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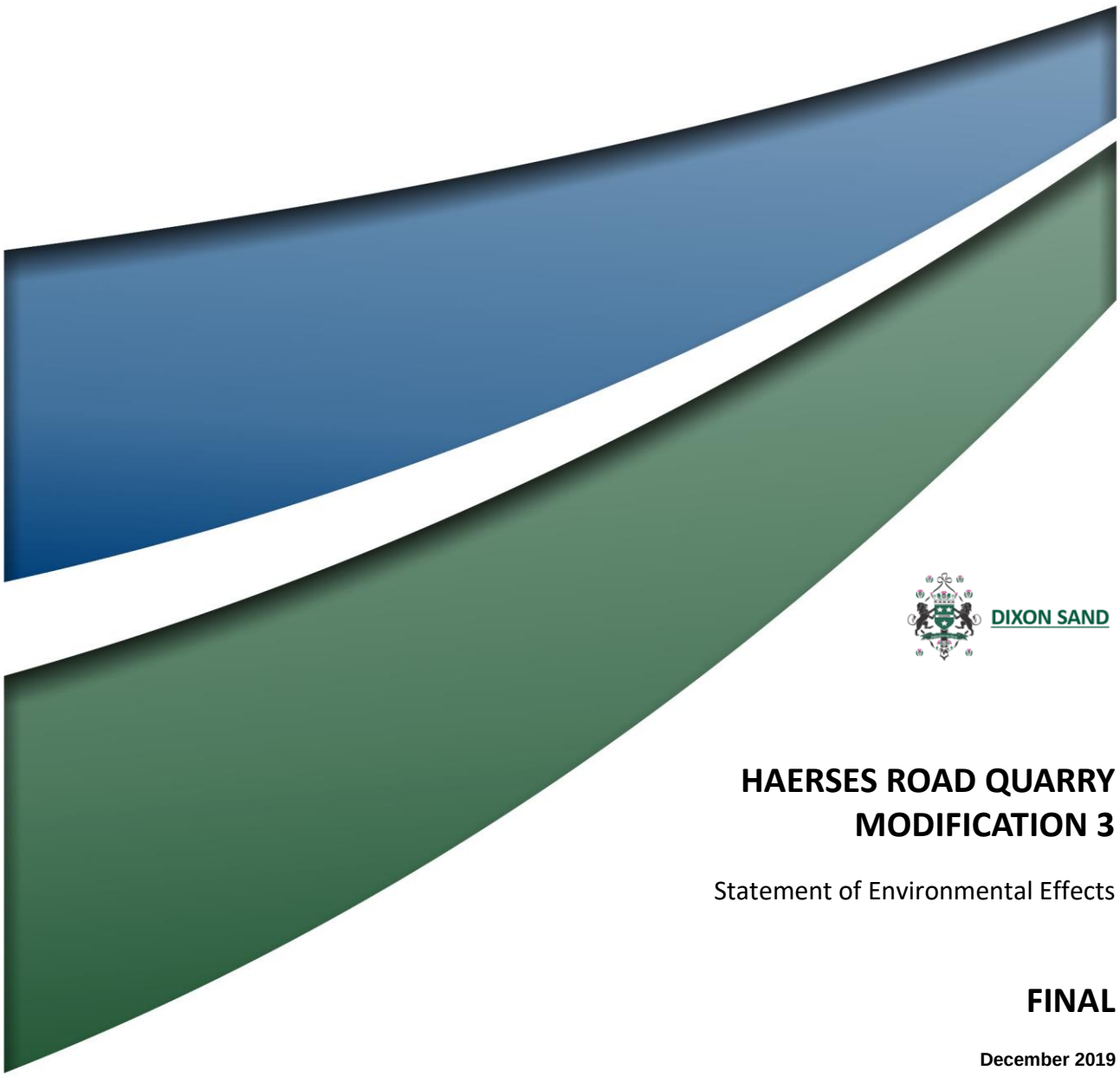

DIXON SAND

HAERSES ROAD QUARRY MODIFICATION 3

Statement of Environmental Effects

FINAL

December 2019

DIXON SAND

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Statement of Environmental Effects

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Dixon Sand (No. 1) Pty Limited

Project Director:	Alex Irwin
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Report No.	4607/R01
Date:	December 2019

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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
Final V3	Alex Irwin	6 December 2019	Alex Irwin	12 December 2019

Executive Summary

Background

Dixon Sand (No. 1) Pty Limited (Dixon Sand) operates the Haerses Road Quarry (the Quarry) located on Haerses Road at Maroota, NSW. Development consent (DA 165-7-2005), which provides for the extraction and processing of sand from the Tertiary Maroota Sand deposit at a rate of up to 250,000 tonnes per annum (tpa) for a period of 25 years, was originally granted by the Minister for Planning in 2006. DA has been modified twice since 2006, firstly in 2018 to extend the extraction area, to include extraction of friable Hawkesbury sandstone, and import Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM) for backfill and selective processing, and again in 2019 to correct an inconsistency between the approved area of disturbance and identified buffers to this disturbance.

Due to the recent increases in demand for medium to coarse grain sands and specialist sands in the Sydney market, Dixon Sand is seeking to modify DA 165-7-2005 to increase production limits, limits on the importation of VENM and ENM and allowable traffic movements.

The Proposed Modification

The key components of the proposed Modification are as follows.

- An increase in the rate of extraction and production from 250,000 to 495,000 tpa. The proposed extraction rate increase would better reflect the approved resource available for extraction which includes the additional 15 million tonnes (Mt) approved by MOD 1 (increasing the total resource to 20.8 Mt).

- An increase in importation of up to 250,000 tpa of VENM and ENM, principally to backfill the Hawkesbury sandstone extraction area, with select materials processed and blended with the Quarry sand resources. The increased rate of importation reflects the increased rate of extraction and production (so as to avoid a significant lag time between completion of extraction and final landform construction and rehabilitation).

- An increase in the number of daily heavy vehicle movements from 56 trucks per day to 180 trucks per day. This will accommodate both the increased production and VENM/ENM importation, as well as the proposed increase in sales direct to market which are likely to use smaller capacity trucks (and hence a greater quantity) than those currently operating between the Haerses Road and Old Northern Road Quarries.

- A small extension to Stage 5 of the Tertiary Sand Extraction Area, which is currently 80 metres (m) from Lot 3 DP111886 to the north (owned by Dixon Sand) (and 100 m to the private landholding on Lot 11 DP835992):
    - 30 m from Wisemans Ferry Road to the northwest,
    - the boundary of Lot 3 DP111886, and
    - 10 m from Hitchcock Road.

Approval for the Proposed Modification is being sought by Dixon Sand under Section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Need for the Modification

The modified quarry would provide a long-term, high quality supply of construction materials into the Sydney local and regional markets. This supply is needed to meet projected increased demand for concrete and other construction materials due to population growth and will contribute to the security and economic viability of the Sydney construction industry along with supply to other key specialty sand markets.

Importing VENM and ENM to the Quarry provides an alternative to disposal at waste management facilities and the use of VENM and ENM as backfill assists in the construction of the final landform, improving the environmental outcomes of the Quarry.

The Modification would also increase employment at the site with up to 16 full time jobs required.

Overview of Environment Impacts

This Statement of Environmental Effects (SEE) includes a detailed assessment of the potential environmental and social impacts of the Modification and identifies the management and mitigation measures that will be implemented as part of the Modification. A brief summary of the key findings of the assessment process is provided in **Table ES1**.

Table ES1 Summary of the Key Environmental Impact Assessment Findings

Environmental issues	Overview of Potential Impacts
Traffic and transport	The Modification would increase the total traffic movements for the quarry by 62 truck movements per day along Wisemans Ferry Road (east or west of Haerses Road) and Old Northern Road (south of Wisemans Ferry Road). Based on assessment, both Wisemans Ferry Road and Old Northern Road operate well within their capacity, providing an overall Level of Service B. The key intersections potentially affected by the Modification are the T intersection of Haerses Road with Wisemans Ferry Road and Wisemans Ferry Road with Old Northern Road. The intersection of Haerses Road and Wisemans Ferry Road is currently being upgraded in accordance with the requirements of the DA 165-7-2005 (as modified in January 2018). Sidra intersection analysis confirms that both intersections would provide capacity to support the increased traffic associated with the Proposed Modification, maintaining Level of Service A with minimal delays for all movements. No further road or intersection modifications are required. Haulage volumes will not increase to the north, therefore the Proposed Modification would not impact the village of Maroota or Maroota Public School.

Environmental issues	Overview of Potential Impacts
Noise	A comprehensive Noise Impact Assessment has been completed in accordance with the Noise Policy for Industry to produce Project Noise Trigger Levels (PNTLs) for DA 165-7-2005 and assess likely compliance against these. Considering operating scenarios in the various extraction stages of the Quarry, under prevailing (noise enhancing) meteorological conditions and after implementation of all reasonable and feasible noise mitigation measures, the modelling predicts the following. • Compliance with the PTNLs is predicted at all but Receiver R02. • A noise agreement with the landowner of Receiver R02, located opposite the Quarry Entrance and therefore subject to noise generated by trucks entering and egressing the Quarry, will be extended for the period of the Proposed Modification. Road traffic noise levels are predicted to increase, but only by 1 dB(A), and therefore comply with the criteria of the NSW Road Noise Policy noise criteria during both day and night periods.
Air quality	Dust emissions during operation of the Quarry have been estimated based on activities and equipment that would be operating under two scenarios considered to represent worst-case for dust emissions. The results for the incremental increases from the Proposed Modification on an annual and worst case operational basis, when added to the background concentrations are below the respective EPA criteria for all of the potential pollutants (PM_{10}, $PM_{2.5}$, total suspended particulates and dust deposition). The results for the cumulative assessment indicate there are no predicted exceedances of the 24-hour average PM_{10} criteria due to the Proposed Modification alone. When considering cumulative concentrations, however, there is one receptor (PF3, owned by a neighbouring Quarry operator), that is predicted to experience one additional day over the EPA cumulative criterion. If the worst day operations happened to coincide with already elevated background concentrations, the relevant criteria may be exceeded. However, this outcome is considered unlikely to occur. For the cumulative 24-Hour $PM_{2.5}$ the results indicate that the Modification would be unlikely to result in any days over the impact assessment criteria of 25 $\mu g/m^3$, and that the Modification would have a very minimal impact on current $PM_{2.5}$ concentrations.
Groundwater	A Groundwater Assessment was undertaken to assess the potential impacts of the Proposed Modification on the existing groundwater regime, i.e. the Maroota Tertiary Sand Groundwater Source (MTSGS) which occurs below the Tertiary Sand Extraction Area. Based on extraction remaining at least 2 m above the wet weather groundwater level of the MTSGS, it has been confirmed that the Proposed Modification would have no direct impact on local groundwater or groundwater users. Through assessment against the Minimal Impact Considerations of the *NSW Aquifer Interference Policy* (DPI NOW, 2012), the Groundwater Assessment has confirmed that the Proposed Modification would not trigger further assessment or the requirement for an Aquifer Interference Approval.
Surface Water	An assessment of the potential impacts of the Proposed Modification on surface water has confirmed that the existing and approved Water Management System (WMS) for the Quarry would remain adequate for the proposed modified operations. The minor extension to Stage 5 of the Tertiary Sand Extraction Area will not increase the maximum Quarry catchment. As such there will be no additional impact on catchment yield and any capture of surface water take will be appropriately licensed. No additional sand washing is proposed and as a result the existing water balance for the Quarry remains valid. With the continued implementation of the erosion and sediment control measures nominated in the Quarry Water Management Plan, it is not expected the Proposed Modification would be likely to result in any additional impacts on surface water.

Environmental issues	Overview of Potential Impacts
Visual amenity	Based on the visual assessment and visual cross-sections from four elevated vantage points to the north and west of the proposed extraction area extension, the main impact of the Proposed Modification would be the closer proximity of the vegetated bund wall. Views of the proposed extension are already obscured by existing intervening topography and vegetation, with impacts further mitigated by the construction and vegetation of an earth bund to the north and northwest of the proposed extraction area extension. Furthermore, the proposed extension to the extraction area represents only a 1.3% increase in the total disturbance area of the Quarry, and will only be disturbed towards the end of the Quarry life. Given the obstructed nature of views, the proposed relocation of the vegetated bund wall to prevent direct views of the Quarry from vantage points to the north and northwest, the impact of this modification is considered to be of low impact.
Ecology	Given the largely rural areas surrounding the proposed extraction area extension, and the highly modified vegetation, the level of connectivity with any remnant vegetation is low and exists as a fragmented landscape. As such, the Proposed Modification will not create additional edge effects on biodiversity values in the surrounding area. Construction and operational noise, dust and light spill impacts resulting from the Proposed Modification will be minimal and temporary in nature and there will be no measurable incremental change to noise, dust or light spill impacts on adjoining habitat areas. Weed and pathogen species could be inadvertently brought into the proposed extraction area extension and spread to the surrounding vegetation with imported VENM and ENM materials. The presence of weed species within the proposed extraction area extension has the potential to decrease the value of extant vegetation to native species, particularly threatened species. With the implementation of appropriate biosecurity management measures, it is unlikely there will be any substantial change to impacts on adjoining vegetation areas from weeds or pathogens.
Aboriginal heritage	In line with current legislative requirements, an Archaeological Due Diligence Assessment has been undertaken in accordance with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (2010). Desktop searches were undertaken along with a visual inspection of the area to be impacted. No Aboriginal objects were identified during the inspection and on the basis of this, and the desktop analysis, it is assessed that there is a low likelihood that the proposed works will result in harm to Aboriginal objects.

Further details of the predicted environmental and social impacts of the Modification are provided in the main text of this SEE and associated technical reports. The SEE includes commitments by Dixon Sand to the implementation of management, mitigation and offset measures to minimise the predicted impacts of the Modification.

Conclusion

The Proposed Modification has been evaluated against the principles of Ecologically Sustainable Development (ESD), section 1.3 (Objects) and section 4.15 (Evaluation) of the EP&A Act and relevant clauses and requirements of local, regional and state planning instruments. This assessment confirms the Proposed Modification to be consistent with the relevant principles and requirements in each case.

On considering the balance of the potential impacts of the Proposed Modification on the environment and community, and the benefits of and the need for the proposed changes, it would be reasonable to consider that with the implementation of the management, mitigation and offset measures proposed by the Proponent, the benefits of the Proposed Modification outweigh the impacts.

Table of Contents

Figures

Plates

Tables

Appendices

1.0 Introduction

1.1 Project Overview

Dixon Sand (No. 1) Pty Limited (Dixon Sand) operates the Haerses Road Quarry (the Quarry) on land adjoining Haerses Road at Maroota in New South Wales (NSW), within the Hills Shire Council Local Government Area (LGA) (refer to **Figure 1.1**). The Quarry site is approximately 128 hectares (ha) and includes Lot 170 DP 664766, Lot 170 DP 664767, Lots A and B DP 407341, Lots 176, 177 and 216 DP 752039 which adjoin Haerses Road (refer to **Figure 1.2**). Haerses Road is a no-through road providing access to the nominated lots of the Quarry, as well as Lot 7308 DP1163424 and Lot 1 DP1139713 of Deerubbin Local Aboriginal Land Council (LALC) (formerly Maroota State Forest).

The Quarry is located within the small rural community of Maroota which supports several other sand extraction operations, including the Old Northern Road Quarry which is also operated by Dixon Sand. The Quarry supplies concrete sand and specialty sands to the Sydney metropolitan market.

Dixon Sand is proposing a modification to the development to allow for a small extension in extraction area, an increase in extraction and production rate and an associated increase in the amount of Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM) to be imported to the Quarry (the Proposed Modification). Associated with the production and importation increase and included as part of the Proposed Modification is an increase in the number of trucks permitted to travel to and from the Quarry.

1.2 The Proponent

The operator of the Quarry and proponent for the Proposed Modification is Dixon Sand Pty Limited; a family-owned and operated business supplying specialty concrete and mortar sands to the Sydney metropolitan region since 1955.

Dixon Sand currently operates three quarries at Maroota (Haerses Road Quarry, Old Northern Road Quarry and Laughtondale Gully Road Quarry) and one at Agnes Banks, NSW.

1.3 Planning Approval History

The Quarry operates in accordance with Development Consent DA 165-7-2005 (State Significant Development under the *State Environmental Planning Policy (State and Regional Development) 2011*) (SRD SEPP), originally issued by the Minister for Planning on 14 February 2006 (the development consent). Since commencing operations in 2006, the DA 165-7-2005 has been modified twice.

- The first modification (MOD 1) was issued under (the now repealed) Section 75W of *the Environmental Planning and Assessment Act 1979* (EP&A Act) on 22 January 2018 and approved an extension to the extraction area as well as the importation of VENM and ENM.
- The second modification (MOD 2) was issued under Section 4.55(A) of the EP&A Act on 29 January 2019 to correct an inconsistency between the approved area of disturbance and identified buffers to this disturbance.

The Proposed Modification described in this report will be the third modification to DA 165-7-2005.

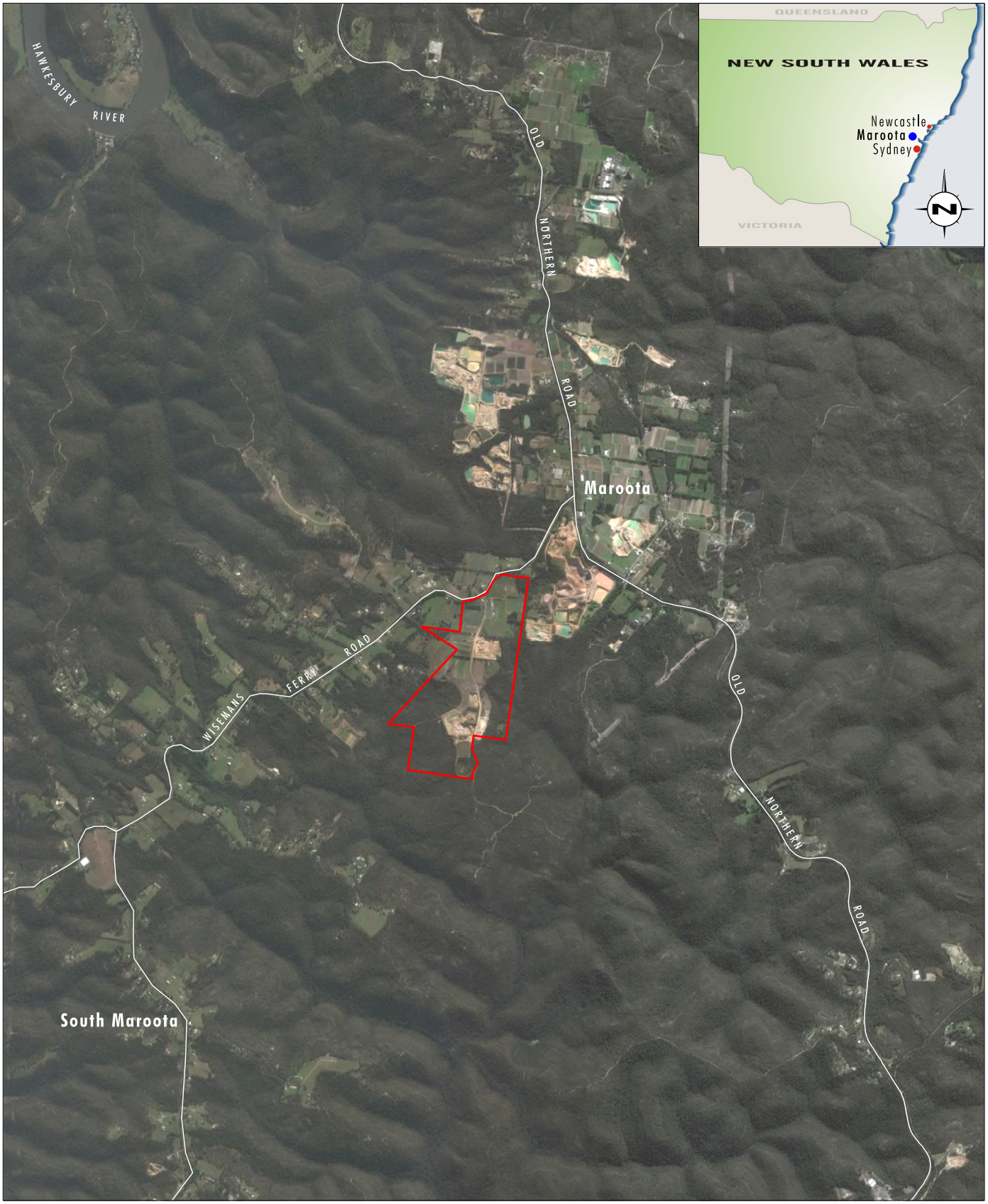

Image Source: Google Earth (2014)

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Legend

Haerses Road Quarry Site

FIGURE 1.1

Locality Map

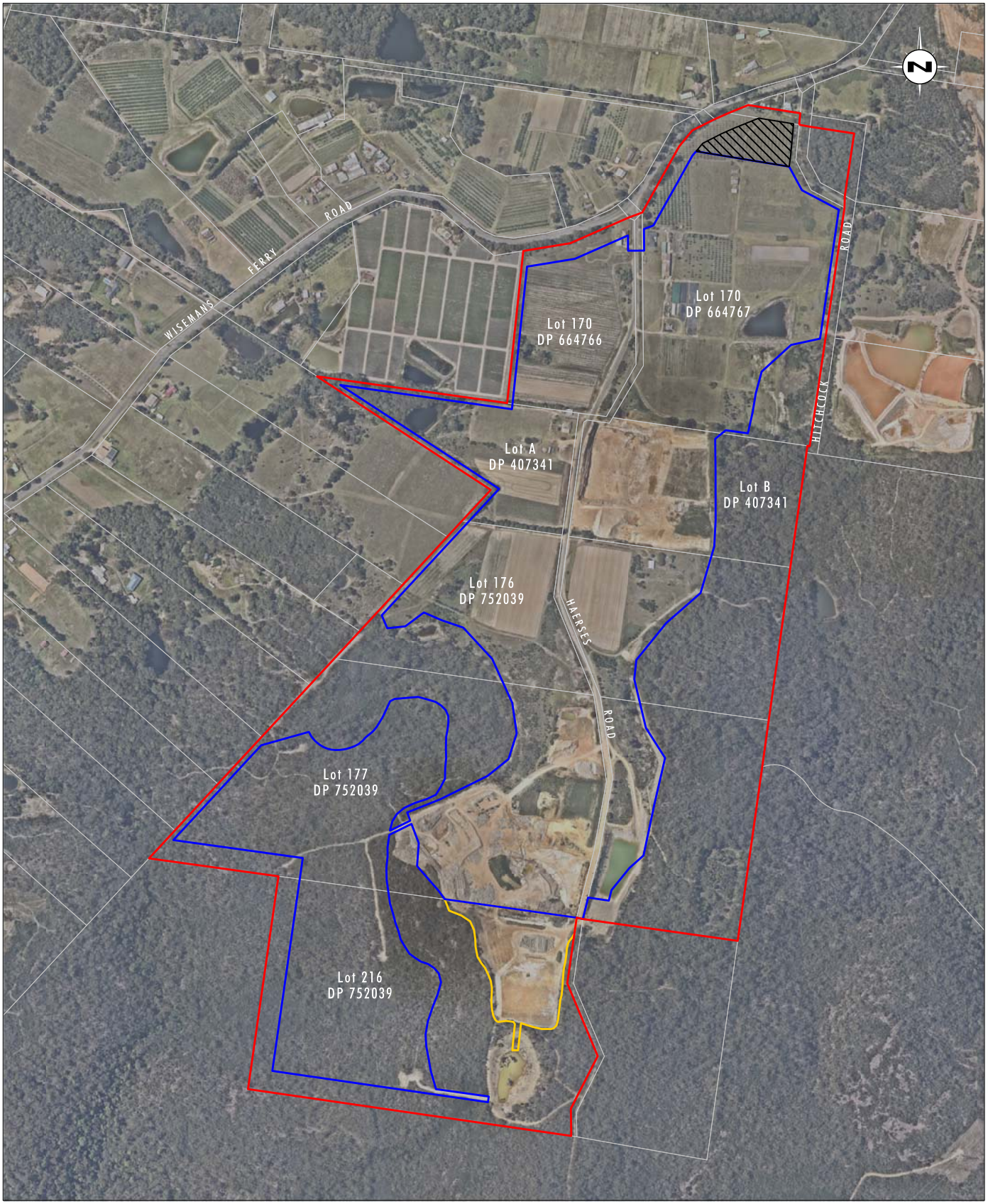

Image Source: Nearmap (Dec 2018)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2019)

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Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Processing and Stockpiling Area
- Proposed Extraction Area Extension

FIGURE 1.2

Site Plan

File Name (A4): R01/4607_009.dgn
20190826 16.56

1.4 Substantially the Same Development

As noted in **Section 1.3**, the Quarry was originally approved under the former Part 3A of the EP&A Act and then modified under the former Section 75W of Part 3A. Modifications to Part 3A approvals are governed by Clause 3BA of Schedule 2 to the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017* (EP&A Reg). In essence clause 3BA provides that section 4.55 will apply to a modification of a former Part 3A Approval if the consent authority is satisfied that "*the development to which the consent as modified relates is substantially the same development as the development authorised by the consent (as last modified under section 75W)*". In this case, DA 165-7-2005 was last modified under Section 75W (under the transitionary provisions of the former Clause 8J(8)(c) of the EP&A Reg) on 22 January 2018 to approve an increase in the extraction area (to include the friable Hawkesbury sandstone extraction stages, importation and either reprocessing or application to land of VENM and ENM, and wet processing).

With respect to the Proposed Modification, no additional development type or activity is proposed. The site would continue to be operated as an extractive industry (sand quarry) targeting the same resource, undertaking the same processing operations and importing VENM/ENM for selective processing and final landform construction. Quantitatively there are some differences between the development as currently approved and the Proposed Modification. However, increases in extraction and production rates are to be balanced by the implementation of operational and environmental controls which would ensure that these modifications do not to impact on ''material and essential'' elements of the current development.

On the basis of their being no additional activities proposed, with increases to extraction, production and transportation limits managed to minimise impacts, it is concluded that the modified development will be substantially the same as the current operations, as last modified, for the purpose of section 4.55 of the EP&A Act.

1.5 Environmental Assessment Requirements

Dixon Sand has consulted with the Department of Planning, Infrastructure and Environment (DPIE) in relation to the Environmental Assessment Requirements (EARs) for the Proposed Modification. The DPIE confirmed the EARs in a letter dated 5 March 2019. A copy of this correspondence is provided in **Appendix 2** and the requirements are summarised in **Table 1.1** below.

Table 1.1 Environmental Assessment Requirements

Requirement	Relevant SEE Section
Prepare technical assessments with respect to noise and air quality (with dispersion modelling) and ensure that the assessments are prepared in accordance with the following: *NSW Noise Policy for Industry* (2017), *NSW Road Noise Policy* (2011), *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (2016), and *Voluntary Land Acquisition Mitigation Policy* (2018).	**Sections 7.4** and **7.5**
Air Quality Consider the air quality impacts of the Proposed Modification on sensitive receivers, with a particular focus on dust emissions, PM10 and PM2.5, having regard to the *Voluntary Land Acquisition and Mitigation Policy*.	**Section 7.5**
Social Consider the potential social impacts arising from the modification, both positive and negative, with reference to the Social impact assessment guideline for *State significant mining, petroleum production and extractive industry development*, having particular regard to impacts on local amenity.	**Section 7.13**
Buffer zones/groundwater Provide a detailed justification for any proposed changes to existing buffer zones. As these changes would allow an expansion of the approved extraction area, the SEE will need to address potential impacts on groundwater.	**Section 7.7**
Visual Consider the visual impacts of the proposed extension to the extraction area, particularly on private landholders and key vantage points in the public domain.	**Section 7.9**
Consultation Recognising the importance of consultation with all relevant stakeholders, such as government agencies, Registered Aboriginal Parties, the Maroota Public School and affected residents, including those residents who may hold a private noise agreement with Dixon Sand, fully document the outcomes of the proposed Community Engagement Strategy.	**Section 6.0**

1.6 Project Team

Umwelt (Australia) Pty Limited (Umwelt) has prepared this SEE on behalf of Dixon Sand. The Traffic Impact Assessment (TIA), which forms part of the SEE, was undertaken by Seca Solution (Seca). The Air Quality Impact Assessment (AQIA) was undertaken by ERM Australia Pacific Pty Ltd (ERM) and the groundwater assessment was undertaken by Golder Associates Pty Ltd (Golder). The remaining specialist studies were completed by Umwelt. Full details of the project team are provided in **Appendix 1**.

1.7 Report Structure

This SEE has been prepared in accordance with the EP&A Act and Regulation (refer to SEE Statement of Authorship in **Appendix 1**) and the Environmental Assessment Requirements for Modification 3 provided by the DPIE (refer to **Appendix 2**). The SEE comprises a main text component and supporting studies, which are included as appendices. An overview of the layout of the main text is presented in **Table 1.2** below.

Table 1.2 Statement of Environmental Effects Structure

SEE Section	Environmental Assessment Details
Executive Summary	Provides a brief overview of the Proposed Modification, the major outcomes of the environmental assessment and key project commitments to mitigate potential impacts
Section 1.0	Provides the background for the Proposed Modification, key Proposed Modification details, the proponent (Dixon Sand) and the assessment team
Section 2.0	Provides the site context and details about the existing environment
Section 3.0	Identifies the existing approvals, describes the existing operations and identifies the activities to be modified
Section 4.0	Justifies the need for the Proposed Modification, describes the Proposed Modifications to approved activities and describes the alternatives considered in the development of the Proposed Modification
Section 5.0	Provides a description of the current planning context for the Proposed Modification
Section 6.0	Describes the stakeholder consultation process undertaken as part of the Proposed Modification and environmental assessment process
Section 7.0	Provides a comprehensive analysis and assessment of the potential environmental and community impacts of the Proposed Modification
Section 8.0	Provides a summary of proposed management and mitigation commitments for the Proposed Modification
Sections 9.0	Provides a conclusion and justification for the Proposed Modification
Section 10.0	References

2.0 Site Context

2.1 Land Ownership

Dixon Sand owns all the land within the Haerses Road Quarry Site, being Lot 170 DP 664766, Lot 170 DP 664767, Lots A and B DP 407341, and Lots 176, 177 and 216 DP 752039, as shown in **Figure 1.2**. The Proposed Modification would not require any works outside the existing Quarry site boundary and therefore is entirely contained within land owned by Dixon Sand.

The land immediately surrounding the Quarry site generally consists of privately owned rural residential lots (including one owned by Dixon Sand), with other quarrying operations to the north, east and west and the Deerubbin LALC property (formerly the Maroota State Forest) to the south and east.

2.2 Land Use

Prior to the commencement of quarrying activities, the land was used for orchards and growing horticultural crops (primarily on Lot 170 DP 664766, Lot 170 DP 664767, Lots A and B DP 407341, and Lot 176 DP 752039) with the southern-most portion of the Quarry site (namely Lots 177 and 216 DP 752039) consisting of native vegetation. The horticultural land uses remain ongoing in the central and northern parts of the Quarry Site where currently unaffected by extraction activities. Those areas of native vegetation on the southern portion of the Quarry Site which are not approved for disturbance are to be conserved and managed as a biodiversity offset for both the Haerses Road and Old Northern Road Quarries of Dixon Sand. These offset areas are identified by conditions 30 to 32 of schedule 3, and figure 1 of Appendix 4 of the development consent (refer to **Figure 2.1**).

There were previously five dwellings located along Haerses Road, however, as a result of the progressive development of the Quarry this has been reduced to three dwellings along the northern part of Haerses Road with a fourth now used as the Dixon Sand Haerses Road Quarry site office.

The predominant land uses within the immediate vicinity of the Quarry site include an extractive industry operated by PF Formation to the immediate east, rural residential properties along Wisemans Ferry Road and bushland associated with the Deerubbin Local Aboriginal Land Council (LALC) property to the south and east of the Quarry site. The land uses in the local area include fruit orchards, market gardens, quarries, grazing of livestock and rural residential properties. Notably, the surrounding region is a significant area for quarrying, and **Figure 2.2** identifies the quarries that are currently operating within 5 km of the Quarry.

- Old Northern Road Quarry (Dixon Sand) – located off Old Northern Road approximately 2 km north.
- Laughtondale Gully Road (Dixon Sand) –Laughtondale Gully Road, approximately 5 km north.
- Maroota Sandstone Quarry (Maroota Sandstone) – located off Laughtondale Gully Road approximately 5 km north.
- Pit 3 and Pit 5 (PF Formation) – located off Old Northern Road approximately 3.5 km north.
- Old Telegraph Road Sand Extraction (PF Formation) – located off Old Telegraph Road approximately 2.5 km north-east.
- Hitchcock Road Sand Extraction (Trig Hill) (PF Formation) – located off Wisemans Ferry Road approximately 700 m east (between Hitchcock Road and Old Northern Road).
- Roberts Road Quarry (Hodgson Quarries) – located off Roberts Road approximately 1.5 km north-east.

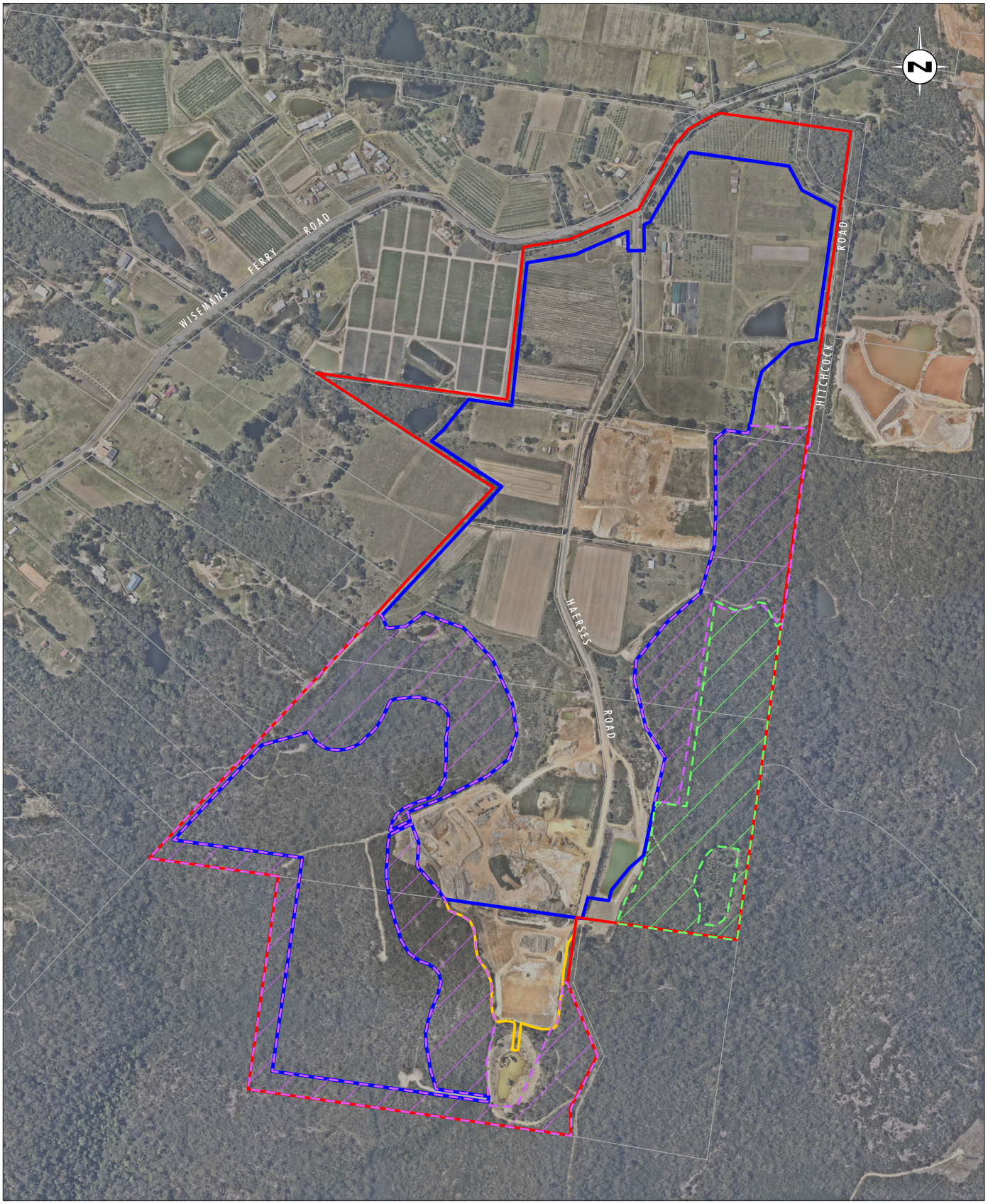

Image Source: Nearmap (Dec 2018)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2019)

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- Haerses Road Quarry Site
- Approved Extraction Area
- Processing and Stockpiling Area
- Biodiversity Offset Area for Old Northern Road Quarry
- Biodiversity Offset Area for Haerses Road Quarry

FIGURE 2.1

Existing Biodiversity Offset Areas

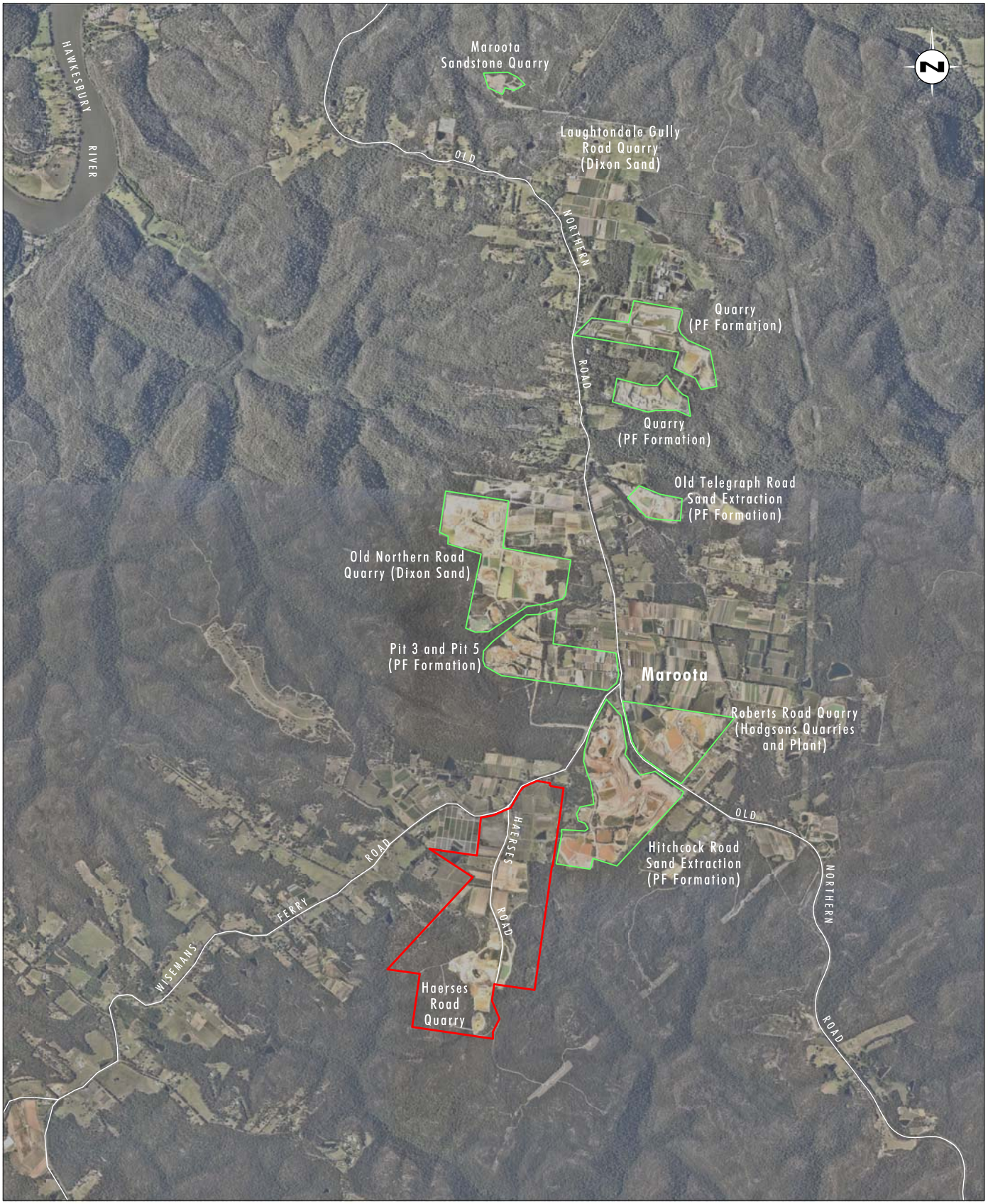

Image Source: Nearmap (Dec 2018)

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- Haerses Road Quarry Site
- Approximate Local Quarry Boundary

FIGURE 2.2

Local Quarry Operations

2.3 Topography and Drainage

The Hearses Road Quarry site is located within the catchment of Little Cattai Creek with surface runoff draining to the west to an unnamed tributary of Little Cattai Creek. To the south of the quarry site Little Cattai Creek flows in a southerly then westerly direction before joining the Hawkesbury River approximately 11 km to the south-west (refer to **Figure 2.3**).

Local topography consists of a north/south aligned ridge on which Haerses Road is located, with the land sloping away to the east and west. Within the Quarry site Haerses Road is at an elevation of approximately 190 m sloping away to the west to the lowest point within the site of approximately 110 m.

2.4 Geology and Groundwater

The geology of the Haerses Road Quarry site is shown in **Figure 2.4** and comprises a tertiary sand deposit of fluvial and eluvial sediments which occurs along the ridgeline which broadly follows the alignment of Haerses Road. The sand deposit sits atop Hawkesbury sandstone which was deposited in the Triassic and is a massive, homogeneous quartz arenite with a fine to coarse matrix (Bureau of Mineral Resources, 1961; EMM, 2018). As shown on **Figure 2.4**, the Hawkesbury sandstone also surrounds the tertiary sand deposit on the site.

There are two key aquifers of relevance to the Quarry site:

- the Maroota Tertiary Sand Groundwater Source (MTSGS), which is a shallow aquifer occurring in the tertiary sand deposit
- the Sydney Central Basin Groundwater Source (SCBGS), a deeper aquifer which occurs within the Hawkesbury sandstone.

Perched water tables also occur within the shallow aquifer where clay layers prevent the infiltration of groundwater by gravity to lower levels of the aquifer.

Further assessment of groundwater with reference to the Proposed Modification and the recently completed *Maroota Extractive Industry Groundwater Study* (EMM, 2018) is contained within **Section 7.7** and **Appendix 8**.

2.5 Sensitive Receivers

The Quarry site is located on the south-western outskirts of the rural community of Maroota, which supports a small rural residential population of 617 people (Australian Bureau of Statistics, 2017). The Maroota Public School is located approximately 1.6 km to the north of the Quarry site. Other small rural communities located in the region include South Maroota, which is located approximately 4 km south-west of the site and Wisemans Ferry, which is located approximately 9 km north of the site.

Haerses Road Quarry is a substantial distance from any major residential areas. The closest being Windsor located approximately 21 km to the south west, Rouse Hill located approximately 24 km to the south south-west and Hornsby located approximately 27 km to the south-east.

There are 21 private residences located in the area immediately surrounding the site, as shown on **Figure 2.5**. At the northern end of the site there are also three additional residences that are owned by either Dixon Sand or the neighbouring PF Formation quarry operation.

