.6	30.5	49.8
	Night	93.5	56.2	44.5	33.1	54.2	31.1	48.0
19/10/2022	Day	92.8	66.8	49.5	35.4	57.6	32.3	56.4
	Evening	-	-	-	-	-	-	-
	Night	84.4	57.6	45.4	32.5	52.6	29.3	48.9

DAY DESIGN	ACOUSTIC PANEL SOUND TRANSMISSION LOSS TEST CERTIFICATE	4725-12

Client:

Sound Control Pty Ltd

Test Specimen:

Sonata 75 mm Panel

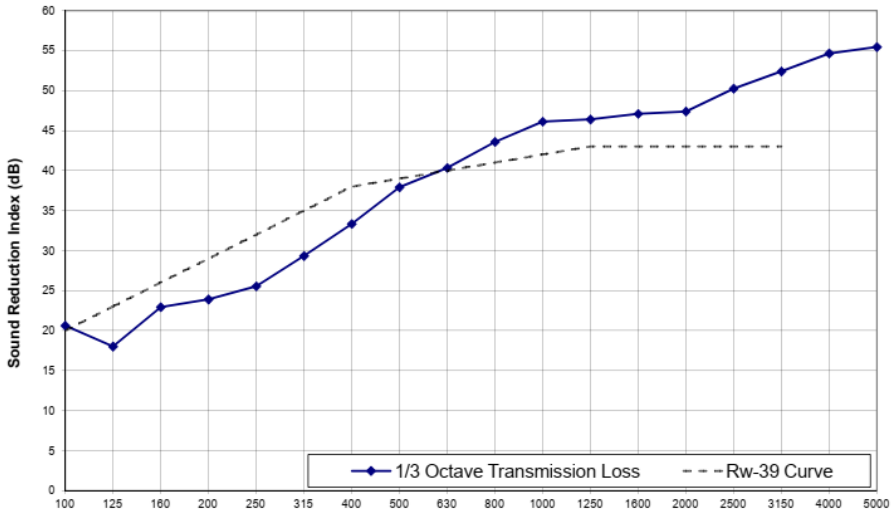
Frequency - Hz	Sound Reduction Index - dB	
	1/3 Octave	1/1 Octave
100	21	
125	18	20
160	23	
200	24	
250	26	26
315	29	
400	33	
500	38	36
630	40	
800	44	
1000	46	45
1250	46	
1600	47	
2000	47	48
2500	50	
3150	52	
4000	55	54
5000	55	
R_w ($C;C_{tr}$)	39 (-2 ; -7)	

Australian Standards:
Measured according to AS 1191-2002
Rated to AS/NZS ISO 717.1:2004

Test Specimen Dimensions:
1.2 m (H) x 1.8 m (W)

Test Location:
Twin Reverberation Rooms
National Acoustic Laboratories
126 Greville Street, Chatswood NSW

Instrumentation:
Brüel and Kjær Pulse Analyser type 3560C
Brüel and Kjær Cathode Follower type 2660
Brüel and Kjær Cathode Follower type 2669
Brüel and Kjær Microphone type 4144 (x2)
Brüel and Kjær Microphone Power Supply type 2804
Brüel and Kjær Sound Level Calibrator type 4231
Yamaha Professional Sound Sources type S500

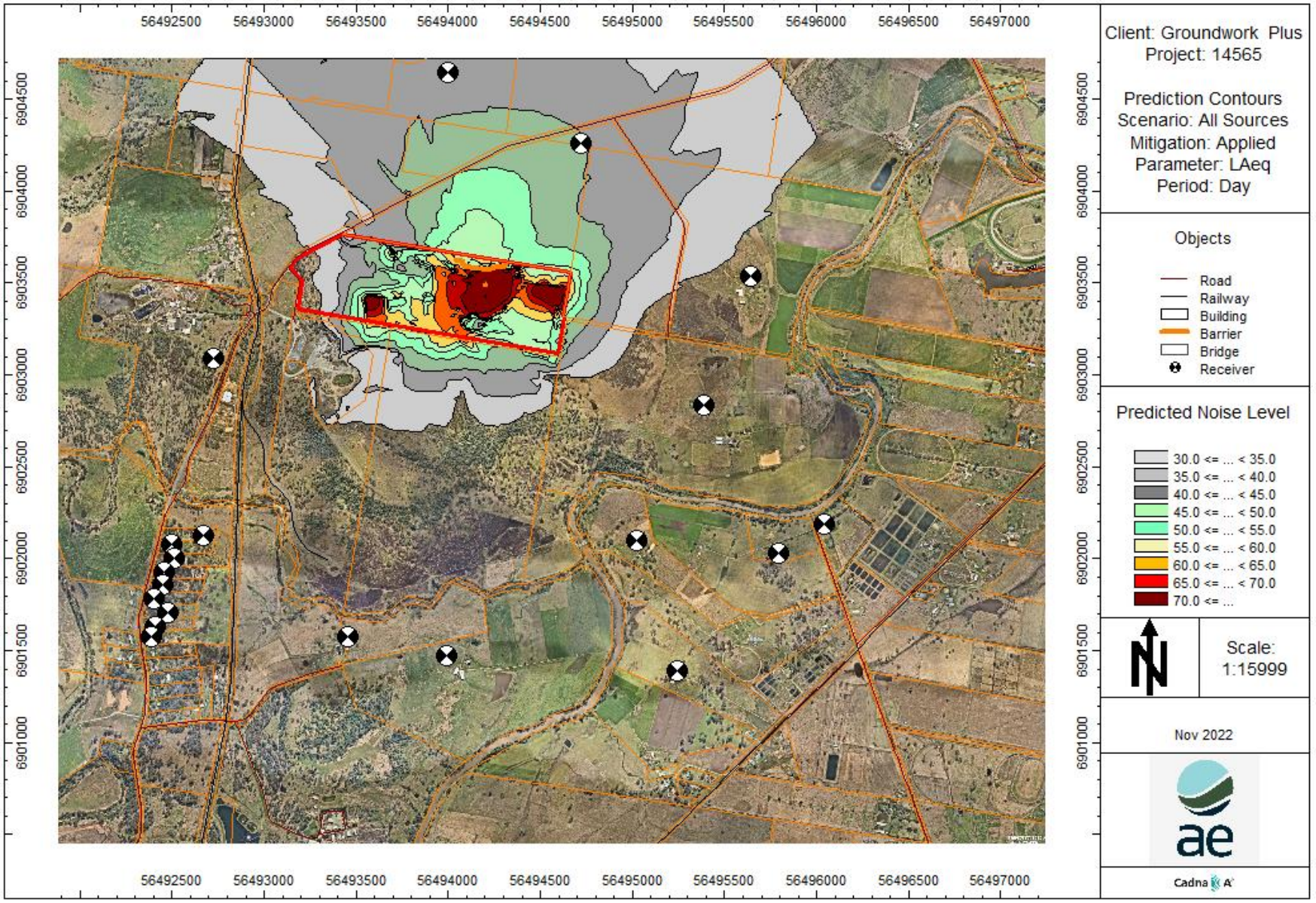


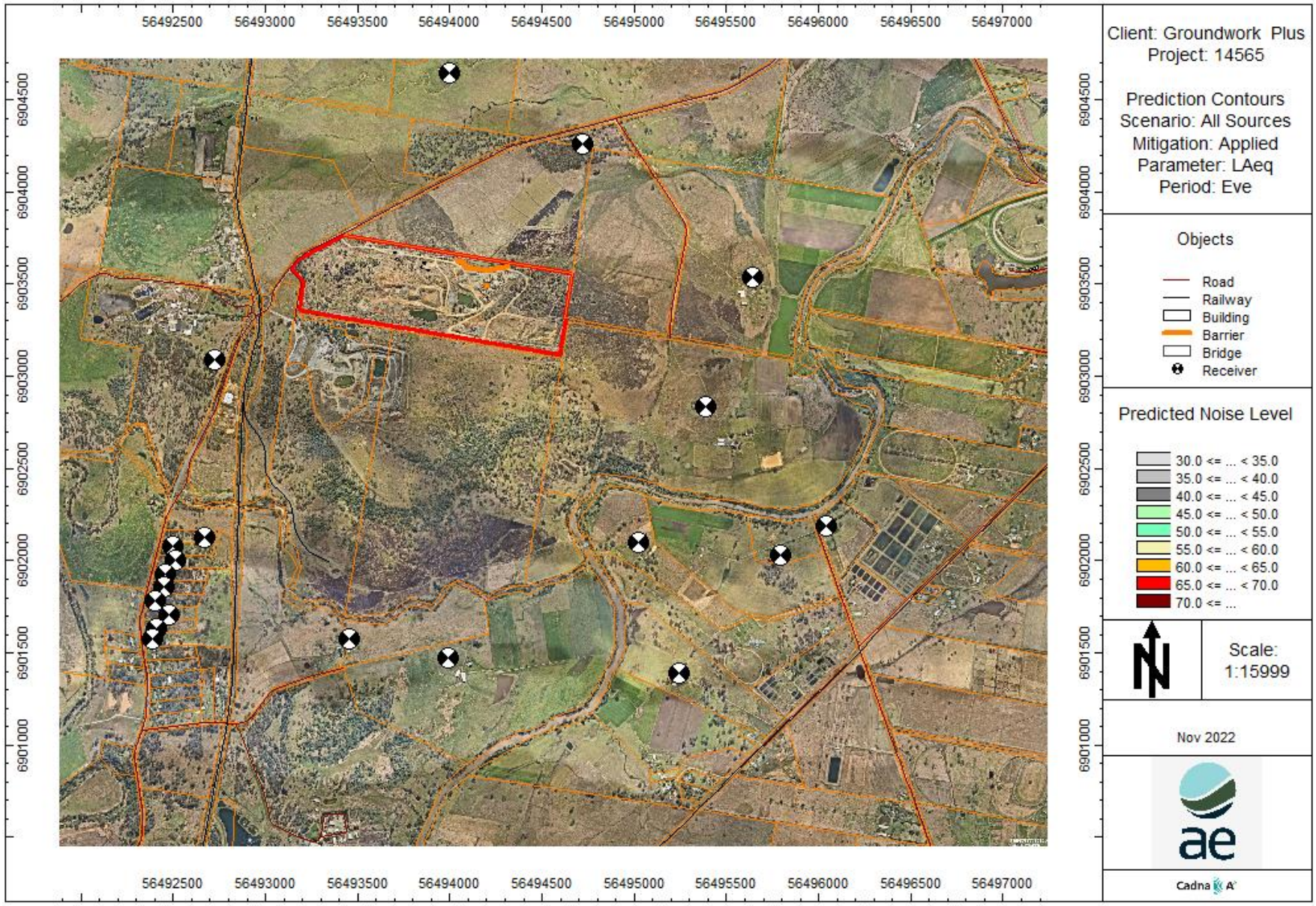
Date of Test: Monday, 31 October 2011
Project Number: 4725-12

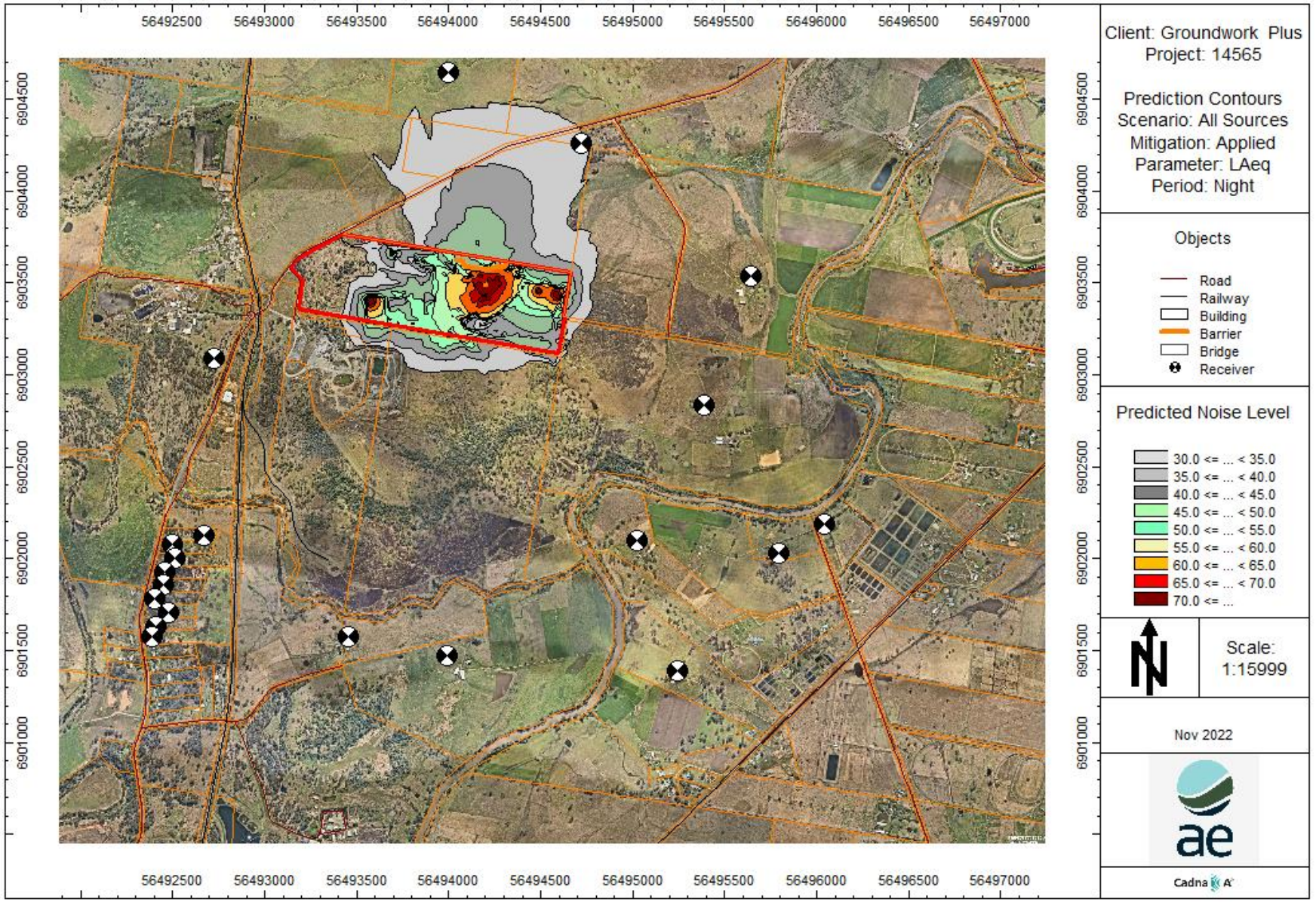
Test Engineer: **Alex Li, BE(Mech) Hons**
For and on behalf of Day Design Pty Ltd

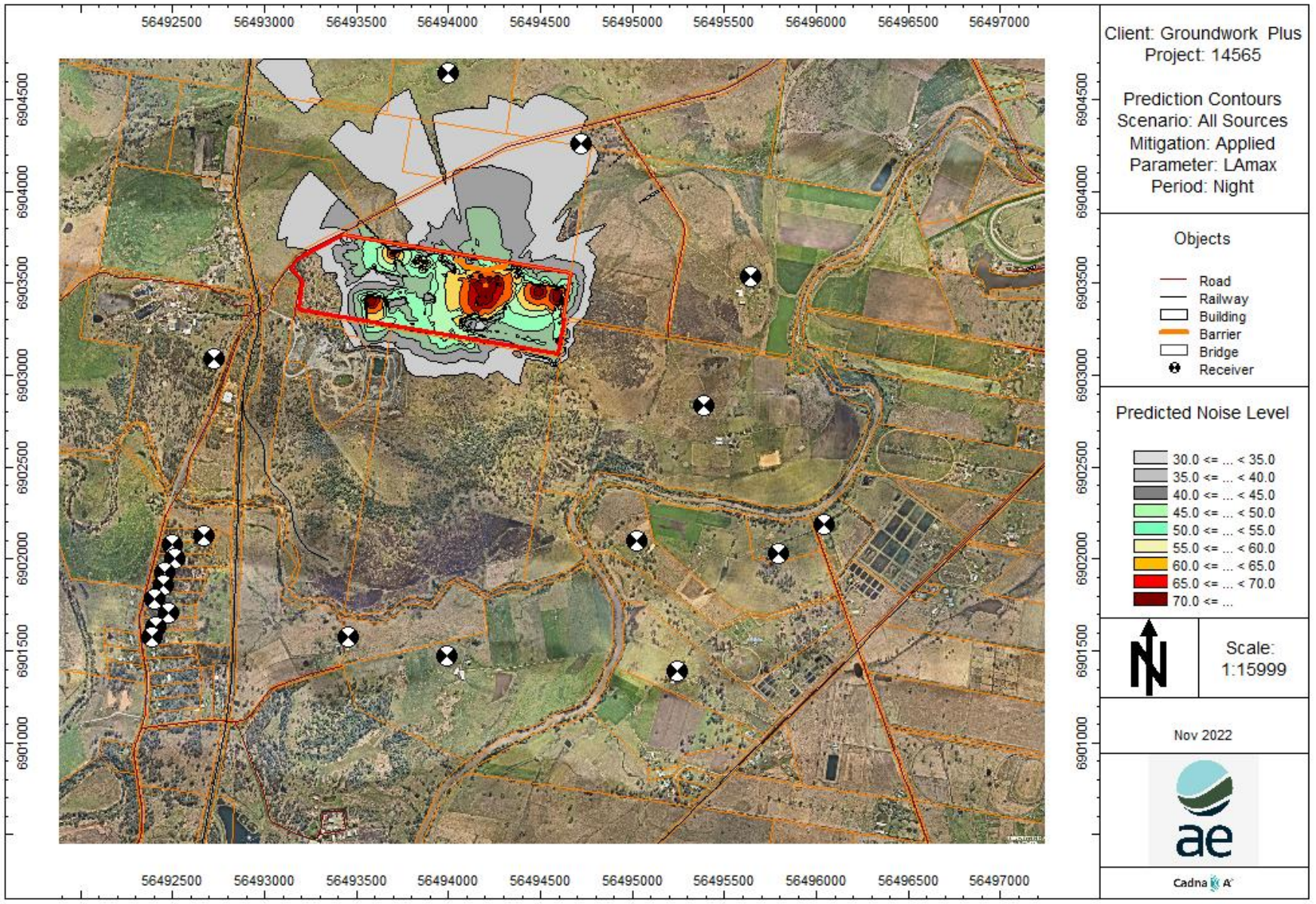
APPENDIX C: NOISE CONTOURS

Contour plots illustrate the spatial distribution of ground-level concentrations across the modelling domain for each time period of interest. However, this process of interpolation causes a smoothing of the base data that can lead to minor differences between the contours and receptor model predictions.


56492500
56493000
56493500
56494000
56494500
56495000
56495500
56496000
56496500
56497000
6904500
6904000
6903500
6903000
6902500
6902000
6901500
6901000
Client: Groundwork Plus
Project: 14565
Prediction Contours
Scenario: All Sources
Mitigation: Applied
Parameter: LAeq
Period: Day
Objects
Road
Railway
Building
Barrier
Bridge
Receiver
Predicted Noise Level
30.0 <= ... < 35.0
35.0 <= ... < 40.0
40.0 <= ... < 45.0
45.0 <= ... < 50.0
50.0 <= ... < 55.0
55.0 <= ... < 60.0
60.0 <= ... < 65.0
65.0 <= ... < 70.0
70.0 <= ...
N
Scale:
1:15999
Nov 2022
Cadna A


56492500
56493000
56493500
56494000
56494500
56495000
56495500
56496000
56496500
56497000
6904500
6904000
6903500
6903000
6902500
6902000
6901500
6901000
Client: Groundwork Plus
Project: 14565
Prediction Contours
Scenario: All Sources
Mitigation: Applied
Parameter: LAeq
Period: Eve
Objects
Road
Railway
Building
Barrier
Bridge
Receiver
Predicted Noise Level
30.0 <= ... < 35.0
35.0 <= ... < 40.0
40.0 <= ... < 45.0
45.0 <= ... < 50.0
50.0 <= ... < 55.0
55.0 <= ... < 60.0
60.0 <= ... < 65.0
65.0 <= ... < 70.0
70.0 <= ...
N
Scale:
1:15999
Nov 2022
Cadna A


56492500
56493000
56493500
56494000
56494500
56495000
56495500
56496000
56496500
56497000
6904500
6904000
6903500
6903000
6902500
6902000
6901500
6901000
Client: Groundwork Plus
Project: 14565
Prediction Contours
Scenario: All Sources
Mitigation: Applied
Parameter: LAeq
Period: Night
Objects
Road
Railway
Building
Barrier
Bridge
Receiver
Predicted Noise Level
30.0 <= ... < 35.0
35.0 <= ... < 40.0
40.0 <= ... < 45.0
45.0 <= ... < 50.0
50.0 <= ... < 55.0
55.0 <= ... < 60.0
60.0 <= ... < 65.0
65.0 <= ... < 70.0
70.0 <= ...
N
Scale:
1:15999
Nov 2022
Cadna A


56492500
56493000
56493500
56494000
56494500
56495000
56495500
56496000
56496500
56497000
6904500
6904000
6903500
6903000
6902500
6902000
6901500
6901000
Client: Groundwork Plus
Project: 14565
Prediction Contours
Scenario: All Sources
Mitigation: Applied
Parameter: LAmax
Period: Night
Objects
Road
Railway
Building
Barrier
Bridge
Receiver
Predicted Noise Level
30.0 <= ... < 35.0
35.0 <= ... < 40.0
40.0 <= ... < 45.0
45.0 <= ... < 50.0
50.0 <= ... < 55.0
55.0 <= ... < 60.0
60.0 <= ... < 65.0
65.0 <= ... < 70.0
70.0 <= ...
N
Scale:
1:15999
Nov 2022
ae
Cadna A

Attachment 2

Air Quality Assessment

BROMELTON NORTH QUARRY - AIR QUALITY ASSESSMENT

Project ID: 14565

9/12/2022

Release: R2

Prepared For:

Groundwork Plus

Assured Environmental

DOCUMENT CONTROL PAGE

Project Title: BROMELTON NORTH QUARRY - AIR QUALITY ASSESSMENT

Project Reference ID: 14565

Report Prepared by:

Assured Environmental
Unit 7, 142 Tennyson Memorial Avenue
Tennyson, QLD, 4105

Report Prepared for:

Groundwork Plus
6 Mayneview Street
Milton, QLD, 4066

M. Clifton

Author: Michelle Clifton

Reviewer: Craig Beyers

Table 1: History of Revisions

Revision	Date	Issued to	Changes
R0	8/11/2022	M. Benham	Initial Release
R1	24/11/2022	M. Benham	Comments
R2	9/12/2022	M. Benham	Comments

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

GLOSSARY

°C	Degrees centigrade
Conversion of ppm to mg/m^3	Where R is the ideal gas constant; T, the temperature in kelvin (273.16 + T°C); and P, the pressure in mm Hg, the conversion is as follows: $mg\ m^3 = (P/RT) \times Molecular\ weight \times (concentration\ in\ ppm)$ $= \frac{P \times Molecular\ weight \times (concentration\ in\ ppm)}{62.4 \times (273.2 + T°C)}$ For the purposes of the air quality assessment all conversions were made at 0°C unless stated otherwise.
g/s	Grams per second.
g/m^2	Gram per metre square.
g/m^2/month	Gram per metre square per month.
ha	Hectares.
m	Metre.
m/s	Metres per second
mg/m^3	Milligrams (10-3) per cubic metre. Conversions from mg/m^3 to parts per volume concentrations (i.e., ppm) are calculated at 0 °C.
kg	Kilograms.
kg/annum	Kilograms per annum.
km	Kilometre
$\mu g/m^3$	Micrograms (10-6) per cubic metre. Conversions from $\mu g/m^3$ to parts per volume concentrations (i.e., ppb) are calculated at 0 °C.
ppb	Parts per billion.
ppm	Parts per million.
PM_{10}, $PM_{2.5}$, PM_1	Fine particulate matter with an equivalent aerodynamic diameter of less than 10, 2.5 or 1 micrometres, respectively. Fine particulates are predominantly sourced from combustion processes. Vehicle emissions are a key source in urban environments.
TSP	Total suspended particulate.
70^{th} percentile	The value exceeded for 70 % of the time.

ABBREVIATIONS

AHD	Australian Height Datum
DES	Department of Environment and Science
EA	Environmental Authority
EPP(Air)	Environmental Protection (Air) Policy 2019
ERA	Environmentally Relevant Activities
KRA	Key Resource Area
GLC	Ground Level Concentration
NPI	National Pollutant Inventory
SDAP	State Development Assessment Provisions
tpa	Tonnes per annum

1 INTRODUCTION

1.1 Background

The Neilsens Group (Neilsens) operate the hard rock quarry known as Bromelton North Quarry, (Subject Site). Bromelton North Quarry is operated pursuant to Consent Order for Material Change of Use – Development Permit for Extractive Industry (ref: 3448 of 2003) granted on 23 June 2004. The Consent Order allows for extraction of 400,000 tonnes per annum of material from the site.

The operation holds an Environmental Authority (EA) EPPR0054113 for the extraction and screening of between 100,000 to 1,000,000 tonnes of material per annum.

Neilsens propose to increase the extraction rate to 800,000 tonnes per annum and extend the east pit footprint. It is not proposed to change the approved hours of operation or location of fixed plant, and equipment.

1.2 Scope of Assessment

Assured Environmental (AE) was appointed by Groundwork Plus to undertake an air quality assessment for the increase in extraction and screening from 400,000 tpa to 800,000 tpa.

In undertaking the assessment, reference has also been made to the following regulations and guidelines:

- Environmental Protection Act 1994;
- Environmental Protection Regulation 2019;
- Environmental Protection (Air) Policy 2019;
- Application requirements for activities with impacts to air (DES, 2021); and
- The Bromelton State Development Area (SDA) Development Scheme.

In accordance with the requirements of the above guidelines, computational modelling and first principle calculations have been undertaken to assess the potential for adverse amenity and health impacts as a result of the proposed development.

1.3 This Report

This report summarises the methodology, results, and conclusions of the air quality assessment.

2 DESCRIPTION OF ENVIRONMENTAL VALUES

2.1 Location

The Subject Site is located at Sandy Creek Road, Bromelton, on Lot 1 on RP98576. The Site is approximately 5 km south west of Beaudesert and has a total site area of approximately 62.792 hectares. The site is located in the Transition Precinct of the Bromelton State Development Area, in which extractive industry is an expected land use. The Subject Site and the adjacent quarry are classified as a Key Resource Area (KRA 61), which is a planning tool designed to protect resources from being rendered inaccessible by urban expansion.

The existing setting dominated by agricultural land used for cropping and grazing purposes interspersed with clusters of rural residential land. Other non-rural activities occur within proximity of the site, including an adjacent extractive industry use to the south and energy facility to the west.

2.2 Receptors

There are 5 sensitive receptors within 1 km of the Subject Site and 20 sensitive receptors within 2 km. All receptors within 2 km of the Subject Site are listed in Table 2 and have been identified as shown in Figure 2.

The nearest sensitive receptor, R1 is a single dwelling located approximately 558 metres south west of the Subject Site boundary. The quarry workings will retain a ridgeline to the south, which will topographically screen the operations from receptors to the south-east and south-west.

Table 2: Modelled Sensitive Receptors

ID	Location (UTM Zone 56)		Elevation (m)	Land use
	Easting	Northing		
R1	492722	6903088	89	Residential
R2	492669	6902126	61	Residential
R3	492499	6902079	66	Residential
R4	492511	6902002	68	Residential
R5	492453	6901925	73	Residential
R6	492452	6901859	73	Residential
R7	492404	6901783	75	Residential
R8	492477	6901708	73	Residential
R9	492405	6901635	81	Residential
R10	492389	6901573	85	Residential
R11	493456	6901579	64	Residential
R12	493992	6901471	68	Residential
R13	495239	6901390	57	Residential
R14	495024	6902098	55	Residential
R15	495795	6902032	57	Residential
R16	496042	6902189	49	Residential
R17	495388	6902837	61	Residential
R18	495644	6903536	54	Residential
R19	494717	6904259	60	Residential
R20	493997	6904642	60	Residential

2.3 Terrain

Figure 3 illustrates the local topography, as obtained from a combination of Lidar data at 10 m resolution. The terrain of the local area is undulating to hilly varying from approximately 30 m to 170 m AHD within 1 km radius of the Subject Site.

2.4 Climatic Conditions

The climate of the Scenic Rim region of Queensland is temperate with hot summers and cool winters (due to elevation) and is cooler than the rest of the state. The average annual temperature for the region is 22°C. The summer average temperature is 25°C, in autumn and spring it is 22°C, and in winter 16°C.

Annual and seasonal average rainfall is variable, affected by local factors such as topography and vegetation, and broader scale weather patterns, such as the El Niño - Southern Oscillation. Annual average rainfall is 1,565 mm, with much occurring during summer either as heavy thunderstorms or from tropical rain depressions.

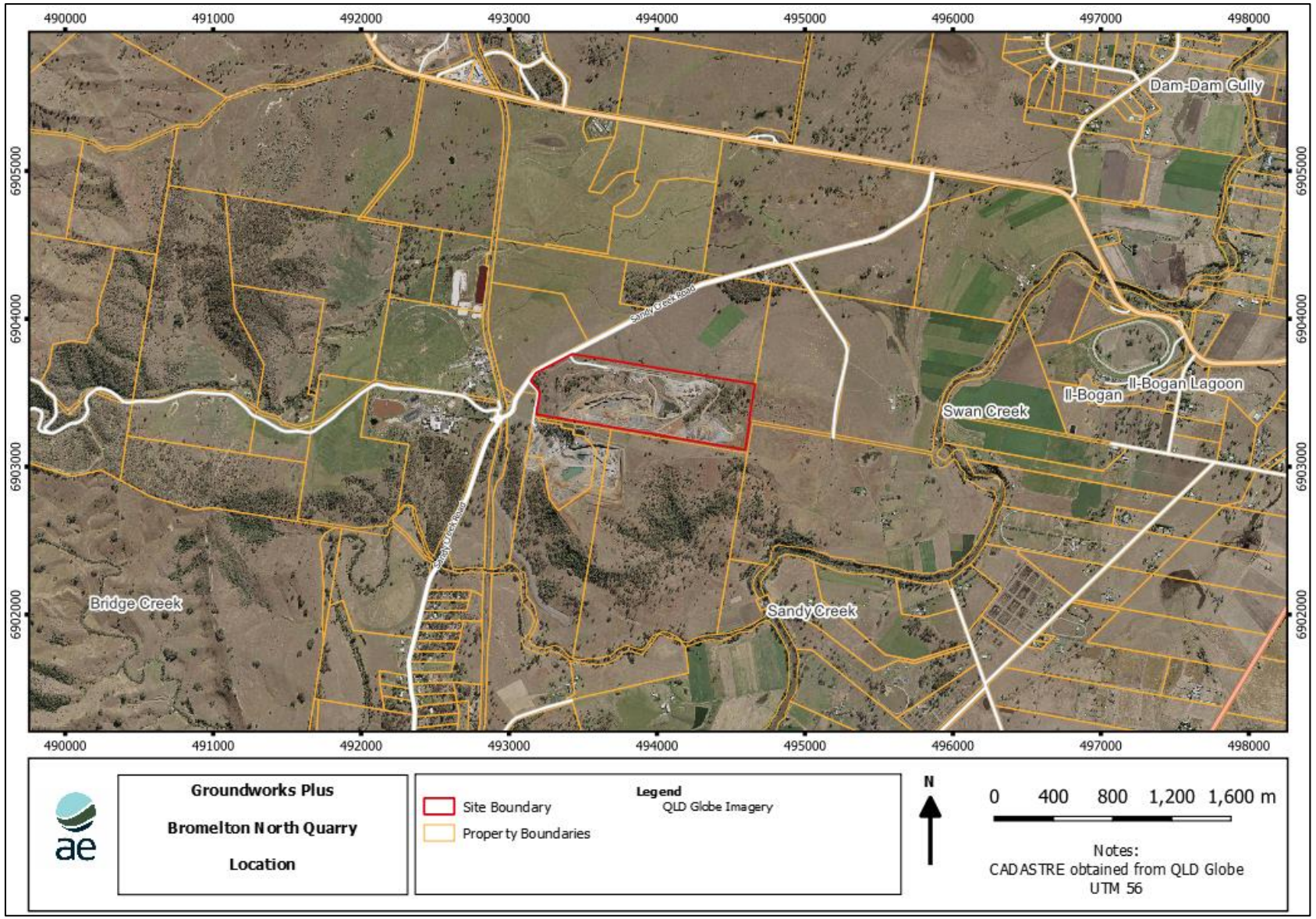


Figure 1: Site Location

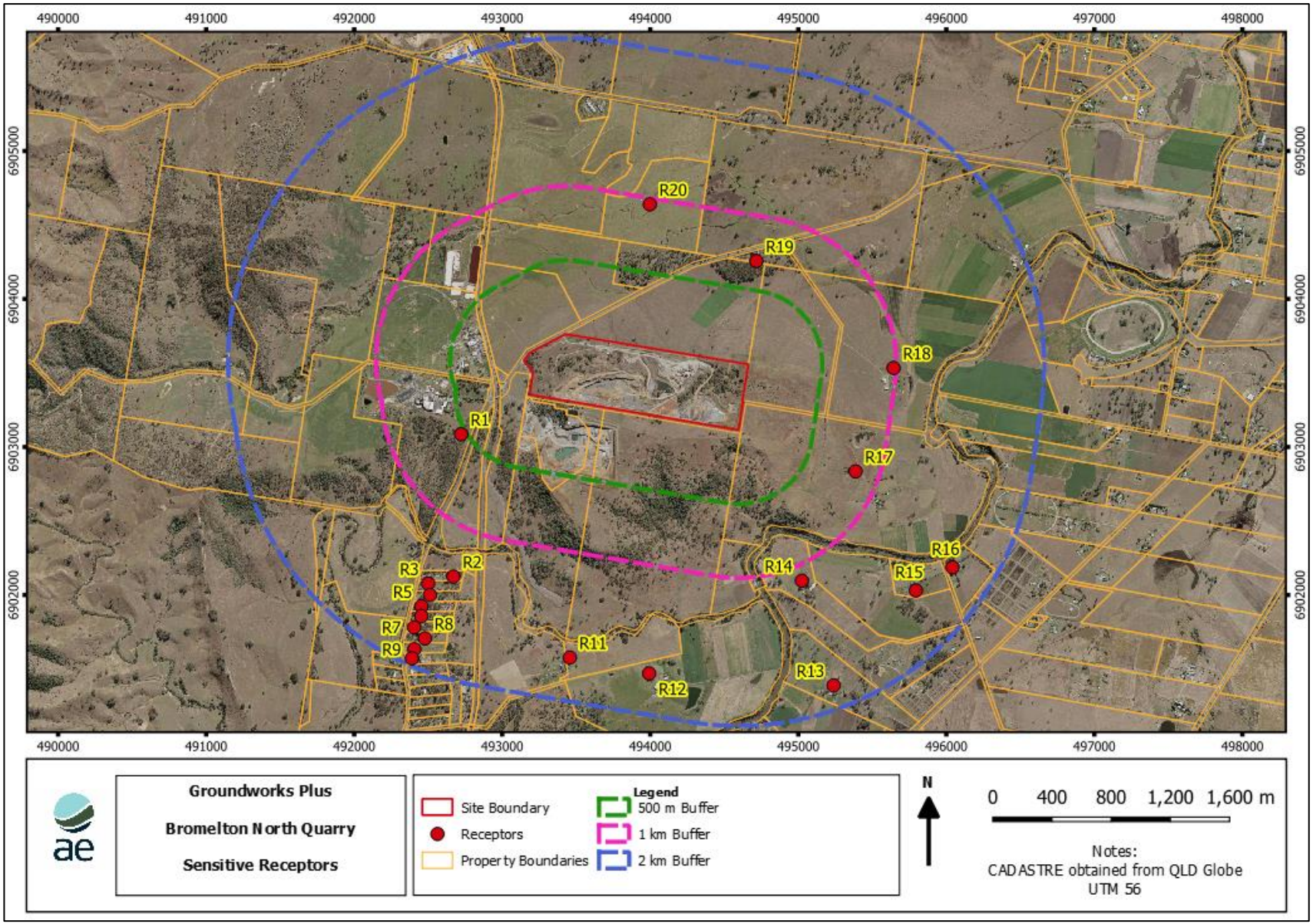


Figure 2: Sensitive Receptors

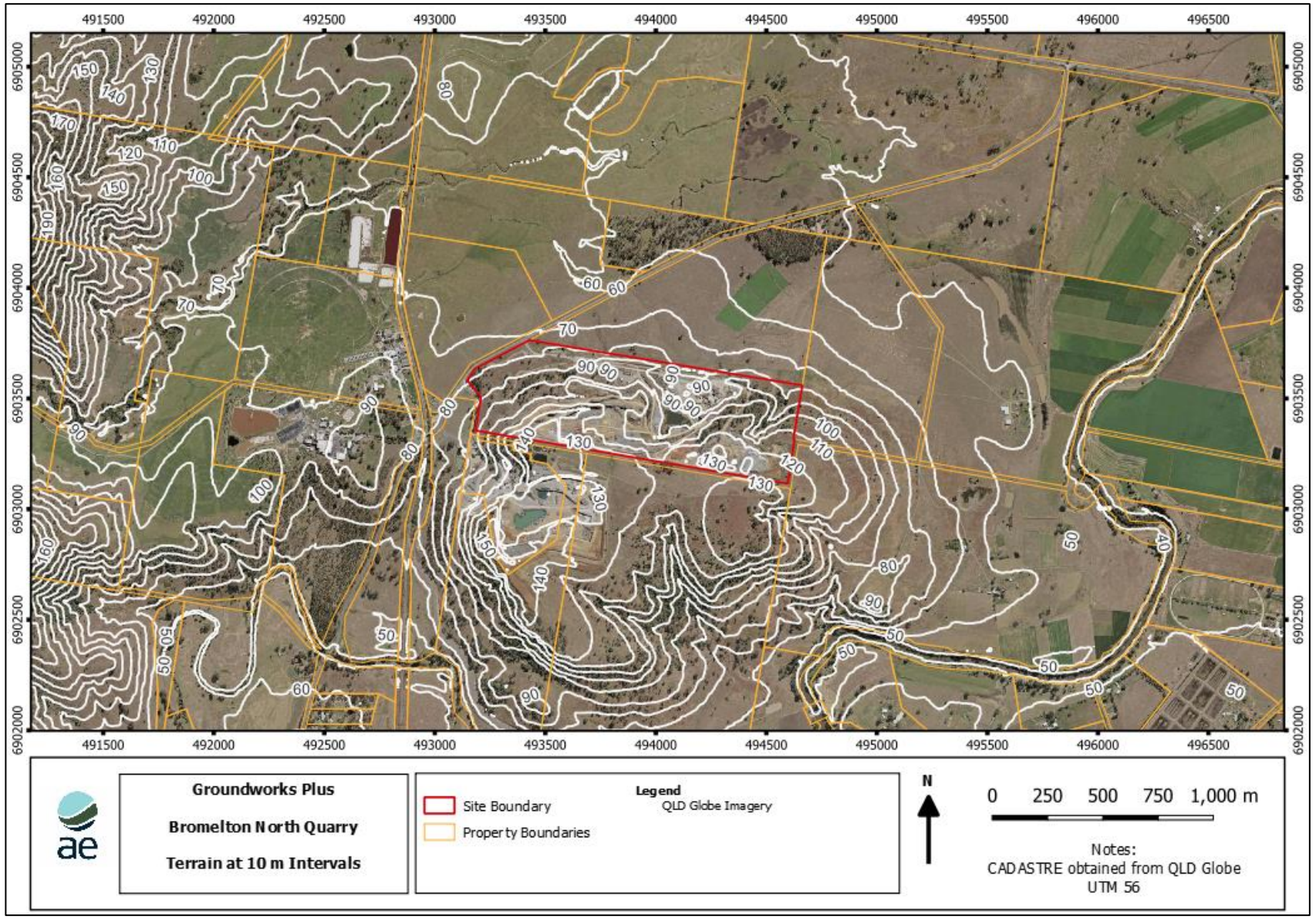


Figure 3: Surrounding Topography at 10 m Intervals (Extracted from LiDAR Data)

3 QUARRY OPERATIONS

3.1 Overview

Neilsens operate the hard rock quarry known as Bromelton North Quarry (Subject Site). The quarry operates under:

- Consent Order for Material Change of Use – Development Permit for Extractive Industry (ref: 3448 of 2003) granted on 23 June 2004;
- Environmental Authority EPPR00540113 (EA), issued by the Department of Environment and Science (DES), authorising the following Environmentally Relevant Activities (ERAs):
    - ERA Threshold 16 (2)(b) - Extractive and screening activities - extracting, other than by dredging more than 100,000 but not more than 1,000,000 tonnes of material in a year.
    - ERA Threshold (3)(b) - Extractive and screening activities - screening more than 100,000 but not more than 1,000,000 tonnes of material in a year.