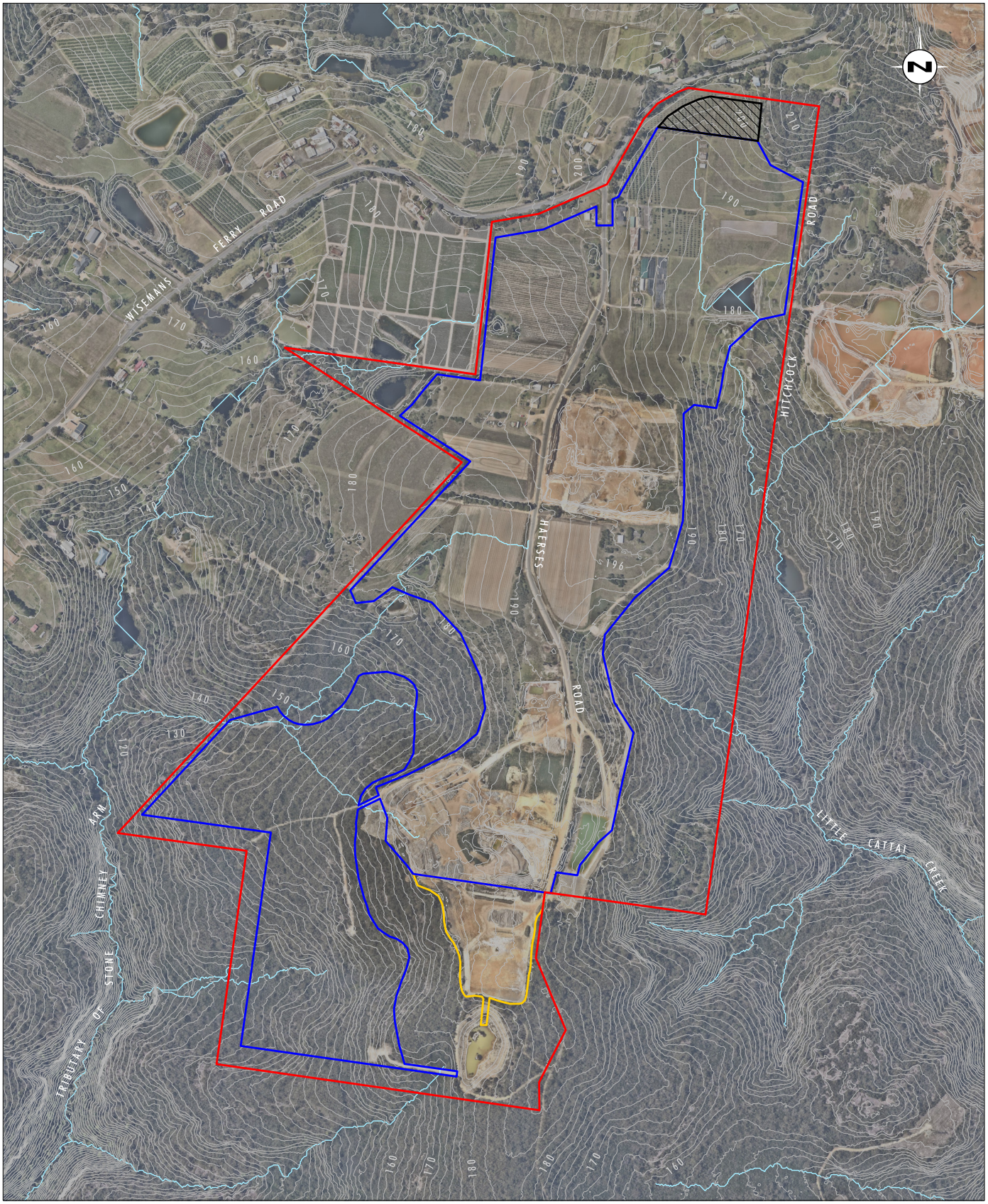

Image Source: Nearmap (Dec 2018)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2019)
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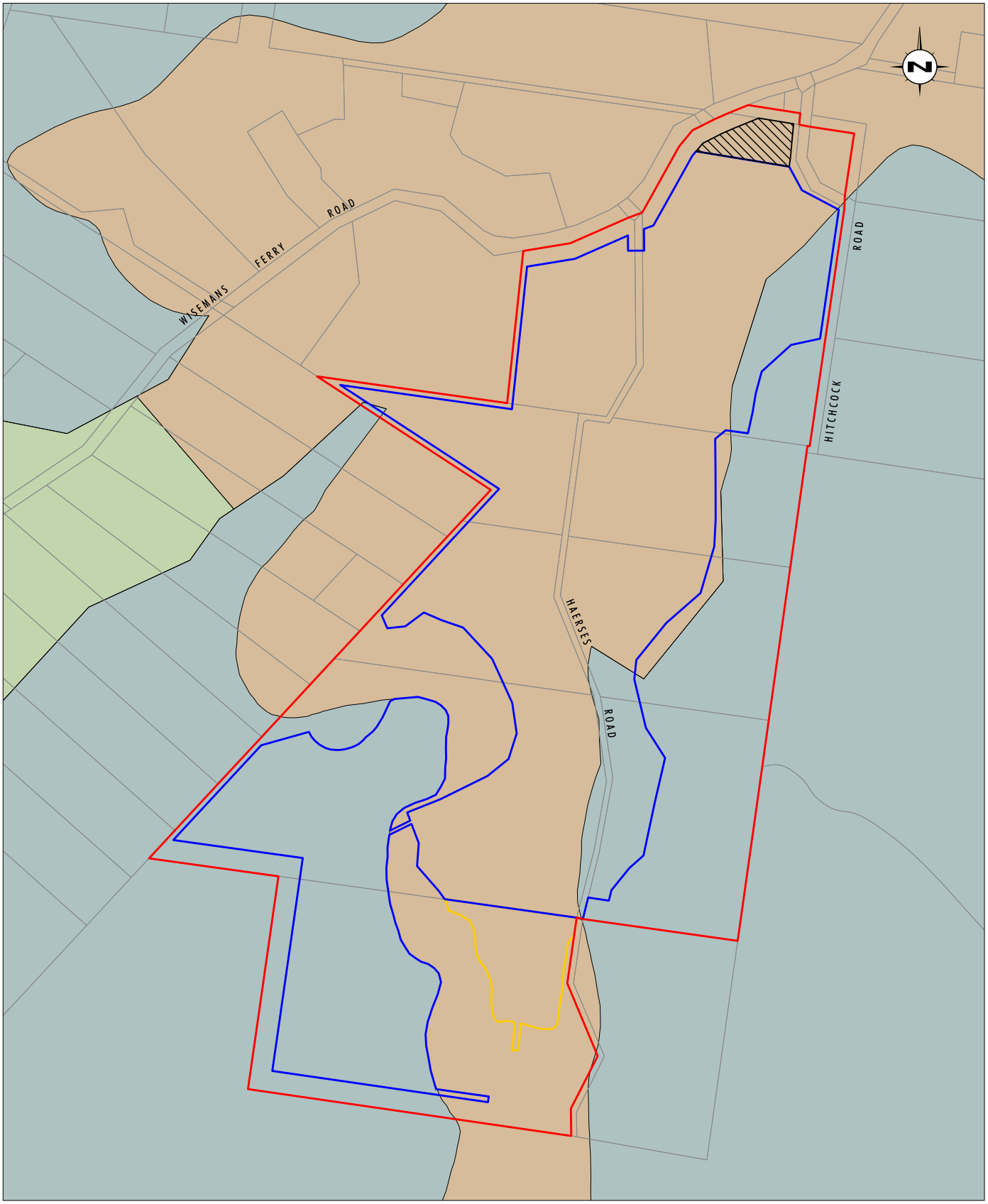
Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Processing and Stockpiling Area
- Proposed Extraction Area Extension
- Drainage Line

FIGURE 2.3

Topography and Drainage



Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2019), Mineral Resources NSW, December 2003

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Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Processing and Stockpiling Area
- Proposed Extraction Area Extension
- Tertiary (Sand, silt, clay & gravel)
- Bringelly Shale, Minchinbury Sandstone, Ashfield Shale
- Hawksbury Sandstone

FIGURE 2.4

Local Geology

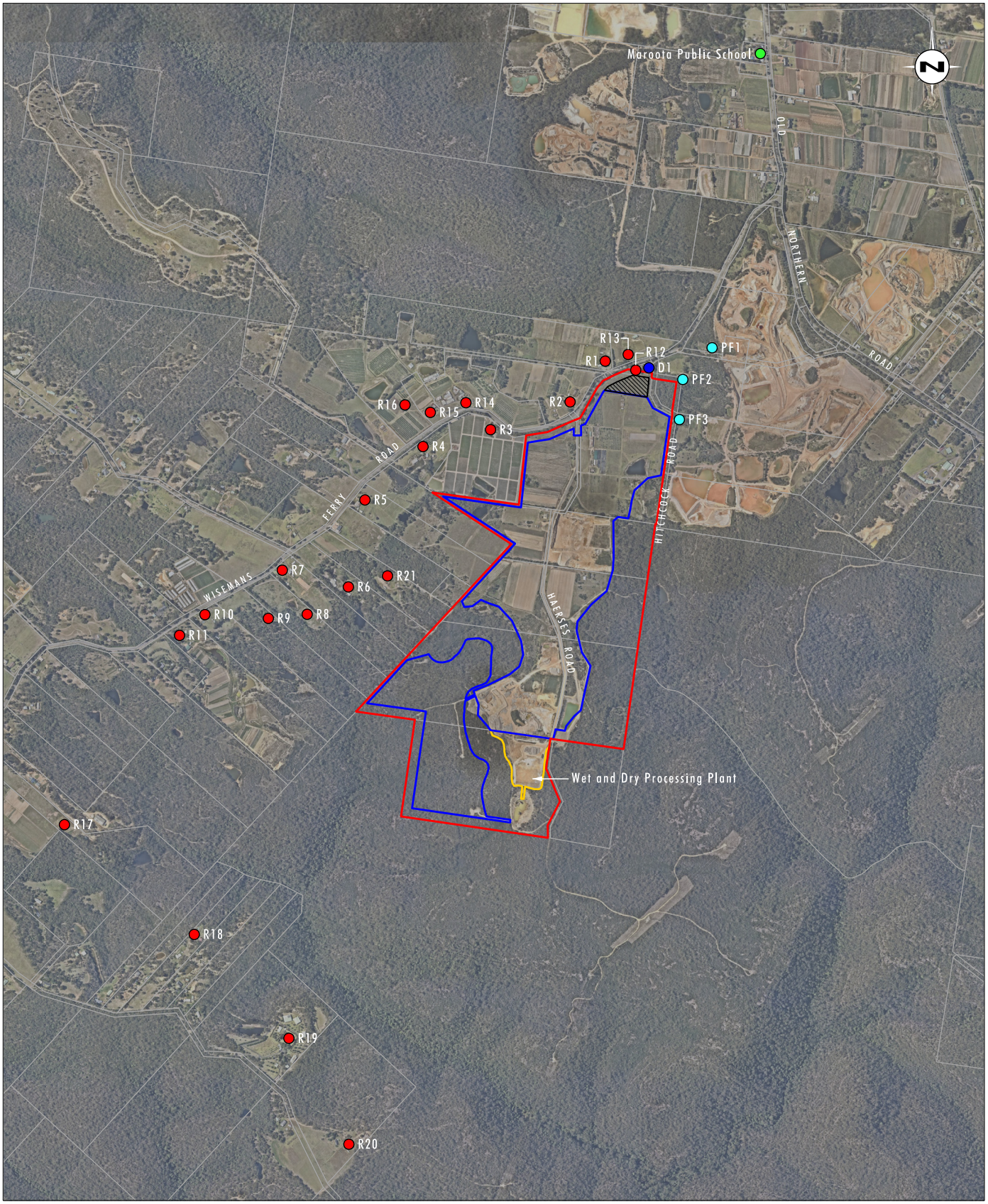

Image Source: Nearmap (Dec 2018)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2019)

0 0.25 0.5 1.0km
1:22 000

Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Processing and Stockpiling Area
- Proposed Extraction Area Extension
- Residential
- Owned by Dixon Sand
- Owned by PF Formation
- Maroota Public School

FIGURE 2.5

Sensitive Receivers

File Name (A4): R01/4607_014.dgn
20150309 9.47

3.0 Approved Development

3.1 Existing Approvals

As previously discussed in **Section 1.3**, the Quarry currently operates under DA 165-7-2005, which has been previously modified twice since approval in February 2006. Dixon Sand also holds an Environment Protection Licence (EPL) 12513 for the scheduled activities of crushing, grinding or separating and extractive activities (as listed in Schedule 1 of the *Protection of the Environment Operations Act 1997* (POEO Act). EPL 12513 establishes conditions relating to air and noise emissions from the site.

Dixon Sand also obtained agreement from the NSW Roads and Maritime Service (RMS) for upgrade works to the Wisemans Ferry Road intersection with Haerses Road, to provide a channelised right turn (CHR) treatment, in satisfaction of Condition 24 of Schedule 3 of the development consent.

Dixon Sand currently holds two surface Water Access Licences (WALs) and associated works approvals for the Quarry. **Table 3.1** presents the WAL details.

Table 3.1 Water Access Licences

WAL Number	Associated Works Approval	Land Holding	Works	Extraction Limit (ML/year)[1]
25956	10CA105044	Lot 170 DP 664767	**Work 1** Bywash Dam **Work 2** 80 mm pump centrifugal pump **Work 3** 80 mm centrifugal pump **Work 4** Bywash Dam **Work 5** 32 mm centrifugal pump	132
25941	10CA104191	Lot B DP 407341	**Work 1** Bywash Dam x 2 **Work 2** 65 mm centrifugal pump	50

Note: [1] Extraction limit assuming a full allocation of 1 ML for each unit share

As all extraction activities are maintained above the wet weather groundwater table of the two regional aquifers, there will be no intentional interception of groundwater and therefore no water access licences for groundwater extraction are required under Section 56 of the *Water Management Act 2000* (WM Act). As State Significant Development (SSD), there is no requirement to obtain a controlled activity approval for works on waterfront land under section 91 of the WM Act.

3.2 Existing Operations

3.2.1 Approved Activities

The approved development consent provides for the operation of a sand quarry at an extraction rate of 250,000 tpa until February 2046. The development consent also approves the importation of up to 100,000 tpa of VENM and ENM.

Key components of the approved operations are as follows.

- Progressive extraction and rehabilitation of the five original extraction stages over the Tertiary Sand deposit and five recently approved extraction stages of MOD 1 from the Hawkesbury Sandstone deposit (refer to **Figure 3.1**).

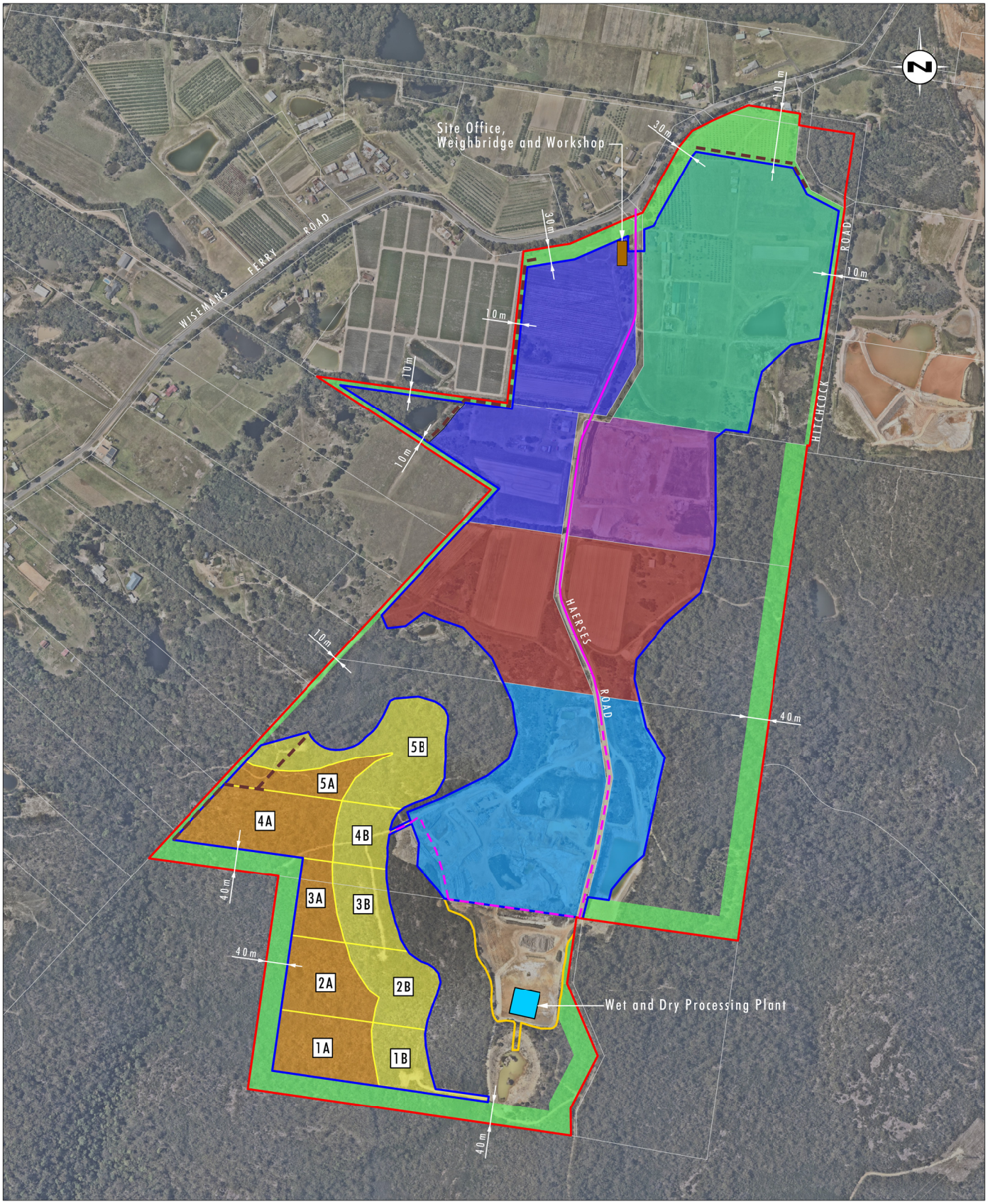

Image Source: Nearmap (Dec 2018)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2019)

0 100 250 500m
1:10 000

Legend

- Haerses Road Quarry Site
- Processing and Stockpiling Area
- Buffer Zone
- Approved Extraction Area
- Approved Extraction Area A
- Approved Extraction Area B
- [1] Extraction Cell Number
- Wet Processing Plant
- Approved Extraction Area Stage 1
- Approved Extraction Area Stage 2
- Approved Extraction Area Stage 3
- Approved Extraction Area Stage 4
- Approved Extraction Area Stage 5
- Site Office, Weighbridge and Workshop
- Indicative Unsealed Haul Road
- Approved Acoustic Bund
- Sealed Haul Road

FIGURE 3.1

Approval Quarry Site Layout

File Name (A4): R01/4607_007.dgn
20191016 13.55

- Extraction from the Hawkesbury Sandstone Stages 1B to 5B, which occur within a 100 m buffer zone to the Maroota Tertiary Sand Groundwater Source (MTSGS) of the tertiary sand deposit, will only proceed once groundwater monitoring data demonstrates groundwater will not be intercepted within this zone (which could be a recharge zone to the MTSGS).
- Progressive extraction and reinstatement of Haerses Road, which runs through the site, so that access is maintained during the life of the quarry.
- On-site crushing of the extracted Hawkesbury Sandstone. The crushing equipment is mobile and may be undertaken either within the active extraction area or the defined processing and stockpile area of the Quarry.
- On-site processing to remove coarse rejects using a mobile screen.
- On-site wet processing (washing) to remove fine material from the sand.
- Haulage of up to 190,000 tpa of screened sand to the Old Northern Road Quarry (for further processing and washing).
- Haulage of up to 250,000 tpa of screened sand direct to local and regional markets.
- Rehabilitation of the Quarry site to either Class 4 agricultural land or native vegetation.

3.2.2 Resource, Product and Markets

The Quarry currently produces a range of coarse, fine and ultra-fine sand and gravel products to the Sydney construction and landscaping market. As discussed in **Section 2.4**, sand is extracted from two distinct geological units with an analysis of the extractable resource (based on the approved extraction area of DA 165-7-2005) as follows.

Tertiary Sand Deposit

There has been no change to the resource assessment originally completed by Environmental Resources Management Australia in the 2005 Environmental Impact Statement supporting the original development application for the Haerses Road Quarry. Based on an average thickness of 10 to 12 m across the deposit, the recoverable resource was estimated at 7.3 Mt to be extracted over 25 years. Approximately 80% of this resource remains to be extracted.

Friable Hawkesbury Sandstone Deposit

A high level resource assessment was undertaken by Umwelt to support the application to undertaken extraction of this resource as a modification to DA 165-7-2005. As the Hawkesbury sandstone is a massive, homogeneous quartz arenite formation, the limiting factor in defining the resource for extraction has been to remain at least 2 m above the wet weather groundwater level. Noting the massive sandstone continues at greater depth below this, a resource of approximately 15 Mt of friable sandstone has been confirmed. Dixon Sand has yet to commence extraction from this resource.

Based on the identified sand resources, an extraction area 2 m above the wet weather groundwater level, and consideration of extraction since 2006, the current approval allows the extraction of a resource of approximately 20.8 Mt, comprising 5.8 Mt of tertiary sand and 15 Mt of friable Hawkesbury sandstone material.

No change to the current product range or markets is proposed. The in-situ resource to be extracted will also remain unchanged by the Proposed Modification.

3.2.3 Sand Extraction

3.2.3.1 Extraction Area

Sand is approved for extraction from two extraction areas as follows.

- Tertiary Sand Extraction Area: which includes the originally approved extraction area of the Quarry and targets the alluvial tertiary Maroota Sands deposits. This extraction area has been divided into five separate extraction stages as identified on **Figure 3.1**.
- Friable Sandstone Extraction Area: which includes the more recently approved extraction area (of MOD 1) and targets the friable Hawkesbury Sandstone deposit. This extraction area has been divided into five extractions cells, which further separated into Areas A and B in each stage representing the areas within the 100 m buffer (Area B) and outside the 100 m buffer to the Maroota Tertiary Sand Groundwater Source (which coincides with the Maroota Tertiary Sand Deposit, refer to **Figure 2.4**).

In accordance with Section 1 of Part 2 of the Hills Shire Council Development Control Plan (Hills DCP), the extraction areas of the Quarry retain the following buffers to the surrounding land (refer to **Figure 3.1**):

- 10 m to an adjoining property
- 30 m to a public road
- 40 m to National Park, State Forest or Crown lands boundary
- 100 m to a residence not associated with the Quarry[1]

A small increase in extraction area and equivalent modification (reduction) to the buffer zone between the Stage 5 Extraction Area and land to the north forms part of the Proposed Modification (refer to Section 4.2.1). Agreements with neighbouring landowners regarding the potential short-term changes in operational impacts have been obtained. While noting Clause 11 of SRD SEPP excludes the requirement for development control plans to be applied to State Significant Development, it is noted that in Section 1 of Part B, Section 1, Part 2 of The Hills DCP, the noted setbacks may be varied 'depending upon the nature and location of extractive industries'.

3.2.3.2 Extraction Methods

Extraction within the two extraction areas is typically undertaken as follows.

- Friable Sandstone Extraction Area
  The sandstone is ripped by bulldozer and then pushed into stockpiles before being loaded by excavator for transfer to crushers for size reduction and screening.
- Tertiary Sand Extraction Area
  No ripping is typically required, with an excavator digging and loading the sand to a dump truck for transfer to the processing area for screening and/or washing.

No changes to the method of extraction are proposed.

Some minor changes to machinery and an increase in extraction rate are proposed. These changes are described in Section 4.2.2.

[1] At the northern boundary of the Quarry site, an 80 m buffer is maintained, with the 20 m wide Crown road easement providing for a 100 m buffer to the residential property boundary.

3.2.3.3 Extraction Sequence and Staging

Extraction cells in the friable Hawkesbury sandstone or the Tertiary sand deposit have both been labelled 1 to 5 reflecting the anticipated sequence of extraction over the life of the Quarry (refer to **Figure 3.1**). As extraction is completed within the Tertiary sand resource, the landform will be profiled to construct a final landform for rehabilitation (refer to **Section 3.2.9**).

As each cell in the friable Hawkesbury sandstone resource is completed, the area will be used for the construction of silt dams for deposition and retention of the silt and fines generated by the sand washing process (refer to **Section 3.2.5**) and/or the placement of VENM and ENM imported to the Quarry Site. As the placement of silt and/or VENM and ENM fills the void space, a final landform will be constructed and prepared for rehabilitation (refer to **Section 3.2.9**).

In order to maximise the efficiency of the excavator and dump trucks, extraction typically occurs in either the friable Hawkesbury sandstone or the tertiary sand deposit. The dozer works independently of the excavator and dump trucks and therefore could be ripping the friable Hawkesbury sandstone (not loading) while the excavator and dump trucks are extracting in the tertiary sand resource.

There are no changes to the proposed sequence or staging of extraction under the Proposed Modification. Some minor changes to machinery and an increase in extraction rate are proposed. These changes are described in Section 4.2.2.

3.2.4 VENM and ENM Importation and Management

Dixon Sand has approval to import up to 100,000 t of VENM and ENM to the Quarry site annually. The *Protection of the Environment Operations Act 1997* (POEO Act) defines VENM as:

> 'natural material (such as clay, gravel, sand, soil or rock fines):
>
> (a) that has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial, mining or agricultural activities, and
>
> (b) that does not contain any sulfidic ores or soils or any other waste,
>
> and includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved for the time being pursuant to an EPA Gazettal notice.'

The *Excavated Natural Material Exemption 2014* (ENM Exemption) under Part 9, Clause 91 and 92 of the *Protection of the Environment Operations (Waste) Regulation 2014* (POEO (Waste) Reg.) defines ENM as:

> 'naturally occurring rock and soil (including but not limited to materials such as sandstone, shale, clay and soil) that has:
>
> a) been excavated from the ground, and
>
> b) contains at least 98% (by weight) natural material, and
>
> c) does not meet the definition of Virgin Excavated Natural Material in the Act.
>
> Excavated natural material does not include material located in a hotspot; that has been processed; or that contains asbestos, Acid Sulfate Soils (ASS), Potential Acid Sulfate soils (PASS) or sulfidic ores.'

Where the imported material contains sandstone or other material suitable for screening and production of sand products, this material will be delivered to the stockpiling and processing area where it is processed along with the sand resources extracted from the Quarry.

Other VENM and ENM will be transferred to the completed stages of the Friable Sandstone Extraction Area for application to land, either as capping to completed silt cells or as direct backfill for landform construction purposes.

There are no changes to the proposed method of VENM and ENM importation or on-site management. An increase in the importation and application rate is proposed (refer to Section 4.2.3).

No changes to the operational scenarios or method of extraction are proposed.

3.2.5 Processing

Dry Processing

The extracted tertiary sand is passed through a screen to remove coarse rejects prior to sale or delivery to stockpile for washing and/or blending with other sand.

The friable Hawkesbury sandstone is first crushed either through a jaw and/or rotary crusher to break up hard patches of sandstone rock fragments into sand. Once crushed, the sand is passed through the screen to remove coarse rejects prior to stockpiling for sale, blending and/or washing.

While the dry processing equipment is fixed, and will typically be located adjacent to the wet processing area, it may be relocated around the Quarry site subject to compliance with noise and air quality criteria.

Wet Processing (Washing)

Dixon Sand has approval to operate a wet processing plant. Water added to the sand reduces the fines (clay/silt) attached to the sand grains with the water/silt then removed, and silt delivered to silt cells constructed in the friable Hawkesbury sandstone area for settlement. Water is returned to the wet plant and the silt allowed to consolidate for incorporation into the final landform.

Tailings from the wet processing plant will be emplaced in cells in the extracted area and progressively dried and rehabilitated to achieve the final landform in the extracted cells.

No change to processing methods or plant are proposed.

3.2.6 Transportation

Dixon Sand is approved to transport up to 250,000 tonnes of quarry product annually, with up to 190,000 tpa to Old Northern Road Quarry for processing off site. DA 165-7-2005 also permits the importation of up to 100,000 tonnes of VENM and ENM.

Daily truck movements to and from the Quarry, including movements between the Quarry and Old Northern Road Quarry, are limited to 56 movements per day (either arrival or dispatch) with no more than 20 truck movements permitted between 6.00 am and 7.00 am.

The transportation of quarry products has typically relied on truck and dog combinations, however, the use of larger trucks, i.e. B-double combinations is approved and accommodated by an approved upgrade to the Haerses Road/Wisemans Ferry Road intersection to a channelised right turn (CHR) treatment.

An increase in the number of truck movements is included in the Proposed Modification as detailed in Section 4.2.4.

3.2.7 Site Infrastructure and Equipment

Operations within the current approved development utilise the following infrastructure:

- powerscreen for separating coarse materials from excavated sand,
- jaw crusher and rotary crusher to break up hard patches of sandstone rock fragments into sand (on an intermittent basis where required),
- wet processing plant consisting of cyclone tanks and pumps,
- water management system consisting of sediment basins, dirty water drains and clean water drains to separate and manage upslope runoff from the clean catchment areas while also collecting and recycling dirty water from active quarrying areas, and
- site office with amenities, workshop and weighbridge (locations as shown in **Figure 3.1**).

There are no changes proposed to site infrastructure and equipment under the Proposed Modification.

3.2.8 Operating Hours and Workforce

The Quarry is currently operated in accordance with the following hours of operation:

- Quarrying operations: 7.00 am to 6.00 pm Monday to Saturday
- Truck arrival, loading and dispatch: 6.00 am to 6.00 pm Monday to Saturday
- Acoustic bund construction: 8.00 am to 6.00 pm Monday to Friday

No works are undertaken on Sundays or Public Holidays.

No modification to hours of operation are proposed.

3.2.9 Rehabilitation

3.2.9.1 Aims and Objectives

A detailed *Biodiversity and Rehabilitation Management Plan* (BRMP) has been prepared for the Quarry and describes the planned approach to rehabilitation. The BRMP, which is provided in full as **Appendix 11**, provides for the progressive rehabilitation of disturbed areas once activities in these areas are complete in order to satisfy the objectives presented in **Table 3.2**.

3.2.9.2 Final Landform and Land Use

The approved conceptual final landform for the Quarry aims to reinstate the pre-Quarry landform of the Friable Sandstone Extraction Area and integrate the retained slopes within the Tertiary Sand Extraction Area with the surrounding terrain across the site and adjoining land.

The land uses intended for the rehabilitated landform are a mix of Class 4 agricultural land, water storages and native vegetation consistent with the surrounding landscape.

Table 3.2 Rehabilitation Objectives

Feature	Objective
All areas of the site affected by the development	• Safe • Hydraulically and geotechnically stable • Non-polluting • Fit for the intended final land uses • Final landform integrated with surrounding natural landforms as far as is reasonable and feasible, and minimising visual impacts when viewed from surrounding land.
Surface infrastructure	• Decommissioned and removed, unless otherwise agreed by the Secretary
Quarry benches and pit floor	• Landscaped and vegetated using native trees and understory species
Final void	• Minimise the size, depth and slope of the batters of the final void • Minimise the drainage catchment of the final void

3.2.9.3 Rehabilitation Methods

The methods to be used to rehabilitate the areas disturbed by quarrying operations are summarised as follows.

- Clearing and rehabilitation. As vegetation is cleared ahead of sand extraction, it would be transferred directly for use in the rehabilitation of a completed section of the final landform.

- Topsoil management. The top 100 to 300 mm of soil will be stripped immediately prior to extraction and applied directly over areas to be rehabilitated. In the event that a rehabilitation area is not ready for topsoil spreading, the topsoil will be stockpiled temporarily (typically less than 12 months) away from drainage lines.

- Landform construction. As extraction is completed in the Friable Sandstone Extraction Area, this will be progressively backfilled with silt generated by the wet processing plant (as described in **Section 3.2.5**) and/or imported VENM and ENM (as described in **Section 3.2.4**). The final layer of VENM and ENM would be profiled by dozer to reinstate the pre-Quarry slopes and drainage lines and then ripped to assist in the keying in of the soil that is applied over this. As extraction is completed in the Tertiary Sand extraction area, the landform will be profiled by dozer to create safe and stable slopes from surface to a shallow north-south sloping floor. Prior to the application of soil, the floor will be ripped by dozer to assist in the keying in of the soil layer.

- Revegetation techniques and species – the Friable Sandstone Extraction Areas will generally be rehabilitated to native vegetation using local native species. The Tertiary Sand Extraction Areas will generally be rehabilitated to agricultural land using a pasture mix. As described in the BRMP, the revegetation will be consistent with the following vegetation communities.

  Native Vegetation

  - HN582 – Scribbly Gum – Hairpin Banksia – Dwarf Apple Heathy Woodland on Hinterland Sandstone Plateaux of the Central Coast, Sydney Basin Bioregion.

  - HN566 – Red Bloodwood – Scribbly Gum Heathy Woodland on Sandstone Plateau of the Sydney Basin Bioregions.

- HN586 – Smooth-barked Apple – Red Bloodwood – Sydney Peppermint Heathy Open Forest on Slopes of Dry Sandstone Gullies of Western Sydney and Southern Sydney, Sydney Basin Bioregion.

Fauna habitat features such as rock piles, reinstated logs and nest-boxes for hollow dependent fauna will be incorporated into the rehabilitation, providing for the colonisation of native fauna species.

Agricultural Land

- Vegetation consistent with an agricultural landscape, primarily consisting of horticultural crops.

- Drainage lines. Stands of native vegetation will be progressively re-established within reinstated drainage lines to stabilise soil and slow runoff into dams and waterways.

3.2.9.4 Performance and Completion Criteria

The rehabilitation performance and completion criteria for the Quarry, as nominated in the approved Biodiversity and Rehabilitation Management Plan (BRMP), are presented in **Table 3.3**.

Table 3.3 Preliminary Closure and Rehabilitation Completion Criteria

Aspect	Performance and Completion Criteria
Decommissioning	All surface infrastructure is decommissioned and removed
Landform	Rehabilitated slopes are stable No significant erosion is present that would constitute a safety hazard or compromise the capability of supporting the end land use Contour banks are stable and there is no evidence of overtopping or significant scouring as a result of runoff Surface layer is free of any hazardous materials
Soil	Topsoil or a suitable alternative has been spread uniformly over the rehabilitation surface Monitoring demonstrates soil profile development in rehabilitated areas (e.g. development of organic layer, litter layer)
Water	Runoff water quality from the site does not pose a threat to downstream water quality
Native vegetation	Revegetation areas contain flora species assemblages and ground cover is within OEH benchmark of the target native vegetation communities (refer to BioNet Vegetation Information System (BioNet VIS) Second generation tree seedlings are present or likely to be, based on monitoring in comparable older rehabilitation sites (i.e. evidence of fruiting of native species observed) More than 75% of trees are healthy and growing as indicated by long term monitoring Ground cover species are characteristic of target vegetation communities The presence of weeds is within OEH benchmark of the target native vegetation communities (refer to BioNet VIS)
Agricultural land	Rehabilitated land is compatible with proposed agricultural land use) as demonstrated by soil assessment Landform comprises broad gentle slopes between 2 - 5% Land capable of supporting suitable sterile cover crop

Aspect	Performance and Completion Criteria
Weeds and pests	Regular inspections indicate declining weed diversity, density and abundance and a decline in signs of feral animal activity The presence of weeds is within OEH benchmark of the target native vegetation communities (refer to BioNet VIS) There is no evidence of significant damage resulting from feral animal activity
Bushfire hazard	Appropriate bushfire hazard controls have been implemented
Ongoing public safety	Appropriate mechanisms are established to control access and manage public safety post-closure

The BRMP also includes triggers for each criteria along with the respective corrective actions.

There will be no change to the current objectives, approach to final landform construction, methods of rehabilitation and approach to the development and management of performance and completion criteria. The Proposed Modification would require a minor modification to the final landform which is assessed along with a review of the current rehabilitation strategy in Section 7.12.

3.3 Environmental Management

The Quarry has an established environmental management system consisting of an Environmental Management Strategy (EMS) which encompasses a range of environmental management plans (EMPs) and an Environmental Monitoring Plan. The EMS provides strategic context around the environmental management of the quarry, while the EMPs detail the management requirements for key environmental issues. The current Quarry EMPs are as follows.

- Pollution Incident Response Management Plan.
- Air Quality Management Plan.
- Noise Management Plan.
- Acoustic Bund Construction Noise Management Plan.
- Soil and Water Management Plan.
- Traffic Management Plan.
- Biodiversity and Rehabilitation Management Plan.
- Bushfire Management Plan.

The EMS and EMPs have been developed in accordance with the current development consent conditions (DA 165-7-2005). Details on how these plans will be updated and applied to the Proposed Modification are discussed in the relevant environmental assessment section of this report (refer to **Section 7.0**).

Other management strategies that continue to be implemented across the operation include:

- use of a monthly Site Condition Checklist,
- Site Induction for Drivers, and
- Complaints Register Form.

There will be no change to the basic principles of the EMS as a result of the Proposed Modification, however, should the Proposed Modification be approved, the EMS and associated EMPs will be reviewed (in accordance with the requirements of Condition 5 of Schedule 5 of the development consent) and updated as necessary to address the modified development.

3.4 Environmental Performance

The most recent Annual Review (AR) completed for the Quarry covers the period 1 July 2018 to 30 June 2019. The AR was prepared by Project Environmental Services Pty Ltd in 2019 as required by condition 12 (Schedule 5) of the current development consent (DA 165-7-2005)[2].

The review assessed the performance of the Quarry against the consent conditions and EPL. The main findings of the AR are outlined below:

- Attended noise monitoring identified that quarry operations were in compliance with the noise assessment criteria at all receivers, at the time of monitoring. Noise from Wisemans Ferry Road traffic, bird and rooster calls, frog calls and on-site residential/agricultural activities contributed significantly to the measured noise levels.
- Groundwater levels are stable and water quality is acceptable, concluding that quarry operations are not impacting the Maroota Tertiary Sands Groundwater Source or the Sydney Central Basin Groundwater Source.
- Approximately 93.5 hours were spent on rehabilitation consisting of promoting native species growth and pest species control.
- Two complaints were received during the reporting period, both related to noise from compression braking of a haulage truck. The first complaint has been closed out after appropriate investigation and the truck company reminded of Dixon Sand's Traffic Management Policy. The second complaint is open and ongoing due to continued use of compression braking by the truck.
- Dust deposition (insoluble solids) levels were high in March 2019, resulting in the annual dust deposition limit being exceeded. These exceedances were the result of an extended dry weather period, together with agricultural and nursery activities in the adjacent areas. Tree felling, mulching, slashing maintenance and earthworks activities were undertaken approximately 50 m away from the dust gauge. From March 2019 to the end of the reporting period, monthly dust levels returned to normal.
- The annual Total Suspended Particulates (TSP) average for the reporting period was 40 µg/m³, lower than the annual TSP average criteria of 90 µg/m³.
- Particulate matter less than 10 µm in diameter (PM_{10}) for the Haerses Road Quarry was reported in conjunction with the Old Northern Road Quarry. The annual PM_{10} average for the 2018-2019 reporting period was 16 µg/m³, well below the EPA criterion of 30 µg/m³. However, there were six 24-hour average PM_{10} exceedances which were not attributed to quarry operations. The exceedances were self-reported to the EPA.

In accordance with the Secretary's approval for submission of the Annual Review by the end of September each year, modification to Condition 12 of Schedule 5, is proposed to formalise the submission date as the "end of September each year".

[2] The Secretary of the DPIE has approved the submission of the Annual Review by the end of September each year, to coincide with the Annual Review period for the Old Northern Road Quarry.

4.0 Proposed Modification

4.1 Summary

Table 4.1 provides a comparative analysis of the Proposed Modification against DA 165-7-2005, as originally approved and as last modified under Section 75W (now repealed) of the EP&A Act in January 2018. The most recent modification, under Section 4.55(1A) of the EP&A Act, was to correct a minor discrepancy to the identification and presentation of buffer zones around the Quarry. Reference to MOD 1 is made given the application of Clause 3BA of Schedule 2 to the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017* (EP&A Reg) to the Proposed Modification (refer to **Section 1.4**).

Table 4.1 Comparison of the Proposed Modification to the Originally Approved and Modified Quarry

Quarry Component	Originally Approved	As Modified (January 2018) (MOD 1)	Proposed Modification
Quarry life	Quarry operations to cease 14 February 2031	Additional 15 years i.e. quarry operations to cease 2046	No change
Limit on production	250,000 tpa	No change	495,000 tpa
Maximum transport of product	To Old Northern Road Quarry:		
	190,000 tpa	No change	No change
	Direct to market:		
	60,000 tpa	Up to 250,000 tpa	Up to 495,000 tpa
Truck movements	28 truck movements into Haerses Road per day (10 movements allowed between 6.00 am and 7.00 am) 28 truck movements out of Haerses Road per day (0 - 7 left hand turns, 21 - 28 right hand turns)	56 truck movements per day (total in and out) Up to 20 vehicle movements between 6.00 am and 7.00 am Removal of restriction on direction of truck movements	Up to 180 truck movements per day (total in and out) No change to vehicle movements between 6.00 am and 7.00 am
Total disturbance footprint	Approximately 52 ha	Approximately 74.5 ha	Approximately 75.5 ha
Overburden	Used for acoustic barriers or stockpiled and used to fill voids	No change	No change
Importation of material	Not included in approved operations	Receival of up to 100,000 tpa of VENM/ENM Reprocessing of clean recycled sand component of VENM/ENM for sale	Increase to 250,000 tpa of VENM/ENM for landform construction or reprocessing and sale

Quarry Component	Originally Approved	As Modified (January 2018) (MOD 1)	Proposed Modification
Infrastructure	Haerses Road is key haul road with existing dams used for water supply	House conversion to site office Construction of site workshop, weighbridge and gravel car parking area	No change
Equipment	Front end loader (1), 40 t excavator (1), 30 t trucks (2), water cart (1), mobile dry screen, dozer, grader, service vehicle	Additional mobile jaw and rotary crushers and wet processing plant	40 t trucks (2) to replace 30 t trucks (2) Additional excavator Additional front-end loaders (3)
Hours of operation	Monday to Saturday 7.00 am to 6.00 pm Vehicle access and sand loading 6.00 am to 7.00 am Monday to Saturday No work on Sundays and public holidays	No change	No change
Employment	Equivalent to 2 people full time	Up to 8 people full time	Up to 16 people full time

4.2 Key Modifications

Quarry operations are to continue generally in accordance with the current limits and restrictions imposed by DA 165-7-2005. The following provides a description of the key changes to Quarry operations proposed by this modification.

4.2.1 Extraction Area Extension

As noted in **Section 3.2.3.1**, the approved extraction area is currently limited by various buffers to surrounding properties, roads and other features (refer to **Figure 3.1**). The majority of these reflect the recommendations of Section 1 of Part 2 of the Hills DCP and would be retained (excluding a minor reduction in buffer between the disturbance area associated with the processing and stockpiling area and the Haerses Road easement approved by MOD 2). It is noted that the effected landowner to the north (Lot 11 DP835992) has agreed to the extension of the extraction area to the boundary of Lot 3 DP111886 (approximately 20 m from the boundary of Lot 11 DP835992).

Dixon Sand proposes to extend Stage 5 of the Tertiary Sand Extraction Area, which is currently 80 m from Lot 3 DP111886 to the north (owned by Dixon Sand) (and 100 m to the private landholding on Lot 11 DP835992), to a minimum of:

- 30 m from Wisemans Ferry Road to the northwest,
- the boundary of Lot 3 DP111886 (owned by Dixon Sand), and
- 10 m from Hitchcock Road (refer to **Figure 4.1**).

This area is currently planted with olive trees over predominantly exotic pasture with disturbance to native vegetation to be limited to occasional groundcover species and some shrubs.

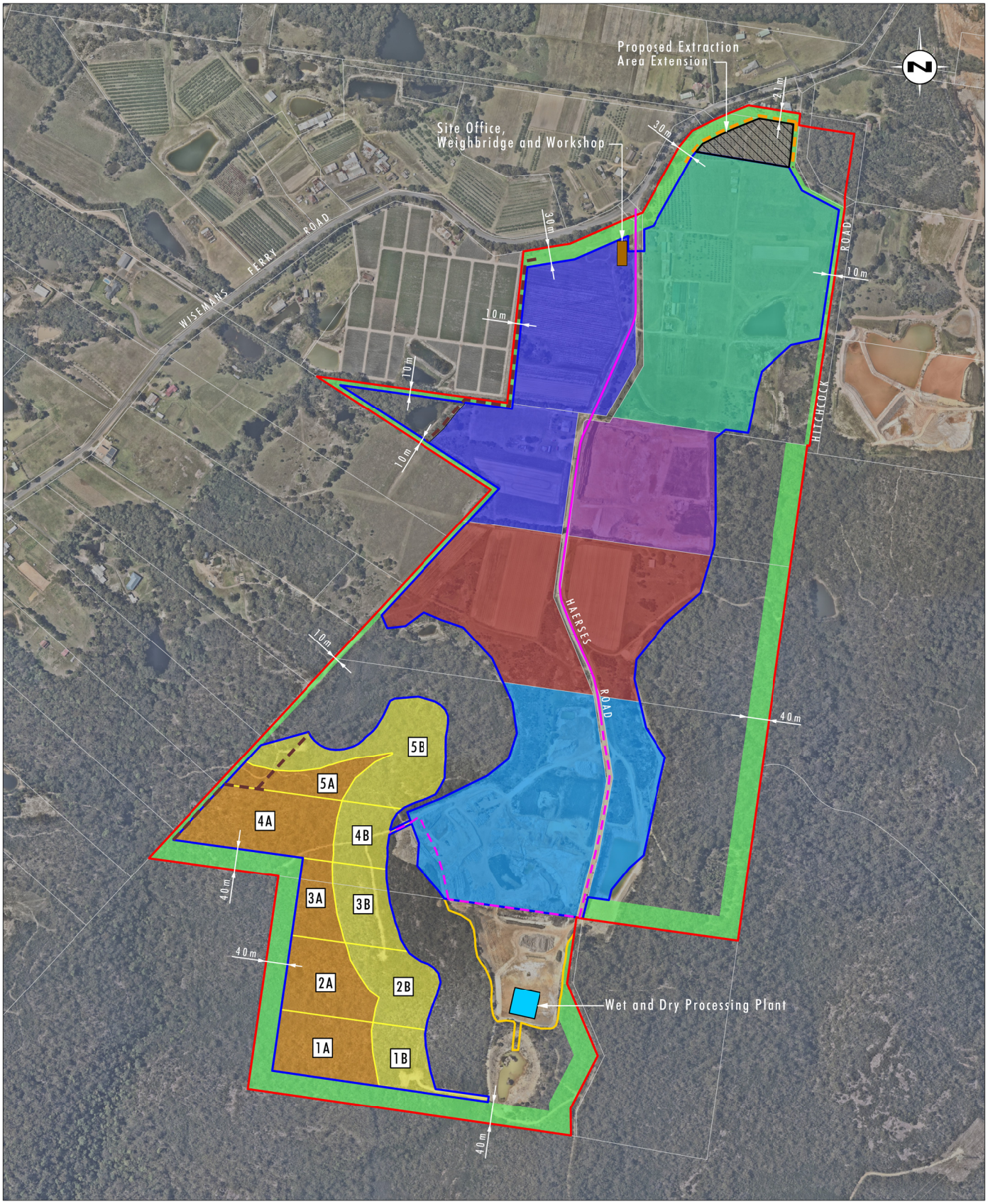

Image Source: Nearmap (Dec 2018)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2019)

0 100 250 500m
1:10 000

Legend

- Haerses Road Quarry Site
- Processing and Stockpiling Area
- Buffer Zone
- Approved Extraction Area
- Approved Extraction Area A
- Approved Extraction Area B
- 1 Extraction Cell Number
- Wet Processing Plant
- Approved Extraction Area Stage 1
- Approved Extraction Area Stage 2
- Approved Extraction Area Stage 3
- Approved Extraction Area Stage 4
- Approved Extraction Area Stage 5
- Site Office, Weighbridge and Workshop
- Indicative Unsealed Haul Road
- Approved Acoustic Bund
- Proposed Acoustic Bund
- Sealed Haul Road
- Proposed Extraction Area Extension

FIGURE 4.1

Proposed Extraction Area Extension and Modification to Buffers

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20191009 8.57

Extraction would be to a depth which remains at least 2 m above the wet weather groundwater table of the MTSGS. This has been identified by a Groundwater Impact Assessment conducted for the Proposed Modification (Jacobs, 2019) as varying from 180 to 185 m AHD, with extraction depth therefore varying from no deeper than 182 m AHD in the southwestern corner of the extension area to 187 m AHD in the north-eastern corner. A more detailed summary of the identification of the wet weather groundwater table is provided in **Section 7.7** with the Groundwater Impact Assessment of Golder (2019) provided in full as **Appendix 8**. Based on an average depth of extraction of 10 m, the proposed extension would increase the available resource by approximately 100,000 m^3 (between 200,000 and 250,000 tonnes).

The proposed modification provides for the 5 m high acoustic bund, which is currently approved for construction along the northern perimeter of Stage 5, to be relocated to the modified northern perimeter of Stage 5 (remaining beyond, not within, the nominated buffer zone). In order to minimise the impact of this bund on visual amenity for properties directly north of the Quarry, this bund would be revegetated with grass and fast-establishing native shrubs as soon as constructed. Based on feedback received from the landowners and residents of properties directly north of the Quarry, the bund would only be constructed and retained for as long as required to maintain the noise levels received at residential receivers to the north below Quarry noise limits (unless requested to be retained by these residents). Dixon Sand will continue to liaise with the landowners and residents to the north of the Quarry Site for which this bund provides for noise and visual impact mitigation. Subject to agreement with these landowners and residents (who may be different towards the end of the Quarry life when the bund is required), or demonstration of compliance with noise criteria by alternative methods, the bund may not be constructed.

As noted in **Section 3.2.3.2**, no change to extraction methods are proposed. Furthermore, Dixon Sand would continue to implement the restrictions on equipment usage and other management, mitigation and monitoring measures nominated in the Quarry *Noise Management Plan* and *Acoustic Bund Construction Noise Management Plan* (refer to **Section 7.4**).

Figure 4.2 provides a modified conceptual final landform reflecting the extended extraction area adjacent to Wisemans Ferry Road. With the exception of this extension of the free draining void to the north, no other modifications to approved final landform and rehabilitation are proposed. It is proposed that the extended extraction area would be rehabilitated to reinstate Class 4 agricultural land, with drainage to the south and revegetated with pasture or horticultural crop species. As identified in the BRMP, a detailed Quarry Closure Plan will be completed approximately three years prior to closure. Dixon Sand will consult with relevant stakeholders, including The Hills Shire Council and DPIE in relation to the development of the Quarry Closure Plan.

4.2.2 Extraction Rate Increase

The Proposed Modification seeks to increase the rate of extraction from the Quarry from 250,000 to 495,000 tpa. The proposed extraction rate increase would better reflect the approved resource available for extraction which includes the additional 15 Mt approved by MOD 1.

Extraction would continue to be from both the friable sandstone and Tertiary Sand Extraction Areas, with current customer demand suggesting a roughly ⅔ : ⅓ proportional split between the two areas respectively. This ratio, which could change over the life of the Quarry subject to customer demand, would result in the completion of extraction within each area at roughly the same time. At the maximum extraction rate, this would require approximately 30 years to exhaust the approved resource.

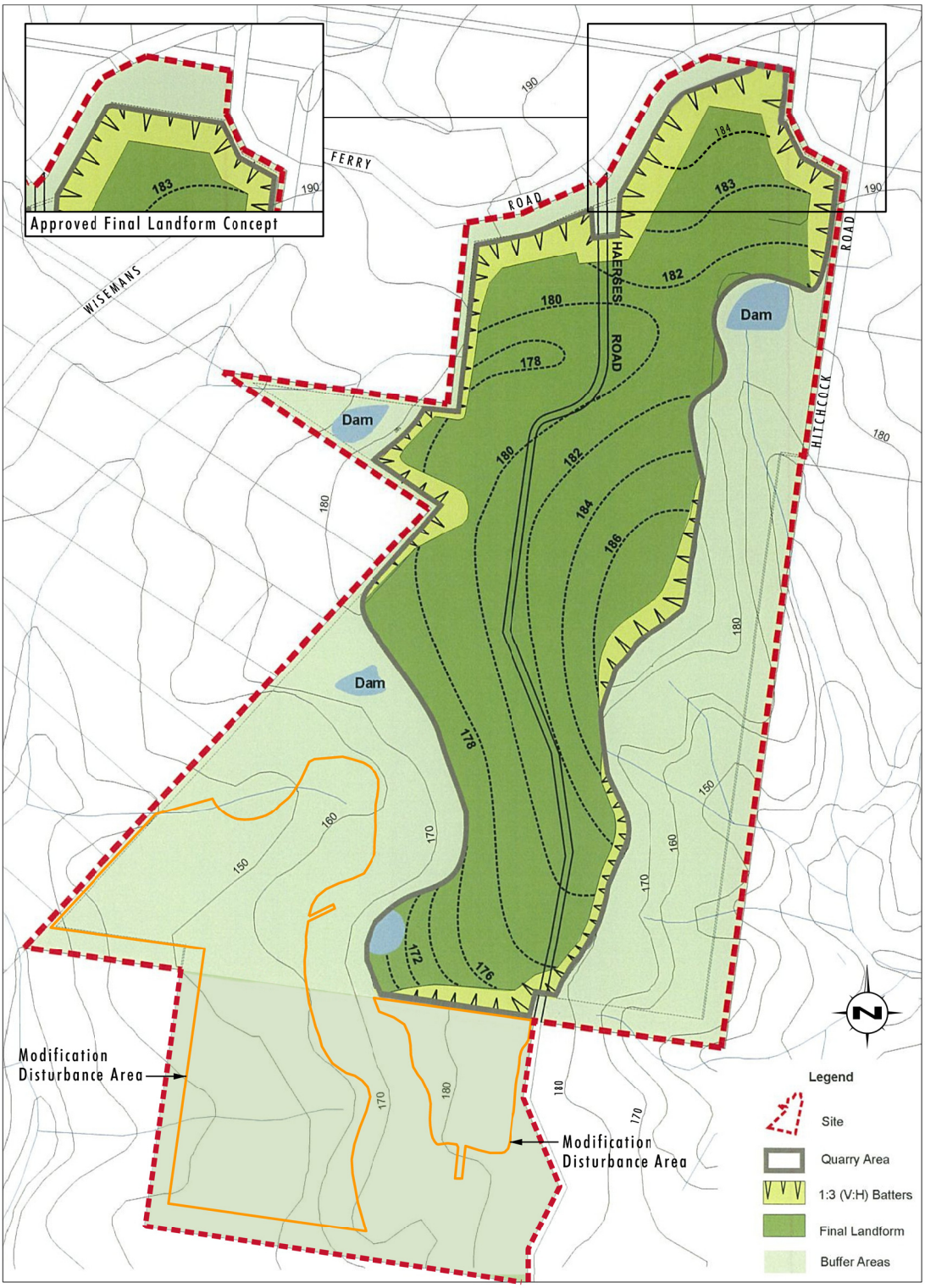

FIGURE 4.2

Modified Conceptual Final Landform

Image Source: ERM (2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)
Note: The identified Site boundary presented on the figure reflects that approved by DA 165-7-2005

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Extraction is typically undertaken in either the tertiary sand or the friable sandstone to improve efficiency and reduce fuel usage associated with extraction and haulage. Typical operating/rehabilitation scenarios adopted are:

1. Tertiary sand extraction – whilst extraction is undertaken within the Tertiary Sand Extraction Area, VENM and ENM placement and profiling would be undertaken within the friable sandstone extraction area.