3.2 Current Consent Conditions

Conditions of Environmental Authority EPPR00540113 (effective 12 August 2020) issued by the Department of Environment and Science provides specific requirements relating to emissions of air from the activity as summarised in Table 3.

Table 3: Conditions Relevant to Air

Condition number	Condition
Air	
A1	Dust or particulate matter that will have or is likely to have an adverse effect on people living in or using the surrounding area shall not be permitted to emanate beyond the boundaries of the premises to which this environmental authority relates.
A2	There must be no release of dust and/or particulate matter: (i) that causes dust deposition, monitored in accordance with Australian Standard AS 3580.10.1 of 1991, to exceed one hundred and twenty (120) milligrams per square meter per day beyond the boundary of the premises to which this environmental authority relates; nor (ii) that causes the concentration of particulate matter with an aerodynamic diameter less than ten (10) micrometre (µm) (PM10) suspended in the atmosphere downwind and beyond the boundary of the premises to which this environmental authority relates to exceed one hundred and fifty (150) micrograms per cubic metre over a twenty four (24) hour averaging time, when monitored in accordance with Australian Standard AS 3580.9.6 `Ambient air - Particulate matter - Determination of suspended particulate PM10 high - volume sampler with size-selective inlet - Gravimetric method" or an alternate method for PM10 permitted in the "Air Quality Sampling Manual" published by the Department of Environment first edition, November 1997, or more recent editions or supplements to that document as such become available.
A3	The holder of this environmental authority must take all reasonable and practicable measures necessary to prevent and/or minimise the release of particulate matter and dust

Condition number	Condition
	to the atmosphere from extractive operations. Reasonable and practicable measures may include but are not limited to: (i) limiting topsoil/overburden removals at any one time to that necessary while providing for effective production of quarry rock; and (ii) limiting removal of topsoil/overburden to periods of favourable weather conditions or maintaining materials in a damp state to avoid dust generation and propagation; and (iii) progressive rehabilitation during the life of the operation; and (iv) designing blast to prevent venting; and (v) installing effective dust collectors at blast hole drilling rigs; and (vi) dampening down of quarry working areas.
A4	The holder of this environmental authority must take all reasonable and practicable measures necessary to prevent and/or minimise the release of particulate matter and dust to the atmosphere from crushing, screening, and conveying equipment. Reasonable and practicable measures may include but are not limited to: (i) enclosure or shielding of conveyors; and (ii) the installation of windshields or barriers to suppress dust emissions; and (iii) keeping the material in a moist state; and (iv) use of water sprays at transfer points
A5	Stockpiles must be maintained using all reasonable and practicable measures necessary to minimise the release of windblown dust or particulate matter to the atmosphere. Reasonable and practicable measures may include but are not limited to: (i) use of water spray as required during winds likely to generate such releases; (ii) use of dust-suppressant shielding; (iii) storage in bunkers; and (iv) covering with tarpaulins.
A6	Trafficable areas must be maintained using all reasonable and practicable measures necessary to minimise the release of windblown dust or traffic generated dust to the atmosphere. Reasonable and practicable measures may include but are not limited to: (i) keeping surfaces clean; (ii) sealing with bitumen or other suitable material; (iii) using water sprays; (iv) adopting and adhering to speed limits; and (v) using dust suppressants and wind breaks.
A7	Any spillages of material onto sealed areas, as a result of delivery or handling, must be cleaned up without delay into storage bins or other suitable receptacles.
A8	The tailgates of all trucks leaving the premises to which this environmental authority relates must be securely fixed prior to loading to prevent loss of material.
A9	The holder of this environmental authority must take all reasonable and practicable measures necessary to prevent spillage and/or loss of particulate matter or windblown dust from trucks used for transporting extracted material from the premises to which this environmental authority relates. The reasonable and practicable measures may include but are not limited to: (i) wetting down the load prior to transport; and (ii) having the entire load covered with a tarpaulin or similar material for the duration of

Condition number	Condition
	transport; and (iii) clearing of spillage from side rails, tail gates and draw bars of trucks prior to departure from the premises to which this environmental authority relates and prior to departure from the premises to which this environmental authority relates to which the load has been delivered.
A10	Vehicle tyres and under bodies must be sufficiently free of dust and mud, including by being washed and/or cleaned prior to leaving the premises to which this environmental authority relates if necessary, so as to ensure that dust and/or mud is not deposited on any public road by vehicles leaving the premises to which this environmental authority relates.
A11	Notwithstanding development conditions A8, A9 or A10 if material is deposited on any public road by vehicles leaving the premises to which this environmental authority relates, clean-up of such material should occur immediately.
A12	All disturbed areas must be revegetated as soon as practicable on the completion of extraction operations.

3.3 Current Operations

The existing quarry operation provides for extraction, processing, stockpiling, ancillary operations area, and stormwater controls over 5 stages. The current operation generally aligns with the approved Stage 4 layout, avoiding mapped remnant vegetation between the east and west pits.

Material is processed using a crushing and screening plant located in the central sector of the quarry. The primary bin tipping platform is approximately 15 metres above the plant and stockpile pad whilst the remainder of the plant (screens and secondary and tertiary crushers) are located on a pad north of the primary bin tipping platform. This processing plant produces a wide range of quality quarried products.

The quarry component of the operation comprises two pits. The quarrying process begins with removal of overburden material and excavation at the quarry face and/or floor using various heavy machinery (excavators, bulldozers, and wheeled loaders).

Fragmented material is transported from the pit floor to the onsite processing area (referred to as the crushing floor) using dump trucks traversing a haul road up and out of the pit to the feeder dump point above the crushing floor.

The crushing floor comprises of an array (or train) of equipment including a feeder, crushers, and impactors as well as numerous conveyors and screens. This crushing floor is a permanent fixture and the range, and the type of material being processed, and its required sizing dictate the number of crushers, conveyors and screens used at any point in time.

It is important to note that not all crushing plant is operated simultaneously; the number of crushers and screens operating is dependent on client contracts. Once crushed and screened, the final product is then loaded again into dump trucks and transported along haul roads to stockpiles awaiting sale or further processing (i.e. aggregate coating). Upon sale, the final product is loaded at its stockpile into trucks of multiple sizes for transportation offsite.

3.4 Proposed Operations

The proposed development is for an increase to the scale and intensity of the existing hard rock extraction operation by:

- extending the eastern quarry footprint north; and
- increasing the extraction rate to 800,000 tpa.

The east pit has been designed to avoid clearing of remnant vegetation. It is not proposed to alter other aspects of the existing operation such as hours of operation or location of fixed plant and equipment. This development application is intended to replace the conditions of the Consent Order.

The fixed processing plant and associated stockpiling area will be retained in the centre of the site. No additional buildings or structures are proposed, including the site office, amenities block, parking areas, weighbridge, workshop, and truck wash down facilities.

3.5 Comparison of Operations

Table 4 provides a comparison of the current approved existing activities and future proposed modification activities as part of the increase in production.

Table 4: Comparison of Activities

Aspect	Current Activities	Proposed Activities
Land Use	Approval granted for an extractive industry and associated processing and crushing and grinding.	Continued use of existing west pit and extension to east pit.
Quarry footprint	As per Figure 5 (Stage 4 of approved plans)	Primarily focused on the East Pit (80%) with some minor extraction in the West Pit (20%)
Approved Hours of operation	06:00 to 18:00 Monday to Friday. 07:00 – 17:00 Saturday No operation on Sundays or Public Holidays	N/A – no change proposed.
Production and Transportation limits	Up to 400,000 tpa from the site. Daily maximum generally 4,000 tpd	Up to 800,000 tpa from the site. No change to daily maximum
Extraction method	Extraction by blast and drill.	N/A – no change proposed.
Site infrastructure and plant	Drilling, blasting, and extraction in quarry pit	No change to the operations in the quarry pit.
	Primary, secondary, and tertiary crushing and screening facilities on crushing floor	No change to the crushing/ screening facilities on crushing floor
Product transport method and access	Via truck to Sandy Creek Road	N/A – no change proposed.
Truck Movements	Average daily truck dispatches based on current payloads (9% trucks/ 86% truck and dog and 5% B-double): • 43 truckloads per day	Average daily truck dispatches based on current payloads (9% trucks/ 86% truck and dog and 5% B-double): • 78 truckloads per day

Aspect	Current Activities	Proposed Activities
	• 85 movements per day Staff vehicles: • 10 movements per peak hour (start and end of shift)	• 156 movements per day Staff vehicles: • 10 movements per peak hour (start and end of shift)
Blasting	Typically 12 blasts per year	Expected 24 blasts per year
Blasting hours	09:00 to 17:00 Monday to Friday	N/A – no change proposed.
Equipment	Refer to Section 3.3.	N/A – no change proposed. Increased extraction and processing based on increasing efficiency

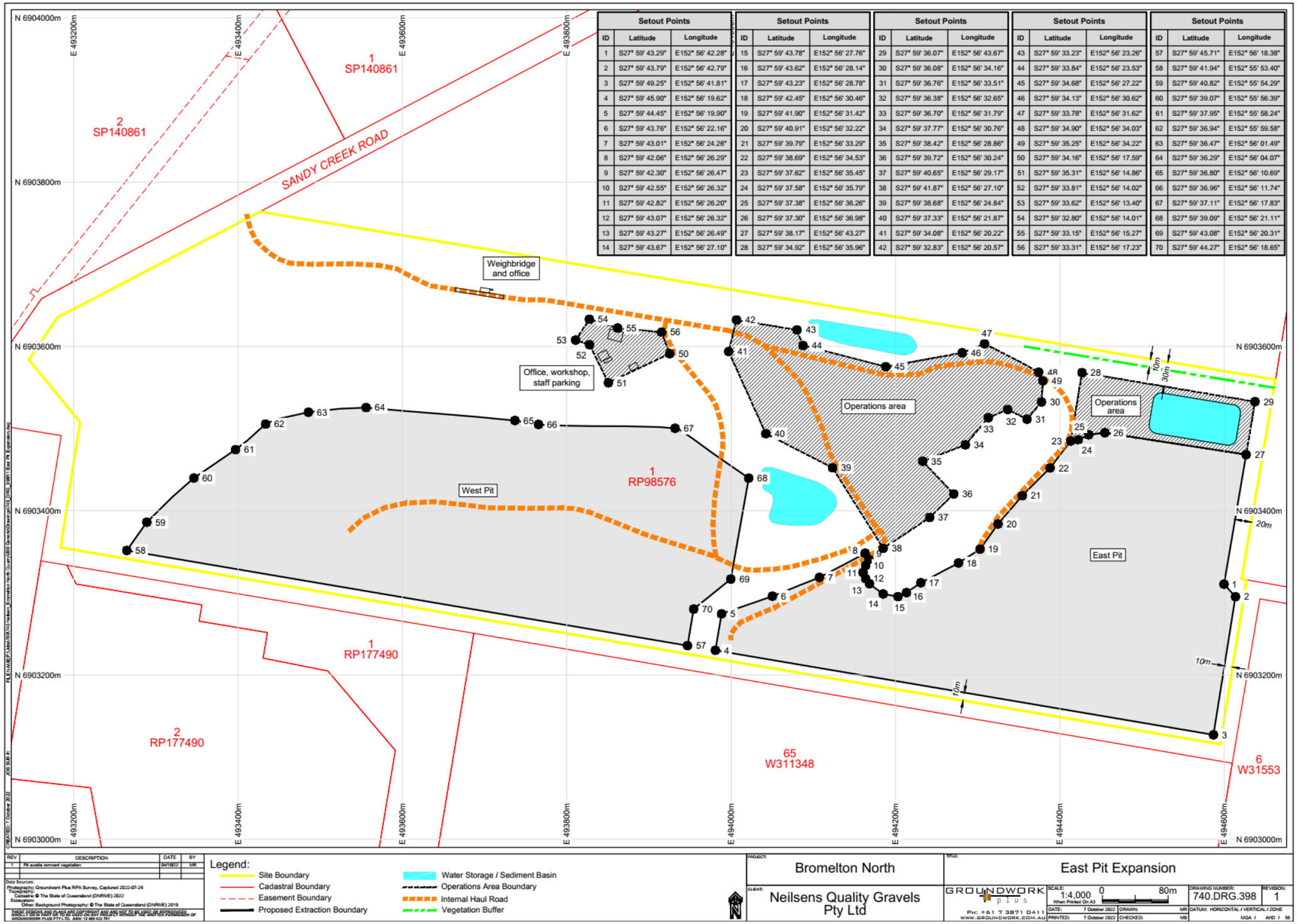


Figure 4: Proposed East Pit Extension

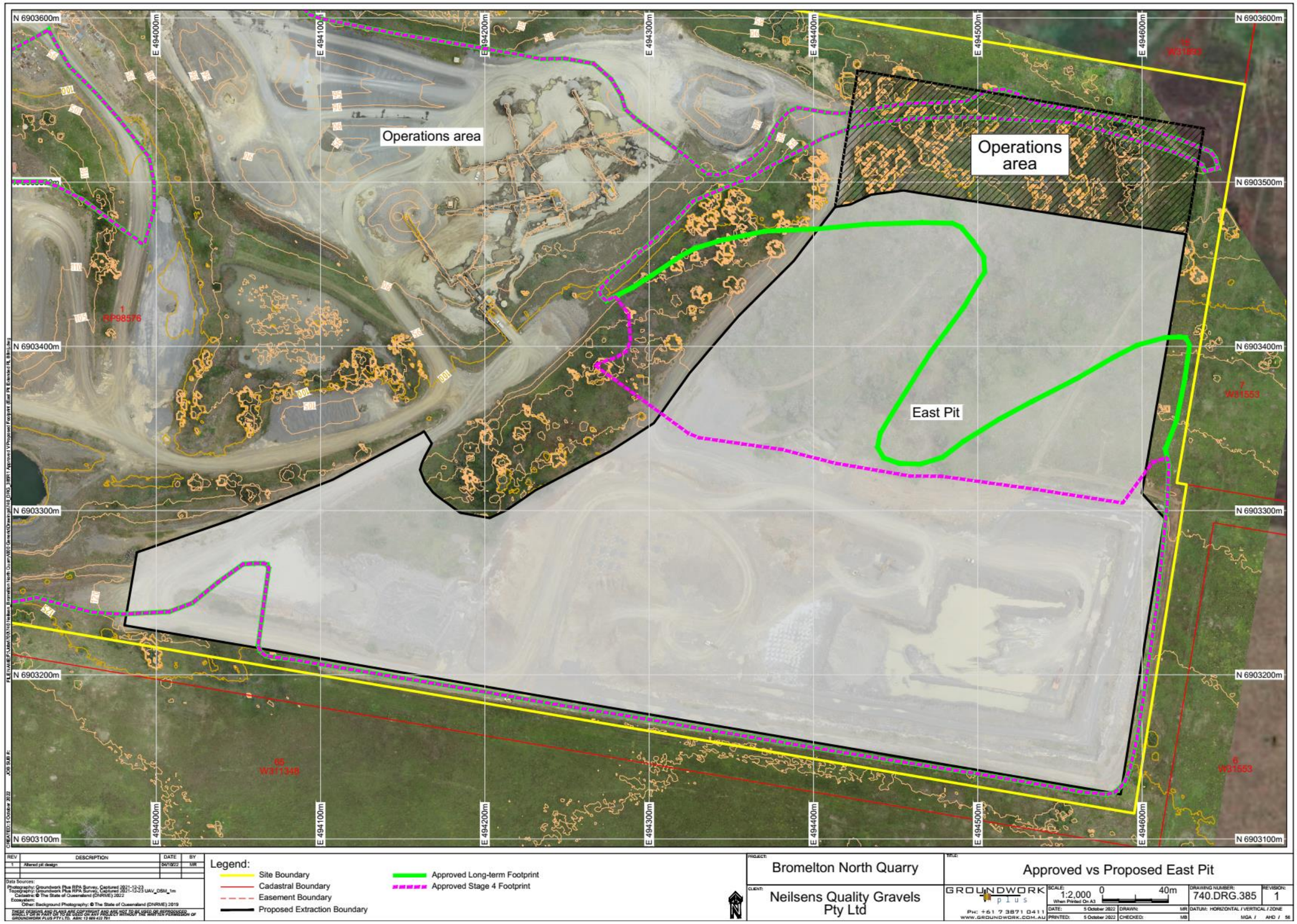


Figure 5: Approved and Proposed Footprint of East Pit

4 REGULATORY REQUIREMENTS

4.1 Overview

This Section reviews the applicable criteria taking into consideration the following:

- Scenic Rim Regional Council Planning Scheme;
- State Development Code 22;
- Bromelton State Development Area Development Scheme; and
- Environmental Protection (Air Quality) Policy 2019.

4.2 Scenic Rim Regional Council

The site is located within the Scenic Rim Regional Council Area. The Scenic Rim Planning Scheme includes assessment benchmarks relating to air quality within the Extractive Industry Code (PO13) as provided in Table 5.

Table 5: Scenic Rim Regional Council Extractive Industry Code Acceptable Outcomes

Performance Outcomes	Acceptance Outcomes
Environmental management requirements for the Extractive industry are properly identified in an Environmental Management Plan prepared by a suitably qualified person and submitted to Council that demonstrates appropriate management practices to protect environmental standards, by addressing the following: (1) Air quality; (2) Stormwater; (3) Noise; (4) Waste; (5) Water quality including, erosion and sedimentation control; (6) Stream bed and bank stability; (7) Landscape and rehabilitation; (8) Workplace procedures; (9) Emergency and hazard procedures; (10) Flora and fauna protection; and (11) Auditing and review.	AO13 No acceptable outcome is prescribed.

4.3 State Development Assessment Provisions (SDAP) Code 22

The purpose of State Code 22 is to ensure that Environmentally Relevant Activities (ERAs):

- are located and designed to avoid or mitigate environmental harm on environmental values of the natural environment, adjacent sensitive land uses and sensitive receptors;
- are designed and located to avoid impacts or, where the matters of state environmental significance cannot be reasonably avoided, impacts are reasonably minimised and mitigated;

- do not result in a significant residual impact on a matter of state environmental significance unless the significant residual impact is acceptable, and an offset is provided.

Table 6 provides the Acceptable Outcomes for air as detailed in State Code 22.

Table 6: SDAP Code 22 Acceptable Outcomes

Performance Outcomes	Acceptance Outcomes
PO2 Development is suitably located and designed to avoid or mitigate environmental harm to the air environment.	AO2.1 Development meets the air quality objectives of the Environmental Protection (Air) Policy 2019

4.4 Bromelton SDA Development Scheme

The Subject Site is located within the Transition Precinct of the Bromelton State Development Area. Section 2.5.4 Emissions details the requirements a development within the SDA area must achieve:

> (1) Development is designed to avoid or minimise:
>
> > (a) adverse impacts from air, noise and other emissions that will affect the health and safety, wellbeing and amenity of communities and individuals and
> >
> > (b) conflicts arising from (but not limited to), spray drift, odour, noise, dust, light spill, smoke, or ash emissions with sensitive and/or incompatible land uses
>
> (2) Development supports the achievement of the relevant acoustic and air quality objectives of the Environmental Protection (Noise) Policy 2008 and the Environmental Protection (Air) Policy 2008.
>
> (3) Development with high levels of emissions is to, in accordance with current best practice, avoid adverse impacts on the cumulative air quality1 of the Bromelton air shed.