2. Friable sandstone extraction – whilst extraction is undertaken in the friable sandstone extraction area (requiring the use of the bulldozer to rip the sandstone), land profiling, preparation and rehabilitation would be undertaken in completed sections of the Tertiary Sand Extraction Area.

4.2.3 VENM/ENM Importation Increase

The current approved operation extracts and blends friable Hawkesbury sandstone material with tertiary sand to make a wide range of specialty sands, both dry and wet. The type of product varies with market fluctuations and demand.

In order to keep pace with the proposed increase in extraction rate, which would result in the extraction area being developed up to twice as quickly as could currently occur, an increase in VENM or ENM importation is proposed to allow for the extraction area to be backfilled at an equivalently increased rate. The proposed increase in VENM and ENM importation from 100,000 to 250,000 tpa is proportionally larger (150 %) than the increase in extraction and production rate (approximately 100 %), however, this reflects two factors which could influence how much backfill material is required and how much VENM and ENM is imported.

1. A potential reduction in the amount of sand washed at the Quarry and therefore the volume of silt available for placement and consolidation as a backfill material. Recent drilling results in the friable sandstone extraction area have identified that a significant proportion of the sand is more suitable as a mortar (brickies) sand product which relies on less washed sand. With less sand to be washed, less silt will be generated for use in extraction area backfill and progressive final landform construction.

2. A potential increase in the amount of imported VENM and ENM recycled and reprocessed, either sold directly or blended and sold from the Quarry.

Market fluctuations and demand for product over the consent period (until 2046) will also impact the amount of each material available for backfilling.

The VENM and ENM will be sourced from large infrastructure projects, such as tunnel projects and infill development projects, in the greater Sydney area. The specific locations of these projects, and specific material types, is likely to vary over the life of the Quarry as infrastructure and other construction projects are undertaken across Sydney. This notwithstanding, Dixon Sand would implement a VENM/ENM Importation Protocol which would specify the relevant requirements for importation to the Quarry in relation to:

- source material,
- site validation and tracking procedures,
- method of transportation,
- stockpiling of fill material, and
- placement and certification of fill material.

The VENM/ENM Importation Protocol would require that for each potential source of fill material information is provided to confirm that the material is suitable for reprocessing or use within the Quarry. The information required would, as a minimum, include:

- a description of the source material,
- the anticipated volume of the material to be imported from the site,
- the fill source location,
- photographs showing the condition of the site,
- NATA stamped laboratory analysis certificates (where required), including Quality Assurance/Quality Control Data, and
- an assessment of whether the material is VENM or ENM in accordance with the requirements of the POEO Act and POEO (Waste) Reg.

Where the material imported is ENM, the assessment report must include a validation certificate that complies with the requirements of the ENM Exemption. The validation certificate must demonstrate that the fill material is free from contaminants, pests and weeds, that it is suitable for its intended purpose and land use, and that it will not pose an unacceptable risk to human health, the environment, or to neighbouring agricultural enterprises from a biosecurity risk perspective. Further details on pest and weed management protocols are contained within the Quarry BRMP (refer to **Appendix 11**).

A material tracking register is to be maintained to ensure that only VENM or ENM is imported to the site. A Quarry staff member would be assigned during importation campaigns to verify loading dockets and record delivery details. Site access will be locked after hours to prevent unauthorised dumping of material.

4.2.4 Increase to Traffic Movements

An increase in the number of daily heavy vehicle movements permitted to access or depart the quarry from 56 trucks per day currently to 180 trucks per day is proposed. This will accommodate both the importation of clean fill, as well as the proposed increase in sales direct to market, which are likely to use smaller capacity trucks (and hence a greater quantity) than those currently operating between the Haerses Road and Old Northern Road quarries.

The Proposed Modification does not seek to increase the volume of quarry product permitted to be transported between Haerses Road Quarry and Old Northern Road (190,000 tpa).

Furthermore, no changes are proposed to:

- the approved operating hours for the Quarry,
- the existing access arrangements and transport routes, and
- the limit of 20 truck movements between 6am and 7am.

Where possible, Dixon Sand would continue to undertake ‘double trucking’ whereby an inbound laden truck (carrying VENM or ENM) would unload and then be loaded with quarry product and become an outbound laden truck.

The proposed increase in truck movements is proportionally greater than the proposed increase in production. This reflects three factors which could influence the number of trucks required to export Quarry products and import VENM and ENM.

1. The majority of the sand products of the Quarry would be sold directly to customers, as opposed to be being transported to Old Northern Road Quarry for further blending, processing and sale. Dixon Sand would have less control over the capacity of the trucks used to transport these materials which are likely to include a higher proportion of smaller capacity vehicles. As a consequence, more truck movements are likely to be required to transport an equivalent amount of sand (than previously estimated when the bulk of products were to be transported to Old Northern Road Quarry).

2. The original approval for 56 movements was to allow transportation of the tertiary sand resource to the Old Northern Rd Quarry for blending with this friable sandstone resource. The approval of extraction of the friable sandstone resource (Mod 1), and the ability to blend and sell direct from the Quarry has resulted in a greater demand for product.

3. While double trucking would be encouraged, there are likely to be periods when this is not possible (due to the locations of VENM/ENM suppliers and Quarry product customers or other scheduling considerations).

4.3 Justification and Alternatives

4.3.1 Demand for Resource

The DPIE is currently undertaking an assessment of the current and future availability of construction materials (sand and hard rock aggregates) for Sydney and wider NSW. Figures obtained from the Institute of Quarrying Australia (IQA) identify the current demand for sand in NSW as 11 Mtpa[3]. Previous assessments of supply requirements for the Sydney and wider NSW construction markets (Pienmunne 2000; Francis 2011; DTIRIS 2013; Goes Mining undated) have all identified that the demand for sand will increase significantly as population and the subsequent demand for concrete and other construction materials grows. Sand in particular has been identified as limited in current availability and supply, with developments such as the Quarry likely to become important suppliers into the future.

As noted in DTIRIS (2013), the larger Sydney market for construction materials is likely to become increasingly reliant on sources from around the Wingecaribee/Mulwaree, Lower Hunter and Lithgow regions. Being closer to Sydney markets, locations such as Maroota are therefore likely to be in increasingly high demand.

Considered in contrast, any shortfall in the production of sand to meet the anticipated demand would have a negative impact on the NSW economy as follows:

- A reduction in the direct contribution of production to the NSW economy, which was estimated to be $366 million by DTIRIS (2013).
- Increased supply costs as a result of reduced availability (supply) or a requirement to source from locations more distant to markets (in particular the Greater Sydney metropolitan area).
- Indirect impacts on the NSW economy as a result of reduced construction activity in response to either increased cost or reduced supply of concrete and other construction materials.

[3] https://www.quarry.com.au/ConstructionMaterials/Sand.aspx

The Quarry has the potential to be a significant supplier of sand and, if approved, would expand its ability to contribute to the long-term supply of sand to local and Sydney markets. It is also relevant that as a smaller independent operator, the Applicant would retain greater flexibility to supply a range of large and small customers and would not be subject to internal demands for concrete as the larger construction materials companies may be.

On the basis of the confirmed resource (22 Mt) and growing demand for the products produced at the Quarry, Dixon Sand considers that there is a demonstrated justification for an increase in production at the Quarry.

4.3.2 Efficient Use of VENM/ENM

The construction of key infrastructure within the greater Sydney metropolitan area is generating large volumes of VENM and ENM. Without sites such as active quarry operations to accept and dispose of these materials, they are likely to be disposed of to waste management facilities which would reduce the capacity of these facilities to manage other waste materials. Furthermore, use in the backfill of quarry sites allows for the construction of a final landform which replicates or more closely resembles the pre-quarry landform, thereby improving the environmental outcomes for the site. While the Quarry is already approved to accept and use VENM and ENM in the backfill of the friable sandstone extraction area, the proposed increase in the rate of importation would allow this backfill to closely follow extraction and avoid delays in the final rehabilitation and closure of the Quarry.

On the basis that the increased rate of VENM and ENM importation would allow for more effective and efficient rehabilitation of the Quarry site, there is a demonstrated justification for this increase.

4.3.3 Alternatives

In addition to the 'do nothing' approach, which is discussed further below, the following alternatives to the Proposed Modification are considered.

Production increase without VENM/ENM importation increase

This alternative could marginally reduce the number of truck movements required, noting that not all VENM/ENM importation projects would be able to utilise the 'double trucking' strategy, however, not significantly, so the proposed increase in maximum daily truck movements is principally to account for the use of smaller capacity trucks.

By not increasing the amount of VENM and ENM imported, the ability to backfill and rehabilitate the Quarry in accordance with the approved final landform would be delayed as extraction is completed well in advance of backfill. This would result in the Quarry site remaining active many years after the completion of extraction which would have ongoing impacts associated with noise, dust and traffic on the surrounding environment.

Furthermore, by restricting the volume of VENM and ENM able to be disposed of in a manner which provides for the improvement in local landforms, these materials could end up in landfill which would reduce the capacity of these facilities to manage other wastes.

Production increase without extraction area extension

The proposed extension to the Tertiary sand extraction area would not increase the total resource significantly and as such would not have a major impact on Quarry viability. However, by not including the extended extraction area, the Quarry would not be maximising the use of the State's resources. The ability to recover this resource, in compliance with the buffer recommendations of The Hills DCP (refer to **Section 3.2.3.1**) would be foregone if not included as a modification to DA 165-7-2005. This would be contrary to the objectives of resource management in NSW where compliance with environmental performance criteria can be demonstrated.

VENM/ENM importation increase with reduced production increase

In the absence of a production increase, the ability to import increased tonnages of VENM and ENM would be effectively capped by the lack of available space within which to apply this to land. While this alternative would not require as large an increase in truck movements, it would have little effect on easing supply requirements within the greater Sydney market.

Do nothing alternative

This alternative, i.e. proceeding with the quarry as currently approved and not proceeding with the Proposed Modification, is not considered desirable as this would restrict access to a high-quality resource of medium to coarse grain sands within the Sydney market which has recently seen an increase in demand for these products. It would also result in the under-utilisation of a site already subject to quarrying which could require the development and operation of greenfield sites elsewhere which have greater impacts on the environment or surrounding community.

It is acknowledged that the Quarry could continue without the proposed changes, however, the changes provide benefits to the Sydney region construction sand market and they can be undertaken without resulting in significant environmental and social impacts as identified in this environmental assessment. In these circumstances, it is considered that the 'do nothing' alternative is not an appropriate alternative.

5.0 Statutory and Planning Framework

5.1 Commonwealth Legislation

Under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), approval from the Commonwealth Minister for the Environment is required for any action that may have a significant impact on matters of National Environmental Significance. These matters are:

- World Heritage Places,
- National Heritage Places,
- Wetlands of International Significance (listed under the Ramsar Convention),
- Listed threatened species and ecological communities,
- Migratory species protected under international agreements,
- Commonwealth Marine Parks,
- Nuclear actions (including uranium mines), and
- A water resource, in relation to coal seam gas development and large coal mining development

The Proposed Modification will not have a significant impact on any of the above matters therefore no further consideration under the EPBC Act is required.

5.2 State Legislation

5.2.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is administered by the DPIE and local government. It is the primary legislation governing environmental planning and assessment in NSW.

The objectives of the EP&A Act relevant to the Proposed Modification are as follows:

- Facilitate ecologically sustainable development

  Consideration of the principles of ecologically sustainable development has been addressed in **Section 9.2.2.1**

- Promote and co-ordinate the orderly and economic use and development of land

  The Proposed Modification provides for the continuation and improved efficiency of an extractive industry supplying sand products critical to the Sydney construction market. The Proposed Modification will facilitate the future development of land by enabling the efficient rehabilitation of the Quarry site to a landform suitable for agricultural pursuits.

- Protect the environment including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats

  As discussed in **Section 7.11**, the Proposed Modification is unlikely to result in any additional impacts to native flora and fauna, ecological communities or habitats.

Measures to protect the environment are presented as a consolidated summary in **Section 8.0**.

- To provide public involvement and participation in the planning and assessment process.

  The public have been consulted regarding the Proposed Modification and have been given the opportunity to provide input to the SEE process and will be provided the opportunity to make a submission during the exhibition process. Further details of the consultation process are provided in **Section 6.0**.

On the basis of the above, it is considered that the Proposed Modification meets the relevant objectives of the EP&A Act.

5.2.2 Protection of the Environment Operations Act 1997

The objectives of the *Protection of the Environment Operations Act 1997* (POEO Act) are to protect, restore and enhance the quality of the environment, in recognition of the need to maintain ecologically sustainable development. The POEO Act provides for an integrated system of licensing and contains a core list of activities requiring Environment Protection Licences (EPL) from the Environment Protection Authority (EPA). These activities are called 'scheduled activities' and are listed in Schedule 1 of the POEO Act.

Application of waste to land is considered a scheduled activity in accordance with Clause 39 of Schedule 1 of the POEO Act. However, under the *Protection of the Environment Operations (Waste) Regulation 2014* (2014 Waste Regulation), the EPA has the power to grant exemption from the requirement for an EPL and to pay the waste levy, where it can be demonstrated that the use of the waste is bona-fide, fit-for-purpose and causes no harm to the environment or human health, rather than a means of waste disposal.

VENM has been pre-classified as general solid waste (non-putrescible) and is exempts the requirement to obtain an EPL for a scheduled activity, to track waste, pay the waste levy and miscellaneous reporting requirements to the EPA. The *Excavated Natural Material Exemption 2014* applies to ENM that is intended to be applied to land as engineering fill or in earthworks and exempts the requirement to obtain an EPL for a scheduled activity, to track waste, pay the waste levy and miscellaneous reporting requirements to the EPA. All fill material entering the Quarry Site will be classified as VENM or meet the requirements of the *Excavated Natural Material Exemption 2014* or a specific resource recovery order issued by the EPA for the site.

A licence is required under the POEO Act to reprocess any VENM or ENM imported to a facility. Dixon Sand currently holds EPL 12513 which includes land-based extraction and crushing, grinding or separating as activities. Prior to processing of ENM, the EPL may need to be modified to include resource recovery to allow for "recovery of general waste, meaning the receiving of waste (other than hazardous waste, restricted solid waste, liquid waste or special waste) from off site and its processing, otherwise than for the recovery of energy" in accordance with Clause 34(1) of Schedule 1 of the POEO Act.

5.2.3 Water Management Act 2000

The *Water Management Act 2000* (WM Act) controls the extraction and use of water, the construction of works such as dams and weirs, and the carrying out of activities in or near water sources in NSW. 'Water sources' are defined very broadly to include any river, lake, estuary or place where water occurs naturally on or below the surface of the ground and NSW coastal waters.

Part 2 of the WM Act applies to the requirement to obtain a licence for the 'taking of water' from a water source. An access licence entitles its holder to specified shares in the available water within a specified water management area or from a specified water source. It enables the licence holder to take water from the environment in accordance with specified rates and conditions under the terms of the licence. The licensing provisions apply to areas of NSW that have a water sharing plan (WSP).

For surface water, the site is located within the *Greater Metropolitan Region Unregulated River Water Sources Water Sharing Plan*, which became operational in July 2011. This WSP covers six water sources which are made up of a total of 87 management zones. The Proposed Modification is located within the Hawkesbury and Lower Nepean Rivers Water Source and the Lower Hawkesbury River Management Zone.

For groundwater, the site falls within the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources* which become operational in July 2011. This WSP covers 13 groundwater sources on the east coast of NSW. The Proposed Modification is located within the Maroota Tertiary Sand groundwater source and Sydney Basin Central Groundwater Source.

Dixon Sand currently holds two water access licences for the Quarry site, as described in **Section 3.1**. No additional water licences are expected to be required under the WM Act to cater for the Proposed Modification (refer to **Section 7.8**).

Part 3 of the WM Act specifies approval requirements for water use, water management works approvals and activity approvals. There are two kinds of activity approvals including controlled activity approvals and aquifer interference approvals.

- Controlled activity approvals confer a right for the holder to carry out a specified controlled activity on waterfront land which is defined as land within 40 m of a river, lake, estuary or shoreline. The definition of controlled activities includes the deposition of material (whether or not extractive material) on land and the definition of a river includes 'any watercourse, whether perennial or intermittent and whether comprising a natural channel or a natural channel artificially improved'. The Proposed Modification involves emplacing clean fill material within 40 m of an intermittent drainage channel. As a State Significant Development, however, the requirement to obtain a controlled activity approval under Section 91(2) of the WM Act does not apply by virtue of Section 4.41(1)(g) of the EP&A Act.

- Aquifer interference approvals are required where a development is likely to have more than a minimal impact on an aquifer or key water-dependent asset. The Proposed Modification will not trigger the need for an aquifer interference approval as the proposed extraction are extension will remain at least 2 m above the wet weather high groundwater level of the Maroota Tertiary Sand groundwater source and no change to extraction is proposed elsewhere on the Quarry site.

5.2.4 Other State Legislation

A summary of the other State environmental and planning legislation potentially relevant to the Proposed Modification is provided in **Table 5.1**.

Table 5.1 Summary of Other State Legislation

Act	Comment	Further approval required?
National Parks and Wildlife Act 1974 **(NP&W Act)**	An Aboriginal Heritage Impact Permit is required under Section 90 of the NP&W Act to harm an Aboriginal object. The site does not contain any identified Aboriginal archaeological sites and as such there is currently no requirement to obtain specific approvals relating to Aboriginal cultural heritage.	No

Act	Comment	Further approval required?
Water Act 1912	This Act has been repealed by the *Water Management Act 2000*; however, some of the licensing provisions remain in force where the water source is not covered by a water sharing plan. The Quarry is within an area covered by a water sharing plan and is therefore administered under the *Water Management Act 2000* (refer to **Section 5.2.3**).	No
Heritage Act 1977	No heritage sites will be affected, and no excavation permits are required under this Act for works associated with the Proposed Modification.	No
Environmentally Hazardous Chemicals Act 1985	The EPA is granted power under the *Environmentally Hazardous Chemicals Act 1985* to assess and control chemicals and declare substances to be chemical wastes. A licence is required for any storage, transport or use of prescribed chemicals. The Proposed Modification will not result in any changes to the storage, transport or use of prescribed chemicals.	No
Roads Act 1993	The *Roads Act 1993* determines the rights of the public and adjacent landowners to use public roads and establishes procedures for the opening and closing of public roads. Under the Act applications are required to be made for the closure of roads and for works in road reserves. The RMS was provided with a preliminary version of the Traffic Impact Assessment for the Proposed Modification and did not identify any issues with road capacity of intersection performance (noting the planned upgrade to the intersection of Haerses Road and Wisemans Ferry Road to be undertaken by the Proponent). No road closures or road works are therefore proposed as part of this modification.	No
Crown Land Management Act 2016	The *Crown Land Management Act 2016* commenced on 1 July 2018 to improve the way that Crown reserves are managed and to strengthen community involvement. As noted above, no road closures or road works are proposed as part of the Modification and no areas of Crown land would be affected.	No
Biodiversity Conservation Act 2016 **(BC Act)**	A licence under this Act is not required for any activity undertaken in accordance with a development consent granted under the EP&A Act and therefore no approvals are required.	No

5.3 State Environmental Planning Policies

5.3.1 State Environmental Planning Policy (State and Regional Development) 2011

The *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP) commenced on 1 October 2011, on the date Part 3A of the EP&A Act was repealed. The SEPP identifies development that is State Significant Development.

The Quarry is currently operated and managed as a State Significant Development in accordance with Schedule 1 of the SRD SEPP under the current development consent DA 165-7-2005.

5.3.2 State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP) aims to facilitate the effective delivery of infrastructure across NSW and, amongst other things, allows for development for the purpose of recycling of construction and demolition material or the disposal of virgin excavated natural material or clean fill to be permitted with consent anywhere mining or extractive industries are permitted to be undertaken.

The policy recognises the enhanced rehabilitation outcomes that can be achieved through importation of clean fill to sites previously disturbed by extractive operations. The project is consistent with the aims and objectives of the policy and will allow for the recycling and beneficial reuse of fill material.

Division 23 of the Infrastructure SEPP includes definitions and consent requirements of Waste or Resource Management facilities. In accordance with Clause 121 (3) of the Infrastructure SEPP:

> *Development for the purpose of the recycling of construction and demolition material, or the disposal of virgin excavated natural material (as defined by the POEO Act) or clean fill, may be carried out by any person with consent on land on which development for the purpose of industries, extractive industries or mining may be carried out with consent under any environmental planning instrument.*

Extractive industries are permissible with consent in the RU1 Primary Production zone of *The Hills Local Environmental Plan 2012*. Therefore, importing of VENM, ENM and other clean fill material for the purpose of site rehabilitation is considered permissible with consent in accordance with the Infrastructure SEPP.

5.3.3 State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

The *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Extractive Industries SEPP) regulates the permissibility and assessment requirements for mining, petroleum production, extractive industries and related development. The SEPP outlines where various extractive industry activities are permissible both with and without development consent. The SEPP also defines mining, petroleum production and extractive industries developments that are prohibited, exempt or complying developments.

Part 3 of the Extractive Industries SEPP requires specific matters to be considered in relation to development applications. These include:

- Compatibility with other surrounding land uses (including other extractive industries) (refer to various parts of **Section 7.0**)
- Natural resource and environmental management (refer to **Section 7.13**)
- Resource recovery (refer to **Section 1.0**)
- Transport (refer to **Section 7.3**)
- Rehabilitation (refer to **Section 7.12**).

5.3.4 State Environmental Planning Policy No. 33 – Hazardous and Offensive Development

State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33) requires the consent authority to consider whether an industrial proposal is a potentially hazardous industry or a potentially offensive industry. The aim of this policy is to link the permissibility of a proposal to its safety and pollution control performance. The assessment process establishes whether the proposal is potentially hazardous or offensive and if this is not the case, SEPP 33 is not applicable.

Existing operations within the Quarry are not considered as hazardous or offensive. The Proposed Modification will not result in any changes to the existing operations which would alter either of these classifications, therefore no further assessment has been undertaken.

5.4 Regional Planning Instruments

5.4.1 Sydney Regional Environmental Plan No 9—Extractive Industry

Sydney Regional Environmental Plan No. 9 - Extractive industry (SREP 9) aims to:

- facilitate the development of extractive resources in proximity to the population of the Sydney Metropolitan Area by identifying land which contains extractive material of regional significance, and
- permit, with the consent of the council, development for the purpose of extractive industries on land described in Schedule 1 or 2, and
- ensure consideration is given to the impact of encroaching development on the ability of extractive industries to realise their full potential, and
- promote the carrying out of development for the purpose of extractive industries in an environmentally acceptable manner, and
- prohibit development for the purpose of extractive industry on the land described in Schedule 3 in the Macdonald, Colo, Hawkesbury and Nepean Rivers, being land which is environmentally sensitive.

The Quarry is located within the land identified in Schedule 4 of SREP 9. As such, development for the purposes of extractive industries is to be permitted with council consent taking into account relevant environmental issues. However, as identified in **Section 4.2.1** the Minister for Planning is the consent authority for the Proposed Modification.

5.5 Local Planning Controls

5.5.1 The Hills Local Environmental Plan 2012

The local environmental planning instrument relevant to the Proposed Modification is *The Hills Local Environmental Plan 2012* (LEP). The LEP applies to The Hills LGA.

The entire site is zoned RU1 Primary Production, the objectives of which are:

- to encourage sustainable primary industry production by maintaining and enhancing the natural resource base
- to encourage diversity in primary industry enterprises and systems appropriate for the area

- to minimise the fragmentation and alienation of resource lands
- to minimise conflict between land uses within this zone and land uses within adjoining zones
- to facilitate the economic extraction of materials from land and the subsequent rehabilitation of that land.

Extractive industries are permissible with development consent within land zoned RU1. As the development is permissible with consent, the Minister (or delegate) can approve the carrying out of the Proposed Modification.

5.5.2 The Hills Development Control Plan

Clause 11 of SRD SEPP excludes the requirement for development control plans to be applied to State Significant Development. This notwithstanding, reference is drawn to Part 2 of Part B of the Hills DCP which relates to extractive industries within the rural zone.

The stated aim of Part 2 is to ensure that rural development is compatible with the capability of land, has regard to the natural environment, scenic qualities and rural character and contributes to the social and economic wellbeing of the rural area. Notwithstanding that as State Significant Development the requirements of The Hills DCP do not need to be addressed, the existing Quarry and Proposed Modification have been designed and operated to comply generally with the development controls applied to extractive industry within the rural zone of The Hills LGA. **Table 5.2** identifies the statement of outcomes, development controls and a compliance statement for each of the 15 identified development features for extractive industries.

Table 5.2 The Hills DCP - Part 2: Extractive Industries

Feature	Statement of Outcomes	Refer to Section
1. Site Planning	• Maintain an effective buffer to protect landscape quality, the habitats of threatened species, populations and ecological communities of the shire. • Maintain and enhance the rural-residential streetscape, existing character and amenity of rural-residential activities.	**Section 4.2.1**
2. Transport	• Maintain and upgrade the safety and efficiency of the existing road network, and achieve safe, coordinated and controlled transport links for extractive industries. • The safety and amenity of existing rural and residential activities is maintained and protected.	**Section 7.3**
3. Water Resources	• Ground water resources and supplies are conserved to protect groundwater dependent riparian ecosystems and natural habitats.	**Section 7.7**
	• The quality, quantity and location of water supplies and downstream drainage patterns are maintained and protected, and water usage is conserved sustainably.	**Section 7.8**
4. Visual Amenity & Scenic Quality	• The natural, scenic and landscape quality of the area is conserved and the rural character is retained. • The aesthetic, visual, cultural, scientific, historic, social and other special values of the landscape are conserved.	**Section 7.9**

Feature	Statement of Outcomes	Refer to Section
5. Flora & Fauna Buffer Zones	• Sufficient separation is provided to threatened species and critical ecological communities, and the scenic and environmental quality of the Shire is retained.	**Section 7.10**
6. Heritage & Archaeological Resources	• Archaeological resources, geological features and areas and items of heritage value are identified, protected and conserved.	**Section 7.11**
7. Soil Conservation	• Wind, water & soil erosion of disturbed and rehabilitated areas are minimised by maintaining effective sediment and erosion control measures for the protection of environmentally sensitive areas and downstream properties.	**Section 7.8**
8. Acoustic Management	• The acoustic quality and environment of residents, Public & community facilities and other receivers in the Shire is maintained and protected. • The potential for offensive noise emission is limited.	**Section 7.4**
9. Air Quality Management	• To preserve the air quality and protect the health and amenity of residents, visitors and industry employees.	**Section 7.5**
10. Rehabilitation	• Extraction sites are fully rehabilitated in an orderly, progressive and controlled manner and the environment of threatened species is protected. • The natural attributes of surrounding catchments are conserved and the scenic, heritage and environmental quality of the Shire is protected and enhanced. • Rehabilitation achieves a final landform that is capable of supporting agricultural production or other post-extraction use that is compatible with the rural/residential character of the region.	**Section 7.12**
11. Community Engagement	• Community participation and employment associated with Extractive Industries is encouraged, facilitated and promoted.	**Section 6.2**
12. Setbacks from Maroota Public School	• To protect and maintain the safety and amenity of the Maroota Public School and residences not associated with extraction.	**Section 7.13**
13. Section 94 Contributions	• To attain sufficient funds necessary to maintain and upgrade the regional and local road networks.	**N/A**
14. Environmental Management Systems	• Extractive Industries consistently perform to good environmental management practices and ensure the ecological sustainability of extractive industry sites. • Internationally and nationally recognised environmental management systems are implemented.	**Sections 3.3** and **3.4**
15. Information Required for an Extractive Industries Development Application	• Council requires a high standard of application, which will enable it to conduct a proper and informed environmental impact assessment of the social, economic and environmental consequences of extractive industries.	**N/A**

6.0 Stakeholder Engagement

Consultation has been undertaken to inform stakeholders about the Proposed Modification, to obtain their views and identify any issues of concern to be investigated and addressed as part of the SEE.

6.1 Agency Consultation

6.1.1 Department of Planning, Industry and Environment

Dixon Sand has consulted with DPIE regarding the proposed changes to operations, the planned approval pathway and approach to the environmental assessment. The DPIE confirmed the key environmental issues for the Proposed Modification in a reply dated 5 March 2019 (refer to **Appendix 2**). The DPIE was generally satisfied with the proposed approach to this assessment and based on the information provided in the Preliminary Environmental Assessment (PEA) (Umwelt, 2019) did not issue formal Environmental Assessment Requirements (EARs). However, the considerations listed in **Table 1.1** were requested for consideration in the environmental assessment.

6.1.2 Other Agencies

Feedback on the Proposed Modification was sought from various NSW government agencies and The Hills Shire Council through an email and accompanying preliminary environmental assessment sent on 21 March 2019. **Appendix 2** provides the responses and assessment requirements (where provided) of these agencies which are summarised in **Table 6.1**.

Table 6.1 Agency Consultation

Agency and Date of Response	Assessment Requirements	Relevant Section
The Hills Shire Council 25 March and 16 April 2019	Council raised concerns regarding the proposed importation of VENM and ENM to the site. The importation of these materials would partially change the use of the site from an 'extractive industry' to a 'waste and resource management facility'. As such, it is considered that a new Development Application is required to substantiate the proposed change in activities on the site and the change in definition of the use. The final documents submitted must also consider the requirements of Council's DCP requirements under DCP Part B Section 1 – Rural, Part 2 which contains Council's requirements for extractive industry operations. Further, any reduction in buffers/setback would need to ensure that impacts such as acoustic and visual impacts are appropriately managed.	**Sections 4.2.1**, **7.4** and **7.9**

Agency and Date of Response	Assessment Requirements	Relevant Section
Environment Protection Authority 1 May 2019	**Air Quality** Undertake an air assessment in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* and *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW*, including: • A description of the existing air quality and meteorology using existing information and site representative ambient monitoring data; • An outline the point and fugitive sources of all pollutant emission and estimate the resulting ground level concentrations of all pollutants at all sensitive receivers; • A description of the effects and significance of resulting pollutant concentrations on the environment, human health, amenity and regional ambient air quality standard and goals; and • Details of the mitigation measures proposed in managing the additional impacts of air emission from the Proposed Modification.	**Sections 7.5 and 7.6**
	Noise Undertake a noise assessment in accordance with the *Noise Policy for Industry* (2017), including: • Details of the existing background (L_{A90}) and ambient (L_{Aeq}) noise levels; • Details of all monitoring of existing ambient noise levels including a statement justifying the choice of monitoring site, including the procedure used to choose the site, having considered the noise sensitive receptors and most affected locations; • A description of the dominant and background noise sources at the site; • Day, evening and night assessment background levels for each day of the monitoring period; and • The final rating background level (RBL) value. Additionally, the noise assessment report should include: • A plan showing the assumed location of each noise source for each predicted scenario of the noise impact assessment; • A list of the number and type of noise sources including road traffic noise used in each prediction scenario to simulate all potential significant operating conditions on the site; • Any assumptions made in the predictions in terms of source heights, direct effects, shielding from topography, buildings or barriers etc. • Details of the expected noise level and noise character (e.g. tonality, impulsiveness, vibration etc.) likely to be generated from noise sources upon modification; • Details of the noise levels likely to be received at the most sensitive locations; • Methods used to predict noise impacts including identification of any noise models used; • An assessment of appropriate weather conditions for the noise predictions including reference to any weather data used to justify assumed conditions;	**Section 7.4**

Agency and Date of Response	Assessment Requirements	Relevant Section
	• Discussion of findings from the predictive modelling and where relevant noise criteria have not been met, recommend additional mitigation measures; and • Details of the most appropriate mitigation measures and expected noise reduction including noise controls and management of impacts; and • Demonstration that the relevant noise criteria can be met, with the inclusion of mitigation measures in the project, if required.	
	Water Undertake an assessment of the impacts on surface and groundwater, including: • An outline how total water cycle considerations are to be addressed as a result of the modification; • Total water balances; • Demonstration of how the impacts on water resources are minimised; • The type, volume, proposed treatment and management and re-use methods for stormwater; • The type, volume, proposed treatment and management and re-use methods for wastewater; and • Identification of any impacts on and management of groundwater.	**Sections 7.7 and 7.8**
Department of Industry – Lands and Water and Department of Primary Industries 1 May 2019	A biosecurity (pests and weeds) risk assessment should be prepared outlining the likely plant, animal and community risks from imported material. A biosecurity response plan to should be prepared manage identified weed/pest animal risks.	**Sections 3.2.4, 7.10 , and Appendix 11**
DPIE Division of Resources and Geoscience 7 May 2019	Include a resource assessment which: • Documents the size and quality of the resource and demonstrates that both have been adequately assessed; and • Documents the methods used to assess the resource and its suitability for the intended applications. The above information should be summarised in the SEE, with full documentation appended. Applications to modify, expand, extend or intensify an existing consent that has already been adequately reported using the above protocol in publicly available documents, may restrict detailed documentation to the additional resources to be used, if accompanied by a summary of past resource assessments and of past production. During the preparation of the SEE, the Division recommends that the proponent consult NSW Department of Planning & Environment's *EIS Guideline - Extractive Industries – Quarries*.	**Section 3.2.2**
Office of Environment and Heritage 9 April 2019	OEH is unable to provide the requested advice at this stage of the Proposed Modification.	**N/A**

Agency and Date of Response	Assessment Requirements	Relevant Section
Office of Environment and Heritage – Heritage Division 3 April 2019	The subject site is neither within the curtilage, or in the vicinity, of any State Heritage Register (SHR) items, or known historical archaeology. Consequently, no specific comments are provided as no impacts to SHR items or State or local archaeological remains have been identified as indicated in the Project Overview and Preliminary Environmental Assessment of the Proposed Modification 3 provided.	**Section 7.11**
Roads and Maritime Services 24 January 2019	The Proponent is currently upgrading the intersection between Haerses Road and Wisemans Ferry Road to a channelised right-turn ('CHR') treatment to satisfy Condition 24 of DA 165-7-2005 (Mod 1). Prior to commencing construction of the CHR treatment the Proponent sought advice from the RMS on the adequacy of the 'CHR' treatment to accommodate the increase in truck movements proposed in the Mod 3 assessment. RMS confirmed that they would allow preliminary assessment of the intersection to be 'brought forward' so that any design considerations (if applicable) to the intersection, could be addressed prior to construction. Following this a Traffic Impact Assessment (TIA) undertaken by SECA Solutions and was submitted to RMS on 20 Dec 2018 for comment. Following review of the TIA, RMS provided advice on 24 January 2019 which supported the 'CHR' treatment to remain the same as approved by Condition 24 of DA 165-7-2005, subject to investigation of trucks queueing out of the right turn bay onto Wisemans Ferry Road through lane and monitoring to assess if the 'CHR' should be extended.	**Section 7.3 and Appendix 5**
WaterNSW 26 March 2019	As it is State Significant Development approved by the NSW Minister for Planning, the matter falls under the jurisdiction and control of NRAR.	**N/A**
Natural Resources Access Regulator	No response received.	**N/A**

6.2 Community Consultation

The key mechanisms used for community involvement in relation to the Proposed Modification was the distribution of two community consultation flyers to the Maroota community. The first Community Information Sheet (CIS), attached in **Appendix 4**, provided details of the proposal and the environmental assessment process to be undertaken. The flyer also contained contact details for Dixon Sand and Umwelt so that members of the community could raise issues or request further information about the Proposed Modification.

Approximately 75 copies of the flyer were distributed in the immediate local area on 11 April 2019. Copies were left in the letterboxes of residences along Wisemans Ferry Road and Old Northern Road with further engagement by Dixon Sand personnel undertaken over concerns or issues raised. A copy of the flyer was also sent to Maroota Public School and distributed by email to members of the Dixon Sand Community Consultative Committee on 16 April 2019. The flyer was also provided to the Community Consultative Committee (CCC) for the Haerses Road and Old Northern Road Quarries and made publicly available on the Dixon Sand website (www.dixonsand.com.au/keepinginformed).

A CCC meeting was held on 14 May 2019 in which community feedback to any issues received, and methods for addressing concerns were discussed with CCC members. The CCC members recommended the preparation and distribution of a general Q&A flyer to address common community concerns.

In June 2019, Dixon Sand prepared and uploaded to their website a General Questions and Answers (Q&A) document to provide additional information on the Proposed Modification. The Q&A flyer, attached in **Appendix 4**, provided further information on the major community concerns related to traffic, dust, noise, visual impacts and groundwater. A copy of the Q&A document was emailed to key community stakeholders for further distribution to local residents and community stakeholders.

Written and/or verbal responses to the information flyer, and Q&A flyer or other communication were received from ten parties; one in support of the Proposed Modification and the other nine respondents identifying the following as the main issues of concern:

- truck noise, driver behaviour and road safety,
- increased proximity of the extraction area and associated noise, air quality and visual impacts, and
- noise and dust issues (generally).

All responses were followed up by the Proponent via either email, phone or face-to-face meetings and consultation continued until the respondents were satisfied with the level of information and feedback provided.

In August 2019, a second CIS was distributed to the local community to outline the results of the key environmental assessments undertaken for the Proposed Modification. The key focus of the flyer (which is also included in **Appendix 3**) was to outline the potential changes and proposed mitigation measures with respect to local traffic, noise and air quality as a result of the Proposed Modification, being the issues identified as of primary concern following the distribution of the first CIS. **Figure 6.1** presents the proportion of mentions of impacts which have been categorised broadly into transport and truck-related concerns, operational concerns, community engagement concerns, economic impacts, personal and property rights and environmental impacts.

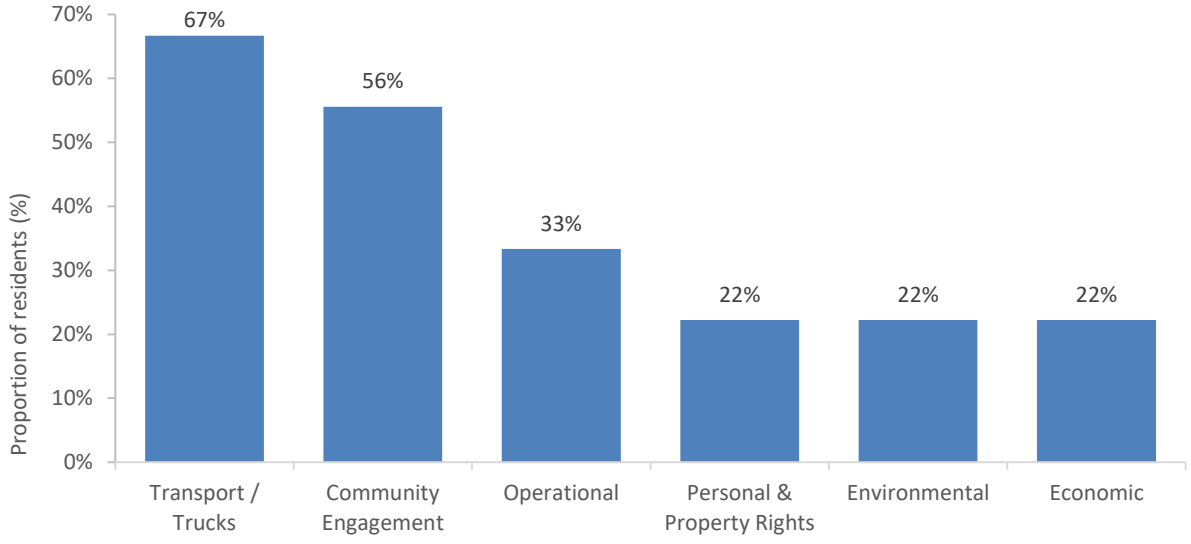

Figure 6.1 **Perceived Community Impact Themes (n = 9 residents)**

N = 53 mentions
Note: Multiple responses allowed; proportions based on total number of mentions of all categories within each theme

Section 5.2 of the Social Impact Assessment (provided in full as **Appendix 9** of this SEE) provides further detail on each of these broad categories and **Section 7.13** investigates the impact of the Proposed Modification on each.

7.0 Environmental Impact Assessment

7.1 Identification of Key Issues

The key environmental and community issues to be assessed in this SEE have been identified through consideration of:

- the existing approved operations and description of the Proposed Modification (refer to **Sections 3.0** and **4.0**)
- the findings of the original Environmental Impact Statement for the quarry development (ERM, 2006), the Environmental Assessment for the first modification (Umwelt, 2016) and the Preliminary Environmental Assessment (Umwelt, 2019) prepared for this modification
- the planning and environmental context for the locality (refer to **Sections 1.3, 2.0** and **5.0**)
- the environmental risk analysis of potential environmental impacts associated with the Proposed Modification (refer to **Section 7.2**)
- feedback from the community and government agencies on issues relevant to the Proposed Modification and Haerses Road Quarry more generally (refer to **Section 6.0**)
- the findings of baseline studies completed as part of preparation of this SEE and the issues that were identified as requiring further assessment.

The issues identified as being relevant to the Proposed Modification are assessed in detail in the following sections.

7.2 Preliminary Environmental Risk Analysis

A preliminary environmental risk analysis was undertaken for the Proposed Modification to identify, from a technical perspective, the key environmental and community issues of relevance and the level of assessment required as part of the EA process.

The method used for the environmental risk analysis encompassed the following key steps:

- identify each element of the Proposed Modification
- identify the environmental and community aspects and potential impacts/risks associated with each element of the Proposed Modification in the context of the existing approved operations (that is, whether or not there is a change to the impacts approved as part of the existing consent for the quarry)
- assess the potential scope of the impact/risk to determine the key issues requiring further assessment and the level of assessment required.

The outcomes of the preliminary environmental risk analysis are detailed in **Table 7.1**.

Table 7.1 Preliminary Environmental Risk Analysis

Environmental Aspect	Preliminary Environmental Analysis	Further Assessment Required?
Traffic	Increased transport associated with the operation of the Proposed Modification has the potential to impact local traffic and a traffic impact assessment is required.	**Yes, refer to Section 7.3**
Public infrastructure	The intersection between Haerses Road and Wisemans Ferry Road is currently under construction and being upgraded to a channelised right-turn ('CHR') treatment, in accordance with Condition 24 of DA 165-7-2005 (Mod 1), to account for the traffic generated by the approved quarry (56 movements per day). Haerses Road will be progressively reinstated after quarrying the resource beneath it in accordance with the existing approval. The modification does not require any additional changes to public infrastructure.	**No, however further information on intersection treatments and roads is provided in Section 7.3**
Noise	The Proposed Modification has the potential to result in changes to noise emissions due to the expansion of the extraction area and increase in road traffic movements, and a detailed noise assessment is required.	**Yes, refer to Section 7.4**
Air quality	The Proposed Modification has the potential to result in changes to air emissions due to the expansion of the extraction area and increase in extraction rates, and a detailed air quality assessment is required.	**Yes, refer to Section 7.5**
Greenhouse gas and energy	The Proposed Modification has the potential to change the energy use and greenhouse gas emissions of the quarry and a detailed greenhouse gas and energy assessment has therefore been undertaken.	**Yes, refer to Section 7.6**
Groundwater	The location and maximum depth of the quarry pit have been determined through groundwater investigations such that there will be no impact to the Maroota Tertiary Sand Groundwater Source or the Greater Sydney Basin Groundwater Source. The Proposed Modification will not change the approved maximum depth of extraction nor the extraction methods, however an updated assessment of groundwater is required to confirm this.	**Yes, refer to Section 7.7**
Surface water	Effective management of water as part of the quarry operations is a key consideration for Haerses Road Quarry. The Proposed Modification will increase the quarry extraction area therefore an assessment of the water requirements and potential surface water impacts has been undertaken.	**Yes, refer to Section 7.8**
Visual amenity	The Proposed Modification will result in an additional extraction area with quarrying activities and overburden emplacement areas which have the potential to change the current visibility of the quarry. A visual impact assessment is therefore required for the Proposed Modification.	**Yes, refer to Section 7.9**
Biodiversity	The Proposed Modification disturbance area consists of introduced pasture and olive trees and is in a highly modified state, however an assessment of the ecological values of the extension area is still required to determine the extent of offsetting required (if any) under the *Biodiversity Conservation Act 2016*.	**Yes, refer to Sections 7.10**

Environmental Aspect	Preliminary Environmental Analysis	Further Assessment Required?
	A review of potential biosecurity (pests and weeds) risks associated with VENM and ENM importation and management has been requested by Department of Primary Industries.	**Yes, refer to Sections 7.10.4**
Heritage	The Proposed Modification disturbance area will need to be assessed for both historic and Aboriginal heritage values to determine the extent of assessment required.	**Yes, refer to Section 7.11**
Rehabilitation and final landform	The overall approach to rehabilitation of Haerses Road Quarry will remain unchanged, however, due to the extension to the extraction area there will be some change to the final landform of the site. An updated rehabilitation and closure strategy will therefore be required for the Proposed Modification.	**Yes, refer to Section 7.12**
Socio-economic	The Proposed Modification will double the employment rate of the quarry, increasing flow on economic effects in the local area. The potential impacts of the Proposed Modification on the social and economic life of the surrounding community have been assessed and methods used to engage the local community in the planning process have been documented in the SEE.	**Yes, refer to Section 7.13**
Soils and agriculture	The Proposed Modification would result in an increase to the quarry extraction area of approximately 1 ha with associated disturbance to the soil profile. Soil erosion issues are addressed as part of the surface water assessment. This area of land will be lost to agricultural production for the life of the quarry (until 2046), however based on its size the potential impact on local agriculture from the Proposed Modification is considered negligible. Upon closure of the quarry this area, as with the adjoining extraction areas, will be rehabilitated to Class 4 agricultural standard to allow agricultural land uses to recommence.	**No**
Land use	The Proposed Modification would result in an area of land approximately 1 ha in size being converted from an olive grove to a quarry extraction area over the life of the quarry. Based on the extent and current condition of the land, and the rehabilitation objectives for the quarry, it is considered that this change will not result in significant impact to land use in the Maroota area.	**No**
Waste	The Proposed Modification does not propose any change to the approved approach to waste management.	**No**
Hazard and risk	Existing operations within the Haerses Road Quarry are not considered as hazardous or offensive. The Proposed Modification will not result in any changes to the existing operations which would alter this classification, therefore no further assessment has been undertaken.	**No**
Contaminated land	A July 2019 search of the OEH contaminated land database identified that there are no registered contaminated sites in the Maroota area.	**No**

7.3 Traffic and Transport

7.3.1 Scope

An assessment of the traffic and transport impacts of the Proposed Modification has been undertaken by SECA Solution (SECA Solution, 2019). The assessment is provided in **Appendix 5** and a summary of findings presented below.

7.3.2 Existing Traffic Environment

7.3.2.1 Road Hierarchy

Wisemans Ferry Road forms part of the state road network extending north from McGraths Hill near Windsor to Old Northern Road at Maroota. Near the Quarry it provides for a single lane of travel in each direction with narrow shoulders and an unsealed verge, typically bounded by small trees and shrubs. No street lighting is provided and there are no pedestrian or cycling facilities, consistent with the rural setting. Wisemans Ferry Road operates under the posted speed limit of 80 km/hr.

Wisemans Ferry Road forms a 'Give Way' sign-controlled T-intersection with Old Northern Road which allows for all turning movements, with Old Northern Road having priority. There are no dedicated turn lanes provided on Old Northern Road at this intersection.

Old Northern Road also forms part of the state road network extending west from Baulkham Hills through Maroota to Wisemans Ferry. Like Wisemans Ferry Road, Old Northern Road provides for a single lane of travel in each direction with narrow shoulders and an unsealed verge. No street lighting is provided and there are no pedestrian or cycling facilities, consistent with the rural setting. The posted speed limit on Old Northern Road is 60 km/hr past Wisemans Ferry Road and through the village of Maroota, increasing to 80 km/hr west of Old Northern Road Quarry and 90 km/hr to the east approaching Roberts Road.

Both Wisemans Ferry Road and Old Northern Road are approved B-Double routes, with each of these roads carrying a high percentage of heavy vehicle traffic associated with surrounding agricultural and extractive industries.

Haerses Road is a local street which forms a 'No Through Road' providing access to the Quarry and a small number of adjoining properties. It has a width in the order of 8 - 9 m along its length allowing for two trucks to pass. It connects to Wisemans Ferry Road via a 'Give Way' sign-controlled T-intersection which allows for all turning movements, with Wisemans Ferry Road having priority.

The intersection between Haerses Road and Wisemans Ferry Road is currently under construction and being upgraded to a channelised right turn (CHR) treatment, in accordance with Condition 24 of DA 165-7-2005 (Mod 1). Truck turning warning signs are also to be installed to the north of Haerses Road on Wisemans Ferry Road and the existing 'Give Way' control on Haerses Road is to be replaced with a 'Stop' sign. A plan for these upgrades is provided in Attachment B of the TIA in **Appendix 5**.

7.3.2.2 Existing Traffic

Seca Solution undertook traffic surveys and automatic tube counts on Wisemans Ferry Road and Old Northern Road to quantify traffic volumes.

- Average daily flows on Wisemans Ferry Road (east of Haerses Road) were 2,284 vehicles per day (vpd), two way.

- Average daily flows on Old Northern Road (north of Wisemans Ferry Road) were slightly lower with 2,260 vpd, two way.

- Haerses Road caters only for traffic generated by the approved quarry i.e. 56 vpd plus a small number of light vehicles.