The Environmental Protection (Air) Policy 2008 has been superseded by Environmental Protection (Air) Policy 2019.

4.5 Environmental Protection (Air Quality) Policy

The Environmental Protection (Air Quality) Policy 2019 (EPP (Air)) provides air quality objectives for a range of compounds with the potential to impact on the health and well-being and aesthetics of the environment. Specifically, the objectives are intended to enhance or protect the following environmental values:

> *(a) the qualities of the air environment that are conducive to protecting the health and biodiversity of ecosystems; and*
>
> *(b) the qualities of the air environment that are conducive to human health and wellbeing; and*

(c) the qualities of the air environment that are conducive to protecting the aesthetics of the environment, including the appearance of buildings, structures, and other property; and

(d) the qualities of the air environment that are conducive to protecting agricultural use of the environment.

Table 7 presents a summary of the air quality objectives applicable to the assessment.

Table 7: Schedule 1 Air Quality Objectives

Indicator	Environmental value	Air quality objectives (µg/m^3 except where noted)	Period
$PM_{2.5}$	Health and wellbeing	25	24 hours
		8	1 year
PM_{10}	Health and wellbeing	50	24 hours
		25	1 year
Total Suspended Particles	Health and wellbeing	90	1 year

5 EXISTING AIR ENVIRONMENT

5.1 Introduction

The quantification of cumulative air pollution concentrations requires an ambient background concentration of each relevant air pollutant, which is representative of the likely concentrations experienced in the region. The background concentration is added to the predicted concentrations associated with the proposed development. This is known as a cumulative assessment and demonstrates that the capacity of the airshed is sufficient to deal with the proposed development.

Background concentrations can be determined from onsite measurements or selected from representative data. The representative background concentration is added to the predicted concentrations from proposed activities and assessed for compliance against the relevant air quality objectives and guidelines.

This section summarises the existing industries in the region surrounding the subject site that are sources of dust emissions, the nearest monitoring data collected by Department of Environment and Science (DES) and monitoring data from monitoring at sensitive receptors around the quarry.

5.2 Ambient Monitoring

5.2.1 Department of Environment and Science

To assess cumulative impacts, daily background air quality data has been obtained from the DES website. DES monitoring station at Josephville is located within 1 km of the Subject Site, but only measures weather parameters.

Background concentrations can be assessed using two methods:

- Contemporaneous hourly data for the same meteorological year assessed; and
- Review of the most recent three years of data as percentile values. These values are typically 70th percentile for hourly and daily time periods and annual average

5.2.1.1 Monitoring Stations

The nearest and most representative monitoring stations have been reviewed for this assessment. There are no monitoring stations near Beaudesert; the nearest monitoring station is North Maclean monitoring station, which is approximately 28 km from the Subject Site. PM_{10} and $PM_{2.5}$ are not measured at North Maclean or Mutdapilly (located 38 km from the Subject Site). Table 8 provides an overview of pollutants measured at the nearest monitoring stations from 2015 until 2021.

Table 8: Measured Pollutants by Monitoring Station

Compound	Monitoring Station (2015 – 2021)				
	Flinders View	North Maclean Mutdapilly		South Brisbane	Southwood
PM_{10}	Yes	-	-	Yes	Yes
$PM_{2.5}$	From Feb 2021	-	-	Yes	Yes

5.2.1.2 Contemporaneous Review

To assess cumulative impacts, ambient monitoring data has been obtained from the Department of Environment and Science (DES) for 2015 from Flinders View, Southwood and South Brisbane as identified in Table 8, as this is the same year as the meteorological dataset utilised in this assessment.

Table 8 provides the statistics for the hourly background concentrations for particulates and gaseous compounds for 2015 from Flinders View, Southwood, and South Brisbane.

Table 9: Background Concentrations for 2015

Compound	Time Period	1-hour Concentration (µg/m^3)			Annual Average (µg/m^3)	Station
		Max	90th Percentile	70th Percentile		
PM_{10}	24-hour	44.5	21.6	16.0	14.6	Flinders View

The *Queensland Air Monitoring 2015 (National Environment Protection (Ambient Air Quality) Measure Report* (DES, 2016) confirms that there was no exceedences of the PM_{10} 24-hour objective at Flinders View. The 24-hour average concentrations for PM_{10} is presented in Figure 6.

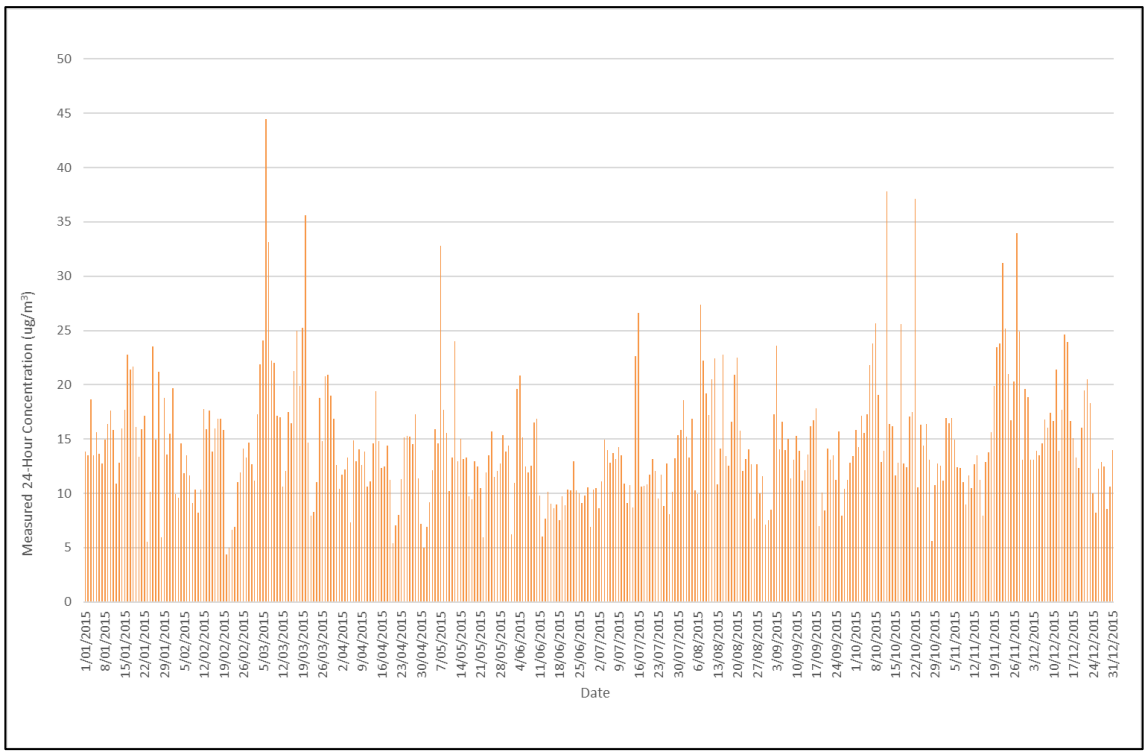


Figure 6: Hourly PM_{10} Concentrations at Flinders View for 2015

5.2.1.3 Three Year Review

It can be seen from Table 8 that $PM_{2.5}$ is only measured at Springwood for the entire period and commenced at Flinders View in February 2021. When using background monitoring data, the monitoring location should be representative of the Subject Site area; with this in mind, Springwood (and other $PM_{2.5}$ monitoring stations) are not considered representative as they're located in heavily urban areas or adjacent to motorways.

A review of the Queensland Air Monitoring National Environmental Protection (Ambient Air Quality) Measure Reports for 2019 – 2021 has identified the following in relation to PM_{10} monitoring:

- Bushfires in 2019 caused regional-wide exceedences of PM_{10}; at Flinders View, 21 exceedences of the PM_{10} 24-hour criterion were determined based on bushfires and dust events.
- There were four exceedences of the 24-hour criteria at Flinders View in 2020, with all of these events attributed to dust events. These dates were:
    - 20 February with concentration of 53.6 µg/m^3 (caused by region wide dust event);
    - 20 July with concentration of 86.2 µg/m^3 (caused by local dust event);
    - 20 August with concentration of 96.2 µg/m^3 (caused by region wide dust event); and
    - 22 August with concentration of 78.6 µg/m^3 (caused by region wide dust event);
- A single exceedence of the PM_{10} was recorded in 2021 Flinders View on 15 October with a concentration of 59.3 µg/m^3 which was the result of a region wide dust event.

Table 10 presents the percentile monitoring data from Flinders View and South Brisbane stations for 2019-2021 as well as 2015.

Table 10: Background Concentrations as Percentiles

Compound	Averaging Period	Parameter	Concentration (µg/m^3)		
			2019	2020	2021
PM_{10} (Flinders View)	1 day	70th percentile	24.7 a)	19.3 a)	16.4
	1 year	Average	24.3 a)	17.0	14.5
$PM_{2.5}$ (Flinders View)	1 day	70th percentile	-	-	6.5
	1 year	Average	-	-	5.9

a) PM_{10} and $PM_{2.5}$ monitoring data influenced by bushfires or dust events.

5.2.1.4 Other Pollutants

The nearest station that records total suspended particles (TSP) is located at Cannon Hill. In lieu of this, research indicates that in rural areas, PM_{10} typically represents 49% of total TSP, therefore, TSP concentrations have been estimated based on the application of this ratio[a].

5.2.2 Local Monitoring

Dust deposition monitoring is undertaken at two locations on a monthly basis (Figure 7). Based on this data, the annual average deposition rate at NBDG5 is 44 mg/m^2/day, which is considered representative of background locations. It is considered that deposition rates at NBDG7 could be attributed to activities occurring at both Bromelton North Quarry and Bromelton Quarry.

[a] Air Noise Environment Pty Ltd (1999) 'Fine dust and the implications for the coal industry', ACARP Project C7009

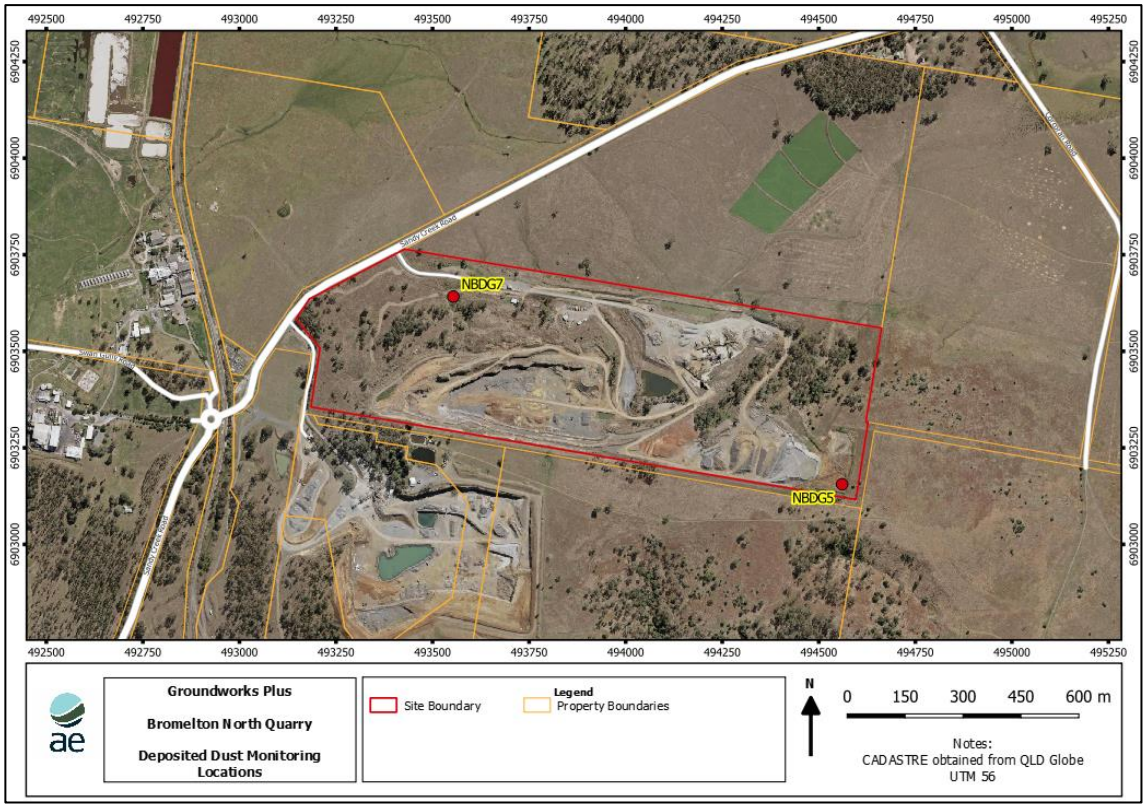


Figure 7: Deposited Dust Monitoring Locations

5.3 Applied Background Concentrations for this Assessment

Following the review of the background monitoring data, Table 11 presents the adopted background monitoring data for this assessment and justification:

- Contemporaneous data for 2015 from Flinders View for PM_{10}. This approach is applied as the PM_{10} data is heavily influenced by bushfires or dust events in recent years; and
- Percentile data for $PM_{2.5}$ for 2021 for Flinders View as this is the only monitoring site which is considered representative, and the only time period measured at this location.

Table 11: Adopted Background Monitoring Data for TSP and Deposited Dust

Pollutant	Time Period	Concentration	Source
TSP	Annual	29.0 µg/m^3	Calculated from PM_{10} for 2015
Deposited Dust	Month	44 mg/m^2/day	Average from NBDG5 Monitoring data from Table 9
PM_{10}	24-hour	Refer to Table 8 and Figure 6	Flinders View for 2015
	Annual		
$PM_{2.5}$	24-hour	6.5 µg/m^3	Flinders View for 2021
	Annual	5.9 µg/m^3	

5.4 Surrounding Industries

5.4.1 National Pollutant Inventory Database

The National Pollutant Inventory (NPI) is an initiative of the Australian Government that provides the community, industry, and government with information about emissions of pollutants to air, water, and land from industrial facilities across Australia. It has emissions estimates for 93 substances and the source and location of these emissions. Industrial facility operators are obliged to submit annual reports of their facilities emissions to the environment, if certain threshold criteria are exceeded.

A review of the NPI database has identified there are two facilities nearby which emit the same pollutants:

- Bromelton Generation Site; and
- Bromelton Quarry.

Since 2018, Bromelton Generation site has only reported NPI in 2020/2021. The reported emissions were for total volatile organic compounds (TVOCs), which were reported as 2,500 kg per annum. TVOCs are not cumulative to the Subject Site and therefore have not been considered in this assessment.

5.4.2 Bromelton Quarry

The Bromelton Quarry operates pursuant to a Planning Permit and Environmental Authority. Conditions on the Planning Permit for not regulate noise and dust emissions, however, do limit the activity to 1.5 Mpta. The Environmental Authority (Ref: EPPR00473413), authorises extraction and screening activities above 1 Mtpa

In order to carry out a cumulative assessment, a review of the NPI database was undertaken and the emissions for 2020/2021 were obtained as shown in Table 12. Based on experience, it is suspected that the particulate emission rates are under-reported and as such a full assessment will be undertaken.

No production rate date relating to the current Bromelton Quarry operations, equipment or mitigation measures is publicly available. As such, emissions from Bromelton Quarry have been calculated using the calculation methodologies in Section 7.3 and Appendix B adopting the maximum extraction rate.

Table 12: NPI Reported Emissions Data for Bromelton Quarry 2020/2021

Substance	Air Fugitive (kg)	Air Point (kg)	Total (kg)	Emission Rate (g/sec)
PM_{10}	10810	-	10810	0.34
$PM_{2.5}$	627	-	627	0.02

Table 13 presents the emission rates for Bromelton Quarry operations. Without any publicly available documents, the following assumptions have been made:

- Operating hours: same as Bromelton North Quarry;
- Production rate: 1.5 Mtpa based on average production as no daily peak production data available;

- Drill and blast every 33,000 tonnes;
- Haul road watering – Level 1 (50%);
- Crushing plant and mobile crushing plant do not have any dust controls;
- Paved internal road from Sandy Creek Road to weighbridge. All other roads are unpaved;
- Future concrete batching plant is included and operating at 90,000 m^3;
- Mobile fleet and haul trucks are ratioed to Bromelton North Quarry for the purpose of combustion emissions.

Table 13 lists the emission rates for Bromelton Quarry. No mitigation except watering of haul roads and concrete plant loading of trucks have been applied.

Table 13: Summary of Emission Rates from Bromelton Quarry

Activity	Emission Rate (g/sec)		
	TSP	PM_{10}	$PM_{2.5}$
Concrete (material transfers and silos)	0.00054	0.00021	1.55×10^{-5}
Drill and Blast	0.060	0.031	0.002
Material Transfers	0.447	0.211	0.032
Crushing and Screening	5.887	2.027	0.14
Paved Roads	1.110	0.213	0.05
Unpaved Roads	10.51	2.87	0.451
Wind erosion area stockpiles	1.14	0.57	0.04
Wind erosion from exposed area	4.16	2.08	0.16
Total	**19.16**	**5.93**	**0.72**

6 MODELLING METHODOLOGY

6.1 TAPM Predictions

Atmospheric dispersion modelling involves the mathematical simulation of the dispersion of air contaminants in the environment. The modelling utilises a range of information to estimate the dispersion of pollutants released from a source, including:

- Meteorological data for surface and upper air winds, temperature, and pressure profiles, as well as humidity, rainfall, cloud cover and ceiling height information;
- Emissions parameters including source, location, and height, source dimensions and physical parameters (e.g. exit velocity and temperature) along with pollutant mass emission rates;
- Terrain elevations and land use both at the source and throughout the surrounding region; and
- The location, height, and width of any obstructions (such as buildings or other structures) that could significantly impact on the dispersion of the plume.

For the purpose of the assessment, meteorological modelling has been undertaken using TAPM (The Air Pollution Model) and CALMET to predict localised meteorological conditions. The meteorological data derived from these models have been used as an input for the CALPUFF dispersion modelling.

A site-specific meteorological dataset has been determined using the prognostic model TAPM. Prognostic models, such as TAPM, permit the development of localised meteorological datasets, based on synoptic weather conditions. The model predicts the regional flows important to dispersion, such as sea breezes and terrain induced flows, against a background of larger-scale meteorology provided by synoptic analyses.

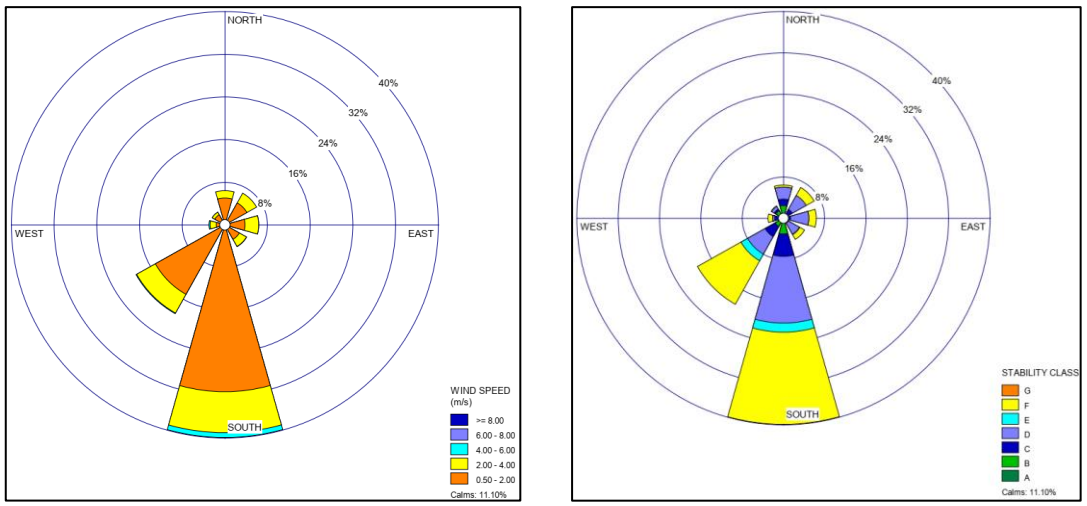
The output of this model, when used with a diagnostic meteorological model, such as CALMET, provides a meteorological dataset suitable for introduction into the wind field results. This methodology is the recommended approach for the modelling of contaminant concentrations using CALMET[b].