The daily flow profiles on Wisemans Ferry Road and Old Northern Road suggest two distinct peaks during the morning, being the local road peak (i.e. 8.00 am-9.00 am) as well as an earlier peak (6.00am-7.00am) coinciding with the various quarry operations, and a more significant peak period in the afternoon (between 3.00 pm-4.00 pm).

Background growth in local traffic has been estimated using historical data for Wisemans Ferry Road and Old Northern Road at 4% per annum and 1.8% per annum respectively.

Both Wisemans Ferry Road and Old Northern Road carry a high percentage of heavy vehicles, with heavy vehicles representing approximately 20% of daytime traffic on Old Northern Road and 21% of daytime traffic on Wisemans Ferry Road. Most of these heavy vehicles are associated with quarries in the surrounding area and the surrounding agricultural lands. Several school bus services also operate along Old Northern Road.

Observations on site indicate that the local road network operates to a high standard during the morning peak period, with very low delays and congestion due to the low traffic volumes on these roads. Based on RMS *Guide to Traffic Generating Developments* performance standards, both Wisemans Ferry Road and Old Northern Road operate well within their capacity, providing an overall Level of Service (LoS) B.

7.3.3 Proposed Changes to Traffic

The Proposed Modification seeks to allow a maximum of 180 truck movements associated with the Quarry per day, representing an increase of 124 truck movements (62 inbound, 62 outbound) over the existing consent. The existing approval allows for the use of a variety of truck arrangement, including truck and dog and B-Double trucks and this is not proposed to change.

Consistent with current operations, truck movements would occur throughout the day with the Proposed Modification having the potential to generate 14-15 trucks per hour (averaged across the operating hours of the quarry i.e. 7.00 am to 6.00 pm). This represents an increase of 11-12 trucks per hour compared with the existing operations (assuming a maximum of 20 trucks entering or exiting between 6.00am and 7.00am as per the existing situation).

The demand for vehicles entering and exiting the Quarry would vary throughout the day, however, efficient loading and weighbridge operations at the Quarry ensure that these movements are spread across the day.

In addition to this, staff arrivals at the beginning of the day and departures at the end of a shift could increase light vehicle movements by up to 16 trips per day (8 inbound, 8 outbound).

7.3.4 Impact Assessment

7.3.4.1 Impact on Road Capacity

Allowing for an equal split of trips to the east and west along Wisemans Ferry Road, the Proposed Modification could see typical daily flows on Wisemans Ferry Road (east or west of Haerses Road) and Old Northern Road (south of Wisemans Ferry Road) increase by 62 truck movements per day. This is an increase in the order of 2.7% over the existing average daily traffic flows on these roads.

Based on the above assessment of the current road network operation, both Wisemans Ferry Road and Old Northern Road (south of Wisemans Ferry Road) operate well within their capacity, providing an overall LoS B throughout the day and during the peak periods

The Proposed Modification to the Quarry has the potential to generate an additional 11-12 truck movements per hour, with these trips being distributed in either direction along Wisemans Ferry Road. On the basis that all traffic generated by the Quarry could use either route (east or west) at any particular point in time, flows on Wisemans Ferry Road could increase to 201 vph in the afternoon peak hour. Similarly, flows on Old Northern Road (south of Wisemans Ferry Road) could also increase by an equivalent amount to 200 vph in the afternoon peak hour. Even with the increased traffic volumes these roads would continue to operate well within their capacity with no impact to the existing level of service (i.e. LoS B).

Given that there is no increase in haulage volumes to the north, the Proposed Modification does not create additional demands for heavy vehicles travel through the village of Maroota nor past Maroota Public School.

Whilst there will be additional trips associated with staff travelling to and from the Quarry each day, these movements are minimal and would have a negligible impact upon the overall operation and capacity of the surrounding road network.

7.3.4.2 Impact on Intersections

The key intersection that could be affected by the Proposed Modification is the intersection of Wisemans Ferry Road and Haerses Road. As detailed in **Section 7.3.3** above, the Proposed Modification could see an average of 14-15 heavy vehicles passing through this intersection per hour.

The intersection, in its upgraded format as described in **Section 7.3.2.1**, was assessed using *SIDRA Intersection 8* to determine its capacity to support the increased demand from heavy vehicles turning into and out of Haerses Road. The following scenarios were considered:

- 2019 surveyed traffic volumes plus additional traffic associated with the Quarry.
- 2028 future design year allowing for 40% background growth on Wisemans Ferry Road (4% per annum), consistent with the reported growth between 2016 and 2019, plus additional traffic associated with the Quarry.

The results confirmed that the upgraded intersection of Wisemans Ferry Road and Haerses Road would provide adequate capacity to support the increased traffic associated with the Proposed Modification together with background growth along Wisemans Ferry Road. All movements provide an overall LoS A with very minimal delays and queuing for both the existing and future design year.

Similar modelling was also undertaken for the Wisemans Ferry Road and Old Northern Road intersection with results similarly confirming adequate capacity to support the increased traffic associated with the Proposed Modification together with background growth consistent with recent years. The additional demands do not result in any change to the LoS for any movement at this intersection.

7.3.4.3 Impact on Access and Parking

Sight distances were assessed by Seca Solution for the Haerses Road intersection and were considered adequate for the road alignment and vehicle speeds at that location. Sight distances do not create any significant safety concerns for vehicles accessing or leaving the Quarry and adequate stopping sight distance is available on both approaches along Wisemans Ferry Road.

The approved upgrades to extend the existing channelised right turn lane at the intersection of Wisemans Ferry Road and Haerses Road have also been assessed and are in excess of the minimum turn treatments recommended by the Austroads Guidelines.

The Hills DCP does not recommend a parking rate for extractive industries. No formal car park will be provided for the Proposed Modification, however given the nature of the development and the large site area, all staff parking can be contained within the site as required. This will therefore satisfy the objectives of *The Hills DCP* in relation to car parking, which seeks to ensure adequate provisions for car parking are available on site.

7.3.5 Monitoring and Management

Based on the findings of the traffic and transport impact assessment, no change to the existing traffic management and monitoring measures implemented by the Quarry are considered necessary for the Proposed Modification. Dixon Sand will continue to operate the Quarry in accordance with the existing *Traffic Management Plan* (Dixon Sand, 2019) and will continue to enforce the *Maroota Local Traffic Management Policy* (2005).

7.4 Noise

7.4.1 Scope

A Noise Impact Assessment (NIA) has been undertaken for the Proposed Modification in accordance with the *NSW Noise Policy for Industry* (NPfI) (EPA 2017) and the *NSW Road Noise Policy* (DECCW 2011). The NIA was undertaken to address the following objectives:

- To identify the closest and/or potentially most affected receivers situated within the area of influence to the Project Site.
- To establish ambient (background noise levels) and Project Noise Trigger Levels (PNTLs) at surrounding receivers.
- To identify all noise sources of the Proposed Modification and predict noise levels that could be received at surrounding receivers under a range of operating scenarios.
- To assess the potential noise impacts associated with Proposed Modification against the PNTLs.
- To provide feasible and reasonable noise mitigation and management measures, and monitoring options, where PNTLs may be exceeded.

The NIA has considered the potential noise emissions of the Quarry against PTNLs established in accordance with the NPfI and has therefore considered noise emissions over the remaining life of the Quarry, including the Proposed Modification.

The NIA (Umwelt, 2019) is provided in **Appendix 6** and a summary of findings presented below.

7.4.2 Existing Environment

7.4.2.1 Local Setting

The site is located within a rural environment with typically low background noise levels. Existing noise sources include local road traffic, agricultural activities and industrial contributions from surrounding quarries.

7.4.2.2 Sensitive Receivers

There are 21 residential receivers located on properties adjoining the Quarry Site (refer to **Figure 2.5**). Of these, Receiver D1 is owned by Dixon Sand and is therefore considered Project-related and excluded from the assessment of noise. Three receivers east of Hitchcock Road (PF1, PF2 and PF3) are associated with the PF Graham (No 2) Pty Ltd sand quarry and are covered by an agreement with Dixon Sand to waiver any potential noise impacts from the proposed development. An agreement with respect to noise impacts is also held with the owner of Receiver R2.

Maroota Public School is located on Old Northern Road approximately 1.3 km to the north of the Quarry Site. As noted in **Section 7.3.4.1**, the Proposed Modification does not propose any increase in traffic to the north of the Old Northern Road/Wisemans Ferry Road intersection and hence this receiver will remain unaffected as a result of the Proposed Modification. No other sensitive locations such as schools, churches or major urban development are located near the Quarry Site.

7.4.2.3 Ambient (Background) Noise Levels

To establish contemporary background levels in accordance with the NPfI and to quantify the existing background noise environment of the area, unattended noise monitoring at two representative locations adjacent to the Quarry. The unattended noise survey was conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics - Description and Measurement of Environmental Noise" and the results are summarised in **Table 7.2**.

Table 7.2 Background Noise Monitoring Summary

Location	Period[1]	Measured Background Noise Level (RBL, dB L_{A90})
L1: 1643 Wisemans Ferry Road, Maroota	Day	36
	Evening	32
	Night	30 (27)[2]
	Morning shoulder[3]	35
L2: 5 Hitchcock Road (corner Wisemans Ferry Road), Maroota	Day	34
	Evening	31
	Night	30 (24)[2]
	Morning shoulder[3]	34

Note: [1] Day: 7.00 am to 6.00 pm Monday to Saturday or 8.00 am to 6.00 pm on Sundays and public holidays; Evening: 6.00 pm to 10.00 pm; Night: remaining periods, [2] Minimum NPI RBL adopted for night, bracketed value denotes measured level, [3] Morning Shoulder: 6.00 am to 7.00 am Monday to Saturday (concurrent with the night time period operating hours of the Quarry)

A review of the noise data identified noise levels higher than the night time RBL during the period between 6.00 am and 7.00 am in the morning (refer to Section 4.1.5 and Figures 4.1 and 4.2 of the NIA – **Appendix 6**). The NPfI recognises that under such circumstances "*it may be unreasonable to expect … operations to be assessed against the night-time project noise trigger levels – especially if existing background noise levels are steadily rising in these early morning hours. In these situations, and where operations outside of daytime hours can be justified, appropriate noise level targets may be negotiated with the regulatory/consent authority on a case-by-case basis.*"

A morning shoulder period of 6.00 am to 7.00 am Monday to Saturday (concurrent with the night time period operating hours of the Quarry) has therefore been established and the RBL ($L_{A90(shoulder\ period)}$) presented in **Table 7.2**.

For the purpose of establishing PNTLs, receivers to the west of Haerses Road were considered against the RBL of L1 and receivers to the east of Haerses Road were considered against the RBL of L2.

7.4.3 Project Noise Criteria

7.4.3.1 Project Noise Trigger Levels

The EPA released the Noise Policy for Industry (NPfI) in October 2017 (EPA, 2017) which provides a process for establishing noise criteria for consents and licenses enabling the EPA to regulate noise emissions from scheduled premises under the POEO Act. The NPfI provides a framework and process for deriving operational noise criteria for project approvals and development consents under the EP&A Act and setting operational noise limits in environment protection licences under the POEO Act. The Proposed Modification is a scheduled activity under Schedule 1 of this latter Act.

The policy sets out the procedure to determine the PNTLs relevant to an industrial development. The PNTL is the lower (i.e., the more stringent) value of the Project Intrusiveness Noise Level (PINL) and the Project Amenity Noise Level (PANL) determined in accordance with Section 2.3 and Section 2.4 of the NPI.

- The PINL (LAeq(15min)) is the RBL + 5 dB and seeks to limit the degree of change a new noise source introduces to an existing environment.
- PANL is relevant to a specific land use or locality. To limit continuing increases in intrusiveness levels, the ambient noise level within an area from all combined industrial sources should remain below the recommended amenity noise levels specified in Table 2.2 (of the NPfI).

Table 7.3 presents the PTNLs for the sensitive receivers surrounding the Quarry for the day, evening, night and morning shoulder periods.

Table 7.3 Project Noise Trigger Levels $L_{Aeq(15\ minute)}$ dB(A)

Receivers	Time of day	PINL	PANL	PNTL
R03, R04, R05, R06, R07, R08, R09, R10, R11, R14, R15, R16, R21	**Day period** (7.00 am-6.00 pm Monday -Saturday; 8.00 am-6.00 pm Sunday & Public Holidays)	41	48	41
	Evening Period (6.00 pm – 10.00 pm)	37	43	37
	Night period (10.00 pm to commencement of morning shoulder)	35	38	35
	Morning shoulder (6.00 am-7.00 am Monday-Saturday)	40	38	38
R01, R02, R12, R13	**Day period** (7.00 am-6.00 pm Monday -Saturday; 8.00 am-6.00 pm Sunday & Public Holidays)	40	48	40
	Evening period (6.00 pm – 10.00 pm)	36	43	36
	Night period (10.00 pm to commencement of Morning Shoulder)	35	38	35
	Morning shoulder (6.00 am-7.00 am Monday-Saturday)	39	38	38

7.4.3.2 Sleep Disturbance (Maximum Noise Levels)

As the Quarry could operate during the night-time period (truck loading and transport operations), the potential for sleep disturbance from maximum noise level events from a project during the night-time period needs to be considered. The screening criteria of the NPfI, which would prompt the requirement for a detailed maximum noise level event assessment are as follows:

- LAeq(15min) of 40 dB(A) or the prevailing RBL plus 5 dB(A) (40 dB(A)), whichever is the greater – 40 dB(A)
- LAmax 52 dB(A) or the prevailing RBL plus 15 dB(A) (50 dB(A)), whichever is the greater – 52 dB(A).

Should the screening criteria be exceeded, the detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

7.4.3.3 Voluntary Land Mitigation and Acquisition

The land acquisition and mitigation assessment criteria used to assess noise impacts can be found in Table 1 of the VLAMP and Table 2.2 of the NPfI. Section 4.3 of the NIA (**Appendix 6**) provide further detail on the characterisation of impacts and application of mitigation or acquisition to landowners.

7.4.3.4 Road Noise Criteria

The NSW Road Noise Policy (RNP) (DECCW 2011) sets out criteria for road traffic noise through the provision of a framework that addresses traffic noise issues associated with new developments, new or upgraded road developments or planned building developments.

Table 7.4 outlines the road traffic noise criteria that would be applicable on Wisemans Ferry Road and Old Northern Road. Under the road category definitions provided in Table 2 of the RNP, these roads are considered to fall under the functional road category of arterial/sub-arterial roads.

Table 7.4 Road Traffic Noise Criteria, dB(A)

Road Category	Type of Project/Land Use	Assessment Criteria, dB(A)	
		Day (7.00 am – 10.00 pm)	Night (10.00 pm – 7.00 am)
Freeway/arterial/ sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	LAeq, 15 hour 60 (external)	LAeq, 9 hour 55 (external)

Where the prevailing noise levels are already higher than the criteria, Section 3.4 of the RNP notes that when assessing noise impacts and the effectiveness of feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

Furthermore, specifically relevant to traffic generated by new land use developments, Section 3.4.1 of the RNP states that for existing residences and other sensitive land uses affected by additional traffic on existing roads, any increase in the total noise level should be limited to 2dB above that of the corresponding level without the project. This is applicable when the noise criteria are exceeded in any time.

7.4.4 Assessment Methodology

7.4.4.1 Quarry Operations

Computer noise modelling was undertaken based on the Cadna/A proprietary environmental noise modelling software package. The noise predictions using the Cadna/A software were undertaken using the CONCAWE noise calculation methodology. To predict noise levels at receivers, the model takes into account the:

- sound power levels of the noise sources, in octave or 1/3 octave frequency bands,
- directivity of noise sources,

- topographical shielding of sound propagation,
- sound reflections from solid flat objects, and
- sound absorption due to ground surface covering.

The modelling was undertaken under meteorological conditions which would enhance received noise levels. This provides for source to receiver winds and temperature inversion in accordance with Option 1 of Fact Sheet D of the NPfI for noise enhancing meteorological conditions.

As the Proposed Modification is being assessed in accordance with the NPfI, whereas previous assessment and establishment of criteria was undertaken in accordance with the Industrial Noise Policy (INP) (EPA, 1999), life of Quarry operations have been assessed, namely, operations with the Hawkesbury Sandstone extraction area (approved by Mod 1) and Stages 3, 4, 5 and the proposed northern extension to Stage 5 of the originally approved Tertiary Sand Extraction Area (refer to Figure 5.1 of the NIA). Additional information on the operating scenarios and approach to noise predictions is provided in the NIA (refer to **Appendix 6**).

7.4.4.2 Road Traffic Noise

The road traffic noise levels have been predicted using the Calculation of Road Traffic Noise (CoRTN) algorithms based on traffic data provided by the TIA (Seca, 2019) (refer to **Section 7.37.3** and **Appendix 6**).

Traffic noise levels have been estimated at varying distances from the road, with the relative increase estimated based on the difference in road traffic noise level contribution from the existing and proposed daily volume of quarry trucks, combined with the other road traffic. The relative increase in quarry truck noise due to the Proposed Modification has been estimated assuming that all additional trucks will occur during the day time period (7.00 am to 10.00 pm).

7.4.5 Incorporated Noise Mitigation Measures

The NPfI requires the implementation of reasonable and feasible noise mitigation measures to meet and minimise any exceedances of noise criteria. This approach was utilised to establish noise mitigation measures incorporated in the modelling. An iterative process of noise modelling, optimisation and refinement was used to investigate and optimise possible options.

Initial modelling accounted for the construction of the various 5 m acoustic bund, and other management, mitigation and monitoring measures nominated in the *Quarry Noise Management Plan and Acoustic Bund Construction Noise Management Plan* (Umwelt, 2019c). The scenario for the northerly extension of Stage 5 (of the Tertiary Sand extraction area) provided for the relocation of the 5 m bund to the northern perimeter of the Stage 5 Extension[4].

Following a review of the results of the initial modelling, the following additional noise mitigation measure was applied to the model:

- Application of 6 dB(A) noise reduction treatment to the dump trucks for operations within Stages 4, 5 and 5 Extension.

[4] Based on feedback received from the landowners and residents of properties directly north of the Quarry, the bund would only be constructed and retained for as long as required to maintain the noise levels received at residential receivers to the north below Quarry noise limits (unless requested to be retained by these residents). Dixon Sand will liaise with the landowners and residents to the north of the Quarry Site prior to extraction in Stage 5 for which this bund provides for noise impact mitigation. Subject to agreement with these landowners and residents (who may be different towards the end of the Quarry life when the bund is required), or demonstration of compliance with noise criteria by alternative methods, the bund may not be constructed.

7.4.6 Impact Assessment

7.4.6.1 Quarry Operations

Daytime Operations

The results of the initial noise modelling, which included the existing noise management and mitigation measures (including establishment of noise bunds at select locations around the perimeter of the extraction area), predicted exceedances of the PTNLs are as presented in **Table 7.5**.

Table 7.5 Predicted Noise Levels for the Proposed Modification (Existing Noise Mitigation)

Receiver	PNTL	Quarry Stage (Tertiary Sand Extraction Area)[1]							
		3		4		5		Stage 5 Extension	
		Calm	Wind	Calm	Wind	Calm	Wind	Calm	Wind
R01	40	31	35	36	39	38	**41**	39	**42**
R02[2]	40	**43**	**45**	**46**	**49**	**48**	**51**	**49**	**51**
R03	41	36	38	**42**	**43**	41	**43**	41	**43**
R05	41	38	41	39	**42**	38	**42**	39	**42**
R08	41	41	39	**42**	39	**42**	39	**42**	39
R12	40	28	32	34	37	37	39	**41**	**43**
R13	40	33	37	38	**42**	40	**43**	**41**	**45**

Note: [1] Considers most exposed location in each stage, [2] Dixon Sand will obtain an agreement with Receiver R02 for noise levels exceeding the PTNL

Receiver R02, which is located opposite the Quarry Entrance and is therefore subject to noise generated by the movement of road registered trucks onto and off the Quarry Site, would be subject to elevated noise levels (of between 3 and 11 dB(A)) for the life of the Quarry. An agreement with the landowner of R02 for noise levels exceeding current noise criteria is currently held by Dixon Sand. Exceedances of up to 5 dB(A) are predicted at several receivers commencing in Stage 4.

With the incorporation of the proposed additional noise mitigation, the predicted noise levels are predicted to be reduced to compliant levels at all receivers, excluding Receiver R02, as presented in **Table 7.6**. It is noted the results presented in **Table 7.6** consider the highest predicted noise level (between calm and prevailing wind conditions) and hence noise levels are expected to be less than presented under other less noise enhancing conditions. Dixon Sand has discussed the predicted noise levels with the landowner of Receiver R02 and extended the noise agreement with this landowner.

Table 7.6 Predicted Noise Levels for the Proposed Modification (with Additional Noise Mitigation)

Receiver	PNTL	Quarry Stage (Tertiary Sand Extraction Area)[1]		
		4	5	Stage 5 Extension
R01	40	36	37	38
R02*	40	**46**	**47**	**47**
R03	41	39	39	39
R04	41	37	37	37
R05	41	41	41	41
R06	41	41	40	40
R07	41	37	37	37

Receiver	PNTL	Quarry Stage (Tertiary Sand Extraction Area)[1]		
		4	5	Stage 5 Extension
R08	41	40	40	40
R09	41	39	39	39
R10	41	35	35	35
R11	41	34	34	34
R12	40	33	36	39
R13	40	38	39	40
R14	41	37	37	37
R15	41	39	39	39
R16	41	33	33	33
R21	41	37	37	37

Morning Shoulder Period Operations

Table 7.7 presents predicted noise levels from the truck loading and dispatch operations under the worst-case noise enhancing meteorological conditions applicable during the morning shoulder period.

Table 7.7 Predicted Noise Levels during Morning Shoulder Period (6.00 am to 7.00 am Monday to Saturday)

Receiver	PNTL	Predicted Noise Level
R01	38	33
R02	38	**45**
R03	38	37
R04	38	34
R05	38	32
R06	38	27
R07	38	31
R08	38	33
R09	38	31
R10	38	28
R11	38	28
R12	38	28
R13	38	36
R14	38	36
R15	38	35
R16	38	26
R21	38	22

As shown in **Table 7.7**, with the exception of Receiver R02 (with whom a Noise Agreement will be established) the predicted noise levels associated with the Proposed Modification are expected to comply with the PNTL during the shoulder period, even under the worst-case noise enhancing meteorological conditions, at all receivers.

Sleep Disturbance (Maximum Noise Levels)

The only proposed noise emissions during the night time (morning shoulder) period are due to the arrival, loading and departure of product trucks via the site access at the intersection of Haerses Road and Wisemans Ferry Road. The predicted noise levels from these operations under worst-case meteorological conditions are less than 38 dB(A) $L_{Aeq(15\ minute)}$ (refer to **Table 7.7**). The predicted noise levels are therefore compliant with the $L_{Aeq(15\ minute)}$ screening level of 40 dB(A) for the assessment of sleep disturbance at receivers.

In regard to the L_{Amax} screening level of 52 dB(A), it is expected that the noise levels of light and heavy vehicles travelling at typical speeds along Wisemans Ferry Road during the shoulder period 6am to 7am would be significantly higher than the L_{Amax} noise levels of trucks accessing and egressing the Quarry which would be travelling at lower speeds. The continued Quarry operations of the Proposed Modification would therefore have no influence on Maximum Noise levels received at residences on Wisemans Ferry Road (refer also to Section 5.5 of the NIA – **Appendix 6**).

Discussion

With the addition of noise control treatments to the 40 t haul trucks to reduce their noise emissions by at least 6 dB(A), the predicted noise levels of the Quarry are expected to comply at all receivers, with whom a noise agreement will not be in place, for all quarry stages under worst-case meteorological conditions. It is noted that the installation of noise mitigation to the haul trucks to reduce noise emissions by at least 6 dB(A) is reasonable and feasible, however, it is noted that should alternative methods of reducing or managing noise levels be identified the modification to the trucks may not be necessary.

On the basis of the noise modelling results, which are based on worst-case meteorological conditions and conservatively modelled scenarios, Dixon Sand is confident that noise emissions can be managed to maintain compliance with the PNTL throughout the Quarry's life.

7.4.6.2 Road Traffic Noise

The relative increase in noise levels due to the Proposed Modification are shown in **Table 7.8.**

Table 7.8 Estimated Increase in Traffic Noise Levels due to the Proposed Modification dB(A)

Time Period	Road	Current Year	10-Year Projection
Day 7.00 am – 10.00 pm	Old Northern Road - North of Wisemans Ferry Road	1	1
	Wisemans Ferry Road - East of Haerses Road	1	1
Night 10.000 pm – 7.00 am	Old Northern Road - North of Wisemans Ferry Road	0	0
	Wisemans Ferry Road - East of Haerses Road	0	0

As shown in **Table 7.8**, the relative increase in road traffic noise levels due to the project modification is predicted to be 1 dB(A) or less at all receivers. An increase of 1 dB(A) from road traffic noise levels would not typically be noticeable by receivers.

7.4.6.3 VLAMP Assessment

With the exception of Receiver R02 (with whom a Noise Agreement will be established) the predicted noise levels do not exceed any of the VLAMP criteria at any receivers.

7.4.7 Monitoring and Management

Until Quarry operations progress to Stage 4 of the Tertiary Sand Extraction Area, no change to the existing management and monitoring measures implemented by the Quarry are required and Dixon Sand will continue to operate the Quarry in line with the existing *Noise Management Plan* (Dixon Sand, 2018b). Most notably, Dixon Sand will construct strategically located noise bunds and undertake extraction operations behind a 6 - 7 m advancing face.

Prior to commencement within Stage 4 of the Tertiary Sand Extraction Area, Dixon Sand will review noise levels and apply relevant modification to the dump trucks to reduce noise emissions by at least 6 dB(A), or implement alternative noise mitigation or management measures to ensure continued compliance with the PTNLs at all receivers with whom a noise agreement is not held.

7.5 Air Quality

7.5.1 Scope

An assessment of the air quality impacts of the Proposed Modification has been undertaken by ERM in general accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (Approved Methods) (EPA 2016). The Air Quality Assessment (ERM, 2019) is provided in **Appendix 7** and a summary of findings presented below.

7.5.2 Existing Environment

7.5.2.1 Meteorology

ERM undertook a review of the local meteorological and ambient air quality conditions in the vicinity of the Quarry with the objective of identifying any existing air quality issues and meteorological conditions which would typically influence the local air quality conditions.

Air quality impacts are influenced by meteorological conditions, primarily in the form of gradient wind flow regimes, and by local conditions that are generally driven by topographical features and interactions with coastal influences, such as the sea breeze. Wind speed, wind direction, temperature and relative humidity all affect the potential dispersion and transport of plumes and are basic input requirements for dispersion modelling.

Wind speed and direction data have been collected locally at the Maroota Public School, approximately 3 km north of the Quarry. The air quality assessment completed for the Proposed Modification used meteorological data from Maroota Public School for the 2017 period. This year was selected on the basis that there is little variation year-on-year, but 2017 is most representative with respect to existing air quality in the area.

On an annual basis, the predominant winds are from the south-south-west, east and north quadrants. Summer and spring winds are predominantly from the east while for winter the winds are mainly from the south-south-west, west-north-west and north, and for autumn the winds are primarily from the south-south-west and south-west.

The stability of the atmosphere plays a large role in determining the dispersion of a plume and it is important to have it correctly represented in dispersion models. ERM (2019) calculated hourly averaged stability indicators for the site with results indicating that the lowest 1km of the atmosphere is stable overnight and becomes unstable as radiation from the sun heats the surface layer of the atmosphere and drives convection. This indicates that the diurnal patterns of stability are realistic.

7.5.2.2 Background Air Quality

For the purposes of assessing potential air quality impacts, the following existing air quality levels were assumed by ERM (2019) for assessment against the long-term criteria. PM_{10} and $PM_{2.5}$ are also assessed against a short-term (24-hour average) criteria.

- Annual average PM_{10} concentration of 13.8 µg/m^3 based on the 5-year average of data collected at Maroota Public School.
- Annual average $PM_{2.5}$ concentration of 5.7 µg/m^3 calculated by applying the $PM_{2.5}$:PM_{10} ratio of data collected at OEH sites to the 5-year average PM10 concentration.
- Annual average TSP concentration of 34.5 µg/m^3 calculated based on the assumption that 40% of TSP is PM_{10}.
- Annual average dust deposition of 1.5 g/m^2/month.
- 24-hour average PM10 concentration – varies daily (Maroota Public School 2017 daily data) with the worst-case 24-hour PM_{10} concentrations strongly influenced by other sources in the area, such as bushfires and dust storms.
- 24-hour average $PM_{2.5}$ concentration – varies daily ($PM_{2.5}$:PM_{10} ratio of 0.41 applied to Maroota Public School 2017 daily data).

7.5.3 Air Quality Criteria

The Approved Methods specify air quality assessment criteria relevant for assessing impacts from air pollution (EPA, 2016). The impact assessment criteria for pollutants relevant to this assessment refer to the total pollutant load in the environment and impacts from new sources of these pollutants must be added to existing background levels for compliance assessment. In other words, consideration of background dust pollutant levels needs to be made when using the goals outlined in the Approved Methods to assess potential impacts.

These criteria are health-based (i.e. they are set at levels to protect against health effects) and for PM_{10} and $PM_{2.5}$ are consistent with the *National Environment Protection Measure for Ambient Air Quality* (Ambient Air-NEPM) (NEPC, 2016). In addition, the Approved Methods include other measures of air quality, namely dust deposition and total suspended particulates (TSP) which are not stated in the Ambient Air-NEPM.

Airborne dust also has the potential to cause nuisance dust effects by depositing on surfaces, including vegetation. Larger particles do not tend to remain suspended in the atmosphere for long periods of time and will fallout relatively close to source. Dust fallout can soil materials and generally degrade aesthetic elements of the environment and is assessed for nuisance amenity impacts.

Table 7.9 summarises the air quality criteria for concentrations of particulate matter that are relevant to this study. It is important to note that these criteria are applied to the cumulative impacts due to the Proposal and other sources. **Table 7.9** also shows the maximum acceptable increase in dust deposition over the existing dust levels from an amenity perspective. These criteria for dust deposition levels are set to protect against nuisance impacts (NSW EPA, 2017).

Table 7.9 NSW EPA Impact Assessment Criteria for Key Emissions

Pollutant	Criteria	Averaging Period	Source
TSP	90 µg/m^3	Annual	NSW EPA (2016)
PM_{10}	50 µg/m^3	24-hour	NSW EPA (2016)
	25 µg/m^3	Annual	

Pollutant	Criteria	Averaging Period	Source
$PM_{2.5}$	25 µg/m^3	24-hour	NSW EPA (2016)
	8 µg/m^3	Annual	
Deposited dust (insoluble solids)	2 g/m^2/month	Annual (maximum increase)	NSW EPA (2016)
	4 g/m^2/month	Annual (maximum total)	

The NSW Voluntary Land Acquisition and Mitigation Policy (VLAMP) (NSW Government, 2018) sets out voluntary mitigation and land acquisition rights for circumstances where it is not possible to comply with the NSW EPA impact assessment criteria even with the implementation of all reasonable and feasible avoidance and/or mitigation measures. The VLAMP criteria are aligned with the NEPM and NSW EPA impact assessment criteria as detailed in **Table 7.9** above.

7.5.4 Impact Assessment

7.5.4.1 Methodology

The air dispersion modelling conducted for this assessment is based on an advanced modelling system using the AERMET/AERMOD model. AERMOD was chosen as the most suitable model due to the source types, location of nearest receptors and nature of local topography.

Worst-case operating scenarios were assessed, based on the assumption that all the potential activities occur simultaneously, namely:

- sand extraction and processing of material from both the approved and proposed Tertiary Sand Extraction Area,
- sand extraction and processing of material from the friable sandstone extraction area,
- rehabilitation in tertiary and friable areas, and
- placement of VENM/ENM in the friable sandstone extraction area.

This is considered a conservative assessment as, due to equipment limitations, only one of the following scenarios would typically occur:

- sand extraction and rehabilitation in Tertiary Sand Extraction Area plus VENM/ENM profiling and management in friable area; or
- sand extraction in friable sandstone extraction area plus rehabilitation in Tertiary Sand Extraction Area for rehabilitation; or
- sand extraction in friable sandstone extraction area plus VENM/ENM profiling and management in friable sandstone area.

The operations of the Proposed Modification have been analysed and estimates of dust emissions for the key dust-generating activities have been made. Emission rates of TSP, PM_{10} and $PM_{2.5}$ have been calculated using emission factors developed both within NSW and by the US EPA. The full emissions inventories and detailed modelling results are presented in **Appendix 7**, with a summary of modelling results provided below.

7.5.4.2 Annual Average PM_{10}, $PM_{2.5}$ and TSP

The results of the modelling indicate that the predicted annual average PM_{10}, $PM_{2.5}$, TSP and dust deposition at the closest sensitive receivers due to both the Proposed Modification alone and cumulatively all comply with the impact assessment criteria.

7.5.4.3 Maximum 24-hour Average PM_{10} and $PM_{2.5}$

It is important to note the difficulty in accurately predicting both the Proposed Modification contribution, and the cumulative, maximum 24-hour average concentrations. This is due to a combination of the day-to-day variability in existing ambient dust levels, and the spatial and temporal variation in any other anthropogenic activity in the vicinity e.g. agricultural activity, bushfires, and other dust-generating activity in the future. The existing air quality data showed the worst-case 24-hour PM_{10} concentrations measured at Maroota Public School have been strongly influenced by other sources in the area, such as bushfires and dust storms, which are essentially unpredictable.

When considering 24-hour averages for $PM_{2.5}$, there are no predicted exceedances of the relevant assessment criteria (either due to the Proposed Modification alone or cumulatively).

There are no predicted exceedances of the 24-hour average PM_{10} criteria due to the Proposed Modification alone. When considering cumulative concentrations, however, there is one receptor (PF3, owned by PF Formation), that is predicted to experience one additional day over the EPA cumulative criterion. As detailed above in **Section 7.5.4**, the operational scenario assessed is considered conservative as in reality not all activities can occur simultaneously. When combined with the uncertainty around what the actual background concentrations will be on a day-to-day basis it considered that the potential for any additional exceedances to occur because of the Proposed Modification is minimal.

7.5.4.4 Deposited Dust

The highest annual average dust deposition rates due to the Proposed Modification are well below the EPA criterion of 2 g/m^2/month. With the addition of the highest background levels recorded there will be no predicted exceedance of the cumulative assessment criterion of 4 g/m^2/month.

7.5.5 Monitoring and Management

Based on the findings of the air quality assessment, no change to the existing management and monitoring measures implemented by the Quarry are considered necessary for the Proposed Modification. Dixon Sand will continue to operate the Quarry in line with the existing *Air Quality Management Plan* (Dixon Sand, 2019).

The following air quality management measures will continue to be implemented at the Quarry as part of the Proposed Modification:

- use of a water cart to control emissions from haul roads (unsealed)
- enforcement of speed limits onsite
- progressive rehabilitation of exposed areas
- minimising drop height of material during truck loading and unloading where possible
- management of dust-generating activities during unfavourable meteorological conditions

7.6 Greenhouse Gas and Energy

7.6.1 Scope

A Greenhouse Gas and Energy Assessment (GHGEA) has been prepared by Umwelt which includes a quantitative assessment of the potential Scope 1, 2 and 3 emissions associated with the Proposed Modification, along with an assessment of the potential impacts of these emissions on the environment.

7.6.2 Methodology

The GHGEA was prepared using an assessment framework consistent with the internationally recognised GHG Protocol (WBCD/WRI 2004) and the most recent Australian emission factors published in the National Greenhouse Accounts (NGA) Factors (DoEE 2018).

The GHG Protocol defines three distinct emissions classes (scopes) for GHG accounting and reporting purposes. The emission scopes are defined as follows.

- Scope 1 emissions are direct emissions which occur from sources owned or controlled by the reporting entity, over which they have a high level of control (such as fuel use).
- Scope 2 emissions are those generated from purchased electricity consumed by the reporting entity, which can be easily measured and can be influenced through energy efficiency measures. Scope 2 emissions physically occur at the facility where electricity is generated, that is, the power station.
- Scope 3 emissions are indirect emissions that are a consequence of the activities of the reporting entity, but which occur at sources owned or controlled by another reporting entity (e.g. outsourced services).

The GHGEA for the Proposed Modification is limited to quantifying the greenhouse gas emissions associated with on-site energy use. The assessment does not assess greenhouse gas emissions associated with product use, product transport or land use change (clearing vegetation, developing biodiversity offsets and revegetation).

The Proposed Modification provides the potential to increase Scope 3 emissions associated with third party contractors transporting products and/or fill materials (VENM and ENM), however, these emissions have not been quantified in this assessment as Scope 3 emissions associated with transport were not included in the GHGEA completed for the approved development.

7.6.3 Data and Assumptions

The following data and assumptions were used to prepare the GHGEA.

- The Quarry will operate between 2020 and 2046.
- The maximum extraction rate will increase from 250,000 to 495,000 tpa.
- All crushing and washing activities will consume grid electricity and not diesel (as was assumed for the approved development).
- Earthmoving equipment will consume up to 198 kL of diesel per annum to extract 495,000 t of tertiary and friable sand and progressively rehabilitate the Quarry.
- A mobile diesel-powered screen will consume up to 44 kL of diesel per annum, to process 175,000 t of tertiary sand.
- Crushers will consume up to 880,000 kWh of grid electricity per annum to process 320,000 t of friable sand.
- A wash plant will consume up to 153,000 kWh of grid electricity per annum to process 250,000 t of friable sand.
- Other on-site services (weighbridge, workshops, etc.) will consume up to 25,000 kWh of grid electricity per annum to support all operations.

7.6.4 Results

Table 7.10 summarises the potential energy demand for the total Quarry life, following the Proposed Modification. The forecast energy demand for the Proposed Modification includes energy demand that has already been assessed and approved as part of the approved Quarry (i.e. energy demand associated with extracting and processing 250,000 tpa). To quantify the additional energy demand associated with the Proposed Modification, all energy demand associated with the approved Quarry must be subtracted from the Proposed Modification. The energy demand that can be attributed to the Proposed Modification is shown in **Table 7.10**.

Table 7.10 Net Impact of the Proposed Modification on Energy Demand

Energy Type	Approved Development (GJ)	Proposed Modification (GJ)	Additional Energy Demand (GJ)
On-site fuel use	239,706	252,212	12,506
Grid electricity use	810	102,843	102,033
Total energy use	240,516	355,055	114,539

Table 7.10 demonstrates that the Proposed Modification is expected to require approximately 115,000 additional gigajoules of energy over the life of the Quarry. **Table 7.10** also indicates that the Proposed Modification is expected to require significantly more electricity than the approved development, and very little additional diesel. The energy use allocation between diesel and electricity has changed due to the product processing assumptions made for the Proposed Modification. The approved Quarry assumed that products would be processed using diesel-powered mobile equipment (high diesel demand, low electricity demand). The Proposed Modification assumes that most of the processing will be powered by electricity (low diesel demand, high electricity demand).

Table 7.11 summaries the potential greenhouse gas emissions for the total quarry life, following the Proposed Modification.

Table 7.11 Net Impact of the Proposed Modification on Greenhouse Gas Emissions

Scope	Source	Approved Development (t CO_2-e)	Proposed Modification (t CO_2-e)	Additional Emissions (t CO_2-e)
1	On-site fuel use	16,827	17,705	878
2	Grid electricity use	189	23,448	23,259
3	Emissions associated with the production of diesel and electricity	891	3,788	2,897
	Total	17,907	44,941	27,034

Table 7.11 demonstrates that the Proposed Modification can be associated with the generation of approximately 28,000 additional tonnes of CO_2-e over the life of the Quarry, primarily generated as Scope 2 emissions.

7.6.5 Impact Assessment

The accumulation of greenhouse gases or carbon in 'carbon sinks' is the primary impact of greenhouse gas emissions. Since the industrial revolution, anthropogenic greenhouse gas emissions have accumulated in three major carbon sinks – the ocean (30%), terrestrial plants (30%) and the atmosphere (40%) (BOM and CSIRO 2014).

The accumulation of greenhouse gases in the atmosphere is an important driver of global warming, sea level rise and climate change (IPCC 2013). Sea level rise and climate change may have many ramifications for the natural and built environment. The accumulation of greenhouse gases in the ocean is an important driver of ocean acidification (IPCC 2013).

The Proposed Modification is forecast to generate approximately 900 t CO_2-e Scope 1 emissions over the life of the Quarry. The Proposed Modification's direct emissions are unlikely to change the potential greenhouse gas impacts already associated with the approved development.

The estimated emissions reflect a small increase and total in the context of State and National emissions and no significant greenhouse gas emissions management is warranted.

Notwithstanding, Dixon Sand is committed to implementing all reasonable and feasible measures to minimise the generation of greenhouse gas emissions. Ongoing commitments documented in the *Haerses Road Quarry Air Quality Management Plan* (Umwelt 2019) include:

- regularly tuning and maintaining mobile and fixed equipment to minimise exhaust and greenhouse gas emissions, and
- reviewing opportunities for improvement in diesel use and energy efficiency when purchasing or replacing equipment at the quarry to reduce greenhouse gas emissions.

7.7 Groundwater

7.7.1 Scope

A Groundwater Assessment (GWA) has been undertaken for the Proposed Modification by Golder Associates Pty Ltd (Golder 2019) to assess the potential impacts of the Proposed Modification on the existing groundwater regime. The objectives of the GWA were to review and describe the hydrogeological setting, including the wet weather groundwater level of the MTSGS, assess the Proposed Modification against the *NSW Aquifer Interference Policy* (NOW 2012) and provide recommendations for ongoing monitoring and management of groundwater. A summary of the key findings of the GWA, which can be reviewed in full as **Appendix 8**, is provided in the following subsections.

7.7.2 Hydrogeological Setting

7.7.2.1 Groundwater Occurrence

Two aquifers have been identified across the Quarry site, namely:

- the Maroota Tertiary Sand Groundwater Source (MTSGS) which occurs in the Maroota Sands deposit and in the upper (weathered) part of the Hawkesbury Sandstone (eluvial sands)
- the Hawkesbury Sandstone, a regional fractured rock aquifer that forms part of the Sydney Central Basin Groundwater Source (SCBGS).

As has previously been discussed, the extraction areas of the Quarry have been defined and designed with reference to these aquifers and **Figure 7.1** identifies the extent of each over the Quarry site and beyond.

Maroota Tertiary Sand Groundwater Source

The MTSGS is recharged by direct rainfall infiltration and is subject to seasonal rainfall variations and longer-term climatic cycles. At the Quarry, water bore drilling has identified the MTSGS comprises of thin layers of gravel, thick sequences of clay, and interbedded clays and sands. These profiles are typical of palaeochannel sequences and represent the meandering nature of old river systems (Woodward and Clyde 1999).

In the weathered profile of the Hawkesbury Sandstone small aquifer zones have developed in the eluvial sand (such as the deposit which is the quarry resource for the approved Quarry), which comprises the leached and weathered profile of the Hawkesbury Sandstone. These zones often form perched aquifer systems above the deeper regional water level of the Hawkesbury Sandstone. In the majority of cases, these perched aquifer systems have limited resource value because, like the Maroota Sand, they have small aerial extent and storage. They act as temporary storage of groundwater prior to leakage to underlying aquifers.

The water level of the MTSGS has been monitored and recorded at the Quarry (from 13 monitoring bores) since 2005 with a strong relationship between rainfall and groundwater level confirmed. Based on this monitoring data, contours of the groundwater table elevation have been derived (refer to **Figure 7.2**) which illustrate groundwater flow is typically in the west to south-westerly direction.

Groundwater quality has also been monitored from water sampled from the Quarry bores. With an average electrical conductivity of 176 µS/cm and TDS of 97 mg/L, the source is classified as a highly productive groundwater source under the criteria of the *NSW Aquifer Interference Policy* (AIP) (DPI 2012).

Sydney Central Basin Groundwater Source

The Hawkesbury Sandstone is generally an impermeable rock and although the rock has very little primary permeability, fracturing and jointing, where open and interconnected, provides secondary permeability and storativity.

Water within the Hawkesbury Sandstone occurs as perched water tables due to the different degree of fracturing and the presence of confining layers (such as the shale lenses) within the rock mass (DWLC 2001), as well as a deeper regional aquifer. The large difference in groundwater elevation between the shallow perched water and deeper regional groundwater level of the Hawkesbury Sandstone suggests poor hydraulic connection between each of the water bearing horizons in the Hawkesbury Sandstone.

7.7.2.2 Groundwater Users

There are a total of 18 existing bores within 1 km of the Quarry, 11 of which target the deep SCBGS with the remaining seven targeting the shallow MTSGS (refer to **Figure 7.1**). The closest bore in the MTSGS is located approximately 250 m north-east of the proposed extraction area extension. This bore, the status of which is unknown, was drilled to a depth of 11.83 m with a reported groundwater level of 10.57 m below ground level (bgl).

7.7.2.3 Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystems (GDEs) are ecological communities that are dependent, either entirely or in part, on the presence of groundwater for their health or survival. In the immediate area of the Maroota Sands and eluvial sands on Hawkesbury Sandstone, Freimanis et al. (2000) identified ten discrete locations that were considered partially groundwater dependent based on their distinct plant communities. These are located primarily around the edges of the sand mass in shallow aquifer discharge areas where springs are likely to occur at the base of the alluvial sand or eluvial sand deposit. The closest GDE to the Quarry identified in the Freimanis et al. (2000) report is located near the edge of the sand mass about 500 m to the north of the MOD3 extension area.

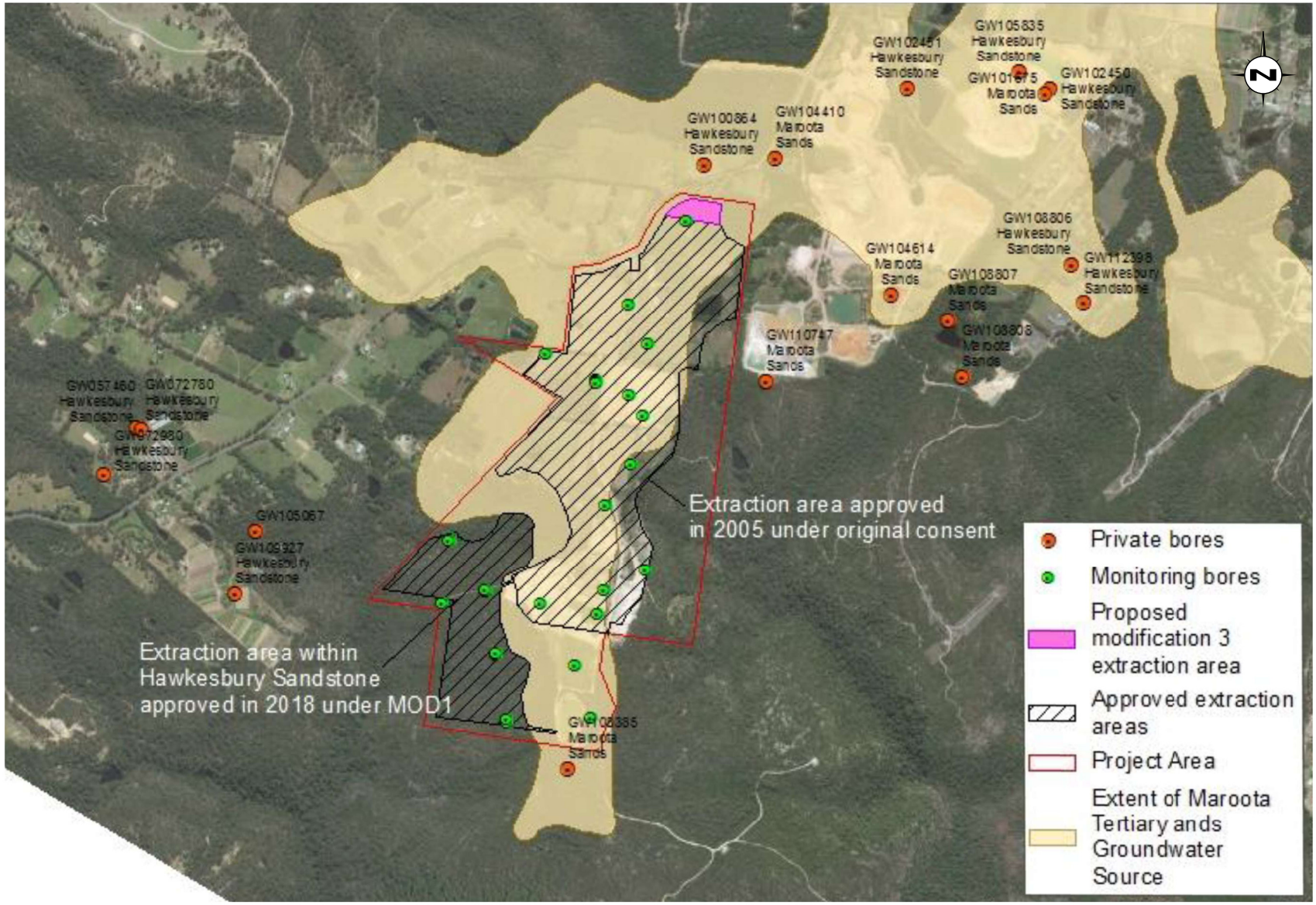

FIGURE 7.1

Hydrogeological Setting

0 0.25 0.5 1.0km

1:20 000

Image Source: Golder (2019)

File Name (A4): R01/4607_037.dgn
20191009 9.19

7.7.3 Wet Weather Groundwater Level and Maximum Extraction Depth

Compliant with the approach taken by Dundon Consulting Pty Ltd to establish the Maximum Extraction Depth (Dundon 2018), which is to remain at least 2 m above the highest recorded wet weather groundwater level, the groundwater level immediately following any rainfall event of at least 50 mm over any 24-hour period has been reviewed.

Since 2005, there have been approximately 31 days when the total daily rainfall exceeded 50 mm. Based on the wet weather groundwater level calculated at H6, the monitoring location closest to the proposed extraction area extension, the hydraulic gradient established for the MTSGS (refer to **Figure 7.2**) and requirement of 2 m separation between the quarry depth and wet weather groundwater level, Golder (2019) identified that the maximum extraction depth for the extension area ranges from 186 m AHD in the west to 188 m AHD in the east.

Golder (2019) also confirmed that the wet weather groundwater level for the remaining monitoring bores, and therefore extraction depth, has not changed since the review of Dundon (2018), and therefore the maximum extraction depth for the current approved extraction areas has not changed.

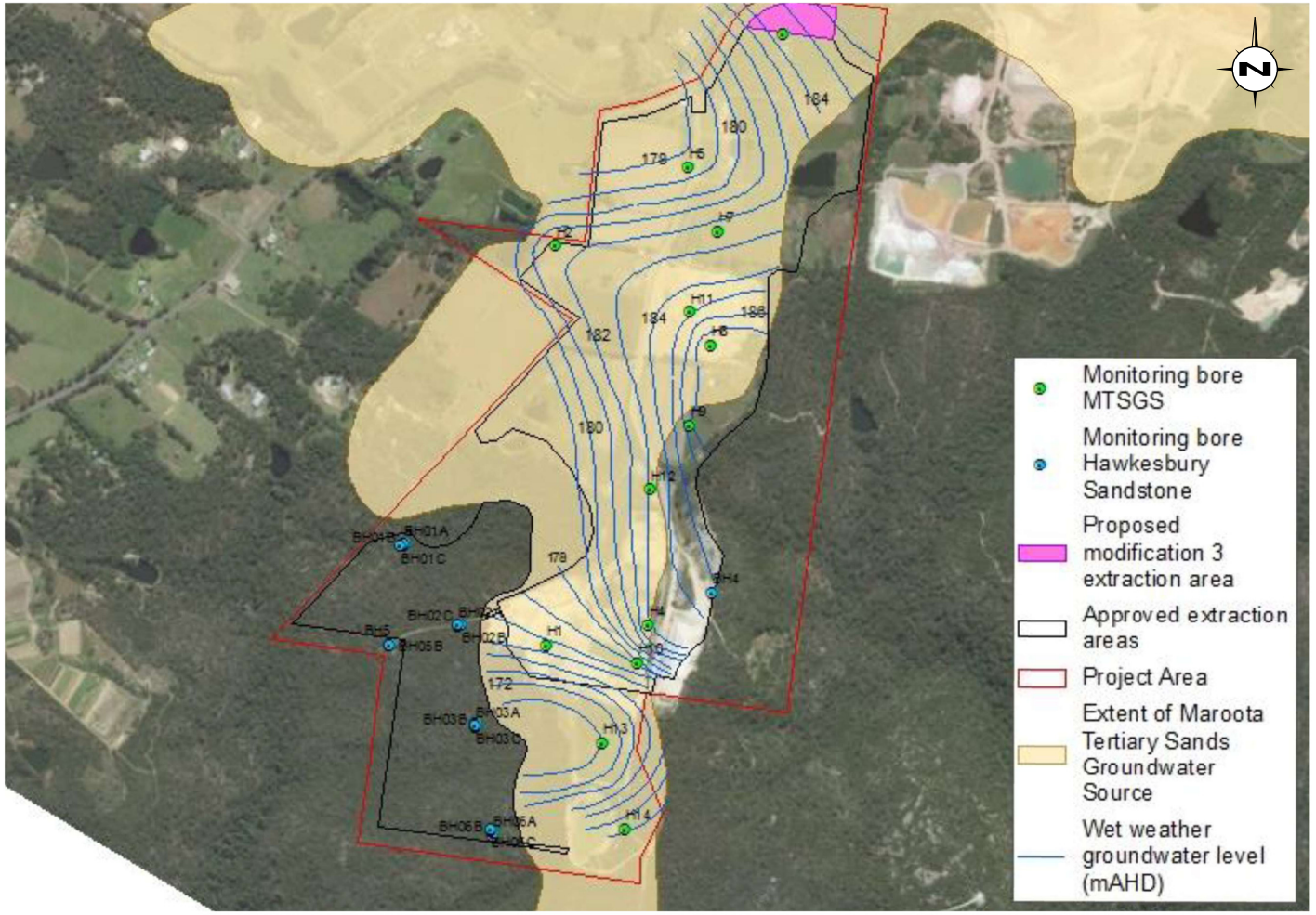

FIGURE 7.2

MTSGS Groundwater Table

0 250 500 750 m

1:15 000

Image Source: Golder (2019)

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20140214 9.05

7.7.4 Impact Assessment

Based on extraction remaining at least 2 m above the wet weather groundwater level of the MTSGS (as identified in **Section 7.3.3**), the Proposed Modification would have no direct impact on local groundwater or groundwater users. **Tables 7.12** and **7.13** provides a summary of the predicted impacts, mitigation and monitoring of the Proposed Modification against the minimal impact criteria for highly productive alluvial groundwater sources outlined in the *NSW Aquifer Interference Policy* (DPI NOW, 2012).

Table 7.12 Aquifer Interference Policy - Highly Productive Alluvial Groundwater Sources

Parameter	AIP Requirement	Response
Water table	1. Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any: (a) High priority groundwater dependent ecosystem; or (b) High priority culturally significant site; listed in the schedule of the relevant water sharing plan. A maximum of a 2 m decline cumulatively at any water supply work.	**Impact** No groundwater impacts to the MTSGS are expected from the Proposed Modification as the extraction depth will continue to be maintained at least 2 m above the wet weather level No GDEs have been identified in the area. **Mitigation** Extraction is currently limited to 2 m above the wet weather groundwater level. The wet weather groundwater level will be reviewed every three years and extraction levels modified as required. **Monitoring** Groundwater level monitoring to continue as described in **Section 7.7.4.2**.
	2. If more than 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40m from any: (a) High priority groundwater dependent ecosystem; or (b) High priority culturally significant site; listed in the schedule of the relevant water sharing plan, then appropriate studies would be required to demonstrate to the Minister's satisfaction that the variations will not prevent the long-term viability of the dependent ecosystem or significant site. If more than a 2 m decline cumulatively at any water supply work, then make good provisions should apply.	
Water quality	1. Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40m from the activity.	**Impact** No groundwater quality related impacts have occurred from existing quarry operations and none are expected to occur as a result of the Proposed Modification There are no GDE or water supply works identified in the greater area that could be impacted. **Mitigation** Quarrying will be maintained 2 m above the wet weather level. **Monitoring** Existing monitoring bores will be maintained on to detect any unforeseen groundwater quality impacts for the life of the Quarry.
	2. If condition 1 is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works.	

Table 7.13 Aquifer Interference Policy – Minimal Impact Considerations

AIP Minimal Impact Requirement	Summary of Compliance
Establishment of baseline groundwater conditions including groundwater depth, quality and flow based on sampling of all existing bores in the area potentially affected by the activity, any existing monitoring bores and any new monitoring bores that may be required under an authorisation issued under the *Mining Act 1992* or the *Petroleum (Onshore) Act 1991*.	Groundwater monitoring network has been continuously upgraded since 2005 and currently includes 22 active monitoring bores. These bores are installed with continuous level data loggers to monitor groundwater levels. Water quality monitoring is also undertaken to assess potential water quality impacts. Baseline groundwater and quality data has been captured since 2005 for MTSGS and 2011 for SBCGS, over a range of climatic variations. From this data the wet weather groundwater level and maximum extraction depth has been determined.
A strategy for complying with any water access rules applying to relevant categories of water access licences, as specified in water sharing plans. For example, returning water of an acceptable quality to the affected water source during periods when flows are at levels below which water users are not permitted to pump.	Dixon Sand holds existing water allocations for dust suppression and the onsite wet processing. The proposed MOD3 extraction will not result in any take of groundwater from the MTSGS or regional SBCGS as extraction will be maintained 2 m above the wet weather groundwater level.
Details of potential water level, quality or pressure drawdown impacts on nearby water users who are exercising their right to take water under a basic landholder right. Consideration will need to be given to any relevant distance restriction requirements that may be specified in any relevant water sharing plan or any remediation measures to address these impacts.	No impact to existing users as extraction will be maintained at least 2 m above the wet weather groundwater level and groundwater will therefore not be intercepted by extraction.
Details of potential water level, quality or pressure drawdown impacts on nearby licensed water users in connected groundwater and surface water sources.	Third party bores have been identified. No impact to existing users as extraction will be maintained at least 2 m above the wet weather groundwater level and groundwater will therefore not be intercepted by extraction.
Details of potential water level, quality or pressure drawdown impacts on groundwater dependent ecosystems.	The closest GDE was identified in the Freimanis 2000 report, which is located near the edge of the sand mass about 500 m to the north of the MOD3 extension area. There will be no drawdown impact on this GDE as the water table will not be intercepted by quarrying.
Details of potential for increased saline or contaminated water inflows to aquifers and highly connected river systems.	Mitigation measures for contamination are in place.
Details of the potential to cause or enhance hydraulic connection between aquifers.	There will be no enhanced hydraulic connection between the MTSGS and underlying SBCGS as extraction will be maintained at least 2 m above the wet weather groundwater level.
Details of the potential for river bank instability, or high wall instability or failure to occur.	Quarrying will not be carried out near any creek or river.
Details of the method for disposing of extracted water (in the case of coal seam gas activities).	N/A

7.7.5 Management and Monitoring

7.7.5.1 Management

Dixon Sand would continue to maintain the maximum extraction depth at least 2 m above the wet weather groundwater level.

The wet weather groundwater level will be reviewed at least every three years and extraction levels modified as required.

The groundwater monitoring program (as described in **Section 7.7.5.2**) will be implemented and reviewed at least annually following the preparation of the Quarry Annual Review.

The risk of groundwater contamination through operational activities is considered very low. This notwithstanding, all hydrocarbon and other potential pollutant storage wold be in bunded containers or areas to prevent spillage and possible seepage to the groundwater. Effective spill prevention and clean-up would further safeguard against the accumulation of contaminants which could seep to the underlying groundwater.

7.7.5.2 Monitoring

The existing and approved groundwater monitoring program, which has been designed to detect changes in groundwater levels, groundwater quality, or to indicate an abnormal condition in response to quarrying, would be continued. Key aspects of the groundwater monitoring program include:

- Continuous monitoring of groundwater levels in the MTSGS and SCBGS,
- water quality sampling from groundwater across the site on a biannual basis, and
- visual inspections of the pit walls, and in the unlikely event that groundwater inflows occur (noting that the existing pit has been designed to stay 2 m above the wet weather groundwater level of the MTSGS), monitor, sample and assess groundwater inflows and quality.

Monitoring will be continued for the life of Quarry operations with the results used to refine the mapping of the extent of the MTSGS and the wet weather groundwater level in both the MTSGS and the SCBGS. The monitoring will also serve to detect any unpredicted groundwater level or quality impacts.

7.8 Surface Water

7.8.1 Local Setting

7.8.1.1 Catchment and Hydrology

The Quarry is located within the Little Cattai Creek catchment, a sub-catchment of the Hawkesbury-Nepean catchment. The Little Cattai Creek catchment covers an area of 9,980 ha with the Haerses Road Quarry site comprising 71 ha or 1% of this catchment area (refer to **Figure 7.3**). Water use within the catchment is regulated under the *Water Sharing Plan (WSP) for the Greater Metropolitan Region Unregulated River Water Sources* which commenced on 1 July 2011.The WSP covers an area of approximately 32,500 km^2, from Shoalhaven Heads in the south, Broken Bay in the north, Lithgow to the west and Goulburn to the south west. The WSP encompasses 87 management zones that are grouped into six water sources.

The Quarry site straddles a flat ridgeline, followed by Haerses Road, which takes an approximately north-south orientation through the site. The western extent of the approved Friable Sandstone Extraction Area lies at approximately 126 m AHD. To the east of the Tertiary Extraction Area, surface elevation rises from 176 m AHD to the east of Haerses Road near the boundary of Stage 2 to approximately 204 m AHD at the proposed north eastern extent of the Stage 5. Runoff from the presently undisturbed catchments either side of Haerses Road flows to tributaries of Stone Chimney Arm (a tributary to Little Cattai Creek) to the west and Little Cattai Creek to the east (refer to **Figure 7.4**). The confluence of Stone Chimney Arm and Little Cattai Creek is approximately 1.5 km south of the Quarry. Little Cattai Creek continues in a southerly and then westerly direction into the Hawkesbury River approximately 10 km south-west of the site.

Runoff from the disturbed areas within the Quarry is contained within the Quarry Water Management system (WMS) and further detail is presented in **Section 7.8.3** . As a consequence of the highly porous nature of the disturbed quarry catchments, a significant proportion of runoff rapidly infiltrates exposed surfaces as groundwater recharge.

7.8.1.2 Soils

The Quarry is underlain by two separate soil landscapes - the Maroota (ma) and Gymea (gy) soil landscapes as per mapping undertaken by McInnes (1997). Both soil landscapes have a high to extreme erosion hazard under concentrated flows and are also highly permeable. Therefore, particular care must be taken with erosion and sediment control measures to prevent erosion of soils.

7.8.1.3 Climate

For water balance considerations it is important to have data that contains the long-term climate records for a site (i.e. typically greater than 100 years). There are numerous Bureau of Meteorology (BoM) stations located in the region surrounding the Quarry that record daily rainfall. Long term daily rainfall data is available for Old Telegraph Road, Maroota (Station 067014) located approximately 2 km north-east of the Quarry with daily rainfall records from 1925 to date. Although the records available are missing some periods of data (i.e. 1954 - 1965), and have patchy data during some periods (i.e. 1986 - 2013), a comparison of long term climate records indicates that the available good quality data captures the long term rainfall variation (i.e. long term wet and dry periods).

The daily rainfall data for the Old Telegraph Road BoM station is summarised in **Table 7.14**. The rainfall analysis undertaken excludes rainfall years with excessive numbers of missing records.

Table 7.14 Annual Rainfall

Statistic	Annual Rainfall (mm)
10th percentile	577
50th percentile	899
90th percentile	1185

In the region surrounding the Quarry, there is only one BoM station which currently records daily evaporation data, the University of Western Sydney (UWS) Hawkesbury Campus (Station 067021). The UWS BoM Station is located approximately 26 km south-west of the Quarry.

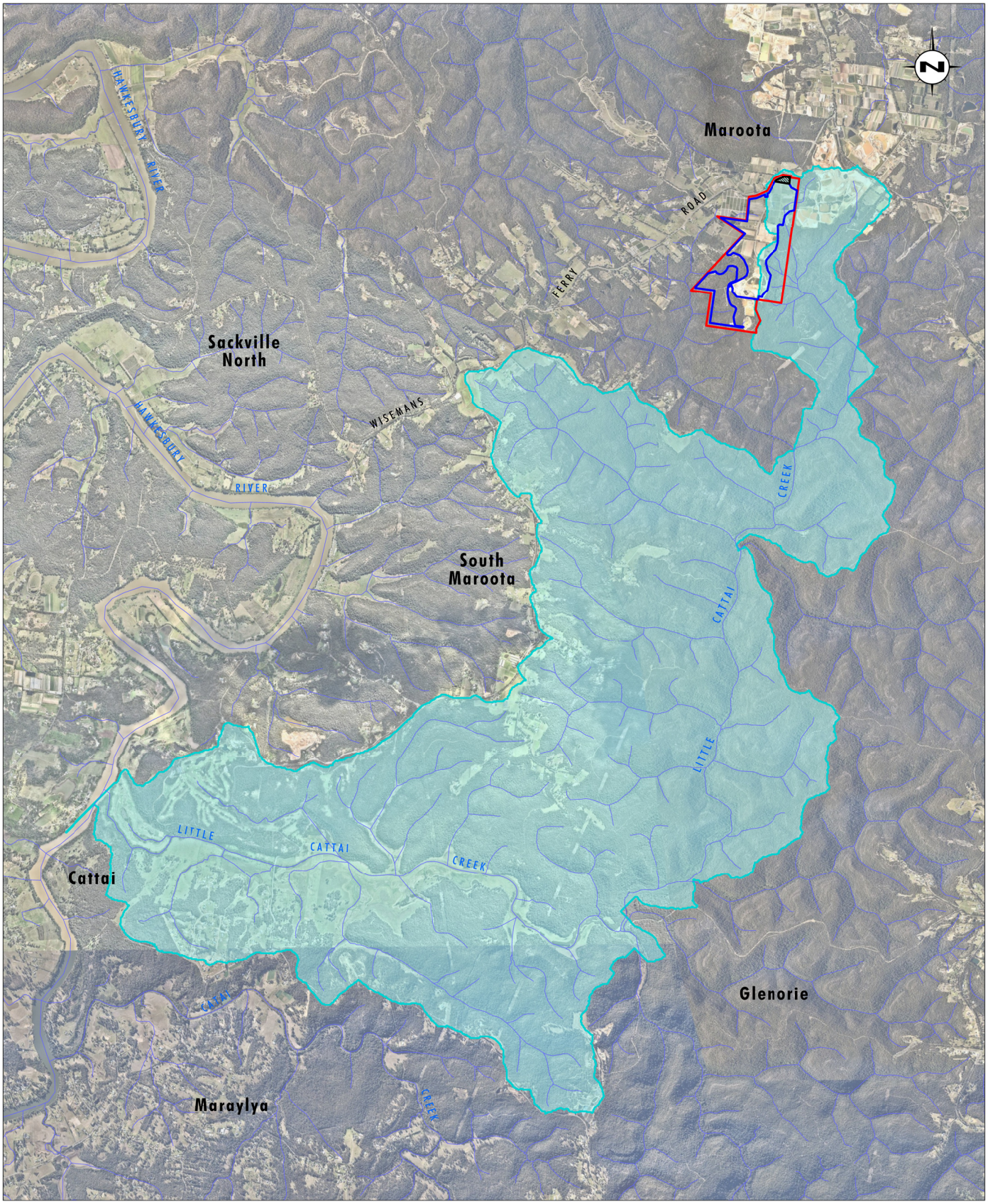

Image Source: Nearmap (July 2019)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014), DSFI (2017)

0 1.0 2.0 3.0km
1:65 000

Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Proposed Extraction Area Extension
- Little Cattai Creek Catchment
- Drainage Line

FIGURE 7.3

Catchment Context

File Name (A4): R01/4607_022.dgn
20191031 11.45

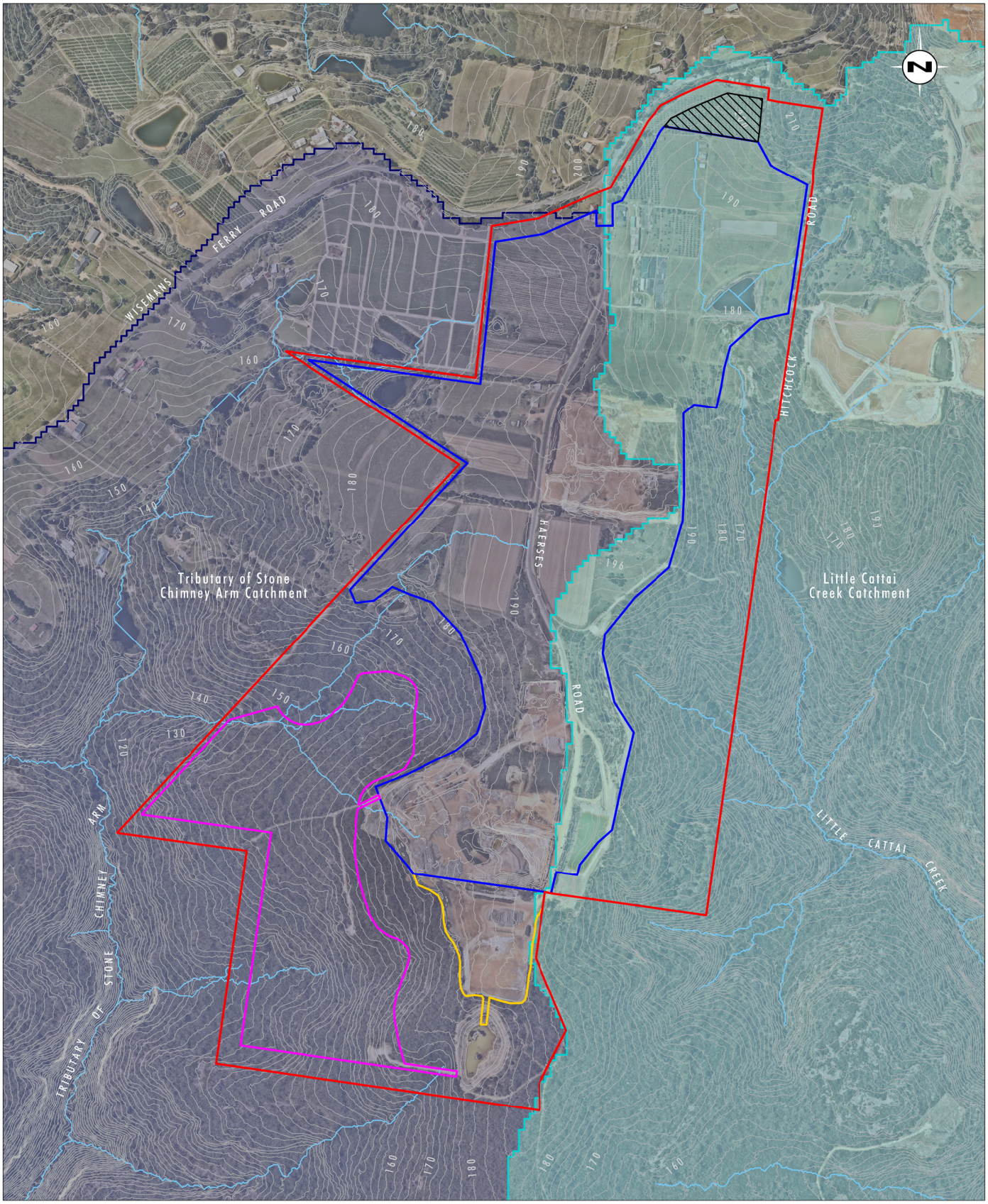

Image Source: Nearmap (Dec 2018)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2019)
Note: Contour Interval 2m

0 100 250 500m
1:10 000

Legend

- Haerses Road Quarry Site
- Approved TertiaryExtraction Area
- Approved Friable Sandstone Extraction Area
- Processing and Stockpiling Area
- Proposed Extraction Area Extension
- Little Cattai Creek Catchment
- Tributary of Stone Chimney Arm Catchment
- Drainage Line

FIGURE 7.4

Local Catchment Context

File Name (A4): R01/4607_023.dgn
20191009 10.21

Annual pan evaporation recorded at the UWS BoM Station has been analysed for the years 1973 to 2016. Analysis of the historical record shows an expected trend of evaporation increasing during the summer months and decreasing during the winter months. Average daily evaporation data for each month of the year is shown in **Table 7.15**.

Table 7.15 Average Daily Pan Evaporation

Month	Average Daily Pan Evaporation (mm/day)
January	5.9
February	5.0
March	3.9
April	3.0
May	2.1
June	1.7
July	1.9
August	2.6
September	3.8
October	4.7
November	5.1
December	5.7

7.8.1.4 Baseline Surface Water Quality

The approved *Haerses Road Quarry Water Management Plan* (WMP) (Umwelt, 2018) provides for the monitoring of receiving water quality at monitoring points in a tributary to Stone Chimney Arm to the west of the Quarry and a tributary to Little Cattai Creek to the east of the Quarry (refer to **Figure 7.5**) in order to establish site specific water quality objectives for the Quarry. Prior to the inception of the WMP, no receiving water surface water quality monitoring was required. Due to dry conditions since the commencement of the WMP and the ephemeral nature of the streams, there has been no water flowing in the streams and therefore no water quality samples have been collected to date. Notably, extraction from the friable sandstone extraction area has yet to commence.

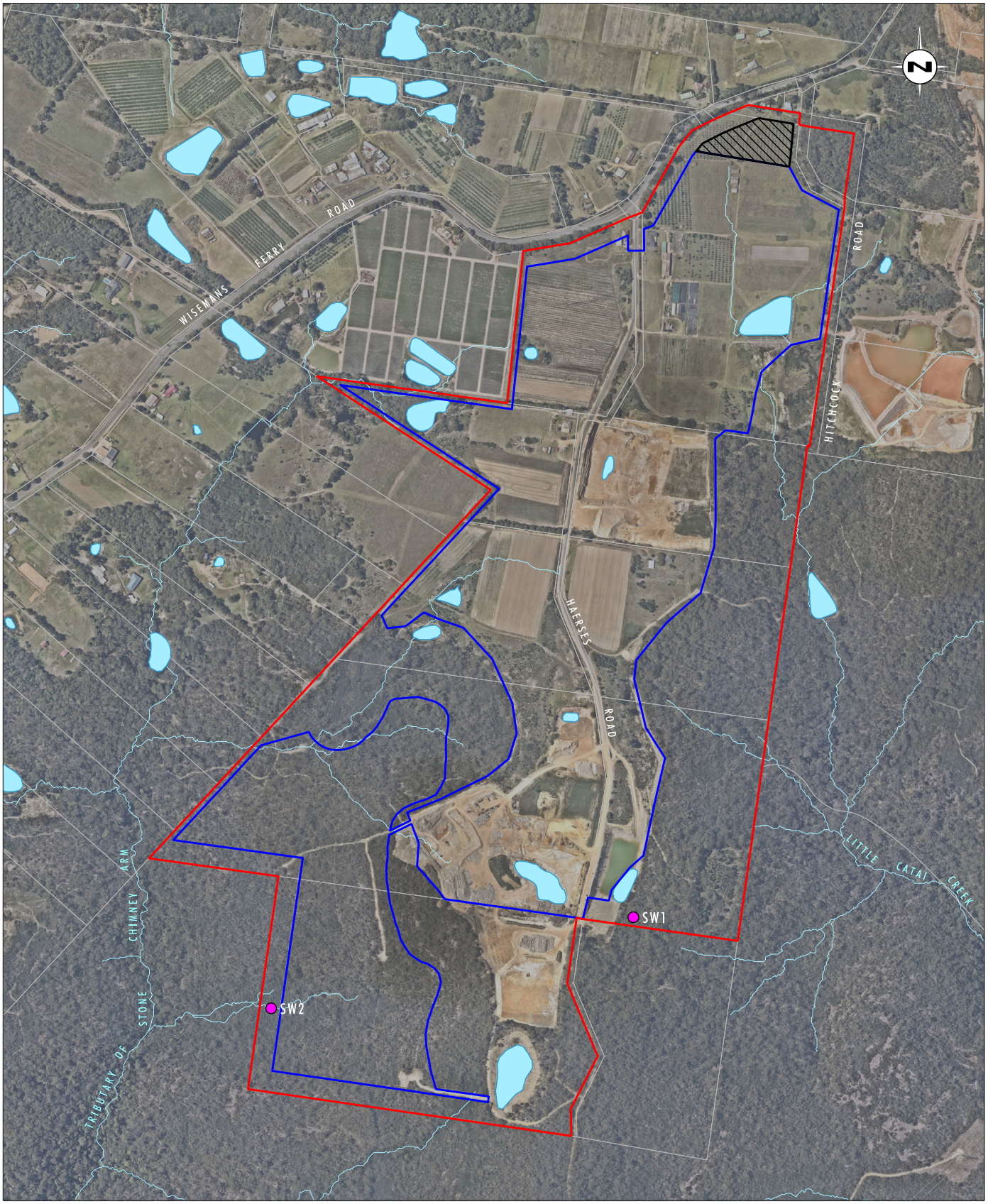

Image Source: Nearmap (Dec 2018)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014), AGT (2016)

0 100 250 500m
1:10 000

Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Proposed Extraction Area Extension
- Dam
- Drainage Line
- Surface Water Monitoring Location

FIGURE 7.5

Surface Water Monitoring Locations

File Name (A4): R01/4607_015.dgn
20191031 11.48

Dixon Sand has historic monitoring data for a stream to the west of Old Northern Road Quarry, also operated by Dixon Sand and located approximately 2 km north of the Quarry (refer to **Figure 7.6**), which is expected to exhibit similar water quality to the streams adjacent to the Quarry. **Table 7.16** presents the statistics for the receiving water quality data collected in the stream to the west of the Old Northern Road Quarry. In the absence of site specific trigger values determined through monitoring within the tributaries of Stone Chimney Arm and a tributary to Little Cattai Creek, the 20th percentile and 80th percentile results in **Table 7.16** will be adopted as interim site specific trigger values for pH and the 80th percentile results will be the adopted trigger values for Total Suspended Solids (TSS) and turbidity.

Table 7.16 Interim Baseline Surface Water Quality and Trigger Values (July 2003 to July 2005)

Parameter	Minimum	20th Percentile	50th Percentile	80th Percentile	Maximum
pH	<2.0	4.0	4.2	4.8	7.1
TSS (mg/L)	<2.0	2.0	2.0	8.0	17
Turbidity (NTU)	0.1	0.1	0.3	3.8	21

Note: Where water quality results were recorded below the limit of detection, the limit of detection was taken to be the result.

It is important to note that the water quality statistics presented in **Table 7.16** are indicative of the expected receiving water quality in the streams adjacent to the Quarry. As such, results obtained under the new receiving water quality monitoring program outside of the baseline water quality range in **Table 7.16** may not indicate a deviation from the normal range for the receiving waters being monitored nor an indication of quarry impacts. Therefore, the data in **Table 7.16** represents the interim baseline values which will be replaced once 12 months of monitoring data becomes available to reflect the actual conditions within the receiving waters of the site.

7.8.2 Licensing

7.8.2.1 Environment Protection Licence

The Quarry operates under EPL 12513 which does not include specific conditions with respect to water management but requires that Dixon Sand comply with Section 120 of the *Protection of the Environment Operations Act 1997* which prohibits the pollution of waters.

7.8.2.2 Water Access Licences

As noted in **Section 3.1**, Dixon Sand currently holds two surface water access licences (WALs) and associated works approvals for the Quarry. **Table 7.17** presents details of the two WALs and associated water supply works (previously presented as **Table 3.1**), the locations of which are shown on **Figure 7.7**.

Table 7.17 Water Access Licences

WAL Number	Associated Works Approval	Land Holding	Works	Extraction Limit (ML/year)[1]
25956	10CA105044	Lot 170 DP664767	**Work 1** Bywash Dam **Work 2** 80 mm pump centrifugal pump **Work 3** 80 mm centrifugal pump **Work 4** Bywash Dam **Work 5** 32 mm centrifugal pump	132
25941	10CA104191	Lot B DP 407341	**Work 1** Bywash Dam x 2 **Work 2** 65 mm centrifugal pump	50

Note 1 – Extraction limit assuming a full allocation of 1 ML for each unit share

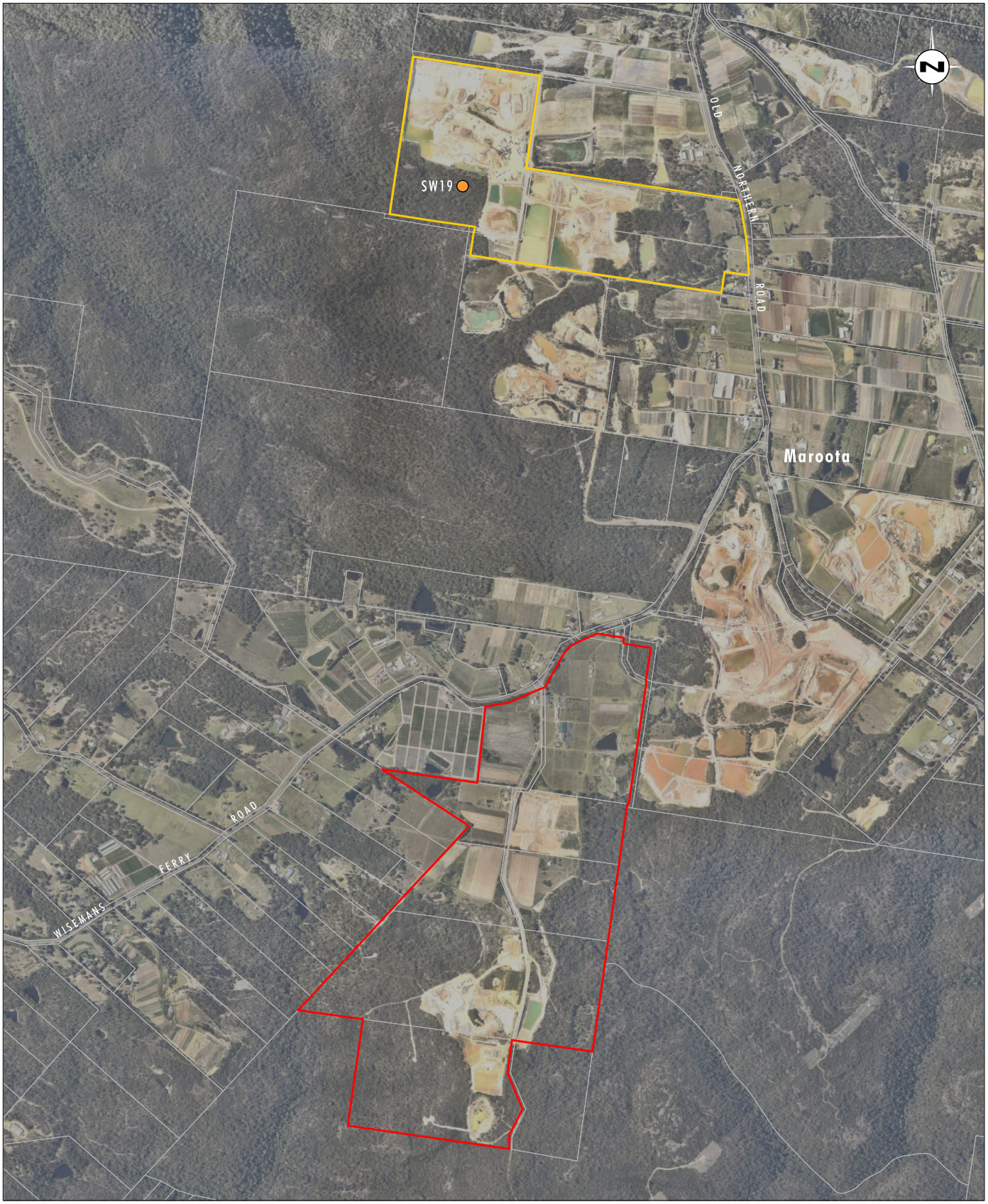

Image Source: Nearmap (Dec 2018)
Data Source: McKilay Morgan & Associates Pty Ltd (2014)

0 0.25 0.5 1.0km
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Legend

- Haerses Road Quarry Site
- Old Northern Road Quarry
- Baseline Receiving Water Monitoring Location

FIGURE 7.6

Old Northern Road Quarry Receiving Water Quality Monitoring Location

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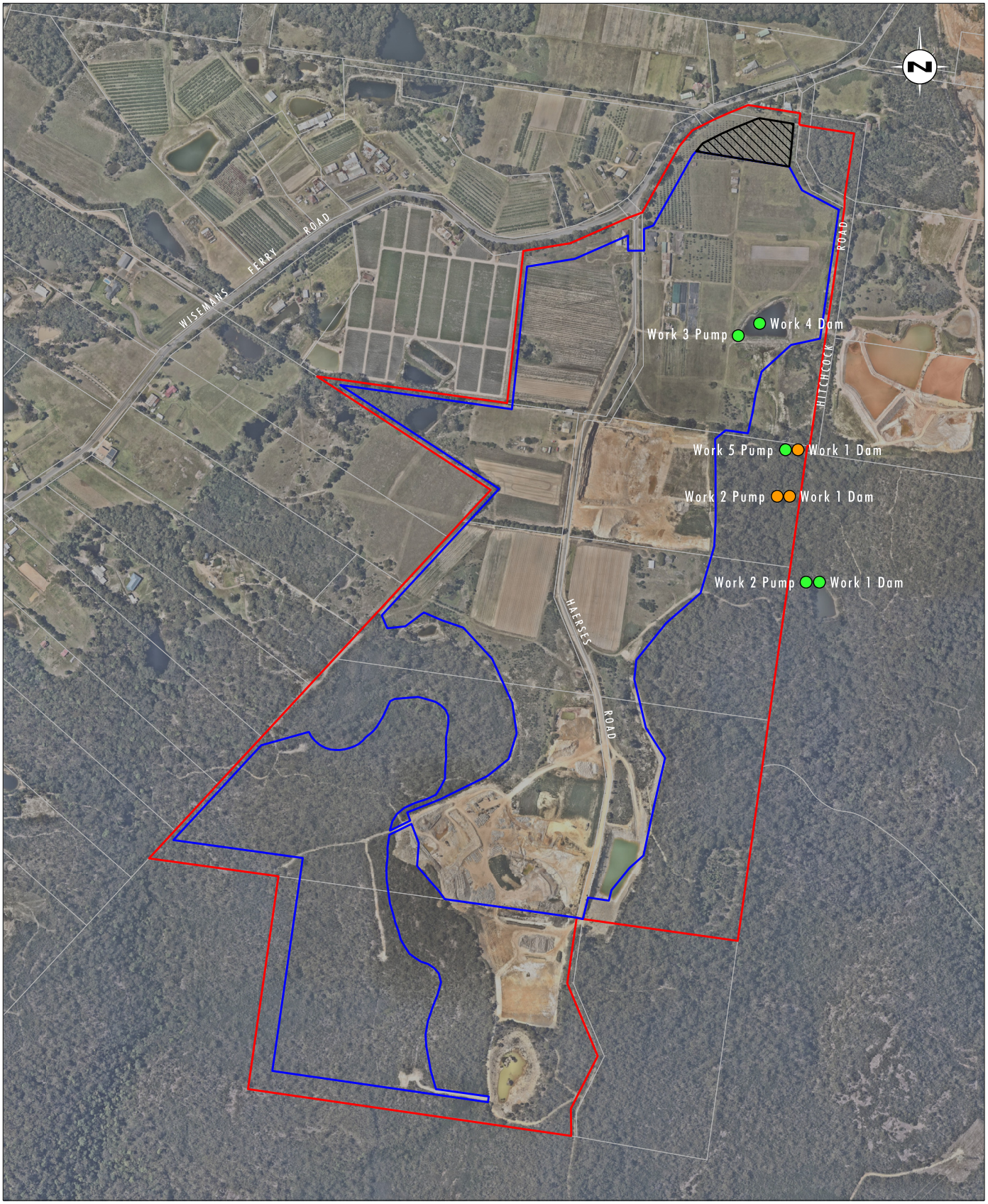

Image Source: Nearmap (Dec 2018)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

0 100 250 500m
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Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Proposed Extraction Area Extension
- WAL 25956 Works
- WAL 25941 Works

FIGURE 7.7

Approved Water Supply Works

7.8.3 Water Management

7.8.3.1 Approved Water Management System

Existing Quarry surface water management is undertaken in accordance with the approved WMP (Umwelt, 2018). **Figure 7.8** and **Figure 7.9** present a plan and schematic of the approved Quarry WMS respectively. The overall strategy for management of runoff for the Quarry WMS is to contain the runoff from disturbed catchments within the active extraction areas (pits) or sediment dams and direct clean runoff from upslope catchments around the disturbed areas. Existing sediment dams (identified as Basin 4, Stage 2 East Sediment Dam and Stage 2 West on **Figure 7.8**) have capacity to accommodate the runoff in excess of a 5 day 90th percentile rainfall event from its immediate catchment and are managed to ensure that the design capacity (i.e. runoff from a 5 day 90th percentile rainfall event from the immediate dam catchment) is restored within 5 days following rainfall.

All approved sediment dams (identified as Stage 2 Sediment Dam and Basins 1 to 3 on **Figure 7.8**) have been designed to accommodate the runoff from a 5 day 90th percentile rainfall event from its immediate catchment and will be managed to ensure the design capacity is restored within 5 days following rainfall. In each case, however, the volume of each sediment dam will be larger than the minimum 5 day 90th percentile rainfall requirement to reduce the possibility of discharge under high rainfall conditions.

The operating pits can hold significant volumes of water without impeding sand extraction operations. Further, the high permeability of the floor will maintain current infiltration and groundwater recharge rates. The permeability of the materials will also ensure that the depth and duration of any surface water ponding within the Quarry is minimal (ERM, 2005).

Runoff from the approved Processing Plant catchment will be captured in Basin 4 (refer to **Figure 7.8**) with tailings from the sand washing process being transferred to tailings storage facilities within the Friable Sandstone extraction cells. Tailings storages will be developed as the Friable Sandstone Extraction Area progresses to the north and cells where extraction activities are complete will be backfilled with tailings or clean fill and rehabilitated. Decant water from the tailings dam will be returned to Basin 4 for reuse as processing water.

Processing plant water demands will primarily be met with runoff collected from disturbed areas (i.e. pit and process plant catchments). Water demands will also be supplemented with clean water transfers from approved water supply works dams in accordance with WAL and Works Approval conditions (refer to **Sections 7.8.2.2** and **7.8.4.1**).

Captured water is reused for operational demands, in preference to clean water imports extracted in accordance with the conditions of the Quarry WALs and associated works approvals (refer to **Section 7.8**), allowed to infiltrate into the pit floor or evaporate.

Water balances for the Quarry have been previously prepared (as part of the Mod 1 Environmental Assessment and Quarry WMP). In both cases, the water balance predicts Quarry operations would be able to operate without constraint posed by a significant deficit of water (which could result in restrictions on production) or surplus (which could require discharge of water from the Quarry Site). Notably, the Proposed Modification does not involve any requirement to increase water consumption (as no increase to washing rates are proposed) and no change to the Quarry catchment as a result of the very minor extension to the extraction area. The above notwithstanding, should a deficit of water be experienced, the Proponent could draw water under allocation from the WALs held by Dixon Sand (up to 182 ML) (refer to Table 7.17). Should high rainfall result in a surplus of water on the Quarry Site, the Proponent would transfer water to the extraction area(s) of the Quarry to ensure sufficient freeboard is retained in the Quarry sediment basins.

As the Proposed Modification would not result in any changes to water inputs or outputs, the water balance assessments completed previously remain valid and no further analysis of water balance is required.

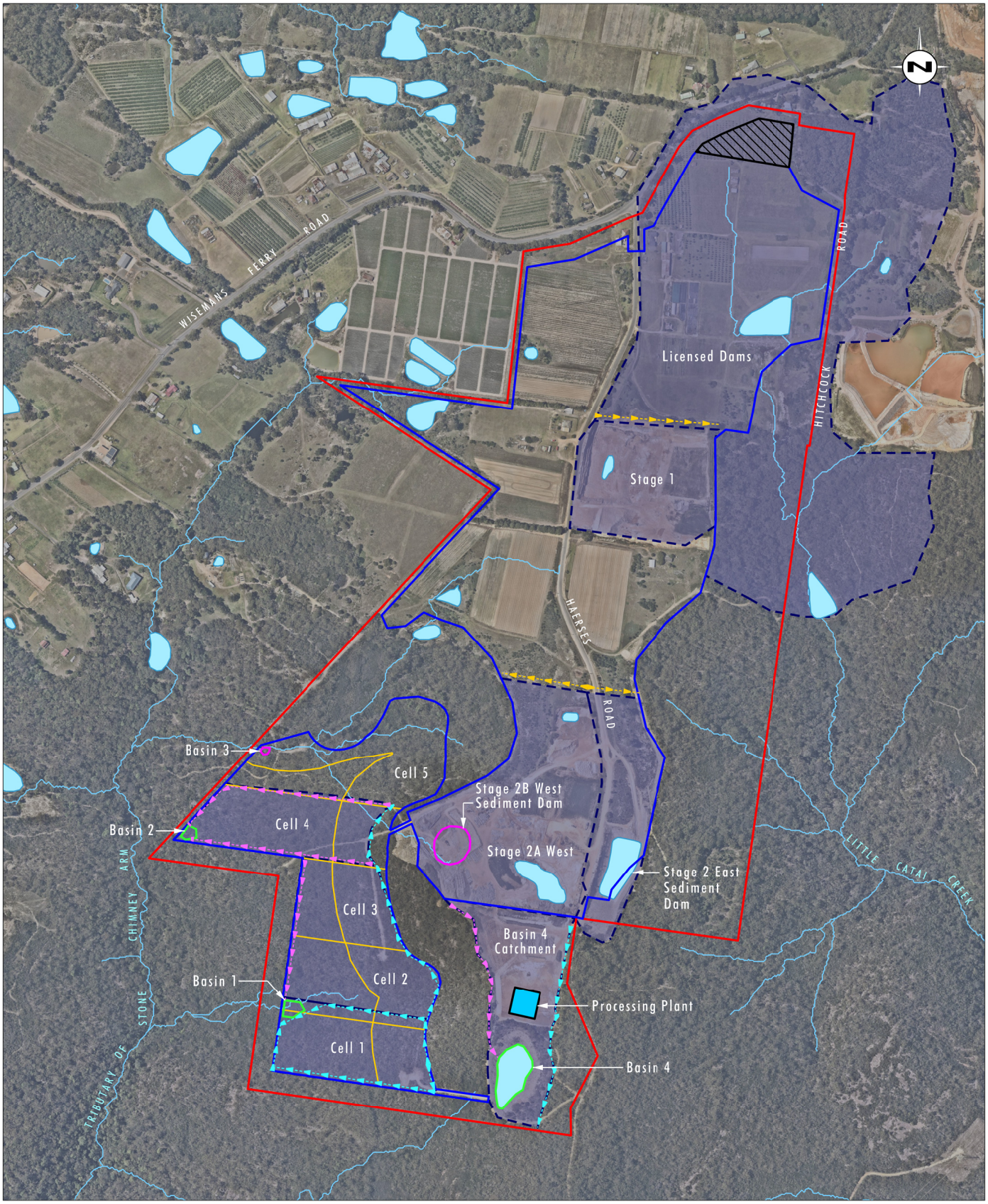

Image Source: Nearmap (Dec 2018)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

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Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Proposed Extraction Area Extension
- Diversion Bund
- WMS Catchment Boundary
- Drainage Line
- Dam
- Basin
- Future Basin to be Constructed
- Clean Drain
- Dirty Drain

FIGURE 7.8

Approved Future WMS Plan

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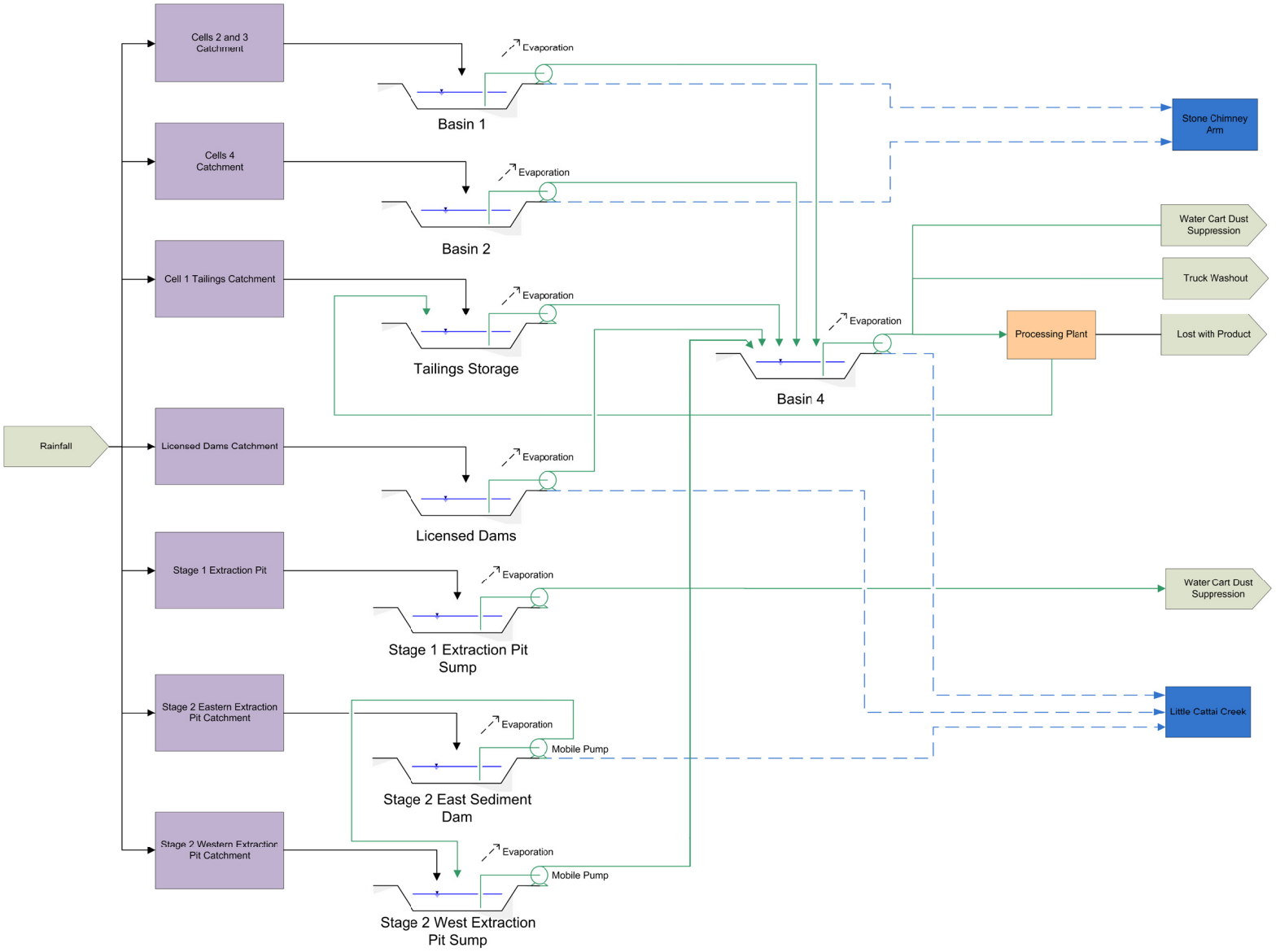

FIGURE 7.9

Approved Future WMS Schematic

Legend

Pumped Flow

Overflow

7.8.3.2 Proposed Water Management

A plan and schematic of a proposed Quarry WMS scenario representing site operations toward the end of the Quarry operational phase are presented in **Figure 7.10** and **Figure 7.11** respectively. The strategy for management of runoff for the proposed Quarry operation will remain unchanged from the approved operation (refer to **Section 7.8.3.1**).