[b]TRC Environmental Corporation (March 2011) 'Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the 'Approved Methods for the Modelling and Assessments of Air Pollutants in NSW, Australia' prepared on behalf of the NSW Office of Environment and Heritage

Table 14: Summary of Meteorological Modelling Parameter

Model	Aspect	Assigned Parameter
TAPM (v4.04)	Year Modelled	One full year - 2015 which is compared to long-term observations to demonstrate suitability. Hourly data from BOM Beaudesert and DES Josephville was assimilated into TAPM.
	Coordinates	Latitude: -27°59.5 / Longitude: 152°56.0
	Domain Grids	25 x 25 x 25 grid points
	Nesting Spacing	30 km, 10 km, 3 km, and 1 km.
CALMET (v 7.1)	Databases	Default databases for sea temperature, terrain and land cover applied
	Model Domain	20-km x 20-km grid (200 m grid intervals)
	Terrain Data	Nasa Shuttle Radar Topography Mission (SRTM) 1-second (approximately 30 m) digital elevation model
	Land Use	Default from USGS for 1 km spacing. Review of the land use was undertaken and updated based on recent aerial imagery
	Vertical Layers	12 Layers - 20 m, 50 m, 75 m, 150 m, 200 m, 500 m, 750 m, 1,000 m, 1,500 m, 2,000 m, 3,000 m, and 4,000 m

Figure 8 presents the annual wind rose for the Subject Site during 2015. Detailed meteorological analysis of the dataset is presented in Appendix A.



Wind Rose

Stability Class Rose

Figure 8: Predicted Annual Wind and Stability Class Roses at Subject Site for 2015

6.2 CALPUFF Dispersion Modelling

The CALPUFF modelling system treats emissions as a series of puffs. These puffs are then dispersed throughout the modelling area and allowed to grow and bend with spatial variations in meteorology. In doing so, the model can retain a memory of the plume's movement throughout a single hour and from one hour to the next while continuing to better approximate the effects of complex air flows.

CALPUFF utilises the meteorological processing and prediction model CALMET to provide three-dimensional wind field predictions for the area of interest. The final wind field developed by the model (for consideration by CALPUFF) includes an approximation of the effects of local topography, the effects of varying surface temperatures (as is observed in land and sea bodies) and surface roughness (resulting from varied land uses and vegetation cover in an area). The CALPUFF model can resolve complex terrain influences on local wind fields including consideration of katabatic flows and terrain blocking.

Post processing of modelled emissions is undertaken using the CALPOST package. This allows the rigorous analysis of pollutant predictions generated by the CALPUFF system. CALPOST is able to provide an analysis of predicted pollutant concentrations for a range of averaging periods from 1 hour to 1 year.

6.3 Receptors

A computational grid of 6 km by 5 km at 100 m spacing has been modelled. Two separate grids covering the two quarries were modelled as follows:

- Grid 1: Centre co-ordinates 494262, 6903472 for a distance of 700 m at 50 m spacing; and
- Grid 2: Centre co-ordinates 493200, 6903300 for a distance of 400 m at 50 m spacing.

In addition, existing receptors were modelled as shown in Figure 2 and receptors were placed at 20 m intervals along the boundary of the Subject Site.

6.4 Other Settings

For the purposes of the assessment, the air dispersion modelling has utilised the following settings for CALPUFF:

- three-dimensional mode using meteorological data file from CALMET;
- ISC rural wind speed profile;
- no chemical transformation;
- no gaseous deposition;
- transitional plume rise;
- stack tip downwash for point sources;
- partial plume penetration for point sources;
- dispersion coefficients using Pasquill–Gifford coefficients or turbulence calculated from micro-meteorology;
- no adjustment of dispersion curves for roughness;
- partial plume path adjustment method for terrain using default coefficients;
- no building wakes were modelled; and
- pit retention was applied to west pit activities only.

7 AIR EMISSION ESTIMATION

7.1 Overview

Emissions from the quarrying operations are typically particulates (TSP, PM_{10}, and $PM_{2.5}$) associated with extraction, material transfers, crushing and screening and vehicle movements. Table 15 presents a summary of the sources and types of emissions from the Project.

Table 15: Summary of Potential Emissions

Element	Activity	Potential Emissions
Quarrying	Vehicle movements on unpaved roads	Particulates
	Blasting and drilling	Particulates
	Rock extraction	Particulates
	Material transfers	Particulates
	Wind erosion from stockpiles	Particulates
	Wind erosion from exposed areas	Particulates
Haul road	Heavy truck movements on unpaved roads	Particulates and gaseous compounds
Processing	Emissions from crushing/screening material transfers	Particulates

7.2 Scenario Assessed

For the purposes of the assessment, only one scenario (future operations) will be assessed. The sources of emissions for this scenario is presented in Table 16.

Table 16: Scenario Assessed

Scenario	Activity
Future Operations (800,000 tonnes per annum) based on operational information in Table 4	Drilling and Blasting
	Processing (screening, primary and tertiary crushing)
	Material transfers (loading / unloading / miscellaneous)
	Vehicle movements (light and heavy) on internal haul roads
	Wind erosion from stockpiles and exposed areas

7.3 Sources of Emissions

7.3.1 Quarrying Operations

Emission estimates for the above activities have been derived based on the USEPA AP-42: Compilation of Air Emission Factors (US Environmental Protection Agency, Various Dates) and National Pollution Inventory (NPI) Emission Estimation Technique Manual for Mining (2012).

Emission factors within these documents are used to estimate emissions of TSP, PM_{10} and $PM_{2.5}$ to the air from various sources. Emission factors relate to the quantity of a substance emitted from a source to some measure of activity associated with the source. Emission factors used to estimate a facility's emissions based on activity rates and control measures are presented in Appendix B.

Table 17 present the emission rates for future operations. The emission rates have been modelled as operational hours and are based on maximum throughput of 1,200,000 tpa which is equivalent to the daily peak production of 4,000 tpd (which is a conservative assessment as the site will be limited to 800,000 tpa). The emission rates for the facility based on the operational information detailed in Appendix B.

Table 17: Summary of Emission Rates for Daily Peak Operations

Activity	Emission Rate (g/sec)		
	TSP	PM_{10}	$PM_{2.5}$
Drill and Blast	0.04	0.02	0.00
Material Transfers	0.45	0.21	0.03
Crushing and Screening	4.70	1.62	0.11
Unpaved Roads	15.18	3.40	0.76
Wind erosion area stockpiles	1.68	0.84	0.06
Wind erosion from exposed area	5.76	2.88	0.22
Total	**22.05**	**6.09**	**0.96**

Figure 9 present the location of existing sources.

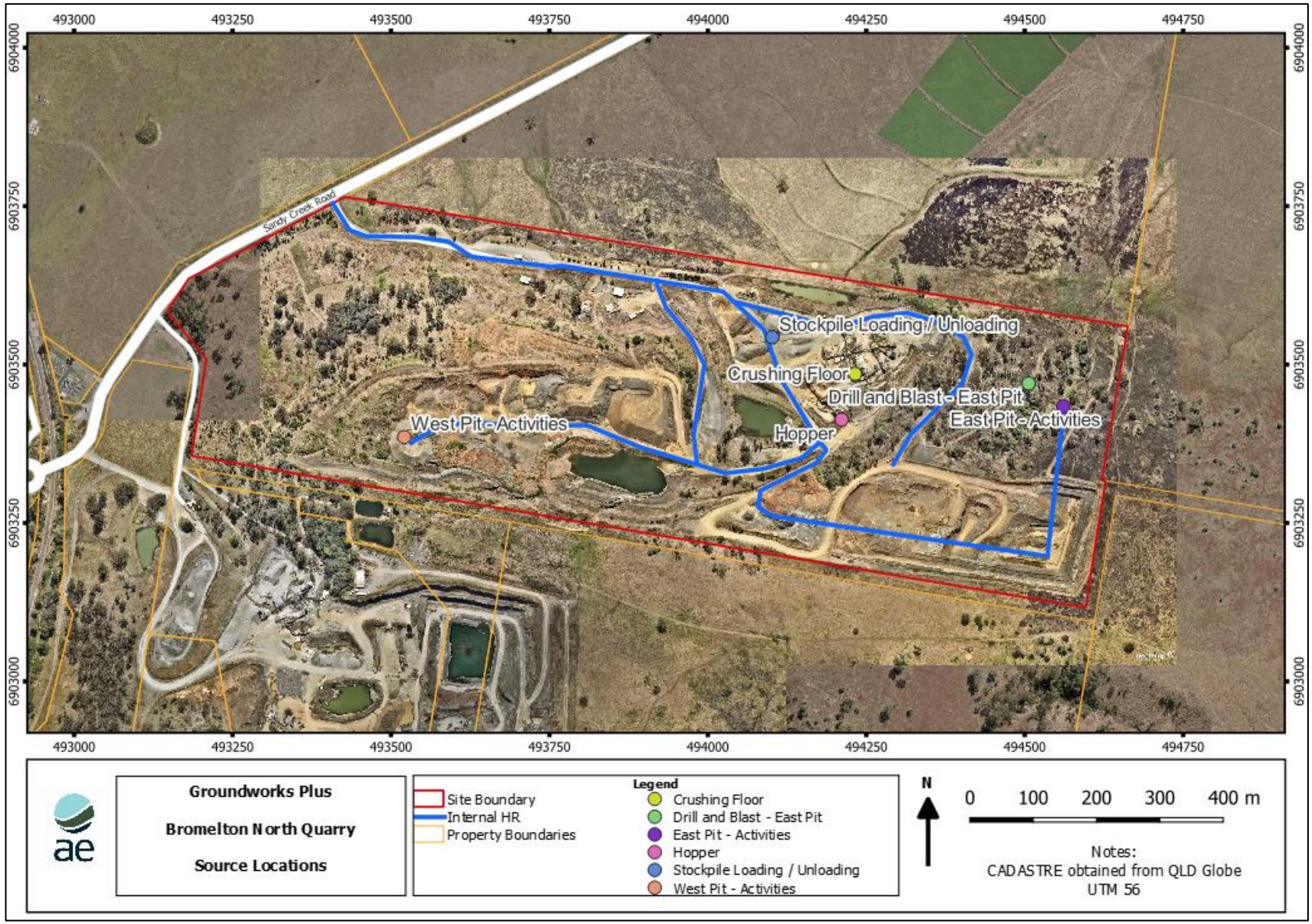


Figure 9: Source Locations

7.4 Source Parameters

Source parameters adopted in the preparation of the model are presented in Table 18 with the location of sources as modelled presented in Figure 9.

Table 18: Source Parameters

Activity	Source Type	Source Parameters			
		Area (m^2)	Effective Height (m)	σY (m)	σZ (m)
Drill and blast	Volume	N/A	10	8.4	2.3
Pit Activities	Volume	N/A	5.0	11.6	1.16
Unpaved Roads	Line volume	N/A	3.0	N/A	1.0
ROM	Volume	N/A	15	1.4	3.5
Crushing Plant	Volume	N/A	10	14.0	2.3
Stockpile Loading/Unloading	Volume	N/A	5.0	3.86	1.16
Wind erosion from stockpiles	Area	Refer to App B	5.0	N/A	2.0
Wind erosion from exposed areas			1.0	N/A	1.0

8 REDICTED GROUND LEVEL CONCENTRATIONS

8.1 Overview

The results in this Section are presented as follows:

- Predicted concentrations from the Subject Site operations of the future expansion in isolation for daily peak production (Table 17); and
- Predicted concentrations from the Subject Site operations of the future expansion in isolation for average production and the adjacent Bromelton Quarry (Table 13) and background concentrations, predicted concentrations (Table 11).

The predicted isopleths presented in Appendix C are for the total predicted concentrations from all cumulative activities and background concentrations.

8.2 Site Only Predicted Results

In accordance with the EPP(Air Quality), the maximum predicted concentrations at the discrete receptors identified in Table 19 for the future Subject Site operations in isolation.

Table 19 presents a summary of the maximum predicted ground level concentrations at the sensitive receptors. It can be seen that the predicted concentrations comply at all sensitive receptors and at the site boundary for all pollutants and time periods.

Table 19: Summary of Maximum Predicted Ground Level Concentrations at Sensitive Receptors from Subject Site Only

Pollutant	Averaging Period	Maximum Predicted GLC at Sensitive Receptors (µg/m^3)	Criteria (µg/m^3)
TSP	Annual	3.3	90
PM_{10}	24 hours	19.0	50
	Annual	3.6	25
$PM_{2.5}$	24 hours	2.5	25
	Annual	0.5	8
Deposited Dust	Month	42.6	120 mg/m^2/day

8.3 Cumulative Predicted Results

Table 20 presents the results from the Subject Site during future daily peak operations and the adjacent Bromelton Quarry and background concentrations. The results show that the predicted concentrations comply at all sensitive receptors for all pollutants and time period.

The maximum predicted PM_{10} 24-hour concentration is predicted to be 49.8 µg/m^3 at Receptor R20, which is located to the north of the Bromelton North Quarry. A review of the particulate contributions identifies the crushing operations are dominating the results, which was visible at site when the wind was blowing particulates from the crushing area towards this receptor.

It can be seen from the isopleths in Appendix C and D that the terrain contributes with constraining dispersion from most pit activities, with the exception of the crushing plant and stockpiling activities.

Table 20: Summary of Maximum Predicted Ground Level Concentrations at Sensitive Receptors from Subject Site, Bromelton Quarry and Background Concentrations

Pollutant	Averaging Period	Maximum Predicted GLC at Sensitive Receptors (µg/m^3)	Criteria (µg/m^3)
TSP	Annual	32.8	90
PM_{10}	24 hours	49.8	50
	Annual	19.2	25
$PM_{2.5}$	24 hours	9.7	25
	Annual	6.4	8
Deposited Dust	Month	109.0	120 mg/m^2/day

Overall, the emissions from the Subject Site are not expected to result in significant adverse impacts on the health and wellbeing of the air environment for the surrounding receptors where the control measures detailed in Section 9 are implemented.

The predicted isopleths are presented in Appendix C.

Table 21: Predicted Cumulative Pollutant Concentrations at Sensitive Receptors including Background Concentrations (Particulates)

Receptor	Maximum Predicted Ground Level Concentration at Receptor (µg/m^3)					
	TSP	PM_{10}		$PM_{2.5}$		Deposited Dust
	1 year	24 hours	1 year	24 hours	1 year	Monthly
R1	32.8	47.7	18.8	9.1	6.3	109.0
R2	30.2	48.8	16.2	8.4	6.1	62.9
R3	29.8	47.0	15.7	8.1	6.0	57.5
R4	29.8	47.2	15.6	8.1	6.0	56.8
R5	29.7	46.7	15.4	8.2	6.0	54.9
R6	29.6	46.7	15.3	8.3	6.0	54.3
R7	29.5	46.4	15.2	8.5	6.0	53.0
R8	29.5	46.8	15.3	8.9	6.0	53.6
R9	29.5	46.3	15.2	8.9	6.0	52.1
R10	29.4	46.2	15.1	9.0	6.0	51.5
R11	29.8	48.5	15.7	8.3	6.0	57.6
R12	29.5	46.5	15.3	8.7	6.0	52.5
R13	29.2	44.5	14.6	7.7	5.9	46.6
R14	29.4	44.8	14.9	7.9	6.0	49.7
R15	29.1	44.3	14.5	7.9	5.9	46.7
R16	29.1	44.3	14.5	7.7	5.9	46.3
R17	29.3	44.3	14.9	7.6	6.0	50.1
R18	29.3	44.3	14.8	8.2	6.0	52.5
R19	32.4	46.4	18.1	9.1	6.4	88.7
R20	32.4	49.8	19.2	9.7	6.4	89.1
Max	32.8	49.8	19.2	9.7	6.4	109.0
Criteria	90 µg/m^3	50 µg/m^3	25 µg/m^3	25 µg/m^3	8 µg/m^3	120 mg/m^2/day
Compliant?	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**

9 MITIGATION MEASURES

The Environment Protection (Air) Policy management hierarchy gives priority to avoiding emissions where reasonable to do so. Where this is not possible, emissions reduction and management currently at the quarry are best practice.

The operations of the quarry aim to reduce emissions of dust and other pollutants by implementing the following control measures as listed in Table 22.

Table 22: Mitigation Controls by Activity

Activity	Mitigation Measure
Work Areas / Trafficable Area	▪ Limit high dust generating activities (vehicle movements) to periods of favourable weather conditions. ▪ The dry stacking will have a high moisture content which will minimise emissions; if visual surveillance indicates dust generation water the dry stacking where operations are occurring. ▪ Dampen down (approx. rate of 2 litres/m²/hour) the internal haul roads by water spraying when visual surveillance indicates excessive dust generation. ▪ Restrict vehicle movements to designated routes to the extent practicable. ▪ Enforce speed limits on internal roads. ▪ Maintain road surfaces in good condition. ▪ Prevent and clean up any spillages or dust accumulation on driveways or sealed roads.
Processing Plant	▪ Use shielding and/or windbreaks where possible. ▪ Maintain equipment in accordance with the original equipment manufacturers' specifications. ▪ Water or use foam-based products when dust from the crushing area is visibly dispersing towards the north.
Stockpiles	▪ Limit the height of any stockpiles to <6m, where practicable. ▪ Regularly water stockpiles to keep down dust emissions if visual surveillance indicates excessive dust generation.

10 CONCLUSIONS

Neilsens propose to increase the extraction rate to 800,000 tonnes per annum and extend the east pit footprint. It is not proposed to change the approved hours of operation or location of fixed plant, and equipment.

An air quality impact assessment has been undertaken to demonstrate the expansion of the quarry will not have adverse effects on surrounding receptors. The assessment has been conducted in accordance with Department of Environment & Science (DES) *Guideline - Application requirements for activities with impacts to air* (2019).

The detailed air quality modelling and assessment of the proposed quarry activities demonstrates that compliance with the air quality objectives prescribed in the Queensland Environmental Protection (Air) Policy 2019 can be achieved at all sensitive receptors with the provision of the control measures detailed in Appendix B, and the general environmental duty of care is adhered to.

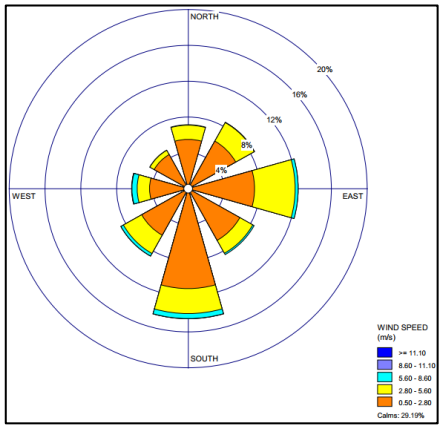
A cumulative assessment of the adjacent Bromelton Quarry has identified a single exceedences of the PM_{10} 24-hour criterion at receptor R1 for one day. A review of the contributions has shown that the Subject Site's contribution is less than the background concentration and the concentration from Bromelton Quarry.

It is recommended that mitigation measures are implemented as per Section 9 of this report to minimise the likelihood of exceedences occurring.

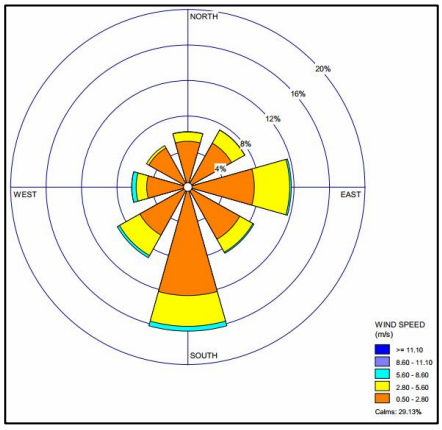
APPENDIX A: METEOROLOGICAL REVIEW

Section of Representative Year

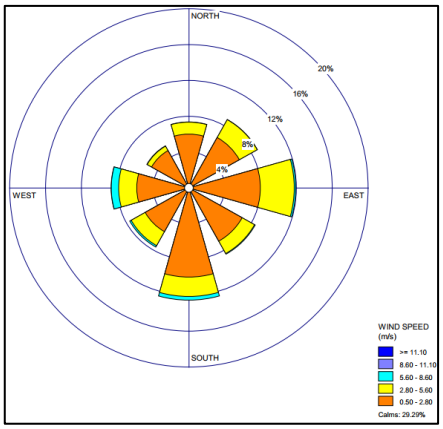
To determine the most representative meteorological year to utilise in the modelling, seven years (2012 - 2019) of meteorological observations from BOM Beaudesert (station number 040983) were reviewed. The Figure below presents the wind roses for 2012 – 2019.



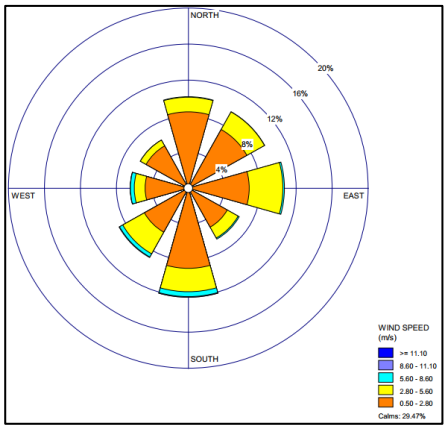
Annual 2012 - 2019



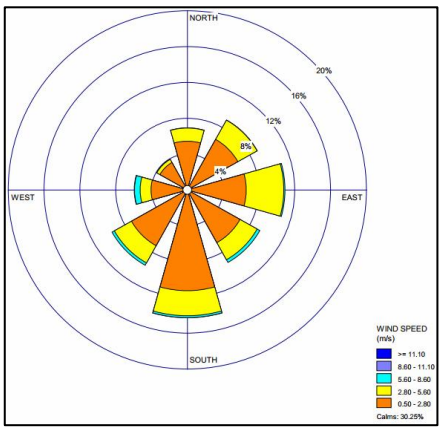
Annual 2015



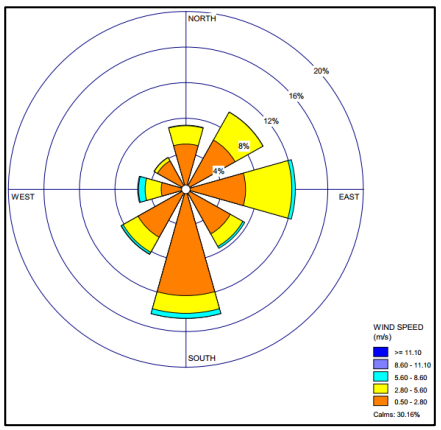
Annual 2016



Annual 2017



Annual 2018



Annual 2019

Long-term Wind Roses from BOM Beaudesert (2012 - 2019)

Figure in this section present the observed annual and seasonal wind roses for BOM Warwick. The following is noted:

- The annual wind roses for all years are very similar in wind direction and wind speed to the seven-year wind roses.
- 2015 and 2018 are the closest representative wind roses of the past five years.

Table 23 presents a yearly comparison of various meteorological parameters against the seven-year dataset. It can be seen form the Table that 2015 is the most representative year based on the percentage of calm conditions and the strongest correlation for relative humidity, temperature, and wind speed by month.

Table 23: Data Analysis

Parameter		Year					
		2012 - 2019	2015	2016	2017	2018	2019
Wind Conditions	Data Availability	99.86	99.92	99.87	99.98	99.98	99.63
	Calm Conditions (%)	29.19	29.13	29.29	29.47	30.25	30.16
	Ave. Wind Speed (m/s)	1.50	1.44	1.43	1.44	1.44	1.55
Rainfall	Data Availability	99.81	99.92	99.8	99.81	99.98	99.63
	Rainfall (mm)	792	868	714	1212	774	392
	Average Hourly Rainfall (mm/hour)	0.09	0.10	0.08	0.14	0.09	0.04
Correlations of Datasets by Month	RH (%)		0.88	0.60	0.65	0.51	0.32
	Temperature (°C)		0.99	0.99	0.97	0.99	0.61
	Wind Speed (m/s)		0.87	0.91	0.66	0.72	0.67

a) Based on long-term data from BOM website

As such, 2015 is considered the most representative year for locations close to Beaudesert.

Validation of Model Performance

Monitoring data from BOM Beaudesert and DES Josephville were assimilated into the modelling. As DES Josephville is <1 km from the site boundary, a detailed comparison has been made to this station instead of BOM Beaudesert.

An evaluation of the performance of the meteorological model is presented in this section. The evaluation compares the observed meteorological data from DES Josephville with the output from CALMET, which included data assimilation in TAPM.

Figure 10 presents a comparison of the 9 am, 3 pm and annual 2015 predicted and observed wind roses at DES Josephville monitoring station. Comparison of the DES site observed wind roses with predicted wind roses indicate that whilst the model has more wind flows from the southeast at 9 am and east at 3 pm, the prediction model

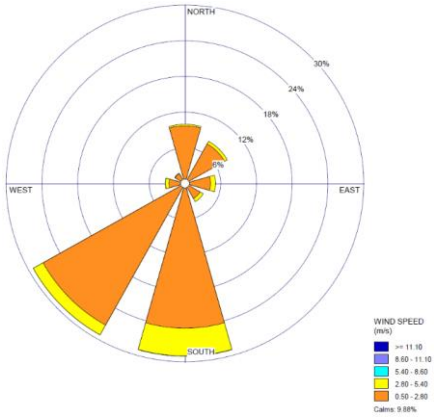
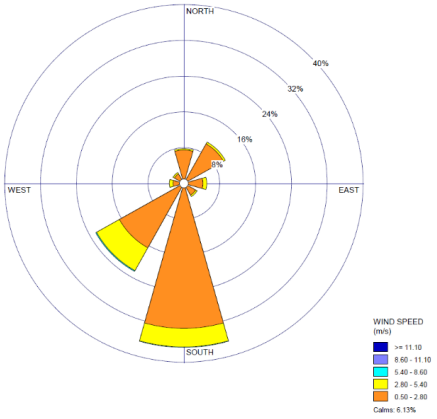
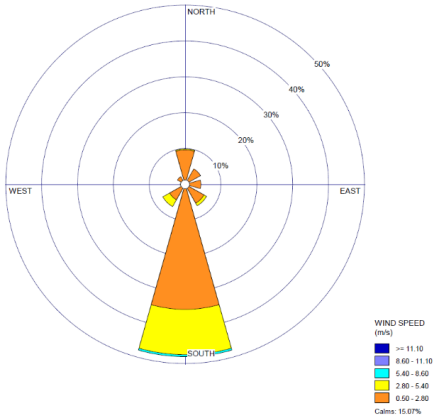
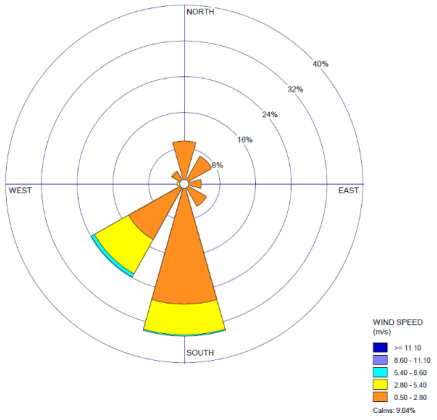
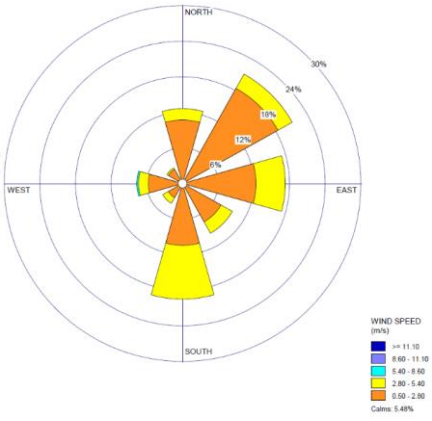
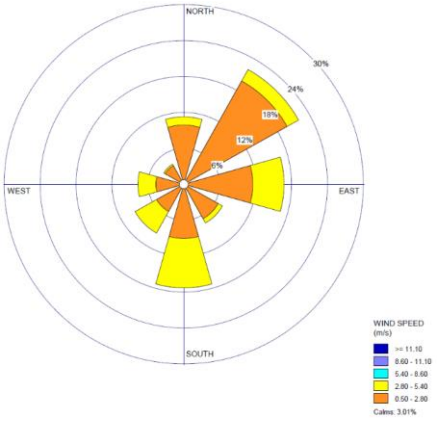
Period	DES Josephville Predicted (2015)	DES Josephville Observed (2015)
Annual		
0900		
1500		

Figure 10: Comparison of Predicted (2015) and BOM Observed Wind Roses (2015) at DES Josephville

Figure 11 shows the probability density functions that graphically compare statistical distributions of individual meteorological parameters between TAPM/CALMET output and observational data, as extracted from the DES Josephville location.

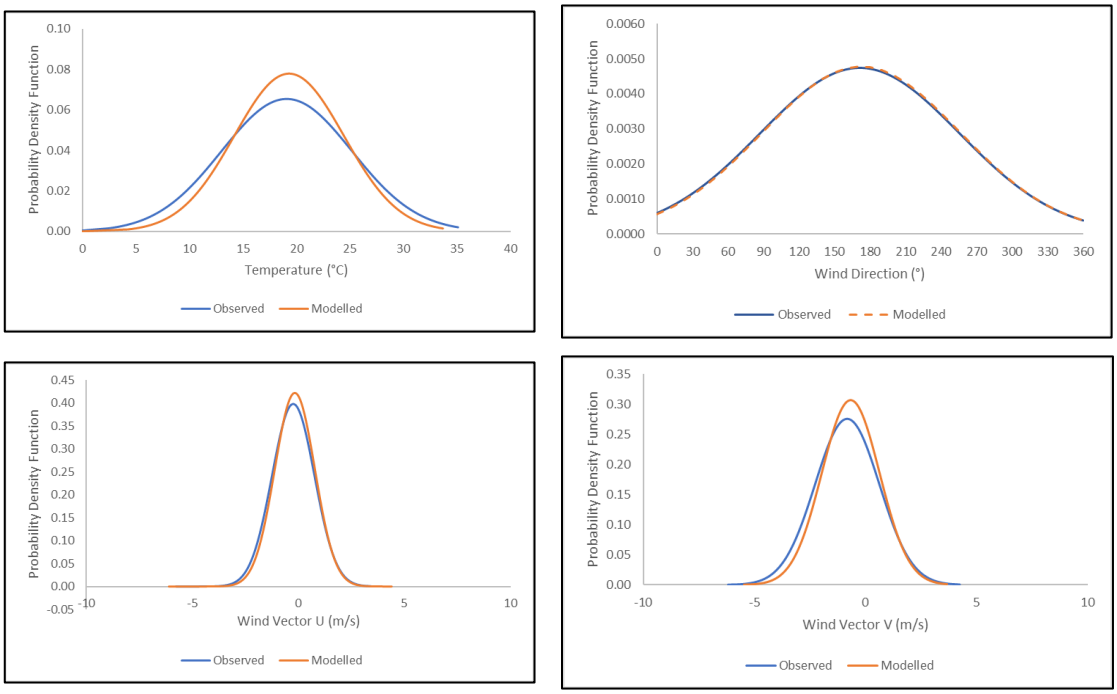


Figure 11: Probability Density Functions (pdf) Comparing Observational and Modelled Data at DES Josephville

Review of the data has identified that the modelled and observed datasets are very similar, with the following noted:

- The modelled temperatures are more likely to be higher than those observed;
- The modelled wind vector V (south/north component) is slightly different to the observed.
- The modelled wind speed and wind vector U (east/ west component) are very similar to those observed with the wind vector U modelled values matching the observed values.

On this basis, the prognostic dataset is considered suitable for the purposes of the assessment.

Prognostic Dataset Review at Subject Site

This section provides an analysis of the prognostic meteorological dataset extracted from the CALMET model for 2015 at the Subject Site.

Predicted Atmospheric Stability

The amount of turbulence in the ambient air has a major effect upon the rise and dispersion of emissions. In particular, the amount of turbulence in the atmosphere plays a key role in diffusion of an emitted plume in the air with stronger turbulence (increased instability) increasing the rate of diffusion. Where the atmosphere exhibits weak turbulence (increased stability), downwind contaminant concentrations can be expected to increase due to the limited diffusion.

Figure 12 presents the diurnal variability in atmospheric stability identified in the predicted meteorological dataset. As can be seen, atmospheric instability increased during the day where the influence of solar energy drives convection in the atmosphere. Conversely, increased stability can be seen during night periods where stable conditions are predicted for more than 90% of the time.

Monin-Obukhov Length

The Monin-Obukhov Length represents a parameter (with dimension of length) which provides a relationship between parameters characterising dynamic, thermal, and buoyant processes. The parameter, first described by Obukhov in 1946, is the characteristic height scale of the dynamic sub-layer of the atmosphere and is positive for stable stratifications and negative for unstable stratifications.

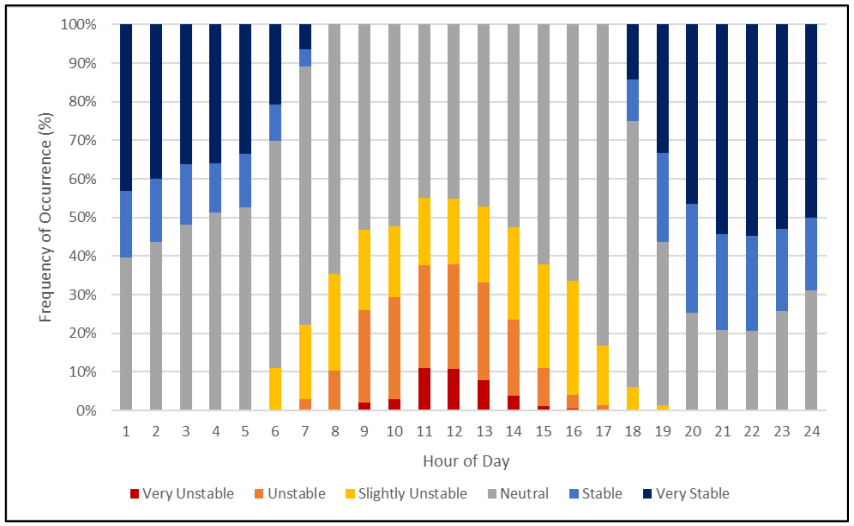
Figure 12 presents a graphical representation of the reciprocal of the Monin-Obukhov length (1/L) for the 2015 prognostic (CALMET) dataset. In this figure, neutral stability conditions have the 1/L value of zero (0), stable conditions have positive values of 1/L and unstable conditions have negative values of 1/L. The more positive 1/L value, the more stable the atmosphere is assumed to be by the model. Similarly, the more negative 1/L becomes, the more unstable the atmosphere is assumed to be by the model.

Predicted Atmospheric Mixing Height

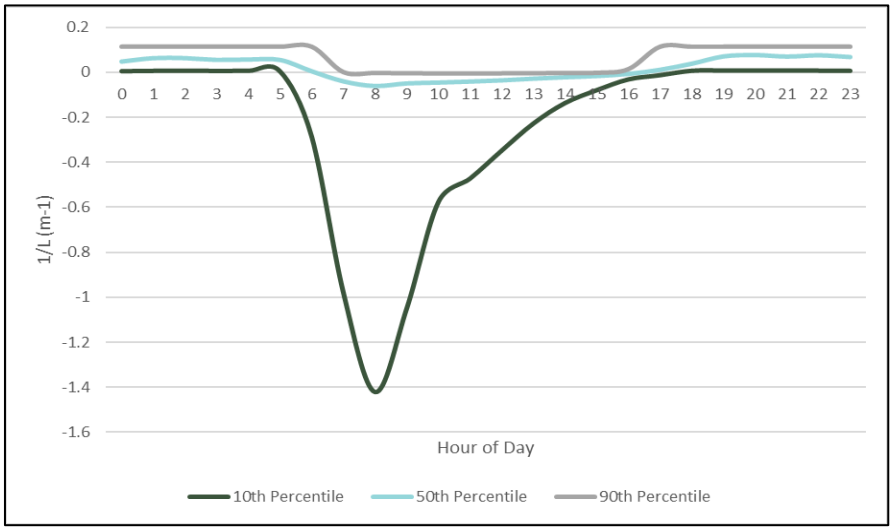
Figure 12 presents an illustration of diurnal variations in maximum and average mixing heights predicted by CALMET at the Subject Site across the 2015 prognostic meteorological dataset. As expected, an increase in mixing height during the morning is apparent, arising due to the onset of vertical mixing following sunrise. Maximum mixing heights generally occur in the mid to late afternoon, due to the dissipation of ground-based temperature inversions and growth of the convective mixing layer. The highest maximum mixing height for the Subject Site occurs during the late afternoon period.

Temperature

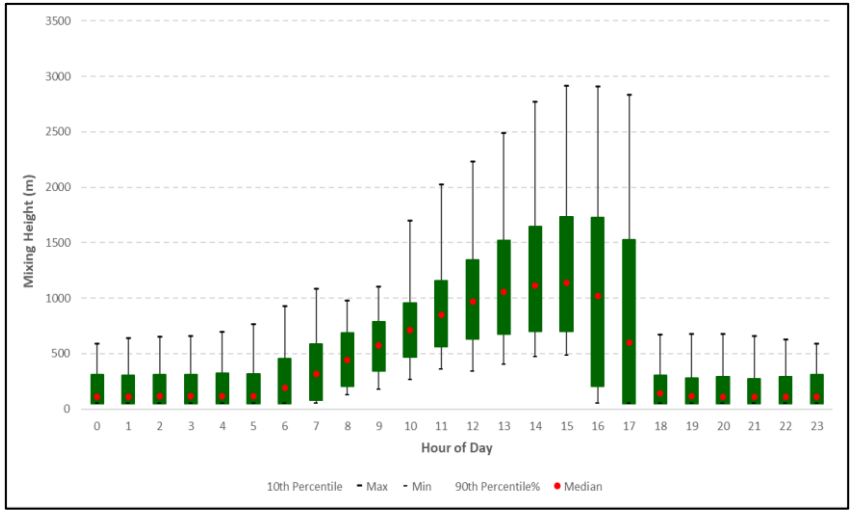
Figure 12 presents an illustration of diurnal variations in maximum and average temperatures predicted by CALMET at the Subject Site across the 2015 prognostic meteorological dataset.



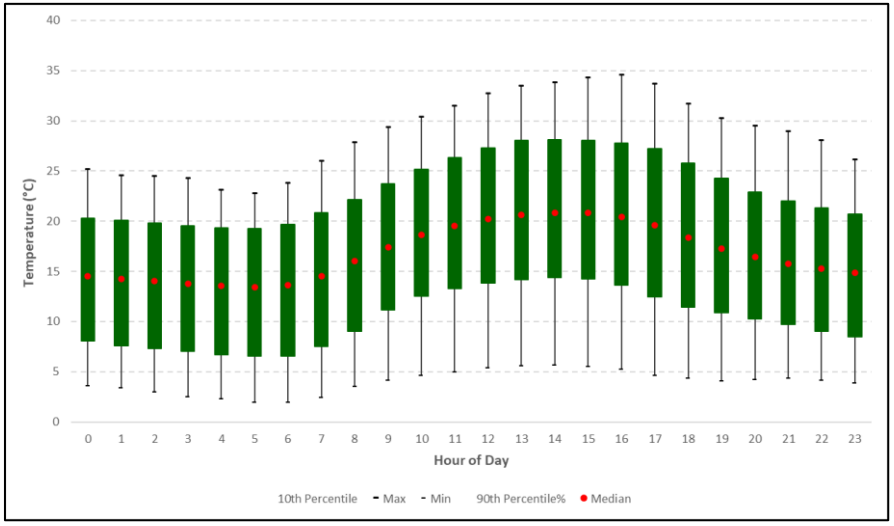
Annual Atmospheric Stability by Hour



Annual Variability of Monin-Obukhov Length by Hour



Atmospheric Mixing Height by Hour



Temperature by Hour

Figure 12: Meteorological Analysis at Subject Site

APPENDIX B: EMISSION ESTIMATION

Emission factors shown in Table 24 and operational information listed in Table 25 can be used to estimate emissions of TSP, PM_{10} and $PM_{2.5}$ to the air from various sources associated with the site.