The WMS for the proposed operating scenario presented in **Figure 7.10** represents a worst case scenario with respect to water security as:

- the operational WMS catchment will be at a minimum with much of the previously quarried catchment rehabilitated and runoff being released off-site, and
- process water demands may still be high to achieve peak production, i.e. washing 250,000 t per year.

The development of Extraction Stage 5 within the Tertiary Sand Extraction Area will result in the licensed clean water dam in this catchment being removed. However, runoff from the undisturbed catchment upslope of Tertiary Sand Extraction Area Stage 5 will be captured in the extraction pit sump and used to supplement operational water demands in accordance with WAL conditions.

Noting the water balance for the Quarry does not predict it will be necessary to discharge water from the Quarry Site, EPL 12513 does not incorporate a licensed discharge point (LDP) for water. Dixon Sand will continue to monitor site water inventories as sand extraction progresses in the Friable Sandstone extraction area and will assess the requirement for off-site discharges and therefore an EPL variation to incorporate an LDP. If discharges from Basin 4 are required in the future, a monitoring (water quality and quantity) and management program for these discharges will be developed. Further, and as noted above, Basin 4 will be managed to ensure adequate freeboard capacity is available to capture the runoff from a 5 day 90th percentile rainfall event from its immediate catchment.

7.8.4 Licensing, Monitoring and Reporting

7.8.4.1 Licensing

The Quarry operates under EPL 12513 which does not include specific conditions with respect to water management but requires that Dixon Sands comply with Section 120 of the *Protection of the Environment Operations Act 1997* which prohibits the pollution of waters.

Dixon Sands holds two surface water access licences (WALs) (refer to **Section 7.8.2.2**).

7.8.4.2 Monitoring

Surface water monitoring will continue to be undertaken in accordance with the approved Quarry WMP (Umwelt, 2018). The approved monitoring program is provided in the following sections.

Water Quality

As part of the implementation of the approved Quarry WMP, Dixon Sand has established two receiving water quality monitoring points in a tributary to Stone Chimney Arm to the west of the Quarry and a tributary to Little Cattai Creek to the east of the Quarry (refer to **Figure 7.5**). However, due to the dry conditions and the ephemeral nature of the streams, there has been no water flowing in the streams and therefore no water quality samples have been collected to date. Monthly monitoring will be undertaken for a period of at least two years to establish baseline data that can be used to develop site-specific trigger values in accordance with ANZECC Guidelines.

Once extraction commences in the Friable Sandstone Extraction Area, water quality in the extraction pit sump will also be monitored on a monthly basis for the water quality parameters listed in **Table 7.18**.

Table 7.18 Receiving Waters and Site Water Monitoring

Parameter	Units	Frequency
pH	-	Monthly
Total Suspended Solids	mg/L	
Turbidity	NTU	
Stream Flow	No Flow, Low Flow, High Flow	

Water Inventories and Transfers

The following parameters relating to water inventories and usage will be monitored to allow the preparation of an annual site water balance.

- Water storage levels/volumes.
- Number of water cart fills per month.
- Monthly water transfer volumes between water storages (based on rated pump capacity and run time).
- Monthly licensed clean water import volumes.
- Monthly processing plant water consumption (on construction) (either metered or based on rated pump capacity and run time).

Water Management Dams

The fill embankments of all water management dam walls will be inspected biennially (every 3 years) for structural integrity by a suitably qualified engineer.

7.8.4.3 Reporting

Incidents

Where an incident relating to surface water management has occurred Dixon Sand will:

- Immediately notify the Secretary (using the contact name, email address and phone number provided by the Department from time to time) and any other relevant agencies of any incident.
- Within 7 days of the date of the incident, provide the Secretary and any relevant agencies with a detailed report on the incident, and such further reports as may be requested. This report must include the time and date of the incident, details of the incident, measures implemented to prevent re-occurrence and must identify any non-compliance with this consent.

Annual Review

The following information relating to water management is provided in the Quarry's Annual Review:

- an assessment of receiving water quality monitoring results with respect to baseline water quality and potential quarry impacts
- a site water balance outlining water source inflows, operational water demands and quarry water inventory changes
- details of any complaints received in relation to surface water
- an assessment of the overall effectiveness of the WMS.

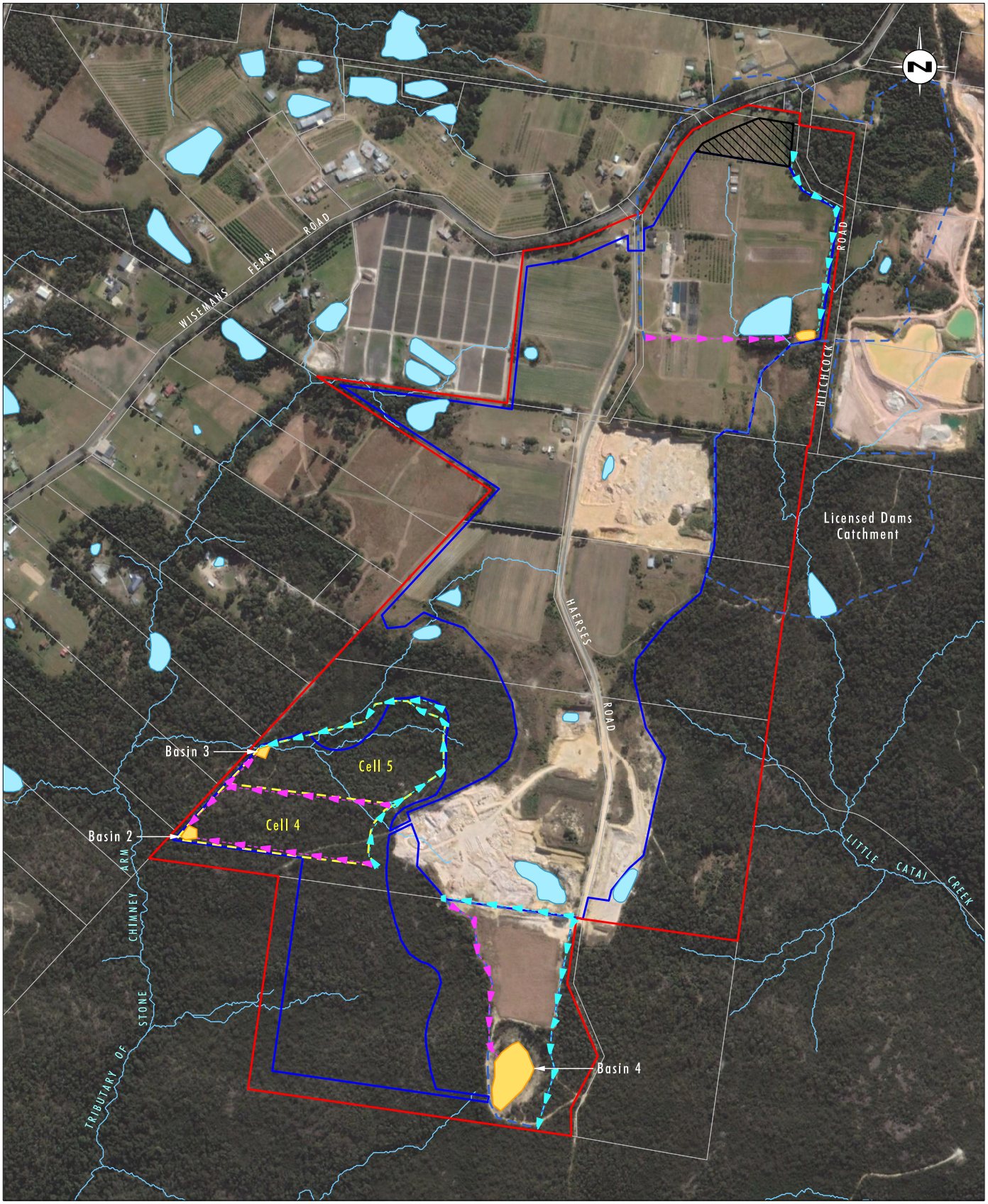

Image Source: Nearmap (Dec 2018)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

0 100 250 500m
1:10 000

Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Proposed Extraction Area Extension
- Catchment Area
- Cell Area
- Sediment Dam
- Existing Dam
- Clean Water Drain
- Dirty Water Drain
- Existing Drainage Line

FIGURE 7.10

Proposed WMS Plan

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20191031 11.41

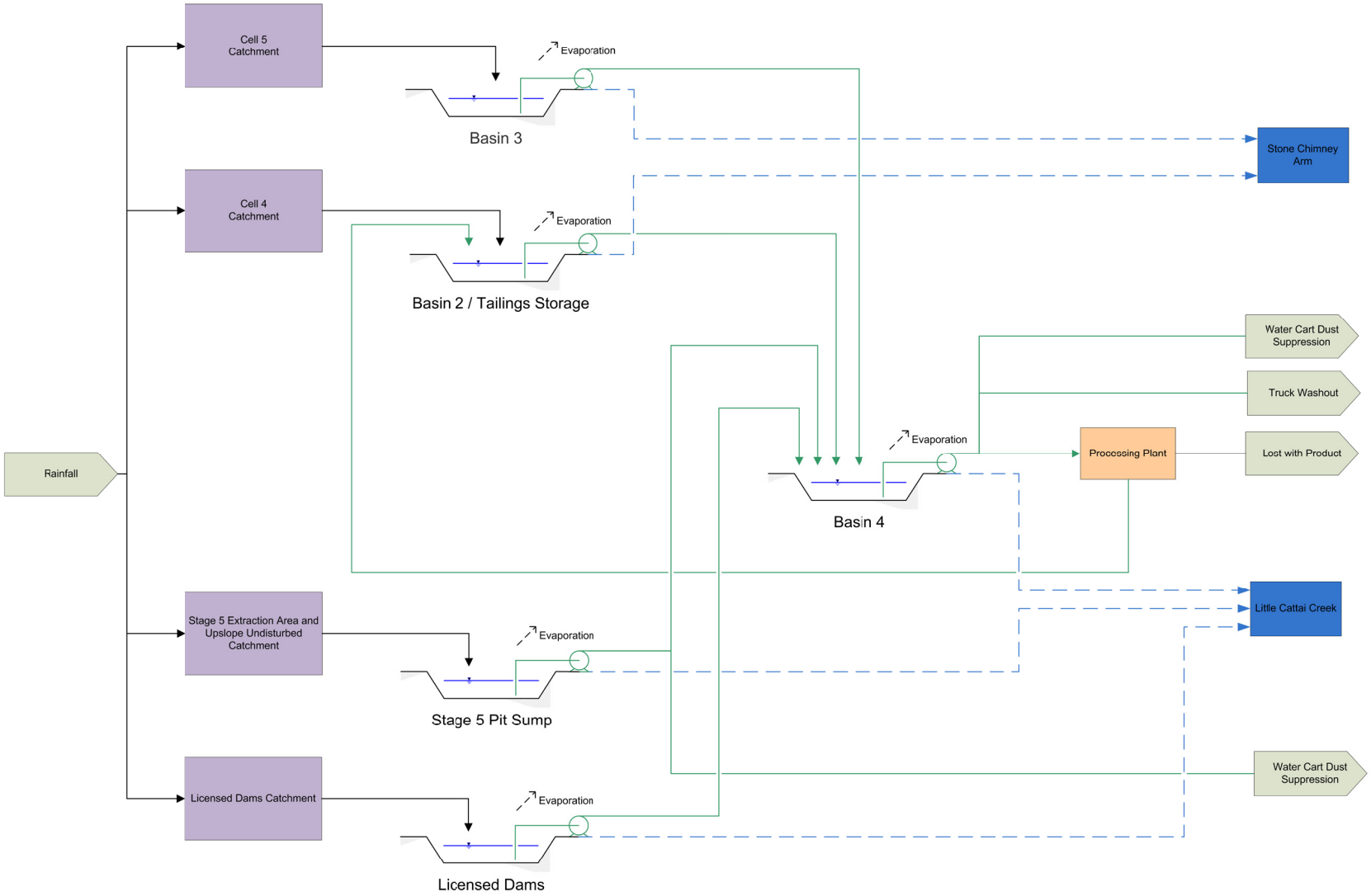

FIGURE 7.11

Final WMS Schematic

Legend

Pumped Flow

Overflow

7.8.5 Management Measures and Impact Assessment

As the WMS for the Proposed Modification will generally remain consistent with the existing approved operation, the key management measure is to continue to operate the WMS in accordance with an updated version of the approved Quarry WMP (Umwelt, 2018). The approved WMP (Umwelt, 2018) will be updated to account for the modified extraction area and production rate.

The Proposed Modification will have a negligible impact on the Quarry WMS. The minor extension to Stage 5 of the Tertiary Sand Extraction Area will not increase the expected maximum WMS catchment given much of the Quarry catchment will have been rehabilitated prior to extraction commencing in Stage 5. As such there will be no additional impact on catchment yield and any surface water take will be in accordance with WAL conditions.

Water balance modelling indicates that the potential for discharges from the Quarry WMS is expected to be consistent with the existing approved operation and, as such, downstream water quality impacts will be consistent with the existing approved operation. Further the maximum sand washing rate will not be increased even though the total sand extraction rate will increase. Therefore the maximum future water demands are expected to be comparable to the existing approved operation.

Provided the Quarry WMS is operated in accordance with an updated version of the approved Quarry WMP (Umwelt, 2018) (updated to account for the modified extraction area and production rate), the surface water impacts associated with the Proposed Modification are expected to be consistent with the approved Quarry operation.

7.9 Visual Amenity

7.9.1 Introduction and Scope

As identified in **Section 6.2**, the potential visual impact of the Proposed Modification associated with the small extension to the extraction area, has been identified as an issue requiring assessment. The following assessment of potential visual impacts has been undertaken Umwelt and provides a review of the local visual setting, identification of Quarry components which could be visible from vantage points surrounding the Quarry and provides an analysis of future views following the implementation of operational controls aimed at limiting the exposure of the Quarry.

7.9.2 Visual Setting

7.9.2.1 Existing Environment

The Quarry, which has been operating since 2006, is located to the south of Wisemans Ferry Road where the dominant land uses, as discussed in **Section 2.2**, are as follows.

- Agricultural and horticultural activities – principally orchards and market fruit and vegetable crops.
- Residential – often associated with the agricultural activities nominated above or 'rural; residential'.
- Passive biodiversity conservation – being the large areas of undisturbed bushland which occur to the south of the Quarry.
- Extractive industry – primarily sand quarries supplying the Sydney construction market.

Wisemans Ferry Road is aligned along the divide between the catchments of Little Cattai Creek (within which the Quarry is located) to the south and Douglas Creek to the north. As a result, the viewing catchment of the Quarry is generally bounded by Wisemans Ferry Road (and select properties which access Wisemans Ferry Road on the northern side). The topography rises to the east and north-east, however, the presence of large areas of native bushland screens views of the Quarry from Old Northern Road and residential vantage points to the east.

Potential public vantage points to the Quarry are as follows.

- Select residences to the north-east, east and north-west on Wisemans Ferry Road and Hitchcock Road have views of the Quarry, which are partially obstructed by remnant vegetation, at distances between 80 m and 500 m.

- Motorists on Wisemans Ferry Road have intermittent views of the site between existing dwellings and roadside vegetation.

Notably, views of the approved Quarry operations are to be mitigated as the extraction progresses to Stages 4 and 5 of the Tertiary Sand Extraction Area with the construction of vegetated earth bunds and planting of tree screens. **Figure 7.12** identifies the residential receivers which may have some views of Quarry operations, along with the location of the proposed bund walls.

7.9.2.2 Key Vantage Points

Two key vantage points have been identified surrounding the Quarry as most representative of the potential impact associated with the Proposed Modification Photos from these vantage points have been taken and presented as **Plates 7.1** to **7.3** to illustrate views towards the approved Quarry area and proposed extraction area extension.

1700 Wisemans Ferry Road

Located on the northern side of Wisemans Ferry Road, the residence is located at an elevation of approximately 205 m AHD which is higher than the Quarry site to the south of Wisemans Ferry Road. **Plates 7.1** and **7.2** present views from this property towards the Quarry site which illustrate that views of the extraction area are obstructed by roadside vegetation, as well as the vegetation on the properties south of Wisemans Ferry Road.

The distance between the residence at 1700 Wisemans Ferry Road and the approved extraction area is approximately 80 m. The distance between the property boundary (from where the photos have been taken) and the approved extraction area is currently 50 m. The views available from 1700 Wisemans Ferry Road are indicative of views towards the Quarry available from 1710 and 1728 Wisemans Ferry Road, the other properties which may have obstructed views towards the Quarry operations.

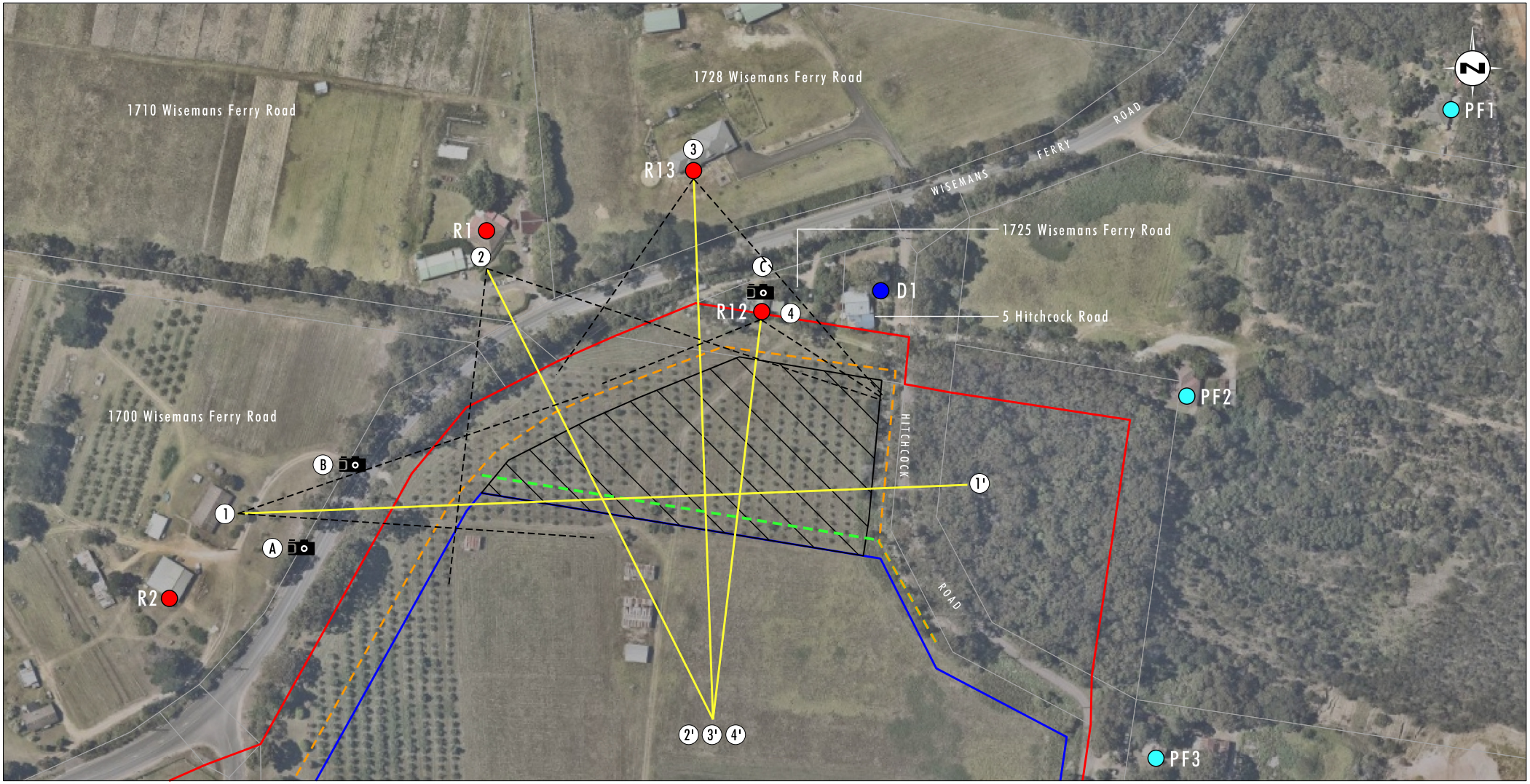

Image Source: Nearmap (Dec 2018)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2019)

0 25 50 100m
1:2 500

Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Proposed Extraction Area Extension
- Section Locations
- Photo Locations
- Approved Noise Bund
- Proposed Noise Bund
- Residential
- Owned by Dixon Sand
- Owned by PF Formation
- Field of View

FIGURE 7.12

Visual Setting

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20140214 9.05

1725 Wisemans Ferry Road

Located on the southern side of Wisemans Ferry Road, the residence is located to the immediate north of the Hitchcock Road easement (Lot 3 DP111886) which forms the northern boundary of the Quarry site. **Plate 7.3** presents a view from this residence towards the Quarry site illustrating that the extraction area of the Quarry is visible from this property. However, as also illustrated by **Plate 7.3**, views are likely to be obstructed by a hedge which has been established along the southern boundary of the property. The distance between the property boundary and approved extraction area is currently 100 m.

Plate 7.1 **1700 Wisemans Ferry Road**: View from the property entrance

Source: IMG_2508 to IMG_2510

Plate 7.2 **1700 Wisemans Ferry Road**: View from the most exposed point of the property

Source: IMG_2519

Plate 7.3 **1725 Wisemans Ferry Road**: View towards Extraction Area extension

Source: IMG_2491

The active extraction area (Stage 1 of the Tertiary Sand Extraction Area) is visible in the distance. Prior to extraction progressing to Stage 5, Dixon Sand would construct and vegetate a 5 m high bund wall along the northern boundary of the extraction area to limit views of the extraction area as it is developed close to the properties and residences to the north.

The views available from 1725 Wisemans Ferry Road are indicative of views towards the Quarry available from 5 Hitchcock Road and 27 Hitchcock Road (both owned by PF Formation who operate the neighbouring Hitchcock Road Quarry).

These locations, along with the sight lines from residential receivers to the north and west to the Quarry operations, are shown on **Figure 7.13**.

7.9.3 Impact Assessment

The Quarry extraction area is to be developed to the north and therefore closer to several properties, most notably 1700, 1710, 1725 and 1728 Wisemans Ferry Road, and 5 Hitchcock Road. Of these, 5 Hitchcock Road (Residence D1) is owned by Dixon Sand and has not been considered further.

Figure 7.13 and **Figure 7.14** provide interpreted visual cross-sections from four residential locations to the north and west of the proposed extraction area extension (refer to **Figure 7.12** for the location of these sections).

These cross-sections, which identify the relative location of the approved and proposed extraction area, bunds and intervening vegetation, illustrate that the main impact of the Proposed Modification would be the closer proximity of the vegetated bund wall. Of particular note with respect to the visibility of the Proposed Modification.

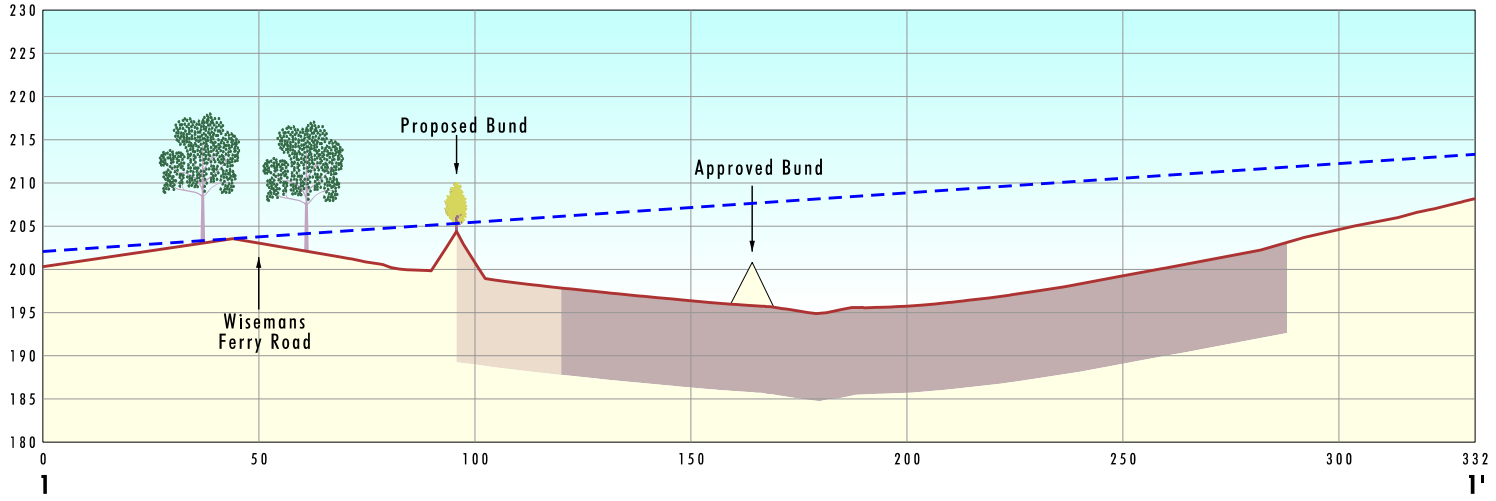
- In the case of properties 1700 and 1710 Wisemans Ferry Road (and Residences R1 and R2), the ground rises towards Wisemans Ferry Road which limits potential views to the top of the bund wall only.

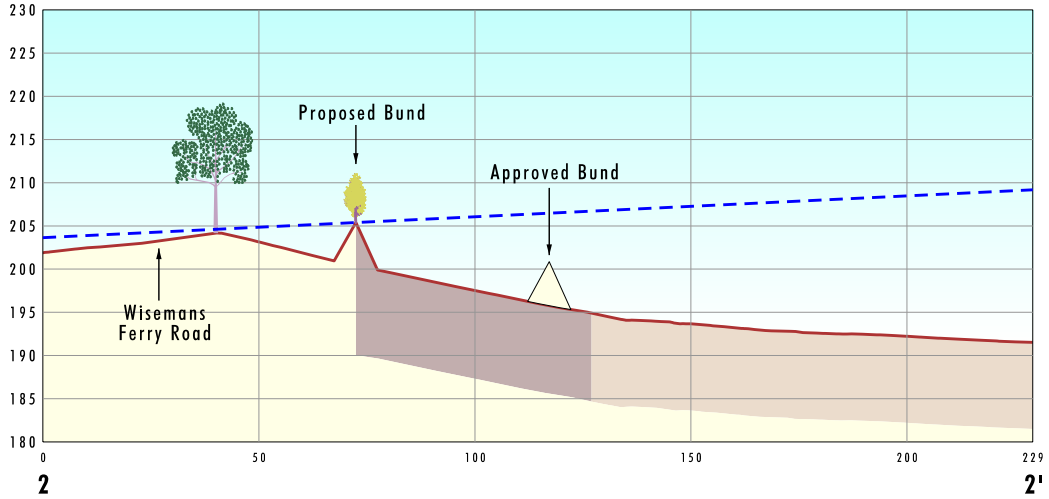
- From Property 1728 Wisemans Ferry Road (and Residence R13), the view towards the Quarry is downslope, however, the field of view is dominated by the intervening vegetation on the property, within the Wisemans Ferry Road easement and on the properties of 1725 Wisemans Ferry Road and 5 Hitchcock Road.

- The final extraction area and bund wall would encroach within 20 m of the property boundary of 1725 Wisemans Ferry Road, however, it is noted that there is an existing vegetation screen along the southern boundary of this property which already obscures views to the south (onto the Quarry Site).

On the basis of the above, views of the proposed extension to Quarry operations are already obscured by existing intervening topography and vegetation, with impacts further mitigated by the construction and vegetation of an earth bund to the north and northwest of the proposed extraction area extension. The timing of bund construction will be negotiated with the landowners to the north of the Quarry Site noting that currently these stakeholders value the views from their properties which are unaffected by constructed bunds. Similarly, depending on the preference of these landowners/residents at the time (development of the extraction area extension is unlikely for at least 15 to 20 years), the bund may be retained or removed as part of final landform construction and rehabilitation.

Furthermore, the proposed extension to the extraction area represents only a 1.3% increase in the total disturbance area of the Quarry, which will only be disturbed towards the end of the Quarry life. Given the obstructed nature of views, the proposed relocation of the vegetated bund wall to prevent direct views of the Quarry from vantage points to the north and northwest, the impact of this modification is considered to be of low impact.





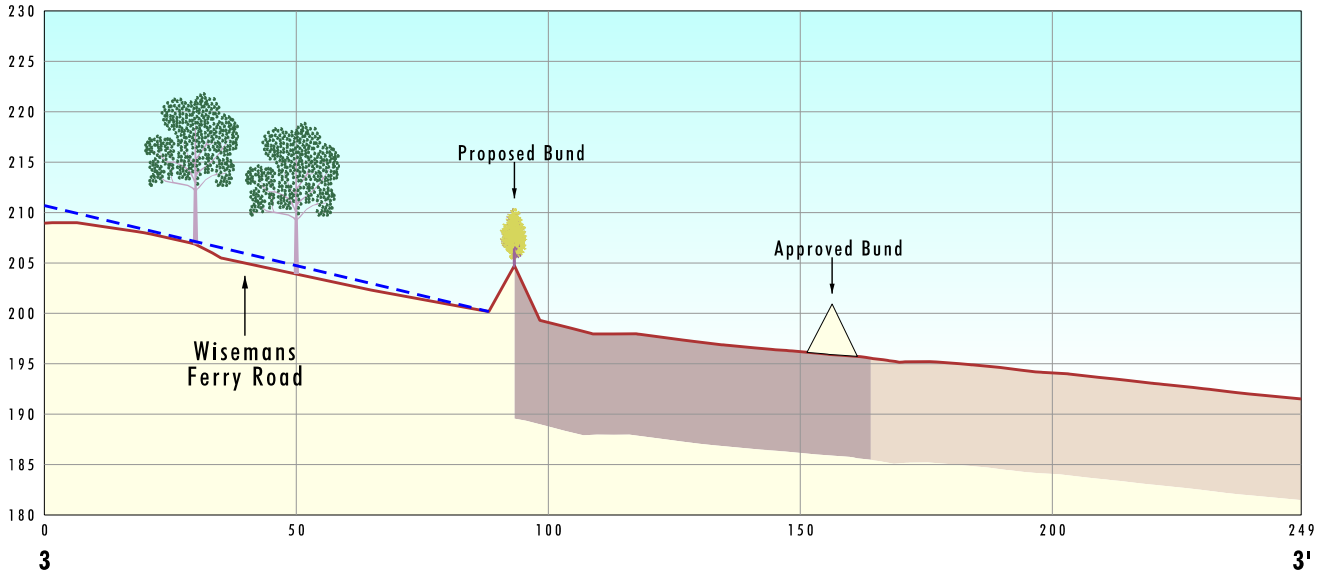
Legend

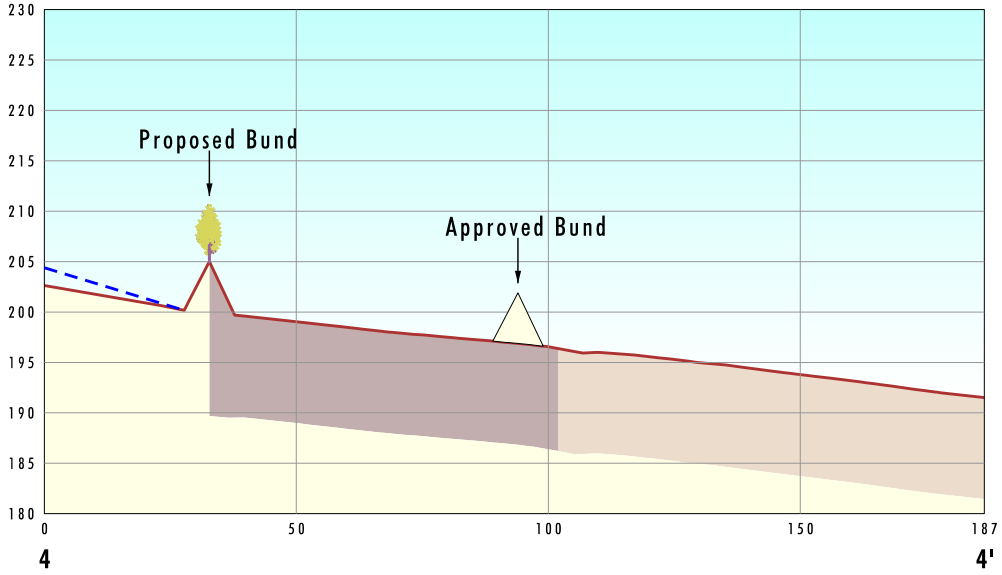
- Proposed Extraction Area
- Approved Extraction Area
- Line of Sight

Note: Vertical Exaggeration 1:2

FIGURE 7.13

Cross Sections





Legend

- Proposed Extraction Area
- Approved Extraction Area
- Line of Sight

Note: Vertical Exaggeration 1:2

FIGURE 7.14

Cross Setions

7.9.4 Controls, Safeguards and Management Measures

In addition to the existing mitigation of potential views provided by existing intervening topography and vegetation, the principal management measure to be implemented to reduce the impact of this extraction area extension would be the relocation of the 5 m high earth bund to the revised northern perimeter of the extraction area (refer to **Figure 7.12**). The bund would be vegetated with stabilising groundcover and fast-growing shrub and tree species prior to the commencement of extraction within the extension area.

Other visibility management measures to be implemented at the Quarry would include:

- Tree screens will be planted along the remaining northern perimeter of the Quarry site to further obstruct views of the Quarry from Wisemans Ferry Road and properties to the north.
- Progressive rehabilitation of the Quarry would be undertaken to limit the area of exposed surfaces at any one time. **Section 7.12** provides further information on proposed rehabilitation.
- Dust suppression would be undertaken to limit the visibility of dust from active areas of the Quarry.
- If lighting is required for early morning loading of trucks, lights would be directed to the south, i.e. away from the Wisemans Ferry Road and vantage points to the north.

In accordance with the rehabilitation objectives and conditions of the Quarry, following the end of operations the final landform will be integrated with the surrounding natural landforms as far as is reasonable to minimise visual impacts when viewed from the surrounding land. As discussed in **Section 4.2.1**, Dixon Sand would discuss the management of the vegetated earth bund at the end of Quarry life with the owners of the properties immediately north of the Quarry. Dixon Sand has provided for the retention and integration of the bund wall into the final landform as part of the proposed rehabilitation of the Quarry site. Subject to the preference of the landowners to the north of the Quarry, Dixons Sand could alternatively remove the bund wall at the cessation of extraction and return this to the pre-Quarry elevation as part of the final landform.

7.10 Biodiversity

7.10.1 Existing Biodiversity Values

The biodiversity values of the proposed extraction area extension are limited due to the highly modified state of the site and surrounding landform and vegetation as a result of previous agricultural land use history. Given the highly modified nature of the proposed extraction area extension, a Biodiversity Development Assessment Report (BDAR) waiver request (refer to **Appendix 10**) was prepared in accordance with Section 7.9(2) of the *Biodiversity Conservation Act 2016* (BC Act) which states that:

> "*Any such application [SSD] is to be accompanied by a biodiversity development assessment report unless the Planning Agency Head and the Environment Agency Head determine that the proposed development is not likely to have any significant impact on biodiversity values.*"

The BDAR waiver application assessed the impacts of the Proposed Modification on biodiversity values to which the biodiversity offsets scheme applies under Section 6.3 of the BC Act. The assessment in the BDAR waiver request included a detailed literature review and on-ground field inspection.

The on-ground field inspection included floristic surveys that involved meandering across the site. Given the highly disturbed nature of the site, basic species-credit fauna habitat assessments and opportunistic fauna surveys were conducted. Based on these field surveys, the proposed extraction area extension represents an established common olive (*Olea europaea*) plantation with exotic pasture dominating the ground layer.

The BDAR waiver request identified that it is unlikely that the Proposed Modification will have a significant impact on the biodiversity values of the site and that a BDAR is not required due to the following:

- the proposed development activity is unlikely to have a 'significant impact' on any threatened species, threatened populations or endangered ecological communities as per the five part test of significance prepared under Section 7.3 of the BC Act for the BDAR waiver
- it does not exceed the biodiversity offsets scheme threshold as
    - no areas within the site are mapped as having 'high biodiversity value' as identified on the NSW Biodiversity Values Map, and
    - vegetation clearing on the site will not exceed the native vegetation clearing thresholds identified in the Biodiversity Assessment Method as the site is not remnant vegetation and consists of a common olive (*Olea europaea*) plantation and exotic dominated grassland
- the development is not being carried out in a declared area of outstanding biodiversity value.

An application for a BDAR waiver was submitted to DPIE in June 2019. The response from DPIE on 22 July 2019 identified that while the proposed extraction area extension contains vegetation with little biodiversity value, it is surrounded by high quality remnant vegetation. As a result, DPIE recommended that a BDAR was not required as long as the potential indirect impacts to the biodiversity values of the adjacent areas as a result of the Proposed Modification were shown to be appropriately managed. These indirect impacts included:

- reduced viability of adjacent habitat due to edge effects
- reduced viability of adjacent habitat due to noise, dust or light spill
- transport of weeds and pathogens from the site to adjacent vegetation, and
- changes to surface and groundwater flows.

The following sections demonstrate the management of these indirect impacts.

7.10.2 Edge Effects to Adjacent Vegetation

The proposed extraction area extension is bordered by two existing roads

- Wisemans Ferry Road (sealed) to the northwest, and
- Hitchcock Road (unsealed) to the east.

A small isolated patch of remnant vegetation exists to the east of Hitchcock Road and to the west of the Hitchcock Road quarrying operations of PF Formation. Other remnant vegetation surrounding the proposed extraction area extension occurs in road easements. The areas immediately to the south, west and north of the proposed extraction area extension primarily consist of privately owned rural residential lots.

Several mitigation measures to reduce the likelihood of edge effects occurring within the surrounding landscape have been identified as part of the broader approved Quarry during construction and operation, and these can be applied to the proposed extraction area extension. These mitigation measures include:

- areas of biodiversity value outside the proposed extraction area extension will be fenced or signposted, where appropriate, to present unnecessary disturbance,
- the minimisation of vegetation clearance to that required for operational purposes, and
- progressive rehabilitation and stabilisation of disturbed land with native vegetation.

Given the largely rural areas surrounding the proposed extraction area extension, the highly modified condition of the vegetation within the extraction area extension, the low level of connectivity with surrounding remnant vegetation and the fragmented surrounding landscape, the Proposed Modification will not create further impacts associated with edge effects. The works associated with the proposed extraction area extension will be temporary in nature with progressive rehabilitation of the areas disturbed by quarrying operations (refer to **Section 3.2.9.3**). Therefore, the Proposed Modification is unlikely to have significant indirect edge effects on biodiversity values in the surrounding area.

7.10.3 Noise, Dust and Light Spill

The proposed extraction area extension is located within a rural environment with typically low background levels of noise, dust and light spill. Construction and operational noise, dust and light spill impacts have the potential to adversely impact biodiversity. Potential indirect impacts to the surrounding biodiversity values resulting from noise, dust and light spill include:

- dust covering vegetation thereby reducing vegetation health and growth,
- noise and light disturbing the roosting and foraging behavior of fauna species, and/or
- noise and light spill reducing the occupancy of areas of suitable habitat.

However, mitigation measures to minimise the potential for adverse noise, dust and light spill impacts have been incorporated into the design of the approved extraction area and these will also be applied in the proposed extraction area extension. These include:

- the use of physical barriers adjacent to operational quarry areas, where practical, such as earthen bunds and noise/light walls including a 5 m high acoustic bund that is currently approved for construction along the northern perimeter of the approved extraction area, which would be relocated to the northern perimeter of the proposed extraction area extension,
- dust suppression on haul roads and other operational areas to reduce vehicle-generated dust emissions,
- the minimisation of vegetation clearance to that required for operational purposes,
- progressive rehabilitation and stabilisation of disturbed land, and
- equipment maintenance to minimise noise generation.

Further to these measures, Dixon Sand would continue to implement the restrictions on equipment usage and other management, mitigation and monitoring measures nominated in the Quarry *Noise Management Plan*, *Acoustic Bund Construction Noise Management Plan* and **Section 7.4** .

Given this information, any noise, dust or light spill resulting from the Proposed Modification will be minimal and temporary in nature. There will be no measurable incremental change to noise, dust or light spill impacts on adjoining habitat areas and the impacts are not expected to be of any level of significance in relation to biodiversity values in the surrounding area.

7.10.4 Weeds and Pathogens

Weed and pathogen species could be inadvertently brought into the proposed extraction area extension and spread to the surrounding vegetation with imported VENM and ENM materials. The presence of weed species within the proposed extraction area extension has the potential to decrease the value of extant vegetation to native species, particularly threatened species. Existing weed management controls for the approved Quarry will be applied to the Proposed Modification. The following management measures will be undertaken to minimise the potential impacts and spread of weeds and pathogens.

- Inspect and clean any vehicles or equipment being brought onto or leaving the Quarry for ground disturbance activities or travelling throughout the site prior to the commencement of any work in order to limit the spread of plant material between sites.
- clearly demarcate areas of ground disturbance to ensure no unnecessary disturbance is undertaken outside of these areas.
- Undertake regular inspections to monitor the spread of weed species.
- Train environmental personnel on the identification of target weed species.

Any outbreak of noxious weeds will be controlled and eradicated as required under the *Biosecurity Act 2015*, and as required by the Local Land Services and other relevant authorities. Weed control and eradication techniques may include:

- spraying with herbicides,
- physical removal (e.g. chipping), and/or
- minimisation of area available for weed infestation, through prompt revegetation of bare areas.

Given this information, there will be no substantial change to impacts on adjoining vegetation areas from weeds or pathogens as the proposed extraction area extension is part of an existing quarry operation with existing impacts.

7.10.5 Surface and Ground Water Flows

7.10.5.1 Surface Water

Surface water management procedures currently used within the existing approved Quarry will be expanded to include the proposed extraction area extension. This will involve the diversion of clean water flows around disturbed areas and containment of dirty water within the quarry water management system for treatment. As the Water Management Plan (WMP) for the Proposed Modification will generally remain consistent with the existing approved operation, the key management measure is to continue to operate the water management system (WMS) in accordance with an updated version of the approved Quarry WMP (Umwelt, 2018). The approved WMP (Umwelt, 2018) will be updated to account for the modified extraction area and production rate.

There will be no additional impact on catchment yield and any surface water take will be in accordance with Water Access Licence (WAL) conditions. Water balance modelling indicates that the potential for discharges from the Quarry WMS is expected to be consistent with the existing approved operation and, as such, downstream water quality impacts will be consistent with the existing approved operation. Further the maximum sand washing rate will not be increased even though the total sand extraction rate will increase. Therefore, the maximum future water demands are expected to be comparable to the existing approved operation.

The following mitigation measures for the approved Quarry will apply to the Proposed Modification for reducing any indirect surface water impacts to surrounding areas.

- During the construction, all works and associated erosion and sediment controls will be inspected monthly and maintained as required to ensure that all required controls are in place and effective.
- All erosion and sediment controls will be designed, constructed and managed in accordance with the Blue Book Volumes 1 and 2.
- Following the completion of construction works, the work areas will be inspected monthly and after any rainfall events generating runoff until revegetation and stabilisation of drainage structures are complete.
- During operations, inspection of the water management controls will be undertaken on a monthly basis and after storm events (i.e. greater than 50 mm in 24 hours).

Provided the WMS is operated in accordance with an updated version of the WMP (updated to account for the modified extraction area and production rate), the surface water impacts associated with the Proposed Modification are expected to be consistent with the approved Quarry operation and are not expected to be of any level of significance in relation to biodiversity values in the surrounding area.

7.10.5.2 Ground Water

A detailed groundwater assessment was prepared for the proposed extraction area extension by Golder Associates Pty Ltd (Golder 2019) to assess the potential impacts of the Proposed Modification on the existing groundwater regime and is provided in **Appendix 8**. This report concluded that the Proposed Modification will not result in any take of groundwater through extraction. Notwithstanding, the following mitigation measures that apply to the approved extraction area will be implemented for the Proposed Modification.

- Dixon Sand would continue to maintain the maximum extraction depth at least 2 m above the wet weather groundwater level.
- The wet weather groundwater level will be reviewed at least every three years and extraction levels modified as required.
- The groundwater monitoring program (as described in **Section 7.7.5.2**) will be implemented and reviewed at least annually following the preparation of the Quarry Annual Review.
- All hydrocarbon and other potential pollutant storage would be in bunded containers or areas to prevent spillage and possible seepage to the groundwater.

A coastal upland swamp community has been previously identified to the south of the proposed extraction area extension (Umwelt, 2016). The coastal upland swamp community is recognised as a groundwater dependent ecosystem (GDE) (BoM, 2019). The key mitigation measure for the approved Quarry operation is the design of a 50 m buffer zone that has been applied around the swamp where extraction will be excluded. The purpose of the buffer zone is to protect and manage this community providing a barrier to direct disturbance. The proposed modification area is approximately 1,000 m to the north of the mapped coastal upland swamp community. No other high priority GDEs are identified in the vicinity of the Quarry in the schedules of the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources* (BoM, 2019)The proposed extraction area extension does not contain any areas of the coastal swamp community and the vegetation surrounding the Proposed Modification has not been mapped as groundwater dependent ecosystem. Regional mapping units are also considered unlikely to be groundwater dependent (Hills Shire Council, 2008). There are no changes to disturbance or operations of the Proposed Modification that would affect any area of coastal upland swamp community or mapped groundwater dependent ecosystems and as such any potential indirect impact to groundwater dependent ecosystems in the area surrounding the Proposed Modification area is unlikely.

7.10.6 Conclusion

Based on the information provided above, coupled with the information provided in the BDAR waiver application and associated test of significance, the Proposed Modification is not expected to result in any substantial indirect impacts on the biodiversity values of the surrounding lands greater than that of currently approved operations.

7.11 Heritage

7.11.1 Scope

DPIE advice on the Proposed Modification did not include specific requirements for archaeological assessment (noting that reference was made to consultation with registered Aboriginal parties as a component of the Community Engagement Strategy for the project). However, in line with current legislative requirements, an Archaeological Due Diligence Assessment has been undertaken in accordance with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (2010). The assessment also included a preliminary historical archaeology and heritage assessment. The assessment specifically relates to the proposed extraction area extension as shown in **Figure 1.2** with the findings presented below.

7.11.2 Heritage Context

A search of the OEH Aboriginal Heritage Information Management Systems (AHIMS) register was undertaken on 15 May 2019 (Search ID: 420915) encompassing Lot 170, DP 664767 with a buffer zone of 1 km. This extensive search identified two sites, neither of which is located within the proposed extraction area extension. Details are provided in **Table 7.19**.

Table 7.19 AHIMS Sites

AHIMS#	Site Name	Type	Distance to Proposed Extraction Area Extension	Validity
45-2-0081	MR1	Shelter with Art and deposit	1.1 km SE	Valid
45-2-2300	Maroota Trig	Artefact: Open Campsite	1.2 km ESE	Valid

A search of the NSW State Heritage Register was also undertaken to determine the presence of any registered heritage items. This search identified one historic item listed under the *NSW Heritage Act, 1977* in the local area. **Table 7.20** outlines details of the item and its proximity to the proposed works, and whether the proposed works will impact these items.

Table 7.20 NSW Heritage Act Listing

Item name	Address	Distance to Proposed Extraction Area Extension	Listing source	Impact caused by Proposed Modification?	SHR number
Great Drain and two houses site	**Wisemans Ferry Road, Maroota**	7.3 km SW	NSW Heritage Register	No	01402

Additionally, a search of *The Hills LEP 2012* was undertaken to determine the presence of any listed heritage items. This search identified eight items. **Table 7.21** outlines the items in proximity to the proposed works, and whether the proposed works will impact these items. There are no historical listings located within the proposed extraction area extension; the closest is the Old Northern Road between Dural and Wisemans Ferry and is located approximately 827 m to the north-east.