Table 24: Emission Factor by Activity

Activity	Units	TSP Emission Factor	PM_{10} Emission Factor	$PM_{2.5}$ Emission Factor	Source
Wind Erosion for exposed areas	t/ha/hr	0.85 x (365-RD)/365	TSP x 0.5	PM_{10} x 0.075	NPI Mining
Wind Erosion from active stockpiles	kg/ha/ hr	1.8 x U x (365-RD)/365	TSP x 0.5	PM10 x 0.075	NPI for Mining
Loading / unloading trucks from stockpiles	kg/t	$0.74\ x\ 0.0016\ x\ \frac{(U/2.2)^{1.3}}{(M/2)^{1.4}}$	$0.35\ x\ 0.0016\ x\ \frac{(U/2.2)^{1.3}}{(M/2)^{1.4}}$	$0.053\ x\ 0.0016\ x\ \frac{(U/2.2)^{1.3}}{(M/2)^{1.4}}$	NPI for Mining / AP-42 13.2.4
Wheel generated particulates on unpaved roads (light vehicles)	kg/VKT	$1.69\ x\ \frac{(s/12)x(S/48)^{0.3}}{(M/0.5)^{0.3}} - 0.0013$	$0.51\ x\ \frac{(s/12)x(S/48)^{0.5}}{(M/0.5)^{0.2}} - 0.0013$	TSP x 0.105	NPI for Mining
Wheel generated particulates on unpaved roads (heavy vehicles)	kg/VKT	$\frac{0.4536}{1.6093}x4.9\ x\left(\frac{s}{12}\right)^{0.7}\ x\left(\frac{Wx1.1023}{3}\right)^{0.45}$	$\frac{0.4536}{1.6093}x1.5\ x\left(\frac{s}{12}\right)^{0.9}\ x\left(\frac{Wx1.1023}{3}\right)^{0.45}$	$\frac{0.4536}{1.6093}x0.15\ x\left(\frac{s}{12}\right)^{0.9}\ x\left(\frac{Wx1.1023}{3}\right)^{0.45}$	NPI for Mining / AP-42 13.2.2
Material transfer	kg/t per transfer point	$0.74\ x\ 0.0016\ x\ \frac{(U/2.2)^{1.3}}{(M/2)^{1.4}}$	$0.35\ x\ 0.0016\ x\ \frac{(U/2.2)^{1.3}}{(M/2)^{1.4}}$	$0.053\ x\ 0.0016\ x\ \frac{(U/2.2)^{1.3}}{(M/2)^{1.4}}$	NPI for Mining / AP-42 13.2.4
Truck Loading / Unloading using FEL	kg/t	$0.74\ x\ 0.0016\ x\ \frac{(U/2.2)^{1.3}}{(M/2)^{1.4}}$	$0.35\ x\ 0.0016\ x\ \frac{(U/2.2)^{1.3}}{(M/2)^{1.4}}$	$0.053\ x\ 0.0016\ x\ \frac{(U/2.2)^{1.3}}{(M/2)^{1.4}}$	NPI for Mining
Tertiary Crushing - Controlled	kg/t	0.0027	0.0012	0.00022	NPI Mining
Screening - Controlled	kg/t	0.01250	0.00430	0.00029	NPI Mining
Conveyor Transfer Point	kg/t	0.00150	0.00055	0.00016	NPI Mining

Where:

WS = wind speed (m/s)
WS_O = threshold for particulate matter lift-off (6.5 m/s)
M = material moisture content (%)
S = material silt content (or surface content in unpaved roads) (%)
U = wind speed (m/s)
W = mean vehicle weight (tonnes)
S = mean vehicle speed (km/h)

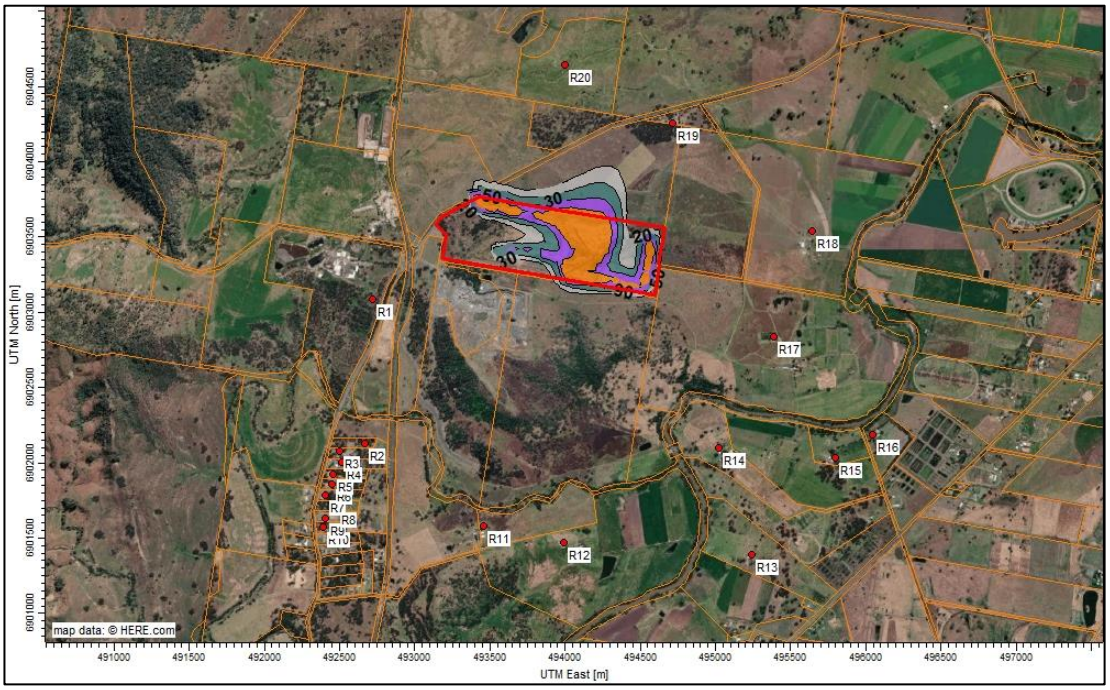
Table 25: List of Activity Data and Assumptions for Nielsen's Quarry

Parameter	Units	Proposed
Operating Times		
Operating hours	hrs per day	11
Operating days	day / year	300
Operating days	days	Mon to Sat
Volumes / Areas		
Annual Production (Average)	tonnes/yr	800,000
Annual Production (Maximum)	tonnes/yr	1,200,000
Exposed Areas	ha	16.5
Exposed stockpiles	ha	2.4
Rehabilitated Area	ha	-
Material Transfer		
Trucks Loading in Pit	tonnes/yr	1,200,000
Truck Unloading at Screening Plant	tonnes/yr	1,200,000
Screening	tonnes/yr	4,881,000
Crushing	tonnes/yr	4,080,000
Stockpile Loading	tonnes/yr	1,200,000
Trucks Loading from Stockpile	tonnes/yr	1,200,000
FEL in Materials Stockpile Area	tonnes/yr	1,200,000
Access Road Haulage	tonnes/yr	800,000
Internal Road Haulage	tonnes/yr	1,200,000
Product Truck Weight (unladen)	tonnes	32
Product Truck Weight (laden)	tonnes	61
Raw Materials Truck (unladen)	tonnes	45
Raw Materials Truck (laden)	tonnes	83
Access Road (Unpaved)	km / VKT	0.53 / 22,484
Internal Haul Roads (Unpaved)	km / VKT	2.36 / 100,232
Drilling and Blasting		
Number of Holes	per blast	255
Area per Blast	m^2	1,600
Number of Blasts per Year	-	24
Weather		
Mean wind speed (Warwick)	m/s	1.8
Rainfall >0.25 mm	Days per yr	78
Material Characteristics		
Raw material moisture content	%	2
Silt content of unpaved road	%	7.1
Emission Controls		
Material transfers (loading stockpiles)	%	0
Material transfers (processing)	%	0

Parameter	Units	Proposed
Material transfers (loading trucks)	%	0
Unpaved roads (water truck)	%	50
Wind erosion of stockpile	%	0
In pit retention	%	TSP – 50% PM_{10} – 5%

APPENDIX C: PREDICTED POLLUTANT GLC ISOPLETHS: SUBJECT SITE ONLY

This Appendix presents the predicted ground level concentrations from daily peak production rates. Due to the interpolation of the gridded results, there may be slight discrepancies with the discrete receptors.



Pollutant:	Period:	Percentile:	Criteria:
TSP	1 Year	100th	90 µg/m³

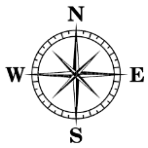
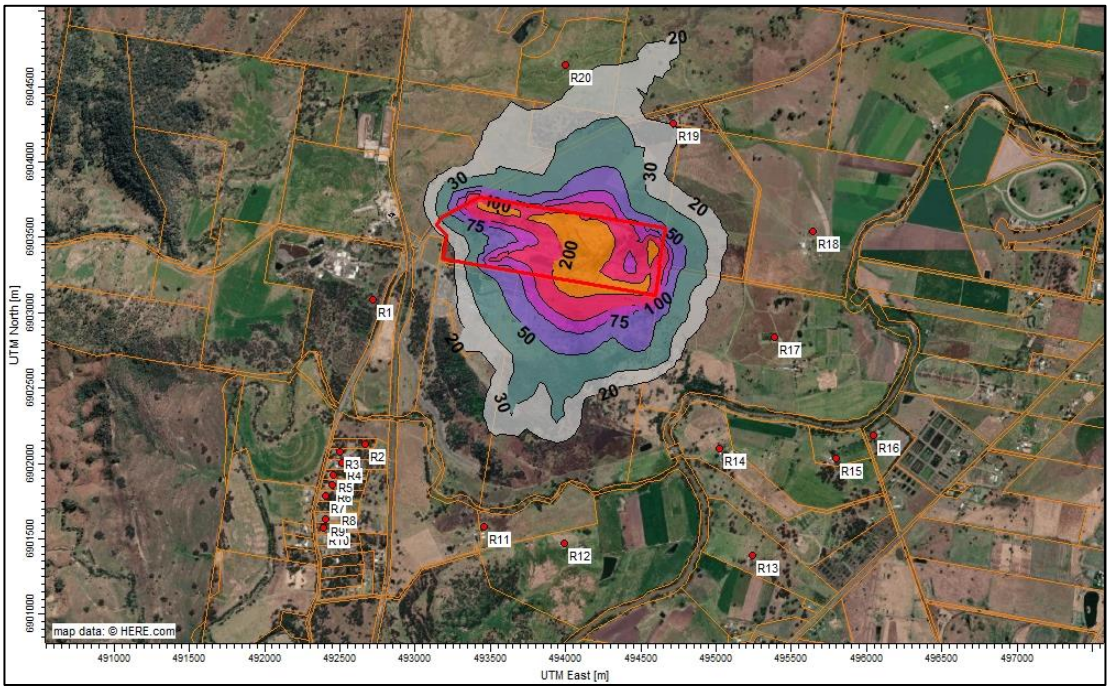


Figure 13: Predicted TSP GLCs for Daily Peak Operations from Subject Site Only



Pollutant:	Period:	Percentile:	Criteria:
PM_{10}	24 Hour	100th	50 µg/m³

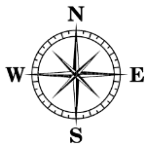
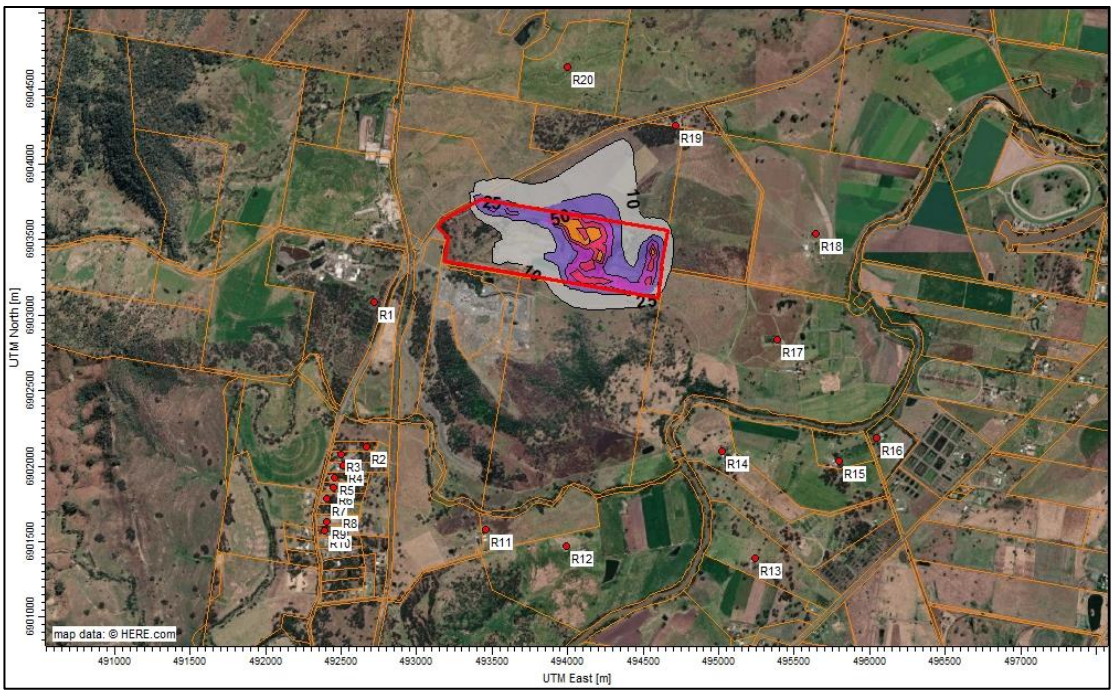


Figure 14: Predicted PM_{10} 24-hour GLCs for Daily Peak Operations from Subject Site Only



Pollutant:	Period:	Percentile:	Criteria:
PM_{10}	1 Year	100th	25 µg/m³

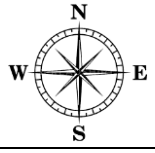
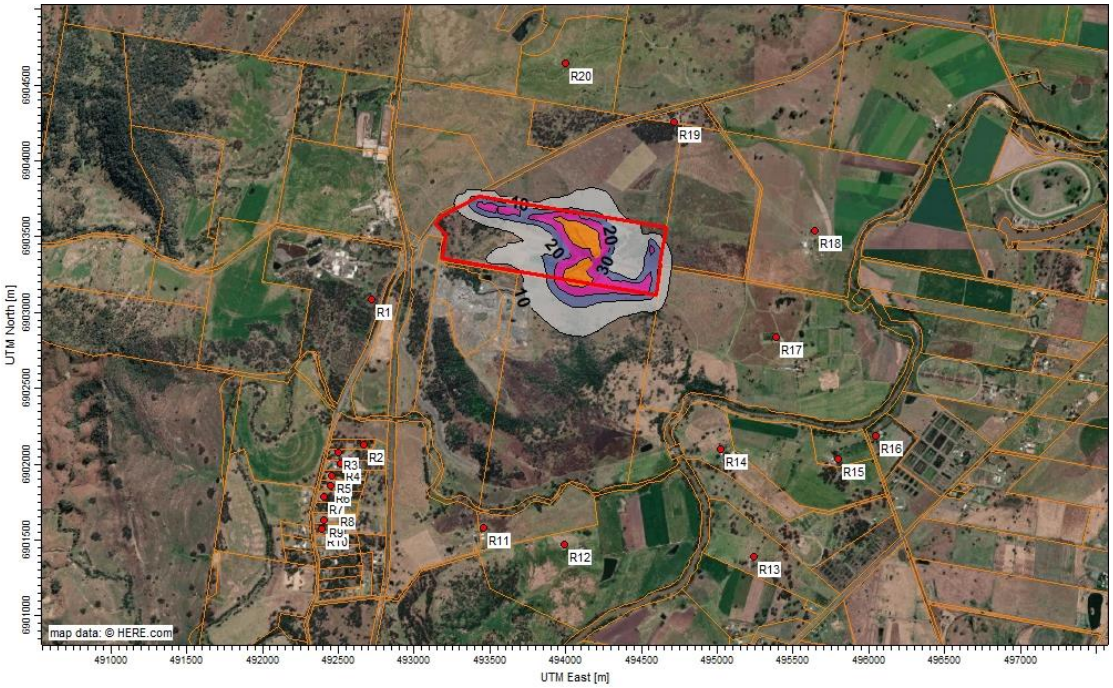
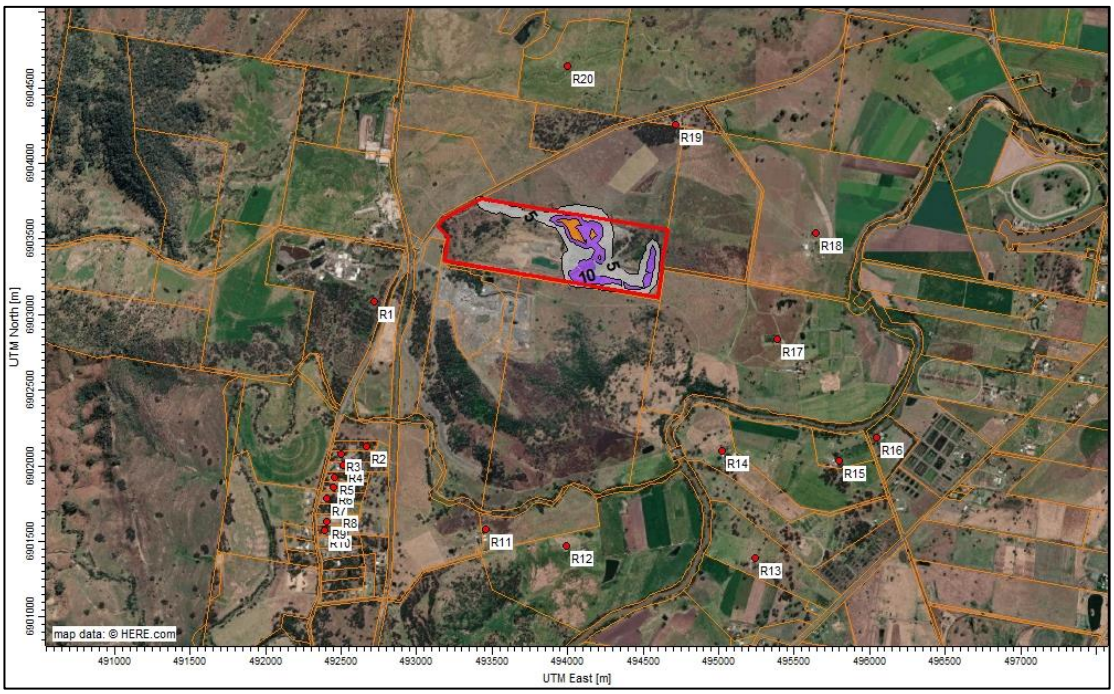


Figure 15: Predicted PM_{10} annual GLCs for Daily Peak Operations from Subject Site Only



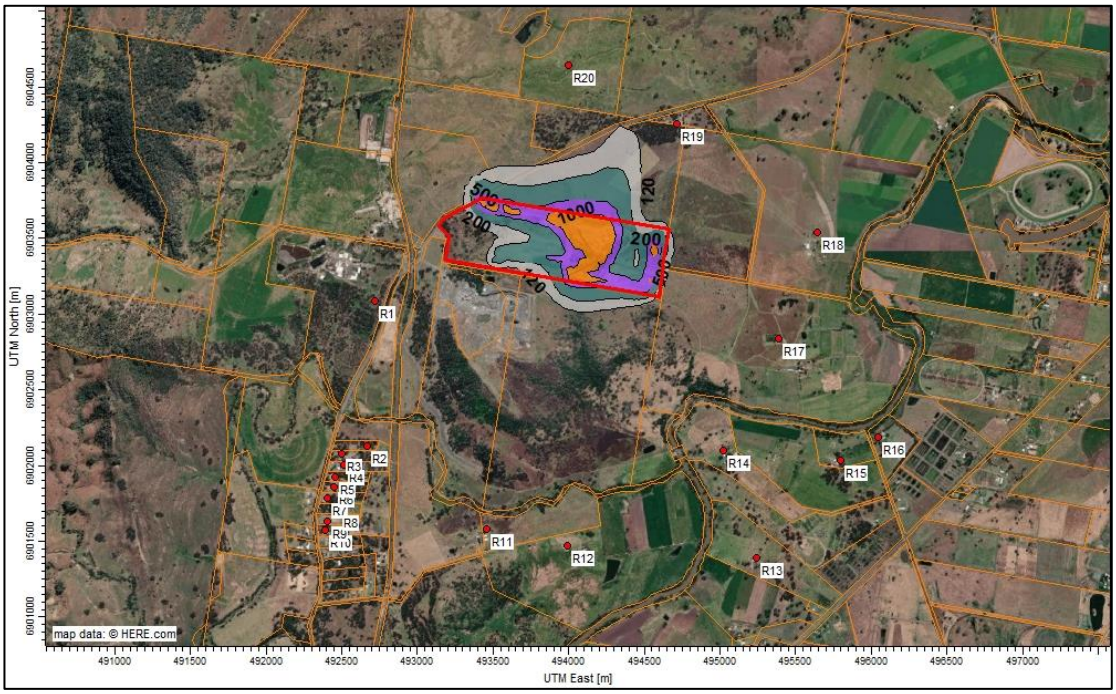
Pollutant:	Period:	Percentile:	Criteria:
$PM_{2.5}$	24 hours	100th	25 µg/m³

Figure 16: Predicted $PM_{2.5}$ 24-hour GLCs for Daily Peak Operations from Subject Site Only



Pollutant:	Period:	Percentile:	Criteria:
$PM_{2.5}$	1 Year	100th	8 µg/m³

Figure 17: Predicted $PM_{2.5}$ annual GLCs for Daily Peak Operations from Subject Site Only



Pollutant:	Period:	Percentile:	Criteria:
Deposited Dust	1 Month	100th	120 mg/m²/day

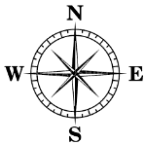
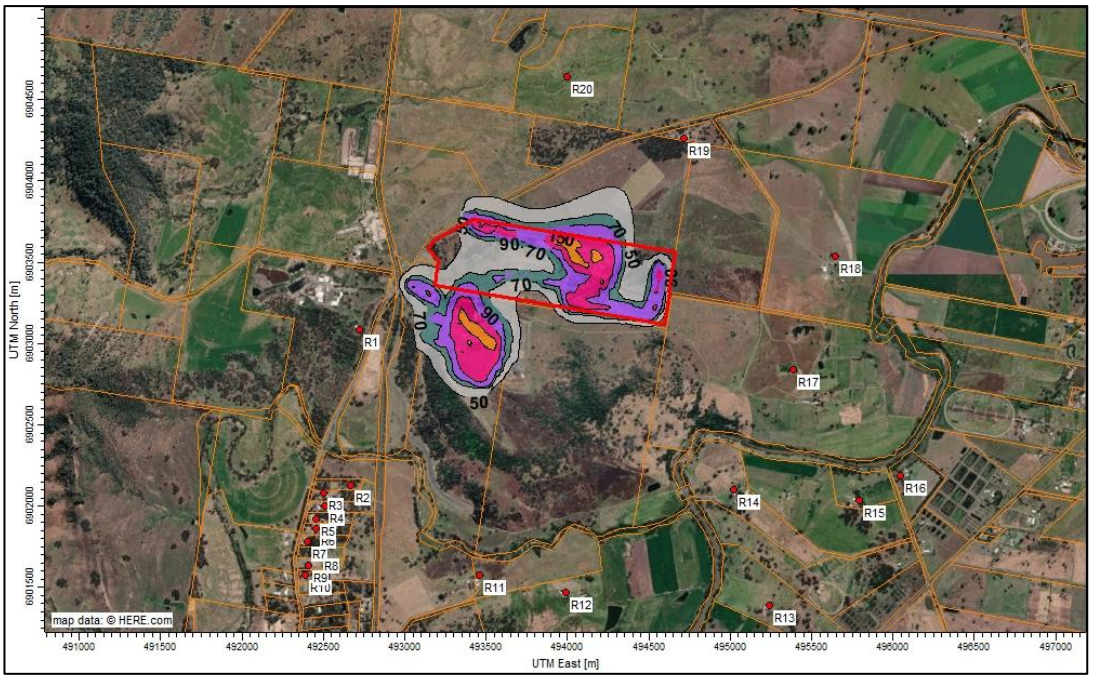


Figure 18: Predicted deposited dust GLCs for Daily Peak Operations from Subject Site Only

APPENDIX D: PREDICTED POLLUTANT GLC ISOPLETHS: CUMULATIVE

This Appendix presents the predicted ground level concentrations from peak daily production rate, adjacent BQ operations and contemporaneous background concentrations (excluding PM2.5, which are percentile background values) included. Due to the interpolation of the gridded results, there may be slight discrepancies with the discrete receptors.



Pollutant:	Period:	Percentile:	Criteria:
TSP	1 Year	100th	90 µg/m3

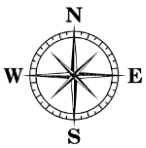
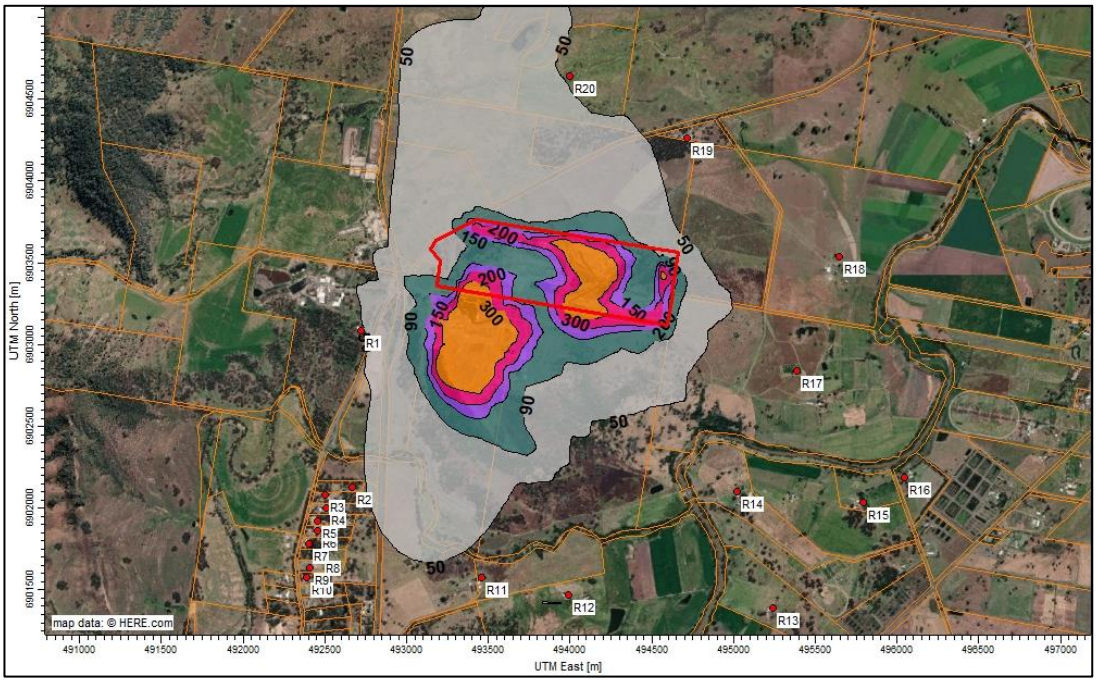


Figure 19: Predicted TSP GLCs for Cumulative Operations and Backgrounds



Pollutant:	Period:	Percentile:	Criteria:
PM_{10}	24 Hour	100^{th}	50 µg/m^3

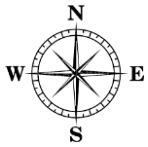
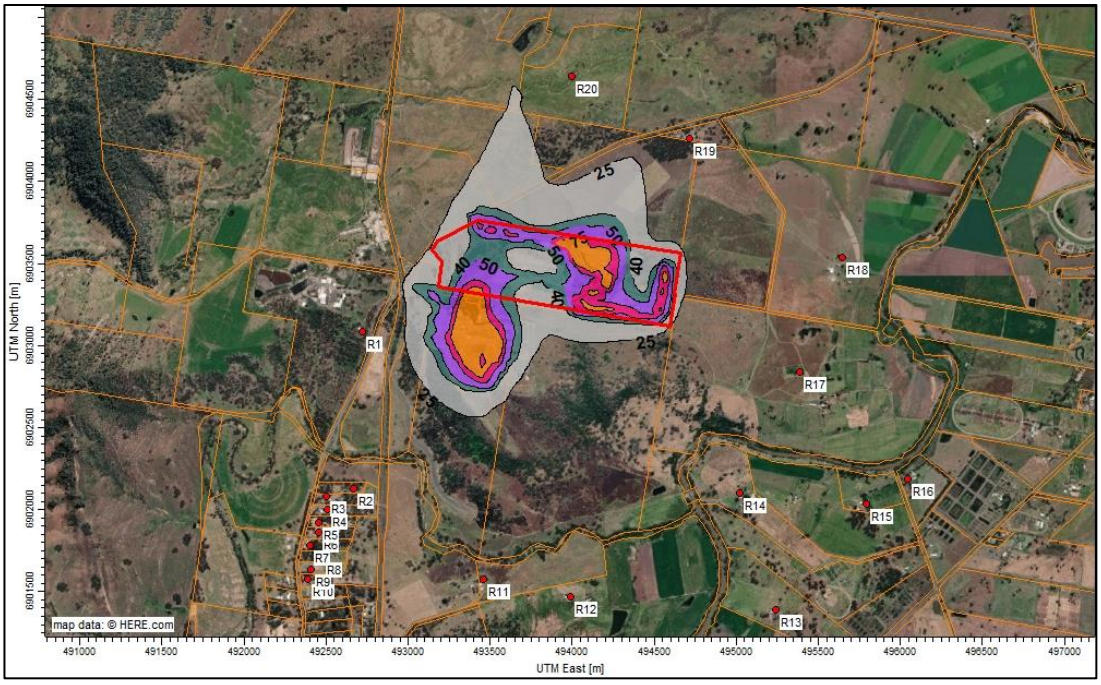


Figure 20: Predicted PM_{10} 24-hour GLCs for Cumulative Operations and Backgrounds



Pollutant:	Period:	Percentile:	Criteria:
PM_{10}	1 Year	100^{th}	25 µg/m^3

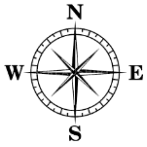
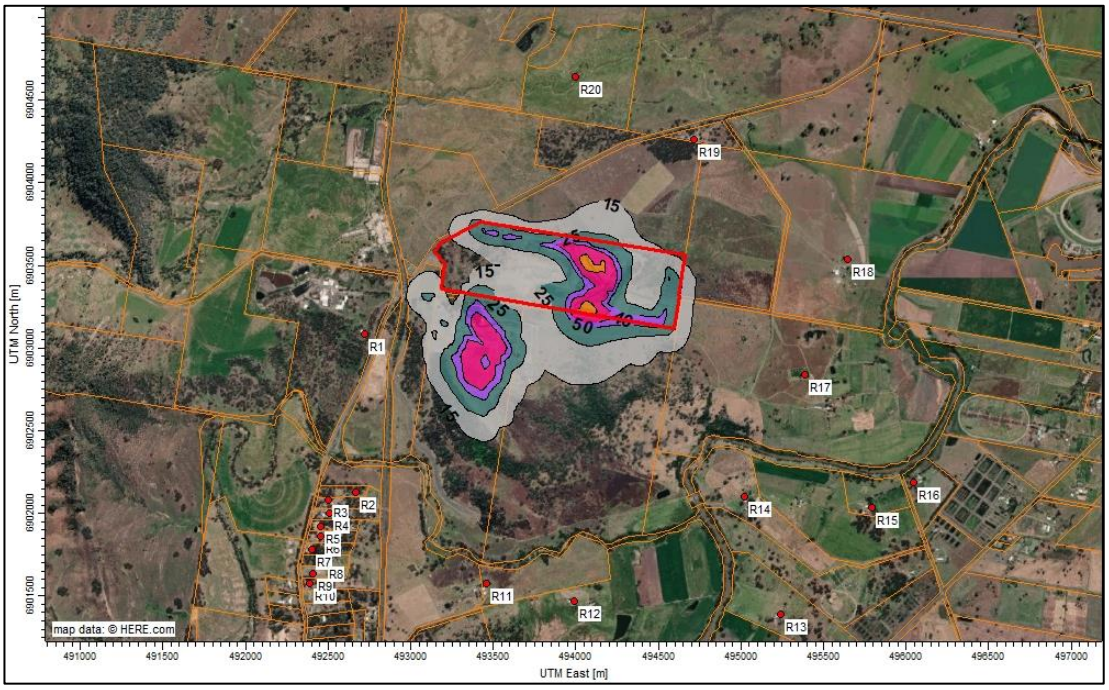


Figure 21: Predicted PM_{10} annual GLCs for Cumulative Operations and Backgrounds



Pollutant:	Period:	Percentile:	Criteria:
$PM_{2.5}$	24 hours	100th	25 µg/m³

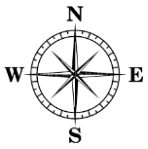
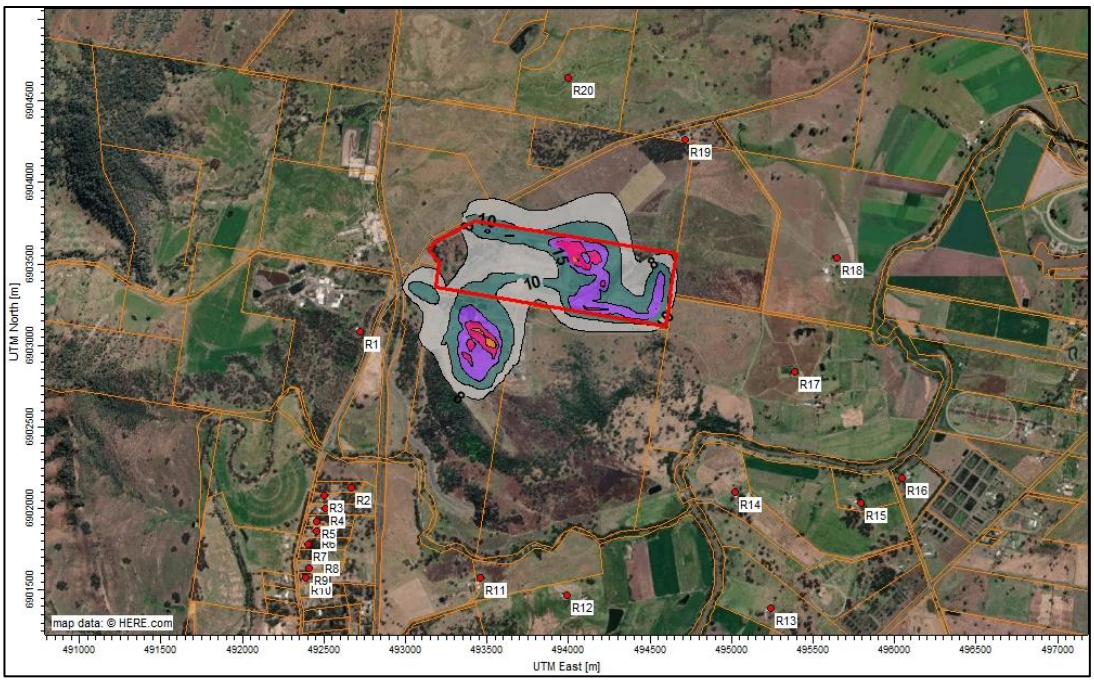


Figure 22: Predicted $PM_{2.5}$ 24-hour GLCs for Cumulative Operations and Backgrounds



Pollutant:	Period:	Percentile:	Criteria:
$PM_{2.5}$	1 Year	100th	8 µg/m³

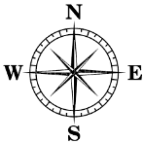
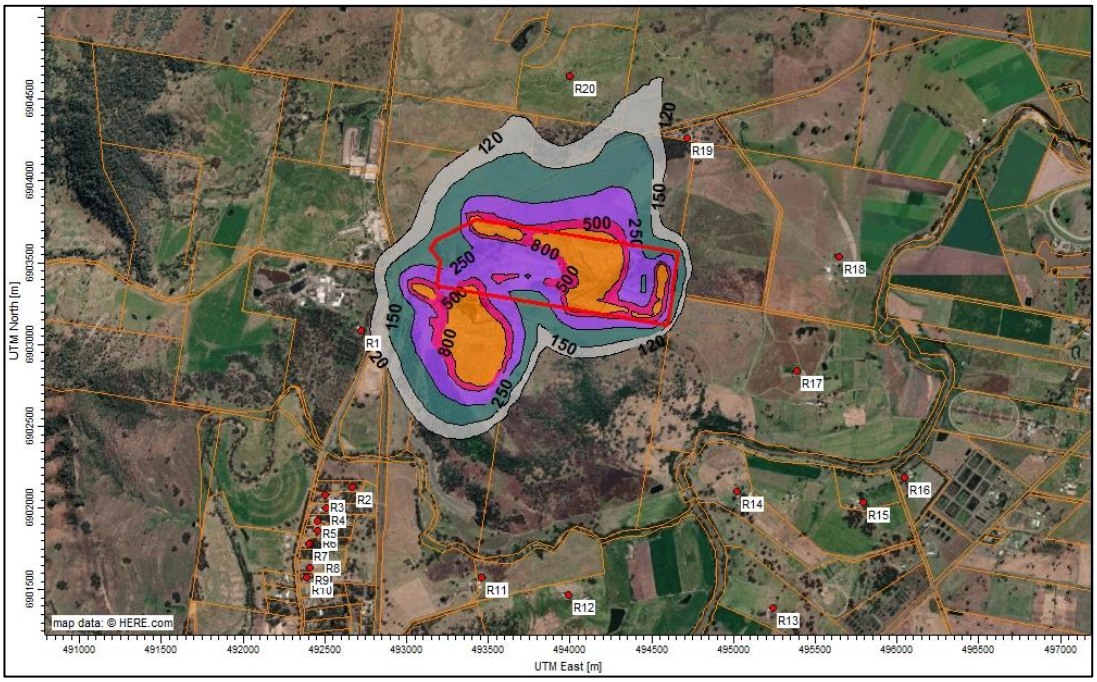


Figure 23: Predicted $PM_{2.5}$ annual GLCs for Cumulative Operations and Backgrounds



Pollutant:	Period:	Percentile:	Criteria:
Deposited Dust	1 Month	100th	120 mg/m²/day

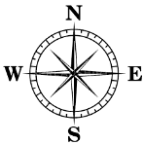


Figure 24: Predicted deposited dust GLCs for Cumulative Operations and Backgrounds

Attachment 3

EMR / CLR Search Results

Department of Environment and Science (DES)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.des.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Dye and Durham
gpo box 2746
brisbane QLD 4001

Transaction ID: 50782533 EMR Site Id: 25 May 2022
Cheque Number:
Client Reference:

This response relates to a search request received for the site:
Lot: 1 Plan: RP98576
291 SANDY CREEK RD
BROMELTON

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if DES has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if DES has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

Administering Authority