Table 7.21 Local Government Listing

Item Name	Address	Distance to Proposed Extraction Area Extension	Listing source	Impact caused by Proposed Modification?	Listing number
Old Northern Road	Old Northern Road between Dural and Wisemans Ferry	827 m NE	LGA	No	A12
McFarland Grave	4 m from the centreline of Old Northern Road and 368 m north of its intersection with Wisemans Ferry Road	1.8 km NE	LGA	No	I141
Original Section of Old Northern Road	4132 Old Northern Road, Maroota	2.2 km SE	LGA	No	A16
Bypassed section of Old Northern Road	4050 Old Northern Road, Maroota	3.3 km SE	LGA	No	A18
Original Northern Road	3952-4006 Old Northern Road, Maroota	3.3 km SE	LGA	No	A15
Bypassed section of Old Northern Road	4050 Old Northern Road, in front of Lot 238, DP752039	3.3 km SE	LGA	No	A17
Convict Built Road (Mr Sharps Track)	2275 and 2277-2349 River Road, Leets Vale	4.4 km NW	LGA	No	A14
Great Drain and Stone Cut Foundations	274 Pacific Park Road, Stone Drain Reserve	6.4 km SW	LGA	No	A25

The proposed extraction area extension is located in a region that would have originally been richly resourced, making it an attractive location for Aboriginal people to frequent, particularly for the purpose of resource procurement. It is likely that occupation activity would have been focussed on key watercourses in the region, including Little Cattai Creek, which would have provided the necessary fresh water to allow Aboriginal people utilising the resources of the Hawksbury to stay for periods of time that would lead to the discard of sufficient artefactual material (stone artefacts) that they may remain in a subsurface context or exposed in areas of ground disturbance/erosion. The presence of registered sites in the general vicinity is demonstrative of this.

However, as noted by Umwelt (2016) the landforms bordering the Quarry site were not suitable for occupation (based on the topography and lack of access to reliable water) and have a shallow soil horizon, which further reduces the potential for preservation of sub-surface archaeological deposits. These predictions are equally applicable to the proposed extraction area extension, within which it is predicted that any archaeological evidence would be indicative of transient use and therefore will be relatively limited in nature and extent.

With regard to historical heritage, based on the available information, it is unlikely that any items of historical heritage significance will be identified within the proposed extraction area extension. In order to confirm these predictions, a visual inspection was undertaken.

7.11.3 Due Diligence Inspection

The due diligence inspection of the project area was undertaken on 23 May 2019 by Umwelt and a representative from Deerubbin LALC. The inspection was undertaken on foot and included all of the proposed extraction area extension.

The purpose of the visual inspection was to assess whether Aboriginal cultural heritage objects and/or places and historical heritage items are present within the proposed extraction area extension and/or have the potential to occur.

No Aboriginal objects were identified during the inspection.

Overall, the proposed extraction area extension was observed to have been disturbed by farming, installation of infrastructure and services, vegetation clearing and vehicle traffic in access tracks.

Due to the factors outlined above, the proposed extraction area extension is assessed to be demonstrably disturbed in the soil subsurface to a depth of up to 30 cm, and the extent of this disturbance is such that it is likely to have resulted in the removal or substantial disturbance of any archaeological material that may have been present (if any). Proximity to permanent fresh water and estuarine water sources along with landform play a big role in the potential usage of the area by Aboriginal people of the past. Given proximity of the proposed extraction area extension to fresh water (760 m), estuarine water sources (8 km) and the proximity of the proposed extraction area extension to elevated ground in proximity to these water sources (demonstrated areas that were preferred for use by Aboriginal people), it is unlikely that the proposed extraction area extension was utilised for intensive Aboriginal occupation and is likely to have been subject to transient use only. On this basis, the proposed extraction area extension is assessed as having low archaeological potential in addition to being clearly and demonstrably disturbed.

No previously unidentified potential historical heritage items or archaeological remains were identified within the proposed extraction area extension and, based on the nature of the historical land use and disturbance, the area is assessed as having low potential to contain historical archaeological deposits.

7.11.4 Due Diligence Assessment

Section 8 of the due diligence code outlines the process to guide due diligence assessments, summarised below in relation to the proposed works.

1. Will the activity disturb the ground surface or any culturally modified trees?

The proposed works will involve wholesale ground disturbance within the proposed extraction area extension. The proposed extraction area extension does not contain any mature trees subject to cultural modification.

2. Are there any:

a) Relevant confirmed site records or other associated landscape feature information on AHIMS?
b) Any other sources of information of which a person is already aware?
c) Landscape features that are likely to indicate the presence of Aboriginal objects?

No sites have been previously recorded within the proposed extraction area extension. The sites recorded in the surrounding area have been recorded on exposed sandstone landforms (including rock shelters) and in proximity to fresh water. The closest site 45-2-0081 (MR1) is located approximately 1.1 km to the south-east of the proposed extraction area extension. 45-2-2300 is located approximately 1.2 km south-east of the proposed extraction area extension. These sites will not be disturbed during the Proposed Modification. The landscape features within the proposed extraction area extension are not conducive to intensive Aboriginal occupation.

Based on the environmental context, as well as the results of previous archaeological investigations undertaken in proximity to the proposed extraction area extension, it is considered the most likely site type to occur within the area surrounding (if present) would be sites containing rock art and artefacts. However, the potential for art and artefactual material to be present within the proposed extraction area extension is significantly limited by the topography of the area.

The proposed extraction area extension is located on a low gentle slope below the Maroota Ridge within which there are no rock outcrops present. The soil profiles in this location have been subject to substantial disturbance. The proposed extraction area extension does not have direct access to freshwater resources, with the closest watercourse being a first order tributary of Little Cattai Creek located approximately 250 m away.

The due diligence code identifies landscape features that indicate the likely existence of Aboriginal objects as including areas within 200 m of waters, ridges and headlands and within 200 m of a cliff face. The Proposed Modification is to occur approximately 250 m from a first order tributary of Little Cattai Creek (fresh water) and are not within any of the other described landforms. Based on the archaeological pattern for the local area, archaeological sites are most likely to occur in sandstone landforms, on ridgelines and/or in proximity to reliable water sources. The proposed extraction area extension meets none of these criteria and is predicted to have been used in a transient fashion by Aboriginal people, therefore limiting the potential for Aboriginal objects to been deposited. Any such deposits are likely to be limited in artefact numbers and extent. Similarly, given the absence of exposed sandstone, there is no potential for rock shelters, rock engravings or grinding grooves to occur.

In addition, the proposed extraction area extension has been subject to substantial disturbance as a result of land clearance and the establishment and maintenance of an olive grove.

3. Desktop Assessment and Visual Inspection

No Aboriginal objects were found within the proposed extraction area extension.

During the inspection it was confirmed that the area had been subject to clearing and observable disturbance due to the clearance of native vegetation and establishment and maintenance of an olive grove. The due diligence code specifies:

'Land is disturbed if it has been the subject of a human activity that has changed the land's surface, being changes that remain clear and observable.'

In addition, the proposed extraction area extension does not meet the description of a sensitive landform (as discussed above) and is assessed as having low archaeological potential.

On the basis of the above, it is assessed that there is a low likelihood that the proposed works will result in harm to Aboriginal objects.

7.11.5 Management and Mitigation

The following recommendations are made with reference to the requirements of the NPW Act, the NPW Regulation and the Due Diligence Code.

- The proposed works may proceed without any further Aboriginal cultural heritage or archaeological investigation, provided that the impacts and extent of the proposed works are consistent with those discussed in this report. Works should, however, proceed with caution.

- All persons working on site that are involved in ground disturbing works should be made aware that it is an offence under Section 86 of the NPW Act to harm or desecrate an Aboriginal object unless that harm or desecration is the subject of an approved Aboriginal Heritage Impact Permit (AHIP).

- All persons working on site that are involved in ground disturbing works should be made aware of their obligations and requirements in relation to the relevant provisions of the *Heritage Act 1977*.

- In the unlikely event that an Aboriginal object is identified whilst carrying out the proposed works, all activities in the immediate vicinity of the identified Aboriginal object should cease and a suitably qualified archaeologist should be contacted to confirm the validity of the object. Should the object be confirmed to be of Aboriginal cultural origin, the landholder/contractor must notify OEH and may need to apply for an AHIP prior to the recommencement of further ground disturbance works in proximity to that object.

- In the unlikely event that unexpected historical (non-Aboriginal) archaeological remains are discovered during works at the proposed extraction area extension, works must cease in the vicinity of the remains and the remains managed in accordance with Section 146 of the *Heritage Act 1977*.

7.12 Rehabilitation, Final Landform and Land Use

7.12.1 Objectives

Dixon Sand is committed to the effective rehabilitation and closure of its quarry sites. This is achieved through progressive rehabilitation and managing quarry operations to work towards the eventual final rehabilitation and closure of the site.

The Proposed Modification requires a minor amendment to the proposed final landform currently nominated for the Quarry, involving a small (1 ha) extension to the void associated with the Tertiary Sand Extraction Area. However, no change to the final land use of the Quarry site is proposed, being a return to agricultural land.

7.12.2 Planning

In accordance with Condition 22 of Schedule 3 of the Consent, a *Rehabilitation and Landscape Management Plan* (RLMP) has been prepared for the approved development. This plan provides a detailed description of the planned approach to rehabilitation of the Quarry. The key aspects of the Proposed Modification which have the potential to revise the rehabilitation strategy outlined in the RLMP is the proposed extraction area extension and increased rate of VENM/ENM importation.

The RLMP has been approved by DPIE and provides a detailed description of the strategies that will be used to rehabilitate the areas disturbed by quarrying operations. The RLMP will be updated for the Proposed Modification to incorporate the rehabilitation of the proposed extraction area extension.

Dixon Sand proposes to rehabilitate the proposed extraction area extension to reinstate Class 4 agricultural land, with drainage to the south. The area would be revegetated with pasture or horticultural crop species and progressively rehabilitated by refilling and contouring with fines from the wash plant combined with unsuitable material from the quarrying process and VENM and ENM to achieve a landform generally consistent with the surrounding topography and pre-quarrying landform.

As part of the detailed quarry planning process, a detailed Quarry Closure Plan will be developed at least three years prior to cessation of quarrying activities. The Quarry Closure Plan will describe in detail the proposed operational and progressive rehabilitation procedures for the remainder of the quarry life and subsequent to the quarry closure. Notably, the Quarry is at least 25 years from closure and hence no Quarry Closure plan has been prepared.

7.12.3 Criteria

Completion criteria will be utilised to demonstrate achievement of rehabilitation and land use objectives/performance standards. No changes are proposed to the current rehabilitation or final land use criteria are proposed (as outlined in **Table 3.3**), noting that these will be subject to ongoing refinement over the life of the quarry and will be incorporated into the updated RLMP.

7.12.4 Assessment of Impact

7.12.4.1 Final Landform

The final landform presented in **Figure 4.2** represents a sympathetic extension of the landform already nominated for the Quarry and approved as part of the RLMP. Noting backfill of the Tertiary Sand Extraction Area is not proposed, there are no reasonable or feasible alternatives to the small extension of the shallow void.

7.12.4.2 Final Land Use

The Proposed Modification does not propose to modify the intended final land use of the Quarry (agricultural). Overall, the Proposed Modification is effectively an extension to current activities on the Quarry Site and therefore, subject to the implementation of the rehabilitation procedures and strategies of the RLMP, unlikely to affect the likelihood of establishing viable agricultural land.

7.13 Social Setting

7.13.1 Scope

A Social Impact Assessment (SIA) has been undertaken for the Proposed Modification by Umwelt to:

- profile key communities in proximity to and associated with the existing operations and the Proposed Modification,
- scope and assess the potential social issues/impacts and opportunities associated with the Proposed Modification on these communities, and
- develop strategies to address any significant identified impacts and opportunities and monitor and manage social impacts associated with the Proposed Modification should it be approved.

The SIA, which can be reviewed in full as **Appendix 9**, was prepared following the Social Impact Assessment: Guidelines for State Significant Mining Petroleum Production and Extractive Industry Development (the SIA Guideline), released in September 2017 by the Department of Planning and Environment (DPE) (now DPIE). A summary of the key findings of the SIA are provided in the following subsections.

7.13.2 Methodology

As discussed in the SIA (refer to **Appendix 9**), assessment of socio-economic impacts involved the following key phases:

- developing a profile of the social and economic context in which the Proposed Modification is located, at a local and regional scale, and summarising the social and community issues of relevance to the communities of interest,
- identifying the impacts and opportunities that are most important to the local community through analysis of secondary data sources and engagement with the local community,
- assessing and predicting the significance of impacts associated with the project through the application of a 'risk-based approach', and integrating both perceived and technical assessment of risk,
- developing strategies to address and manage the predicted social impacts and those which may enhance opportunities in a manner that values existing community aspirations and assets
- identifying what will require monitoring should the project be approved and how any unanticipated social impacts that may result from the project will be identified.

Consistent with the SIA Guideline (DPE, 2017), the social impacts of the Proposed Modification were considered as changes to the following.

- people's way of life, that is: how they live, work, play and interact with one another on a day to day basis
- their culture, that is: their shared beliefs, customs, values and language or dialect
- the community, that is: its cohesion, stability, character, services and facilities

- their political system, such as: the extent to which people are able to participate in decisions that affect their lives, the level of democratisation that is taking place, and the resources provided for this purpose
- their environment, such as: the quality of the air and water people use, the availability and quality of the food they eat, the level of hazard or risk, dust and noise they are exposed to, the adequacy of sanitation, their physical safety, and their access to and control over resources
- their health and wellbeing: health is a state of complete physical, mental, social and spiritual wellbeing and not merely the absence of disease or infirmity
- their personal and property rights: particularly whether people are economically affected or experience personal disadvantage which may include a violation of their civil liberties
- their fears and aspirations, that is: their perceptions about their safety, their fears about the future of their community, and their aspirations for their future and the future of their children.

7.13.3 Social Profile

Analysis of key demographic data from the 2016 Census found that:

- the population of Maroota was 617 people with the median age of 39 years,
- approximately a quarter (24.5%) of the houses in Maroota were rentals, approximately a third of the houses were owned with a mortgage (32.4%) and the remainder was owned outright (36.7%),
- the majority of the households in Maroota were families (80.2%),
- most households had children either as a family household (45.5%) or single parent family (16.0%),
- the median weekly household income in Maroota ($1,761), which is below the median weekly household income of The Hills Shire LGA ($2,363) but above the median weekly household income of NSW ($1,486),
- unemployment in Maroota is low (2%), below the unemployment rate of The Hills Shire LGA (4.6%) and NSW (6.3%), and
- the top industries of employment in Maroota are vegetable growing (outdoors) (9.0%), road freight transport (6.3%), mineral sand mining (5.0%) and nursery production (3.6%).

Key characteristics of Maroota and The Hills LGA more broadly are as follows.

- The LGA comprises a diverse range of land uses, including suburban, rural residential, industrial/commercial and bushland. The area around Maroota is predominantly bushland and rural residential, while the more southern areas of the LGA are more suburban in nature.
- These land uses are also reflected in the key industries of employment in Maroota, namely vegetable growing, road freight transport, mineral sand mining and nursery production.
- Population projections suggest that the population will grow rapidly over the next two decades and also age, with the proportion of persons aged over 75 years expected to also increase over this timeframe.
- Maroota is seen to have a higher than average level of socio-economic advantage.

- Maroota has lower costs of living (rental prices) compared with NSW, however this is not consistent throughout the LGA, where the average rental costs are higher than NSW.

- For Maroota and the LGA, unemployment rates are below the State, while workforce participation rates are above the State average.

Table 7.22 summarises the findings of the social profile indicating the strengths and vulnerabilities of Maroota and The Hills Shire LGA.

Table 7.22 Summary of Social Profile

	Strengths	Vulnerabilities
Environment	Abundant and diverse natural resources, including mineral sand resources, agricultural lands and bushland	Potential land use conflicts Housing developments and industry impacting on environment
Community	Significant population growth Lower proportions of lone person households	Low levels of cultural diversity Limited community services and facilities in Maroota
Infrastructure	Metro-Northwest train line increasing connection of the LGA to the Sydney metropolitan area Road upgrades	Disparity in infrastructure between northern and southern suburbs Limited public transport in Maroota Housing developments concentrated in the southern suburbs
Economic	Lower costs of living Above State average household income	
Industry	Diverse economy Low unemployment	Industry dependent on natural resources (e.g. sand quarries, agriculture)

The analysis suggests that the Maroota area is a socially robust community.

7.13.4 Assessment of Impact

In order to assess the perceived and predicted social impacts that may occur as a result of the Proposed Modification, the SIA considered the potential impacts on the social setting with reference to:

- The results of the various technical assessments described in **Section 7.3** to **7.12**,

- analysis of secondary data sources,

- analysis and assessment of similar projects, and

- review of impacts and issues nominated by the local community during stakeholder engagement.

In assessing the significance of any changes to the social parameters, the following relevant social impact characteristics that have been considered.

- **extent** – geographical area affected by the impact (or the proportion of people or population groups affected)

- **duration** – the timeframe over which the impact occurs

- **severity** – scale or degree of change from the existing condition as a result of an impact
- **stakeholder perceived risk ranking** - the importance placed or level of concern that those potentially affected feel about the social matter
- **sensitivity** – susceptibility or vulnerability of people, receivers or receiving environments to adverse changes caused by the impact, including value or importance to the community.

In order to determine whether the significance of an impact was 'low', 'moderate' or 'high', the SIA applied a consequence and likelihood framework, i.e. assessing the consequence of a given social impact factor (e.g. catastrophic, major, negligible) against the likelihood that it will occur (e.g. almost certain, likely, possible). Both positive and negative impacts were considered in this regard. Further detail on the social risk matrix is provided in Section 6.0 of the SIA.

The following key social impact themes were identified by the SIA.

Social Amenity

Social amenity impacts are those that relate primarily to the change in land use within the immediate locality, increase of trucks and subsequent impacts of dust, noise, traffic and land management. The key social amenity issues have been further categorised as follows.

- Traffic: in particular the potential impact on road safety, road conditions and congestion
- Noise – traffic: associated with the increased frequency of truck movements on local roads.
- Noise – operational: associated with the extension of the extraction area to the north and changes to noise management measures, e.g. bunds,
- Visual: associated with product stockpiling and extension to the extraction area which could change existing natural views from local properties,
- Dust: and effect on local amenity,
- Biodiversity: as it impacts on native wildlife, and
- Water: and the potential to impact on surrounding land uses.

Decision making and engagement

This relates to the distribution of information and opportunity available to local stakeholders to understand and evaluate the Proposed Modification.

Economic

Matters related to economic impacts related principally to the positive opportunities that may be created by local contribution and investment by Dixon Sand. A small number of stakeholders also expressed concerns with regards to the possible negative impacts of the Proposed Modification on house and property values and current uses of neighbouring land for business purposes.

Community sustainability, values and place impacts

Community sustainability, values and place include impacts such as those due to population movements or changes to the economy, as well as less tangible psychosocial aspects of change, such as the impacts of stress, how people value their homes and surroundings, and the sustainability of the community as a whole. During consultation, stakeholders did not raise concerns relating to community sustainability.

After application of the SIA risk assessment framework, and on consideration of the results of the technical environmental assessments and proposed mitigation and management measures, **Table 7.23** provides a summary of the predicted social impacts in relation to the Proposed Modification.

Table 7.23 Potential Positive and Negative Social Impacts of the Proposed Modification

Impact Theme	Project Aspect	Social Impact	Affected Parties	Duration	Perceived Stakeholder Ranking	Social Impact Ranking - Mitigated
Traffic	Increased truck movements	Environment – public safety	Road users Pedestrians Local residents Haul route residents	Long term	High	Moderate
Noise	Truck noise	Health and well-being Way of life	Local residents Haul route residents	Long term	High	Moderate
	Operational noise	Health and well-being Way of life	Local residents Haul route residents	Long term	Moderate	Low
Visual	Change to visual amenity/ landscape	Environment – aesthetic value	Local residents	Long term	High	Low
Dust	Impact of operations on air quality – in particular dust emissions	Environment – amenity Health and wellbeing	Local residents	Long term	Moderate	Low
Biodiversity	Increased truck movements impacting on wildlife	Environment – public safety and amenity	Road users Pedestrians Local residents Haul route residents	Long term	Low	Low
Water	Impact on surface and groundwater due to proposed expansion of the extraction area	Environment – access to and use of the natural and built environment	Local residents Regional residents	Long term	Low	Low
Decision making and engagement	Information provision and community engagement	Political systems	Local residents Haul route residents	Long term	Moderate	Low

Impact Theme	Project Aspect	Social Impact	Affected Parties	Duration	Perceived Stakeholder Ranking	Social Impact Ranking - Mitigated
Economic – employment and economy	Positive economic impacts on employment, and local and regional economy	Way of life	Local residents Regional residents	Long term	Low	*Moderate (positive)*
Economic – property values & local business	Negative impacts on property prices and local businesses	Way of life Personal and property rights	Local residents Haul route residents	Long term	Low	Low
Community	Population change as a result of workforce influx	Community composition	Local residents Regional residents	Long term	Low	Low
	Impacts on housing availability and community infrastructure as a result of workforce influx	Community composition	Local residents Regional residents	Long term	Low	Low
	Changes to sense of community resulting from the Proposed Modification	Community and sense of place	Local residents Regional residents	Long term	Low	Low

7.13.5 Management and Enhancement

Based on the social impact assessment summary of **Table 7.23**, the issues most likely to impact on the social setting relate to the increased movement of trucks on Wisemans Ferry Road and associated increase in traffic noise. Dixon Sand has a number of existing arrangements to encourage good driver behaviour to reduce the potential for impacts on social amenity. These include:

- toolbox talks with Quarry personnel and drivers to reinforce positive driver behaviours and messaging,
- enforcement of a 'three strikes out' policy on bad behaviour, enforced through the Maroota Local Traffic Management Policy to which Dixon Sand is a signatory with two other quarry operators,
- reminders of driver responsibilities under the code of conduct in cases of community complaints that identify a specific truck (first two strikes),

- training inductions for drivers on the *Maroota Local Traffic Management Policy*, and
- efforts to lobby the RMS for a decrease in the speed limit along Wisemans Ferry Road.

In addition, Dixon Sand currently provide a contribution to social infrastructure maintenance under 'section 94 Contribution' of Council's development control plan, which requires that quarries pay $1 for every tonne of material sold. Between the financial years of 2014 and 2018, Dixon Sand has contributed $2.2 million under section 94 contribution and, given that an increase in production would lead to a greater contribution towards Council infrastructure maintenance, the Proposed Modification would provide Council with increased capital to maintain public roads in the LGA.

On approval of the Proposed Modification, Dixon Sand would also undertake to:

- conduct monitoring of trucks along the haul route (Dixon Sand personnel stationed on roadside),
- provide the community with information regarding:
    - the review of the Maroota Local Traffic Management Policy,
    - traffic monitoring results, and
    - upgrade of the intersection at Wisemans Ferry Road and Haerses Road and RMS endorsement of this upgrade.

The management of impacts associated with noise, air quality, visual amenity, biodiversity and water are nominated throughout **Section 7.0** and summarised in **Table 8.1** (refer to **Section 8.0**)

Dixon Sand will continue to maintain meaningful engagement with the local community. Mechanisms for this engagement are to include:

- bi-annual meeting of the CCC with representatives from the community, council, school, and stakeholder groups,
- provision of environmental monitoring reporting and CCC minutes on the Dixon Sand website,
- a dedicated environment officer and contact details available on the website for community queries and complaints, and
- preparation and distribution of FAQ's or similar documentation on matters of key environmental concern over the life of the Quarry.

7.13.6 Conclusion

On consideration of the potential social impacts of the Proposed Modification and the management measures and enhancement strategies to be implemented, it is concluded that the Proposed Modification:

- represents a continuation of an extractive industry which has been operational since 2006, and is therefore consistent with existing land use of the local setting,
- provides for impact management and mitigation measures to reduce impacts on social amenity, decision making and engagement, community and economics as much as reasonable and feasible given the nature of the Proposed Modification,
- is consistent with strategic plans of The Hills LGA to grow and diversify the economy base and employment opportunities,

- is unlikely to have significant negative social impacts to the local setting and/or broader LGA, and
- proposes no change to the overall duration of Quarry operations.

The results of the stakeholder engagement undertaken as part of the SIA supports the conclusion that the local community is largely accepting of the current and proposed quarrying operations subject to the management of impacts associated with traffic, noise, dust and visual amenity.

On balance therefore, the Proposed Modification would not result in any social impacts which exceed reasonable community expectations.

8.0 Summary of Environmental Management Commitments

The Proposed Modification seeks to increase the extraction area, extraction rate and amount of imported VENM and ENM for rehabilitation and reprocessing. The ongoing implementation of the EMS is the most efficient and effective way to manage the changes associated with the Proposed Modification. Consequently, pending approval of the Proposed Modification, the EMS will be updated to reflect these changes to ensure effective management of ongoing operations.

Table 8.1 summarises the environmental management commitments that will be implemented for the Proposed Modification. It is noted that these commitments include those already in place and documented within the various environmental management plans of the Quarry where they have been relied upon as part of this assessment.

Table 8.1 Summary of Environmental Management Commitments

Environmental Management Measures
Traffic and Transport
• Continue to implement the *Traffic Management Plan* (2019) • Continue to enforce the *Maroota Local Traffic Management Policy*
Noise
• Continue to implement the *Noise Management Plan* (2019) • Extend noise agreement with Landowner of Receiver R02 • Install dump truck noise mitigation (of at least 6 dB(A)) prior to commencement within Stage 4 o the Tertiary Sand Extraction Area (or equivalent on-site noise mitigation and management)
Air Quality
• Continue to implement the *Air Quality Management Plan* (2019) • Use of a water cart to control emissions from haul roads (unsealed) • Enforcement of speed limits onsite • Progressive rehabilitation of exposed areas • Minimising drop height of material during truck loading and unloading where possible • Management of dust-generating activities during unfavourable meteorological conditions.
Greenhouse Gas and Energy
• Regularly tuning and maintaining mobile and fixed equipment to minimise exhaust and greenhouse gas emissions • Reviewing opportunities for improvement in diesel use and energy efficiency when purchasing or replacing equipment at the quarry to reduce greenhouse gas emissions.
Groundwater
• Maintain the maximum extraction depth at least 2 m above the wet weather groundwater level • The wet weather groundwater level will be reviewed at least every three years and extraction levels modified as required • The existing approved groundwater monitoring program would be continued • Continue to implement the *Soil and Water Management Plan* (2019)

Environmental Management Measures
Surface Water
• Update the approved *Soil and Water Management Plan* (2019) to account for the modified extraction area and production rate • Continue to operate the WMS in accordance with an updated version of the approved SWMP • Following the completion of construction works, inspect work areas monthly and after any rainfall events generating runoff until revegetation and stabilisation of drainage structures are complete • During operations, inspect water management controls on a monthly basis and after storm events (i.e. greater than 50 mm in 24 hours)
Visual Amenity
• Relocation of the 5 m high earth bund to the revised northern perimeter of the extraction area and revegetate with stabilising groundcover and fast-growing shrub and tree species prior to the commencement of extraction within the extension area • Tree screens will be planted along the remaining northern perimeter of the Quarry site • Progressive rehabilitation of the Quarry to limit the area of exposed surfaces at any one time • Dust suppression to limit visibility of dust • Direct lighting away from residences and vantage points
Biodiversity
• Fence and/or signpost areas of biodiversity value outside the proposed extraction area extension • Minimise vegetation clearance to that required for operational purposes • Inspected and clean (if required) vehicles or equipment brought onto, or leaving the Quarry for ground disturbance activities or travelling throughout the site to limit the spread of plant material between sites • Clearly demarcate area to be cleared to ensure no unnecessary disturbance is undertaken outside of these areas • Complete regular inspections to monitor the spread of weed species • Provide environmental with relevant training on the identification of target weed species • Complete weed control and eradication as required. • Complete progressive rehabilitation and stabilisation of disturbed land with native vegetation
Heritage
• All persons working on site that are involved in ground disturbing works should be made aware of their obligations under the NPW Act and the Heritage Act • In the unlikely event that an Aboriginal object is identified whilst carrying out the proposed works, all activities in the immediate vicinity of the identified Aboriginal object should cease and a suitably qualified archaeologist should be contacted to confirm the validity of the object
Rehabilitation and Final Landform
• Complete progressive rehabilitation of the Quarry • Produce a final landform which can sustain ongoing agricultural land uses
Social
• Continued implementation and enforcement of the *Maroota Local Traffic Management Policy* • Continue toolbox talks, inductions and other training to remind personnel and drivers of obligations under the *Maroota Local Traffic Management Policy* • Conduct random monitoring of trucks along the internal haul route • Prepare and distribute documentation on matters of key environmental concern to the CCC over the life of the Quarry

9.0 Evaluation, Justification and Conclusion

9.1 Introduction

This SEE has been prepared by Umwelt to assist in the assessment of the likely environmental and social impacts associated with the Proposed Modification. The potential impacts have been identified and carefully assessed following consideration of the design features, operational controls and management measures currently in place or proposed.

On the basis of the assessment of each potential impact, the Proposed Modification can be justified as the residual impacts on the biophysical environment are either understood and determined to be acceptable, or can be predicted and appropriately managed, there would be no notable additional socio-economic impacts and the consequences of not proceeding are considered more adverse than proceeding. Each of these factors considered in the justification of the Proposed Modification are presented below.

9.2 Evaluation

9.2.1 Residual Environmental Impacts

The potential environmental impacts of the Proposed Modification have been identified through a process involving:

- assessment of the site characteristics
- consultation with government agencies
- consultation with surrounding landowners
- expert technical assessments.

The key issues identified were the subject of comprehensive technical assessment to identify and assess the potential impacts of the Proposed Modification on the existing environment and community. The results of these assessments are detailed in **Section 7.0** and the appendices of this SEE.

The environmental and social impacts of the Proposed Modification have been minimised through refining the project design and operational procedures in consideration of environmental constraints and implementation of appropriate control measures.

With the existing and proposed measures to avoid, minimise or manage impacts associated with the Proposed Modification, it is anticipated that the Quarry can continue to operate within acceptable environmental standards without significantly adversely impacting the environment or local community.

9.2.2 Ecologically Sustainable Development

9.2.2.1 Principles of Ecologically Sustainable Development

The EP&A Act aims to encourage ecologically sustainable development (ESD) within NSW. As outlined in **Section 1.0**, the Proposed Modification requires approval under section 4.55 of the EP&A Act. As such, the consent authority needs to be satisfied that the Quarry is consistent with the principles of ESD.

To justify the Proposed Modification with regard to the ESD principles, the benefits in an environmental and socio-economic context should outweigh any negative impacts. The ESD principles encompass the following:

- the precautionary principle
- inter-generational equity
- conservation of biological diversity, and
- valuation and pricing of resources.

Essentially, ESD requires that current and future generations should live in an environment that is of the same or improved quality than the one that is inherited.

9.2.2.2 The Precautionary Principle

In making decisions about developments, the application of the precautionary principle is guided by careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and an assessment of the risk-weighted consequences of various options.

In order to achieve a level of scientific certainty in relation to potential impacts associated with the Proposed Modification, this SEE has undertaken an evaluation of all the key components. Detailed assessment of all key issues and necessary management procedures has been conducted and is documented in this SEE.

The assessment process has involved a detailed study of the existing environment and the use of engineering and scientific modelling and study to assess and determine potential impacts as a result of the Proposed Modification. To this end, there has been careful evaluation to avoid, where possible, irreversible damage to the environment.

The decision-making process for the design, impact assessment and development of management processes has been transparent in the following respects:

- Relevant government authorities and community representatives were consulted during SEE preparation (refer to **Section 6.0**). This enabled comment and discussion regarding potential environmental impacts and proposed environmental management procedures.

- The approved Quarry incorporates environmental management plans, procedures and environmental monitoring that will be revised in regard to the Proposed Modification. In addition, the management controls that will be implemented by Dixon Sand as part of the Proposed Modification have been clearly specified in **Section 8.0** and the Development Consent for the Quarry (DA 165-7-2005).

- This SEE has been undertaken on the basis of the best available scientific information about the Proposed Modification area. Where uncertainty in the data used in the assessment has been identified, a conservative worst-case analysis has been undertaken and contingency measures have been identified to manage that uncertainty.

9.2.2.3 Intergenerational Equity

Intergenerational equity refers to equality between generations. It requires that the needs and requirements of today's generations do not compromise the needs and requirements of future generations in terms of health, biodiversity and productivity.

The Proposed Modification would provide ongoing high-quality supply of sand products into the local and Sydney markets. This supply will assist to meet the current and growing demand for high quality sand products. As a modification to existing quarrying operations, reliance is placed on the extension to the rehabilitation strategies and final land use objectives of the Quarry RLMP. As discussed in **Section 7.12**, the Proposed Modification does not propose any significant variation from the approved final landform and land use strategy of the approved Quarry and therefore will not have any significant additional impact on the local environment or community. The environmental management measures discussed in **Section 7.0** and summarised in **Section 8.0** have been developed to minimise the impact of the Proposed Modification on the environment and community to the extent reasonably practicable.

The management of environmental issues as outlined in this SEE will assist to maintain the health, diversity and productivity of the environment for future generations whilst also realising the benefits of the quarrying operations.

9.2.2.4 Conservation of Biological Diversity

The conservation of biological diversity refers to the maintenance of species richness, ecosystem diversity and health and the links and processes between them. All environmental components, ecosystems and habitat values potentially affected by the Proposed Modification are described in this SEE. As discussed in **Section 7.10**, the Proposed Modification is unlikely to have any additional impact on biodiversity of conservation significance.

9.2.2.5 Valuation and Pricing of Resources

The principle of improved valuation and pricing of resources refers to the need to determine proper values of services provided by the natural environment. The objective is to apply economic terms and values to the elements of the natural environment. This is a difficult task largely due to the intangible comparisons that need to be drawn in order to apply the values.

The Proposed Modification optimises the valuation and pricing of the sand resource with minimal impact by maximising its efficient extraction at the existing Quarry through modification to the extraction area and increasing extraction rates.

Feasibility considerations during the design process for the Proposed Modification have included the costs of integration of effective management measures to minimise potential environmental and social impacts.

9.2.3 Environmental Planning & Assessment Act 1979 Considerations

9.2.3.1 Section 4.15 - Evaluation

In determining an application for the modification of development consent, the consent authority must take into consideration such of the matters referred to in Section 4.15(1) of the EP&A Act (as relevant to the development). These matters for consideration by the consent authority and the sections where they are addressed in this SEE are provided in **Table 9.1**.

Table 9.1 Section 4.15 Matters for Consideration

Matters for Consideration	Relevant SEE Section
(a) the provisions of:	
(i) any environmental planning instrument	Sections 5.3 – 5.5
(ii) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Secretary has notified the consent authority that	Sections 5.3 – 5.5

Matters for Consideration	Relevant SEE Section
the making of the proposed instrument has been deferred indefinitely or has not been approved), and	
(iii) any development control plan,	Not Applicable based on SSD provisions refer to Section 5.5.2
(iiia) any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4	N/A
(iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph),	Not applicable as the development does not represent any of the development types nominated by Clause 92 of the EP&A Reg
(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality	Section 7.0
(c) the suitability of the site for the development,	Sections 2.0, 4.3 and 9.2.1
(d) any submissions made in accordance with this Act or the regulations	N/A
(e) the public interest	Section 7.13

9.2.3.2 Objects of the EP&A Act

Table 9.2 provides a short description of how the Proposed Modification and this SEE have addressed and satisfy the objects of the EP&A Act.

Table 9.2 Objects of the EP&A Act

Object	SEE Coverage
to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,	Socio-economic effects are assessed in **Section 7.13**, with the Proposed Modification likely to provide for an ongoing socio-economic benefit to The Hills LGA. The Proposed Modification would incorporate measures to avoid or mitigate impacts to the natural environment arising from potential impacts on water resources (refer to **Sections 7.7** and **7.8**) and biodiversity (refer to **Section 7.10**). Operational controls would also be implemented to manage potential impacts from noise (**Section 7.4** and air emissions (refer to **Section 7.5**).
to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,	The principles of ecologically sustainable development have been considered in **Section 9.2.2**.
to promote the orderly and economic use and development of land,	The Proposed Modification would involve the continued operation and extension of the Quarry and would maintain the supply of construction materials to the region. The Proposed Modification would be a significant contributor to the local and regional economy and community.
to promote the delivery and maintenance of affordable housing,	The Proposed Modification would not limit the provision of affordable housing in The Hills LGA.

Object	SEE Coverage
to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,	Ecological surveys and assessment have determined that the Proposed Modification would be unlikely to have a significant impact on any threatened population, species or community (refer to **Section 7.10**). It is concluded that the Proposed Modification would not increase the risk of local extinction of any species.
to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),	The Proposed Modification would not result in disturbance to any identified Aboriginal heritage site.
to promote good design and amenity of the built environment,	The Proposed Modification would have no impact on the built environment.
to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,	The Proposed Modification does not require construction of buildings.
to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,	The SEE includes a review of the relevant State, regional and local environmental planning regulations, plans and strategies including how these have been addressed (refer to **Section 5.0**).
to provide increased opportunity for community participation in environmental planning and assessment.	The Hills Council, various government agencies and local landholders were consulted during the planning of the Proposed Modification and preparation of the SEE.

9.3 Justification

9.3.1 Suitability of the Site

The Quarry is located within a rural environment in an area dominated by extractive industries, as discussed in **Section 2.0**. The site is considered suitable for the Proposed Modification for the following reasons:

- The site contains extensive sand resources and is located within proximity to markets for these resources.
- The site has been used for sand extraction since original approval was granted in 2006.
- The site is located within a Primary Production zone and the development is consistent with the objectives of the zone.
- The proposed extraction area extension consists of cleared agricultural land, currently in use as an olive grove, limiting the potential ecological impacts of further disturbance.
- The Proposed Modification is compatible with surrounding land uses and can co-exist with these existing uses.
- The site includes suitable buffers to environmentally sensitive areas.
- Topography and vegetation provide some visual shielding from the surrounding area.
- Suitable safe access to Wisemans Ferry Road is provided from the site without impacting adversely on the local road network.

9.3.2 Benefits of the Proposed Modification

The key benefits of the Proposed Modification include:

- Maximising the efficient extraction of the resource at the existing quarry, thereby delaying or eliminating the need for further quarry development on another less suitable greenfield site.
- Providing a suitable alternative use for VENM/ENM resources for rehabilitation and for reuse that may otherwise be disposed of to waste management facilities.
- The environmental impact of the Proposed Modification can be managed within acceptable environmental standards.
- The Proposed Modification will provide continued employment for existing staff and additional employment to essentially double the workforce at the quarry.
- The Proposed Modification will result in ongoing operational expenditure that will have flow-on economic benefits for the region.

9.3.3 Substantially the Same Development

The Proposed Modification is considered to be substantially the same development as that approved on the basis of the following:

- The type of development, namely extractive industry and resource recovery, remains the same with no additional development types proposed.
- No change to extraction methods, processing methods or operating hours is proposed.
- The predicted impacts of the Proposed Modification would remain equivalent to those approved by DA 165-7-2005.

On the basis of their being no additional activities proposed, with increases to extraction, production and transportation limits managed to minimise impacts, it is concluded that the modified development will be substantially the same as the current operations, as last modified, for the purpose of section 4.55 of the EP&A Act.

9.4 Conclusion

Based on the comparative analysis, the Quarry would remain essentially and materially the same as originally approved (refer to **Section 1.0**) and is considered unlikely to result in significantly greater impacts than those already approved (refer to **Section 7.0**). The proposed increased rate of extraction would better reflect the available resource and can be undertaken without any major alteration to the currently approved operations. The proposed increase in the importation of VENM and ENM would reflect the increased rate of extraction and allow for the construction of the final landform to be completed without significantly lagging behind the completion of extraction. The proposed increase in daily traffic reflects the proposed increased extraction and production rate, as well as accounting for a greater proportion of deliveries direct to customers (as opposed to Old Northern Road Quarry). As a result, it is likely the number of smaller capacity trucks would increase requiring a greater number of truck movements at the maximum production rate.

On the basis that the Proposed Modification does not propose any new activity, any further increase in disturbance and is unlikely to result in significant changes to the environmental impacts associated with the Quarry, it is concluded that the modified quarry would remain substantially the same development to that originally approved and may be modified under section 4.55(2) of the EP&A Act.

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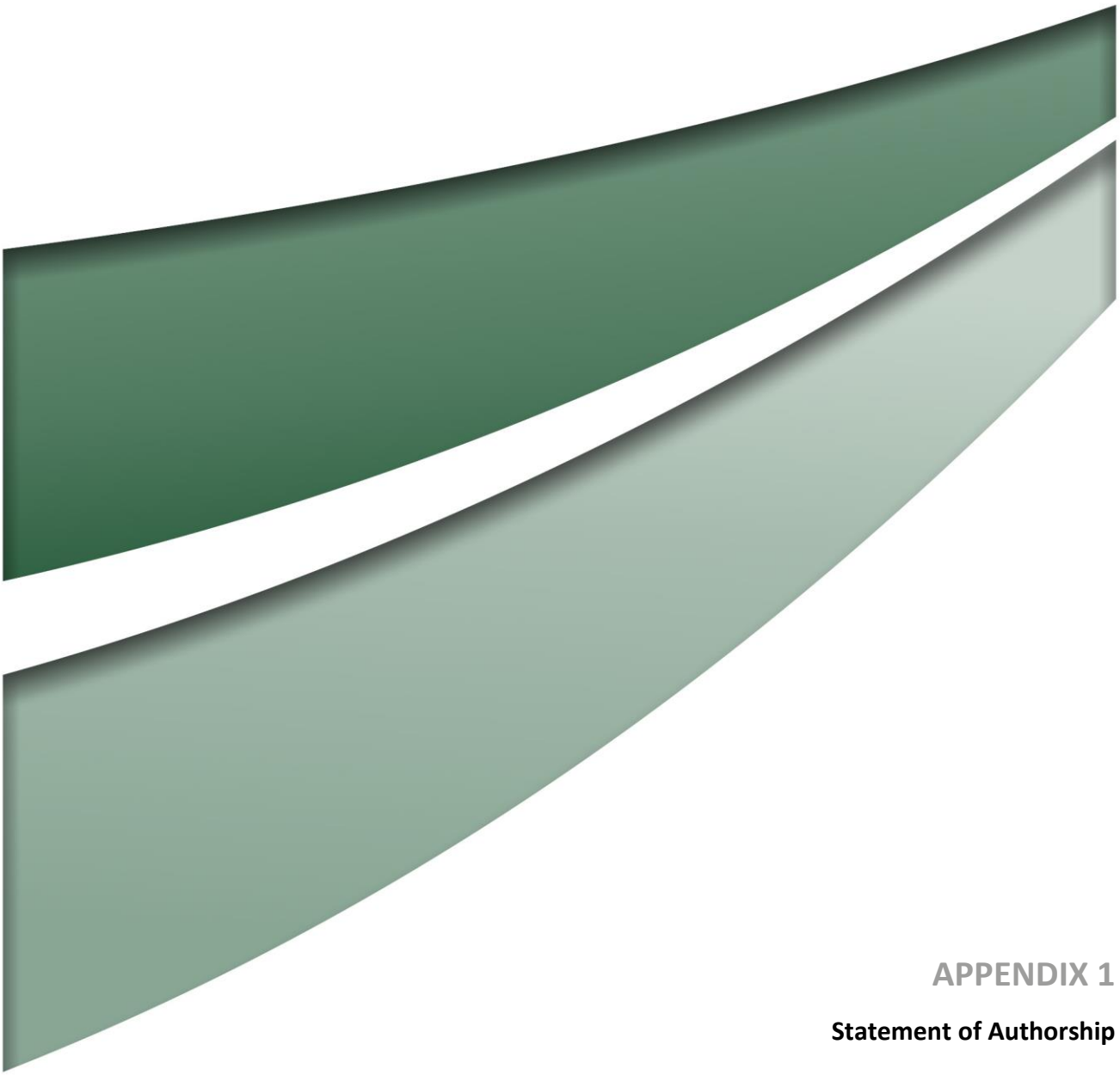


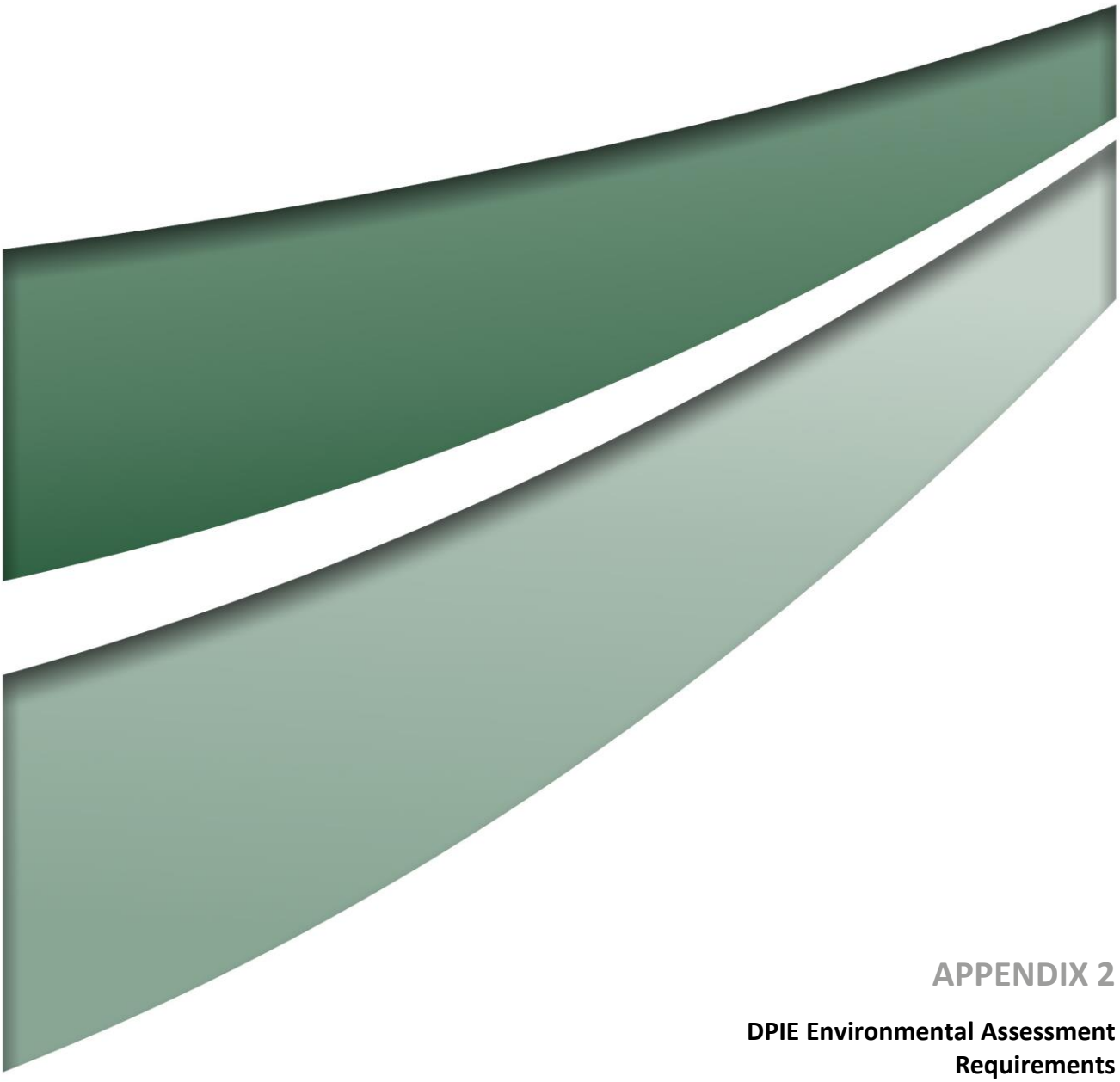
APPENDIX 1

Statement of Authorship

Project Team

Umwelt (Australia) Pty Limited – SEE Preparation	
Alex Irwin, Principal Environmental Consultant – B Sc (Hons)	Project Director
Ruth Tapp, Environmental Engineer - B.Nat.Res.(Hons)	Project Manager
Chris Bonomini, Senior Engineer - Water, Process and Risk - B.Eng.(Chem)(Hons)	Surface Water Assessment and Water Balance Assessment
Ryan Parsons, Senior Ecologist – Botanist – B.Env.Sc.(Hons)	Ecological Assessment
James Garnham, Ecologist - PhD, B.Env.Sc.(Hons)	Ecological Assessment
Malcolm Sedgwick, Principal Energy & Greenhouse Specialist B Sc	Greenhouse Gas and Energy Assessment
Dave Davis, Principal Acoustician - B.Eng.(Mech)(Hons)	Noise Impact Assessment
Amanda Buckeridge, Senior Acoustician – B.Env.Sc.	Noise Impact Assessment
Thomas Hall, Graduate Acoustician - B.Env.Sc.	Noise Impact Assessment
Nicola Roche, Manager Cultural Heritage – B.A.(Hons) Anthropology	Aboriginal Cultural Heritage and Archaeological Assessment
Amanda Crick, Archaeologist – B.A.	Aboriginal Cultural Heritage and Archaeological Assessment and Historic Heritage
Sarah Bell, Senior Social Consultant – PhD, B.Dev.Studies(Hons)	Social Impact Assessment
Jackson Newberry-Dupe, Social Consultant – B.Psych.(Hons)	Social Impact Assessment
Michael Ong, Senior Draftsperson – Adv.Dip.Civ.Eng.	Drafting, Graphic Design
Leanne Ott, Project Administrator	Report Formatting and Document Control

Other Specialist Investigations	
ERM Pty Ltd Judith Cox Justine Firth	Air Quality Impact Assessment
Golder Pty Ltd Jason van den Akker	Groundwater Assessment
SECA Solution Sean Morgan	Traffic Impact Assessment



APPENDIX 2

DPIE Environmental Assessment Requirements

Planning Services
Resource Assessments
Contact: Rob Beckett
Phone: 9274 6388
Email: Rob.Beckett@planning.nsw.gov.au

Alex Irwin
Principal Environmental Consultant
Umwelt (Australia) Pty Ltd
Office 1, 3 Hampden Drive
ORANGE NSW 2800

Dear Mr Irwin

Haerses Road Quarry - (DA 165-7-2000)
Modification 3 – Environmental Assessment Requirements

I refer to your email dated 25 January 2019 seeking Environmental Assessment Requirements (EARs) for the above proposal. The Department understands that the proposed modification involves:

- increasing the rate of extraction to 495,000 tonnes of sand per annum;
- increasing daily truck movements to 180 per day (90 inbound and 90 outbound); and
- reducing buffer zones along the quarry's northern disturbance boundary.

The Department has reviewed the Preliminary Environmental Assessment (PEA) provided and is generally satisfied with the proposed approach to the preparation of the Statement of Environmental Effects (SEE). In particular, the Department notes that you intend to prepare detailed technical assessments with respect to noise. The Department also considers that an air quality assessment with dispersion modelling will be required.

Based on the information provided, the Department does not intend to issue formal EARs for the proposed modification. However, you should ensure that the above assessments are prepared in accordance with the:

- *NSW Noise Policy for Industry* (2017);
- *NSW Road Noise Policy* (2011);
- *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (2016); and
- *Voluntary Land Acquisition Mitigation Policy* (2018).

The Department also requests that the SEE consider:

- the air quality impacts of the proposed modification on sensitive receivers, with a particular focus on dust emissions, PM_{10} and $PM_{2.5}$, having regard to the *Voluntary Land Acquisition and Mitigation Policy;*
- the potential social impacts arising from the modification, both positive and negative, with reference to the *Social impact assessment guideline for State significant mining, petroleum production and extractive industry* development, having particular regard to impacts on local amenity;
- a detailed justification for any proposed changes to existing buffer zones. As these changes would allow an expansion of the approved extraction area, the SEE will need to address potential impacts on groundwater; and
- the visual impacts of the proposed extension to the extraction area, particularly on private landholders and key vantage points in the public domain.

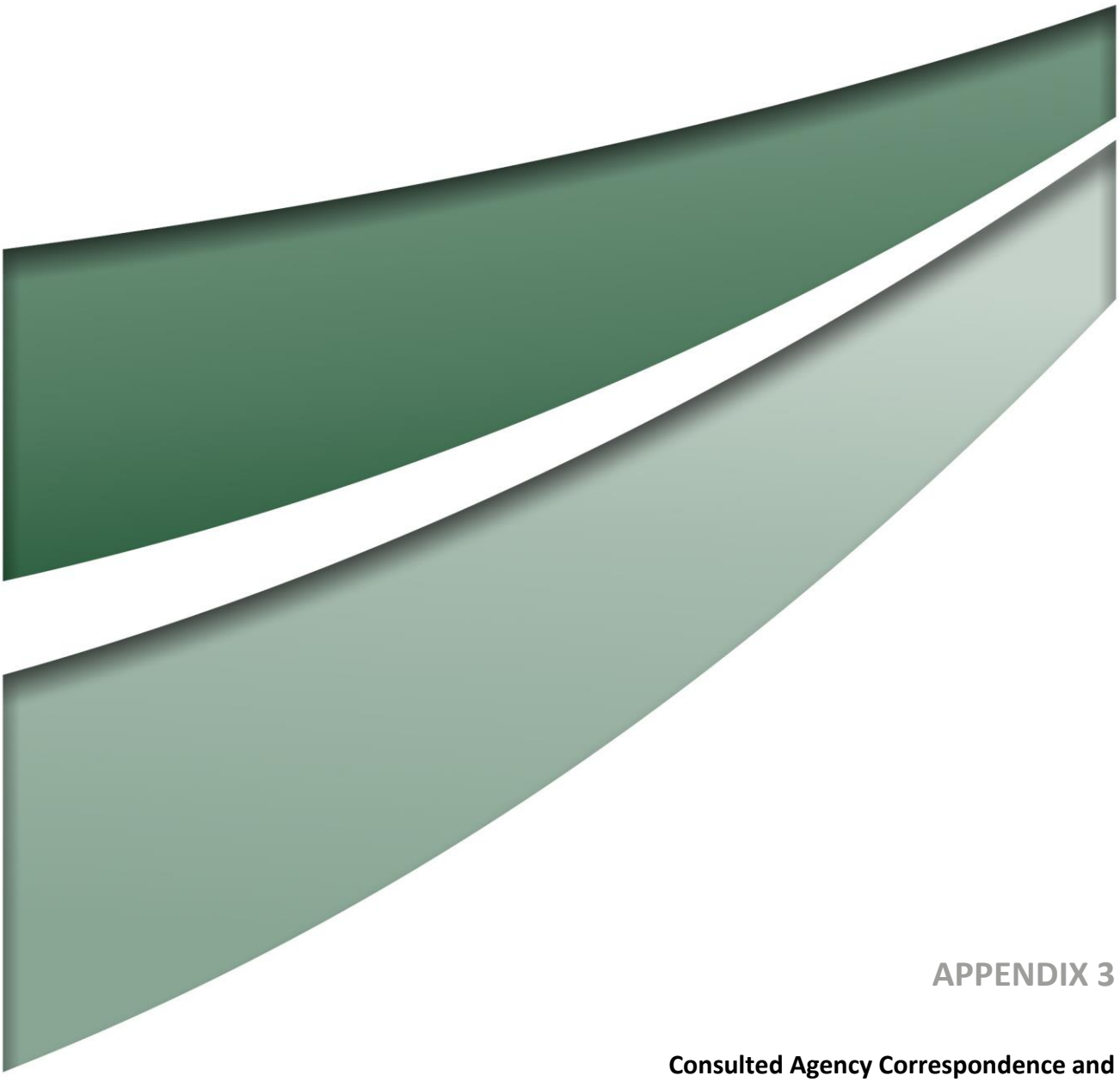
The Department would also like to emphasise the importance of consultation with all relevant stakeholders, such as government agencies, Registered Aboriginal Parties, the Maroota Public School and affected residents, including those residents who may hold a private noise agreement with Dixon Sand. The Department requests that you fully document the outcomes of the proposed Community Engagement Strategy in the SEE.

Should you have any questions in relation to the above, please contact Rob Beckett at the details above.

Yours sincerely

Howard Reed 5.3.19

Howard Reed
Director
Resource Assessments



APPENDIX 3

Consulted Agency Correspondence and Assessment Requirements

From:	Kristine McKenzie
To:	Alex Irwin; Ruth Tapp
Cc:	Lauren Evans (Lauren.Evans@planning.nsw.gov.au)
Date:	Monday, 25 March 2019 10:26:51 AM
Attachments:	image003.png

Hi Alex and Ruth,

Re: Dixon Sand – existing consent 165-7-2005 for Hearses Road, Maroota.

I have reviewed the Preliminary Environmental Assessment and raise concerns regarding the proposed increase in production and truck movements in respect to the use of Section 4.55 of the EP and A Act. The modified proposal, from its original approval, proposes an increase in production from 250,000 tonnes per annum to 495,000 tonnes per annum and an increase in truck movements from 56 truck movements per day to 180 truck movements per day. An increase of this nature indicates that the proposal is not substantially the same development as was originally proposed. It is also noted that the modification application approved in January 2018 did not increase production of truck movements. As such, it is considered that a new Development Application is required to substantiate the proposed increase.

The proposal also refers to the modification to the buffers/setbacks to the northern boundary however there is no information within the Preliminary Environmental Assessment to describe the reduced buffer/setback area. Concerns would be raised if the reduced setback resulted in a variation to Council's DCP requirements under DCP Part B Section 1 – Rural, Part 2 which contains Council's requirements for extractive industry operations. Further, any reduction in buffers/setback would need to ensure that impacts such as acoustic and visual impacts are appropriately managed.

Regards,

logo

Kristine McKenzie

Principal Executive Planner

+61298430319 | kmckenzie@thehills.nsw.gov.au

Administration Centre, 3 Columbia Court Norwest NSW 2153

PO Box 7064, NORWEST NSW 2153 | DX 9966 Norwest

www.thehills.nsw.gov.au

From:	Kristine McKenzie
To:	Alex Irwin
Cc:	Lauren Evans (Lauren.Evans@planning.nsw.gov.au)
Date:	Tuesday, 16 April 2019 12:18:38 PM
Attachments:	image001.png

Hi Alex,

Re: Dixon Sand – existing consent 165-7-2005 for Hearses Road, Maroota.

I have reviewed your additional email dated earlier today and raise concerns regarding the proposed importation of VENM and ENM to the site. The importation of these materials would partially change the use of the site from an 'extractive industry' to a 'waste and resource management facility'. As such, it is considered that a new Development Application is required to substantiate the proposed change in activities on the site and the change in definition of the use.

The final documents submitted must also consider the requirements of Council's DCP requirements under DCP Part B Section 1 – Rural, Part 2 which contains Council's requirements for extractive industry operations.

Regards,

logo

Kristine McKenzie

Principal Executive Planner

+61298430319 | kmckenzie@thehills.nsw.gov.au

Administration Centre, 3 Columbia Court Norwest NSW 2153

PO Box 7064, NORWEST NSW 2153 | DX 9966 Norwest

www.thehills.nsw.gov.au

DOC19/253107-2
Your Ref.

Alex Irwin
Principal Environmental Consultant
Umwelt (Australia) Pty Ltd
Level 3, 50 York Street
Sydney NSW 2000

1 May 2019

Dear Mr Irwin

RE: EPA Response to Haerses Road Quarry Modification 3 (DA165-7-2005)

I refer to your latest correspondence dated 16 April 2019 seeking EPA advise in relation to the environmental impact assessment required to accompany the modification application for Haerses Road Quarry located at Haerses Road on Lot 170 DP 664766, Lot 170 DP 664767, Lots A and B DP 407341, Lots 176 and 177 DP 752039 and Lots 216 DP 752039 Maroota NSW 2756.

The EPA understand that the proposed modification involves:

- The increase rate of extraction from 250,000 tonnes to 495,000 tonnes per annum (tpa);
- Increase of the approved daily truck movements from 56 to 180 movements per day;
- An extension of the extraction area of approximately 1 hectare between the approved extraction area and Wiseman Ferry Road which will require modification of the northern buffer to 30m from Wisemans Ferry Road or 100 metres from the residential receivers north of Wiseman Ferry Road;
- An increase in the maximum amount of virgin excavated natural material/excavated natural material (VENM/ENM) imported to the quarry from 100,000 tpa to 250,000 tpa to provide the required backfill material for rehabilitation; and
- Some VENM/ENM reprocessing and blending with other materials on site for resale as quarry products.

Activities at the premises are permitted under Environmental Protection Licence (EPL) 12513 which EPA issued to Dixon Sand Pty Ltd (the licensee). Extractive and crushing/grinding activities at the premises are each permitted up to 500,000t per year. With the proposed reprocessing of the VENM and ENM, EPL 12513 will require a variation application to include resource recovery and/or waste processing (non-thermal treatment) activities.

The EPA has considered the details of the preliminary environmental assessment and noted the following should be included in the final environmental assessment:

Air Quality

The additional importation and processing of some VENM and ENM materials, increase in daily truck movements, the increase rate of extraction and the proposed extension of extraction area has the

Phone 131 555
Phone +61 2 9995 5555 (from outside NSW)
Fax +61 2 9995 5999
TTY 133 677
ABN 43 692 285 758
PO Box 668 Parramatta NSW 2124 Australia
L13, 10 Valentine Ave Parramatta NSW 2150 Australia
info@epa.nsw.gov.au
www.epa.nsw.gov.au

potential to increase the generation of dust (PM10 & PM2.5) and other pollutant emission beyond the boundary of the premises. It is therefore recommended that you undertake an air assessment in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW and Approved Methods for the Sampling and Analysis of Air Pollutants in NSW,* including:

- a description of the existing air quality and meteorology using existing information and site representative ambient monitoring data;
- an outline the point and fugitive sources of all pollutant emission and estimate the resulting ground level concentrations of all pollutants at all sensitive receivers;
- a description of the effects and significance of resulting pollutant concentrations on the environment, human health, amenity and regional ambient air quality standard and goals; and
- details of the mitigation measures proposed in managing the additional impacts of air emission from the proposed modification.

Noise

The additional activities proposed have the potential to increase the generation of noise beyond the boundary of the premises. It is therefore recommended that you undertake a noise assessment in accordance with the *Noise Policy for Industry* (2017), including:

- details of the existing background (LA90) and ambient (LAeq) noise levels;
- details of all monitoring of existing ambient noise levels including a statement justifying the choice of monitoring site, including the procedure used to choose the site, having considered the noise sensitive receptors and most affected locations;
- A description of the dominant and background noise sources at the site;
- Day, evening and night assessment background levels for each day of the monitoring period; and
- the final rating background level (RBL) value.

Additionally, the noise assessment report should include:

- A plan showing the assumed location of each noise source for each predicted scenario of the noise impact assessment;
- a list of the number and type of noise sources including road traffic noise used in each prediction scenario to simulate all potential significant operating conditions on the site;
- any assumptions made in the predictions in terms of source heights, direct effects, shielding from topography, buildings or barriers etc.
- details of the expected noise level and noise character (e.g. tonality, impulsiveness, vibration etc.) likely to be generated from noise sources upon modification;
- details of the noise levels likely to be received at the most sensitive locations;
- methods used to predict noise impacts including identification of any noise models used;
- an assessment of appropriate weather conditions for the noise predictions including reference to any weather data used to justify assumed conditions;
- discussion of findings from the predictive modelling and where relevant noise criteria have not been met, recommend additional mitigation measures; and
- details of the most appropriate mitigation measures and expected noise reduction including noise controls and management of impacts; and
- demonstration that the relevant noise criteria can be met, with the inclusion of mitigation measures in the project, if required.

Water

It is recommended that you undertake an assessment of the impacts on surface and groundwater, including:

- an outline how total water cycle considerations are to be addressed as a result of the modification;
- total water balances;

- demonstration of how the impacts on water resources are minimised;
- the type, volume, proposed treatment and management and re-use methods for stormwater;
- the type, volume, proposed treatment and management and re-use methods for wastewater; and
- identification of any impacts on and management of groundwater.

Should you have further questions in relation to this matter, please contact Lilian De Torres at 02 9995 5059 and/or email Lilian.DeTorres@ epa.nsw.gov.au.

Yours sincerely

JACQUELINE INGHAM
Unit Head– Sydney Industry
Environment Protection Authority

From:	NAJARI ALAMOUTI Zhaleh
To:	Ruth Tapp
Subject:	RE: 3479E: Proposed Modification to Haerses Road Quarry Maroota, DA 165-7-2005
Date:	Monday, 1 April 2019 2:57:35 PM
Attachments:	RE 3479_Haerses Road Quarry_Traffic Impact Assessment for a proposed increase in traffic movements.msg

Hi Ruth,

Roads and Maritime has reviewed the information and reiterates its previous comments on the proposal (attached email dated 24 January 2019).

Roads and Maritime will formally review and provide response on the EIS when submitted from Department of Planning and Environment.

Please contact me or Development Sydney at Development.Sydney@rms.nsw.gov.au if you have any question.

Regards

Zhaleh Alamouti
A/Senior Land Use Planner
North West Precinct
T 02 8849 2331
www.rms.nsw.gov.au
Every journey matters

Roads and Maritime Services
Level 5, 27 Argyle Street Parramatta NSW 2150

From: Ruth Tapp [mailto:rtapp@umwelt.com.au]
Sent: Thursday, 21 March 2019 1:25 PM
To: Development Sydney
Subject: 3479E: Proposed Modification to Haerses Road Quarry Maroota, DA 165-7-2005

Please see attached letter for your attention.

Additional information is provided in the Preliminary Environmental Assessment available via the following link: https://umwelt.sharefile.com/d-s59306effb884e589

Ruth Tapp
Environmental Scientist

Umwelt (Australia) Pty Limited
75 York Street
Teralba, NSW 2284

Phone: (02) 4950 5322

My regular working days are Tuesday, Wednesday and Thursday. In my absence, please contact Gabrielle Allan on gallan@umwelt.com.au or 02 4950 5322, otherwise I will respond on my return.

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From: NAJARI ALAMOUTI Zhaleh
To: Alex Irwin; Mark Dixon
Subject: RE: 3479_Haerses Road Quarry_Traffic Impact Assessment for a proposed increase in traffic movements

Hi Alex/Mark,

Reference is made to your email below regarding the proposed increase of extraction rate and daily truck movements from the Haerses Road Quarry which was referred to Roads and Maritime for advise prior to lodging a formal application with the Department of Planning and Environment.

Roads and Maritime has reviewed the submitted information and would support the 'CHR' treatment at the intersection of Wisemans Ferry Road/Haerses Road, which has been approved as part of the modification application, to remain the same under the proposed increase of truck movements. However, the potential for trucks queueing out of the right turn bay onto Wisemans Ferry Road through lane should be investigated at the 'CHR' intersection and to be monitored if there are issues then the 'CHR' should be extended.

It is emphasised that the comments provided above are informal and of a Pre-DA nature. They are not to be interpreted as binding upon Roads and Maritime and may change following formal assessment of a submitted development application from the appropriate consent authority.

Please contact me if you have any question on the above comments,

Regards

Zhaleh Alamouti
A/Senior Land Use Planner
North West Precinct
T 02 8849 2331
www.rms.nsw.gov.au
Every journey matters

Roads and Maritime Services
Level 5, 27 Argyle Street Parramatta NSW 2150

From: Alex Irwin [mailto:airwin@umwelt.com.au]
Sent: Thursday, 20 December 2018 3:28 PM
To: Development Sydney
Cc: Mark Dixon
Subject: 3479_Haerses Road Quarry_Traffic Impact Assessment for a proposed increase in traffic movements

Attn: Pahee Rathan

Dear Pahee,

Please find attached a Traffic Impact Assessment and cover letter which reviews the adequacy of a new CHR intersection between Haerses Road and Wisemans Ferry Road. Confirmation from RMS is sought that this intersection treatment will remain suitable for a planned increase in daily

truck movements from the Haerses Road Quarry.

Regards,

Alex Irwin
Principal Environmental Consultant

Umwelt (Australia) Pty Limited
Office 1, 3 Hampden Avenue
Orange, NSW 2800

Phone: (02) 4950 5322
Mobile: 0436 606 529

www.umwelt.com.au

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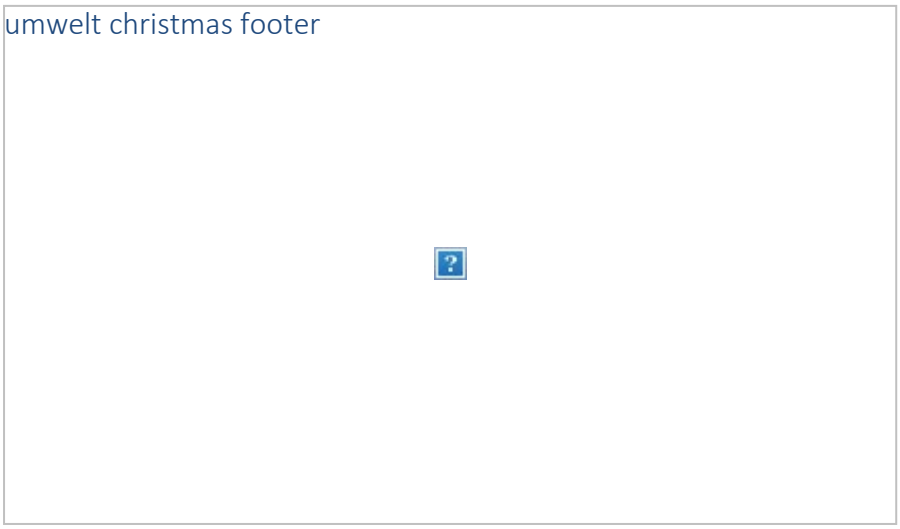
umwelt christmas footer



Thankyou for your support throughout 2018. Please note our office will be closed from COB 21st December, re-opening on the 7th January. We wish you and your family a safe

and happy holiday season.

From:	Richard Bonner
To:	Ruth Tapp
Cc:	Rob Beckett
Subject:	RE: 3479E: Proposed Modification to Haerses Road Quarry Maroota, DA 165-7-2005
Date:	Tuesday, 9 April 2019 12:09:03 PM

Hello Ruth, OEH is unable to provide the requested advice at this stage of the proposed modification.

Regards

Richard Bonner
Senior Conservation Planning Officer
Greater Sydney Branch, Communities and Greater Sydney Division
Office of Environment & Heritage
T 02 9995 6917

From: Ruth Tapp <rtapp@umwelt.com.au>
Sent: Thursday, 21 March 2019 1:25 PM
To: Richard Bonner <Richard.Bonner@environment.nsw.gov.au>
Subject: 3479E: Proposed Modification to Haerses Road Quarry Maroota, DA 165-7-2005

Please see attached letter for your attention.

Additional information is provided in the Preliminary Environmental Assessment available via the following link: https://umwelt.sharefile.com/d-s59306effb884e589

Ruth Tapp
Environmental Scientist

Umwelt (Australia) Pty Limited
75 York Street
Teralba, NSW 2284

Phone: (02) 4950 5322

My regular working days are Tuesday, Wednesday and Thursday. In my absence, please contact Gabrielle Allan on gallan@umwelt.com.au or 02 4950 5322, otherwise I will respond on my return.

From:	Jacqueline Dalton
To:	Ruth Tapp
Subject:	RE: 3479E: Proposed Modification to Haerses Road Quarry Maroota, DA 165-7-2005
Date:	Wednesday, 3 April 2019 9:03:16 AM
Attachments:	image001.png

Our reference: DOC19/237727

Dear Ms Tapp,

Thank you for the request for feedback received on 21/3/19 relating to the proposed modification to Haerses Road Quarry – DA 165-7-2005.

A preliminary review has indicated that the subject site is neither within the curtilage, or in the vicinity, of any State Heritage Register (SHR) items, or known historical archaeology. Consequently, no specific comments are provided as no impacts to SHR items or State or local archaeological remains have been identified as indicated in the *Project Overview and Preliminary Environmental Assessment of the Proposed Modification 3* provided.

Please note, the Hunter Central Coast Division of the Office of Environment and Heritage may provide separate comment in relation to Aboriginal cultural heritage.

Regards,
Jacky Dalton

Jacky Dalton
Assistant Heritage Assessment Officer
Customer Strategies
Heritage Division

Level 6, 10 Valentine Ave, Parramatta
Locked Bag 5020, Parramatta 2124
T 02 8837 6375

www.heritage.nsw.gov.au

From: Ruth Tapp <rtapp@umwelt.com.au>
Sent: Thursday, 21 March 2019 1:24 PM
To: OEH HD Heritage Mailbox <HERITAGEMailbox@environment.nsw.gov.au>
Subject: 3479E: Proposed Modification to Haerses Road Quarry Maroota, DA 165-7-2005

Please see attached letter for your attention.

Additional information is provided in the Preliminary Environmental Assessment available via the following link: https://umwelt.sharefile.com/d-s59306effb884e589

Ruth Tapp
Environmental Scientist

Umwelt (Australia) Pty Limited
75 York Street
Teralba, NSW 2284

Phone: (02) 4950 5322

My regular working days are Tuesday, Wednesday and Thursday. In my absence, please contact Gabrielle Allan on gallan@umwelt.com.au or 02 4950 5322, otherwise I will respond on my return.

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7/5/2019

Ruth Tapp
Umwelt (Australia) Pty Ltd
75 York Street
Teralba NSW 2284

Emailed: rtapp@umwelt.com.au

Your Reference: 3479E_DPERG_20190321_ltr
Our Reference: DOC19/261728

Dear Ruth,

Re: Secretary's Environmental Assessment Requirements (SEARs) for the Proposed Modification (MOD 3) to Haerses Road Quarry (DA 165-7-2005).

Thank you for the opportunity to provide advice on the Secretary's Environmental Assessment Requirements (SEARs) for the above quarry modification proposal. This is a response from NSW Department of Planning & Environment – Division of Resources & Geoscience (the Division).

Sand is not a prescribed mineral under the *Mining Act 1992*. However, the Division is the principal government authority responsible for assessing the State's resources of construction materials and for advising State and local government on their planning and management.

All environmental reports (Statement of Environmental Effect (SEE) or similar) accompanying Development Applications for extractive industry lodged under the *Environmental Planning & Assessment Act 1979* should include a resource assessment which:

- Documents the size and quality of the resource and demonstrates that both have been adequately assessed; and

- Documents the methods used to assess the resource and its suitability for the intended applications.

The above information should be summarised in the SEE, with full documentation appended. If deemed commercial-in-confidence, the resource assessment summary included in the SEE should commit to providing the Division with full resource assessment documentation separately. Applications to modify, expand, extend or intensify an existing consent that has already been adequately reported using the above protocol in publicly available documents, may restrict detailed documentation to the additional resources to be used, if accompanied by a summary of past resource assessments and of past production.

The Division collects data on the quantity of construction materials produced annually throughout the State. Forms are sent to all operating quarries at the end of each financial year for this purpose. The statistical data collected is of great value to Government and industry in planning and resource management, particularly as a basis for analysing trends in production and for estimating future demand for particular commodities or in particular regions. Production data may be published in aggregated form, however production data for individual operations is kept strictly confidential.

During the preparation of the SEE, the Division recommends that the proponent consult NSW Department of Planning & Environment's *'EIS Guideline - Extractive Industries – Quarries'*. This guideline is available from:

http://www.planning.nsw.gov.au/Assess-and-Regulate/Development-Assessment/~/media/4A89C0947A8C4D70A983F8EE1D7B9790.ashx

The Division requests early consultation to ensure there is no consequent reduction in access to prospective land for mineral exploration, or potential for sterilisation of mineral or extractive resources.

Queries regarding the above information should be directed to the Division of Resources & Geoscience - Land Use team at landuse.minerals@geoscience.nsw.gov.au.

Yours sincerely

Steven Palmer
Acting Manager - Land Use

From:	alistair.drew@industry.nsw.gov.au on behalf of Landuse Enquiries
To:	Alex Irwin
Subject:	Re: 3479_Haerses Road Quarry_Proposed Modification
Date:	Wednesday, 1 May 2019 8:34:55 AM

Dear Mr Irwin,

The **Department of Industry - Lands & Water**, and **Department of Primary Industries (DPI)** has reviewed the increase in the maximum amount of VENM/ENM imported to the Quarry. Please address the below comments from DPI Agriculture in your environmental assessment.

- A biosecurity (pests and weeds) risk assessment should be prepared outlining the likely plant, animal and community risks from imported material.
- A biosecurity response plan to should be prepared manage identified weed / pest animal risks.

The reasoning for the above is:

- There are a number of farms operating in the area.
- Biosecurity is important because it protects our economy, environment and community from pests, diseases, weeds and contaminants.
- Biosecurity is a shared responsibility, and everybody has a role to play in protecting NSW from these biosecurity risks.
- Everyone has a general biosecurity duty – this means anyone who deals with biosecurity matter is required to prevent, eliminate or minimise any biosecurity risks they encounter.

Regards,

Alistair

On Tue, 16 Apr 2019 at 09:41, Alex Irwin <airwin@umwelt.com.au> wrote:

> Good morning,
>
> A request for environmental assessment requirements on a proposed modification to the Haerses Road Quarry of Dixon Sand Pty Ltd (SSD DA 165-7-2005) was previously forwarded to the DOI – Land Resource and Energy.
>
> After review of the proposed modification, it was identified that the operation is likely to be well short of the necessary backfill material to construct the final landform as nominated in Appendix 6 of DA 165-7-2005. An increase in the maximum amount of VENM/ENM imported to the Quarry from 100,000 tpa to 250,000 tpa to provide the required backfill material is therefore to be included as a component of the proposed

modification.

The Preliminary Environmental Assessment for the proposed modification has been updated and it is requested that is considering and preparing environmental assessment requirements, the DOI – Land Resource and Energy consider this additional component of the proposed modification.

Regards,

Alex Irwin
Principal Environmental Consultant

Umwelt (Australia) Pty Limited
Office 1, 3 Hampden Avenue
Orange, NSW 2800

Phone: (02) 4950 5322

Mobile: 0436 606 529

www.umwelt.com.au

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--

Alistair Drew I Policy Officer Assessments

NSW Department of Industry I Lands & Water I Strategic Relations

Level 3 | 26 Honeysuckle Drive | Newcastle | NSW 2300

M: 0417 626 567

E: landuse.enquiries@dpi.nsw.gov.au

From:	Martin Holland
To:	nrar.enquiries@nrar.nsw.gov.au
Cc:	wr_coastal; Water Enquiries; Ruth Tapp
Subject:	FW: [Fwd: Request ID: #310532 : 3479E: Proposed Modification to Haerses Road Quarry Maroota, DA 165-7-2005]
Date:	Tuesday, 26 March 2019 2:31:39 PM
Attachments:	image001.png image002.jpg 3479E_WaterNSW_20190321_ltr.pdf

Good afternoon,

This matter has come to WaterNSW as a customer enquiry. I understand because it is State Significant Development approved by the NSW Minister for Planning, that the matter falls under the jurisdiction and control of NRAR.
For your information.

Thank you.

Regards,

Martin Holland
Water Regulation Officer
Assessments and Approvals
Customer and Community

Ground Level
5 O'Keefe Avenue
PO BOX 309 Nowra NSW 2541.
T: 02-98652831 **M:** 0413 186 719
martin.holland@waternsw.com.au
www.waternsw.com.au

Please take the opportunity to subscribe to the WaterNSW email updates below.

From: Chloe Dale
Sent: Monday, 25 March 2019 1:43 PM
To: wr_coastal <WR_coastal@waternsw.com.au>
Subject: FW: [Fwd: Request ID: #310532 : 3479E: Proposed Modification to Haerses Road Quarry Maroota, DA 165-7-2005]

Good Afternoon,

For you team.

Kind regards,

Chloe Dale
Business Support Officer, Catchment Protection; Land & Catchment

T: 02 9865 2514
www.waternsw.com.au

From: WaterNSW Advisory Services <water.enquiries@waternsw.com.au>
Sent: Friday, 22 March 2019 11:33 AM
To: Environmental Assessments <Environmental.Assessments@waternsw.com.au>
Subject: [Fwd: Request ID: #310532 : 3479E: Proposed Modification to Haerses Road Quarry Maroota, DA 165-7-2005]

Status : Open Priority : Normal Mode: E-Mail

Category : General - Sub Category: Water Regulation - Item: Enquiry

Account :

Contact Name : Ruth Tapp PH: MOB:

Contact Email : rtapp@umwelt.com.au

Description :

Please see attached letter for your attention.

Additional information is provided in the Preliminary Environmental Assessment available via the following link: https://umwelt.sharefile.com/d-s59306effb884e589

Ruth Tapp
Environmental Scientist

Umwelt (Australia) Pty Limited
75 York Street
Teralba, NSW 2284

Phone: (02) 4950 5322

My regular working days are Tuesday, Wednesday and Thursday. In my absence, please contact Gabrielle Allan on gallan@umwelt.com.au or 02 4950 5322, otherwise I will respond on my return.

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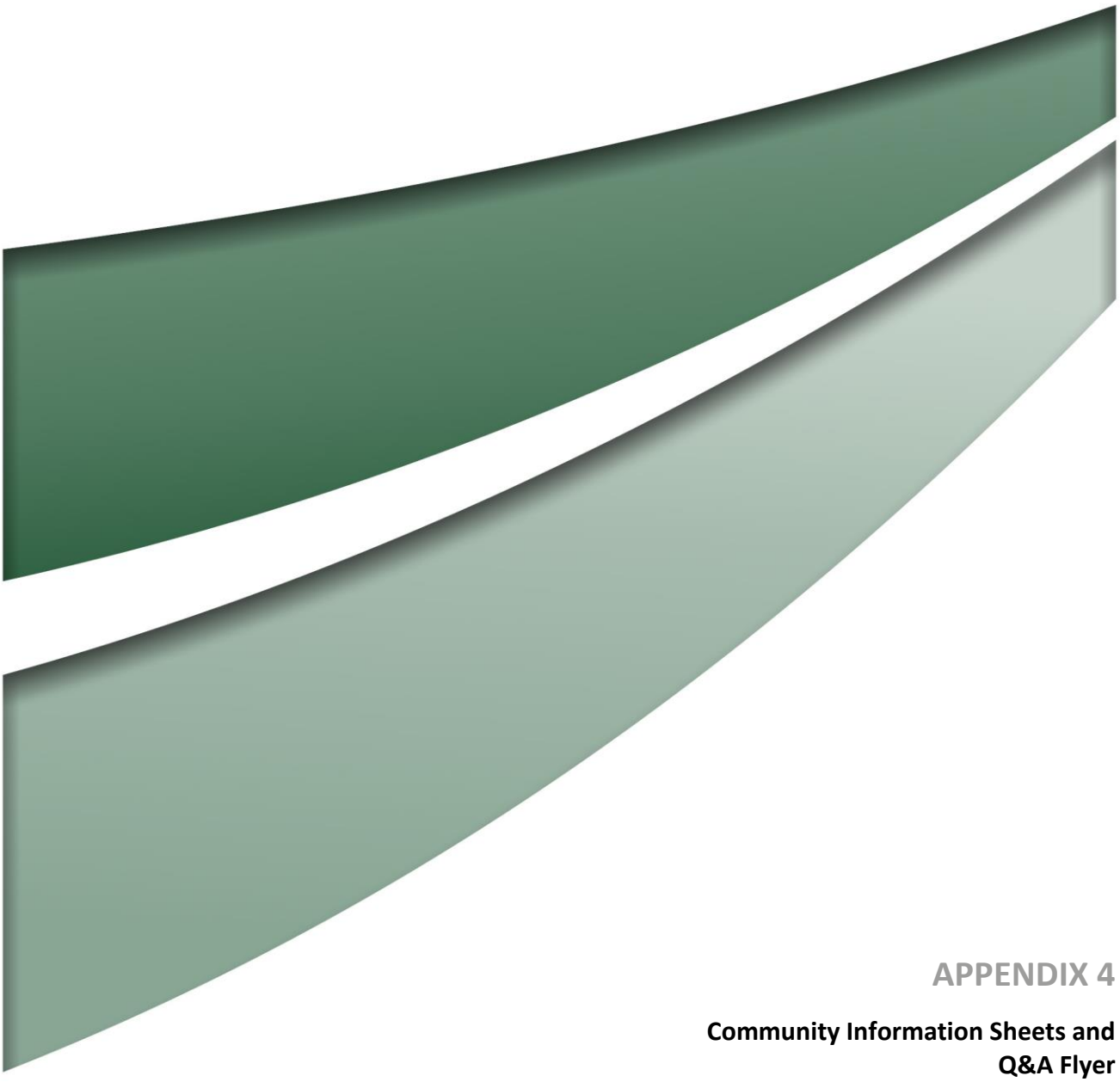

APPENDIX 4

Community Information Sheets and Q&A Flyer

Dixon Sand (Penrith) Pty Ltd

umwelt
Environmental & Social Consultants

Community Information Sheet - for a Proposed Modification to Operations at the Dixon Sand Haerses Road Quarry, Maroota, NSW - April 2019

Background

Dixon Sand Pty Ltd (Dixon Sand) currently operate the Haerses Road Quarry, extracting and processing sand to supply concrete and specialty sand products to the Sydney metropolitan market. The Quarry Site is approximately 128 hectares (ha) and includes various parcels of land which adjoin Haerses Road, a no through road providing access to the nominated lots of the Quarry.

Under the conditions of the existing development consent, Dixon Sand has approval to extract up to 250,000 tonnes (t) annually until February 2046. **Figure A** identifies the Quarry Site boundary, as well as the areas of approved extraction and other disturbance which are limited by buffers retained to surrounding properties.

As a result of the continued and growing demand for sand products for use in construction within the greater Sydney metropolitan area, Dixon Sand has identified the need to increase annual extraction rates to supply this demand. Dixon Sand will be making an application to the Department of Planning & Environment (DPE) to modify the development consent to allow for these increases.

What is Proposed?

The following provides further detail on the proposed increase to extraction rates, along with additional modifications proposed to compliment these increases.

Extraction Rate Increase

The proposed modification seeks to increase the annual rate of extraction from 250,000 to 495,000 t. The increase would better reflect the approved resource available for extraction which includes the additional 15 million tonnes of resource approved through modification to the development consent in 2018. A complimentary increase in the importation of clean fill for rehabilitation/reprocessing from 100,000 to 250,000 t annually would ensure the construction and rehabilitation of the approved final landform over the term of the Quarry operation (to 2046).

Increase to Traffic Movements

An increase in the number of daily truck movements from 56 to 180 trucks per day (90 inbound, 90 outbound) is proposed. This will accommodate the proposed increased extraction rate and corresponding increase in direct sales to the local and regional market, including the number of smaller local trucks buying direct from site, as well as the proposed increase in clean fill imported to the Quarry.

Dixon Sand will upgrade the intersection with Haerses Road to facilitate this increase and provide for a safer intersection in accordance with RMS design requirements.

Extraction Area Extension / Buffer Modification

The extraction area is currently limited by various buffers to surrounding properties, roads and other features (refer to **Figure A**). Dixon Sand proposes a minor extension of the extraction area of approximately 1 hectare between the approved extraction area and Wisemans Ferry Road, in accordance with design guidelines.

No changes to on-site operations or hours of operation are proposed, with quarrying and processing to occur between 7.00am and 6.00pm Monday to Saturday, and truck loading and dispatch to occur between 6.00am and 6.00pm Monday to Saturday.

The Planning Process

DA 165-7-2005 is classed as State Significant Development under the *State Environmental Planning Policy (State and Regional Development) 2011*. As the Quarry will remain substantially the same as that originally approved in 2006, an application to modify the development consent will be made to the DPE under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979*.

Dixon Sand will prepare an application, including a Statement of Environmental Effects, to be lodged with the DPE. The Statement of Environmental Effects, which is being prepared by Umwelt (Australia) Pty Limited (Umwelt), will address those environmental issues that could or would be affected by the proposed modification to operations. Based on a preliminary assessment of impacts, and consultation with the DPE, key matters for assessment have been identified as follows.

- Impacts of air and noise emissions.
- Increased traffic on local roads.
- Changes to surface water systems.
- Modifications to local landforms and land uses.

Your Involvement

Dixon Sand seeks community perspectives on matters to be addressed in the Statement of Environmental Effects. This could include environmental, economic or social matters you consider important and relevant to the assessment of the proposed modification. We welcome your input on any relevant matters or local knowledge that you believe should be considered.

Please direct any comments or feedback as follows.

David Dixon	**Ruth Tapp**	**Hunny Churcher**
Dixon Sand Pty Ltd	Umwelt (Australia) Pty Ltd	Dixon Sand Pty Ltd
Email: david@dixonsand.com.au	Email: rtapp@umwelt.com.au	Email: environment@dixonsand.com.au
Ph: 0414 330 490	Ph: (02) 4950 5322	Ph: 02 45 666 348

Information gathered will be collated and considered as part of the Statement of Environmental Effects. Once completed, an opportunity will be provided to you to review and comment on the assessment and raise concerns, request additional information or indicate support.

umwelt

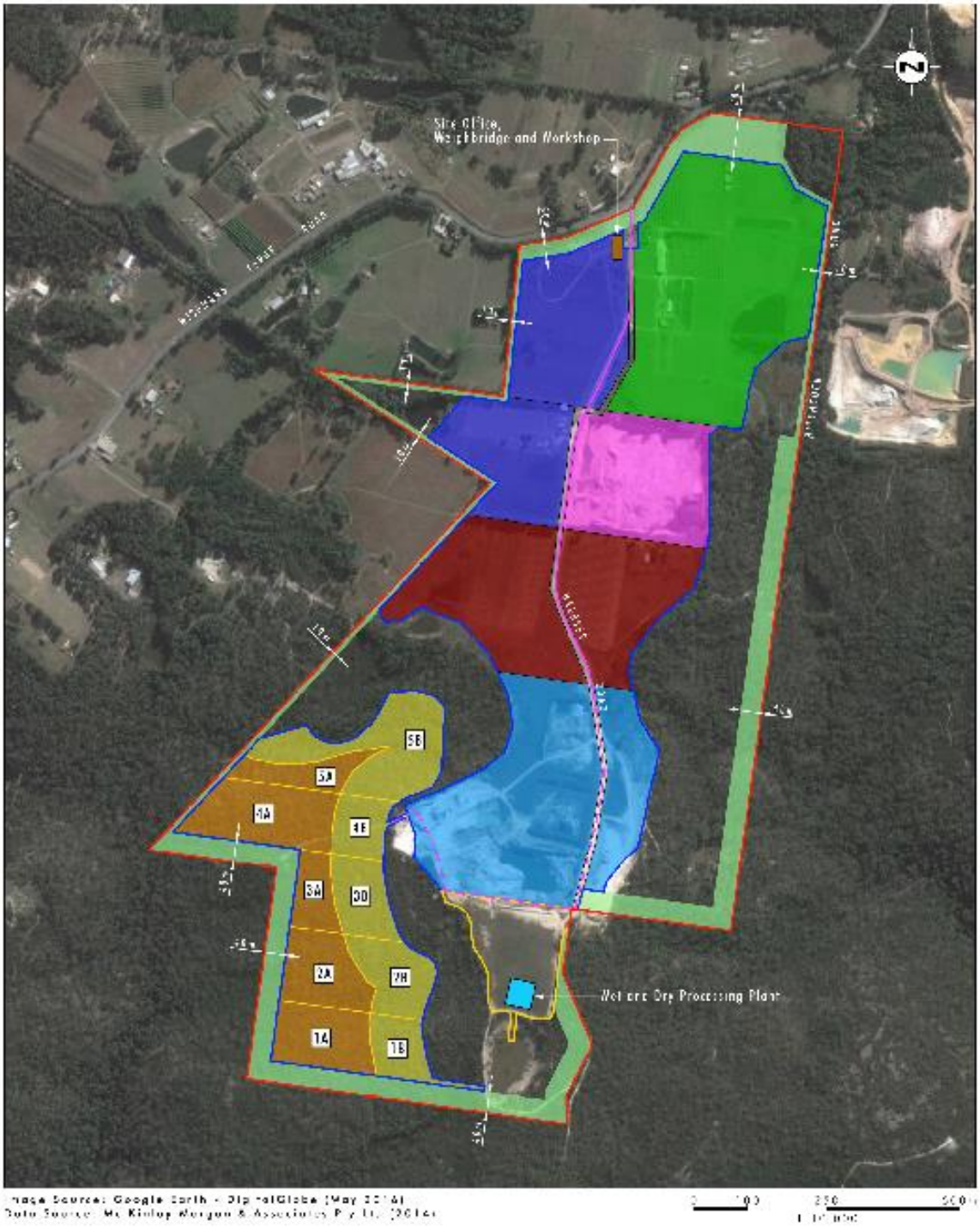

Image Source: Google Earth - DigitalGlobe (May 2014)
Data Source: McKinlay Morgan & Associates Pty Ltd, (2016)

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Legend

- Quarry Site
- Buffer Zone
- Approved Extraction Area
- Stockpile and Additional Extraction Area
- Approved Extraction Area A
- Approved Extraction Area B
- Extraction Cell Number
- Approved Extraction Area Stage 1
- Approved Extraction Area Stage 2
- Approved Extraction Area Stage 3
- Approved Extraction Area Stage 4
- Approved Extraction Area Stage 5
- Site Office, Weighbridge and Workshop
- Wet Processing Plant
- Indicative Unsealed Haul Road
- Sealed Haul Road

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FIGURE A

Approved Quarry Operations

DIXON SAND

Community Information Sheet - for a Proposed Modification to Operations at the Dixon Sand Haerses Road Quarry, Maroota, NSW - June 2019

General Questions and Answers

Why will truck movements increase from 28 to 90 one-way movements ?

Dixon Sand own and operate the Haerses Rd Quarry located on Wisemans Ferry Rd, Maroota, which received approval to commence operations in 2006. During this time, the demand for high quality sand and sandstone products has grown considerably within the Sydney Metro region and within the locality. In order to meet this demand, Dixon Sand are proposing to increase the number of heavy vehicle movements from the quarry, associated with the haulage of materials for the industry.

A large proportion of the required increase in trucks (28 to 90 movements) will come from local loads and small axle vehicles that use the site. This is the case with the existing Dixon Sand quarry at Old Northern Rd, where up to a third of trucks are local and small axle vehicles. Therefore, not all of the increase in movements will be large trucks and not all will be travelling along the main arterial routes. Of the larger trucks that currently use the site, approximately half are shown to access the site from Wisemans Ferry Rd and half from Old Northern Rd. On average the proposed increase in trucks will result in an additional *2.5 trucks per hour* on both Wisemans Ferry Rd and Old Northern Rd respectively. Furthermore, some of these trucks comprise of local operators and small trucks which will not travel long distances on major routes.

Truck record compliance is also submitted to Council for compliance. Truck record compliance audits may be conducted by Council and Department of Planning and Environment.

Will the increased truck movements increase the risk of motor vehicle accidents on local roads?

Dixon Sand is committed to both the safety of road users and the level of service of local roads affected by heavy vehicle movements. Our commitment includes a site-specific induction to all haulage suppliers which outlines the importance of adherence to Council, local and federal laws and restrictions, as well as a mutual agreement with other local quarries through the enforcement of our inter-pit policy which eradicates any repeat offenders of our traffic management plans and regulations. Dixon Sand openly and voluntarily share information with other local quarries aimed at removing unwanted dangerous driver behaviour.

Dixon Sand along with several other major quarries and local businesses utilise the local road network.

What are the approved access hours for the quarry ?

Approved operating hours for the Haerses Rd Quarry are between 6am and 6pm, Monday to Saturday (inclusive). Operating hours for the quarry are strictly enforced by Dixon Sand. Gates to the quarry open at 6am daily on approved dates. Government authorities regularly audit the operation of the quarry in accordance with the conditions of approval and licences. Dixon Sand does not permit the queuing of heavy vehicles outside the premises prior to operation.

Dixon Sand do not have the ability to enforce road rules and regulations on public roads, this is left to the Police and RMS. However, through onsite traffic management controls Dixon Sand are able to manage and enforce controls within the site and educate safe driving behaviour outside of the quarry.

Is silica dust from the quarry a possible health risk?

Long term exposure to silica dust, a mineral component of sand, sandstone and many naturally occurring products, has been linked to silicosis and diseases of the lungs. Occupationally attributed silicosis is most commonly experienced by workers with a very high level of exposure to dusts of quartz, tile, marble and manufactured stone products.

The NSW Ministry of Health (May 2017) guideline includes a factsheet on the potential health effects resulting from dust emissions at quarries and mines and from very fine silica dust. It should also be noted that airborne dust does not contain silica dust.

A fact sheet issued by the NSW Ministry if Health is attached.

<u>The NSW Ministry of Health states;</u>

"Provided that mines are operated with proper dust controls it is unlikely that healthy adult residents would suffer any serious health effects from the expected exposure to particulate matter."

In addition to environmental dust monitoring, Dixon Sand conducts work health & safety dust monitoring on a regular and on-going basis. Staff undergo medical screening and x-rays for identifying lung functionality and any health concerns related to potential impact from silica dust. Dixon Sand has staff working on site for over 30 years and no evidence from these regular health screening indicates health impact from silica dust.

Dixon Sand engages independent occupational hygienists to undertake dust, noise and vibration hazard assessment on site. Dust monitors were fitted to staff operating

machineries identified as the potential sources of Respirable Crystalline Silica, respirable dust and inhalable dust .

What are the predicted local noise and visual impacts?

It is not proposed to significantly increase the overall scale of the current operations at the Dixon Sand operated Haerses Rd Quarry. It is proposed to increase truck movements into and out of the site to cater for increased demand for sand in both the greater Sydney metropolitan region and the locality.

The Proposal would result in additional heavy vehicle movements spread over the standard operational shift (6am to 6pm) equating to an average of only 2.5 additional heavy vehicle movements per hour on each of the arterial road networks. The Proposal would result in additional heavy vehicle haulage. Dixon Sand currently operates to strict noise impact limits which are monitored and reported regularly.

As the overall scale of the operations will not be significantly increased the visual impact of the quarry will remain unchanged through progressive rehabilitation.

What are the predicted impacts on groundwater?

Dixon Sand implements on-going groundwater monitoring as part of the quarry environmental monitoring program. Periodic review of the groundwater data is undertaken by an independent hydrogeologist and submitted as part of development consent for compliance. The groundwater data is regularly reviewed by the Department of Planning and Environment and Department of Industry. Dixon Sand is required to maintain its operation and extraction above the regional groundwater. No regional groundwater impact is anticipated.

What other controls are being implemented by Dixon Sand?

Dixon Sand operates its quarry operations in accordance with the conditions outlined in the development consent and relevant licences issued by Government Authorities. Dixon Sand is required to submit the Annual Review yearly which is a comprehensive report on environmental compliance, monitoring results and progress on rehabilitation.

Dixon Sand is required to undergo 3-yearly Independent Environmental Audits by an independent auditor to identify compliance and non-compliance, and report back to the Department of Planning and Environment.

Dixon Sand is subjected to regular compliance audits by Government Authorities including the Department of Planning and Environment, NSW Environment Protection Authority and the Resources Regulator.

Dixon Sand holds a Community Consultative (CCC) meeting bi-annually. The purpose of the CCC is to provide a forum for discussion between Dixon Sand and representatives of the community, Maroota Public School, stakeholder groups and the local Council on issues directly related to the operation and compliance of the quarry.

For further information please contact the recipients below:

David Dixon	**Ruth Tapp**	**Hunny Churcher**
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Factsheet

Mine dust and you

People living near mine sites often ask about the effects of dust emissions in the air as a result of mining activities.

Last updated: 04 May 2017

What is this fact sheet?

People living near mine sites often ask about the effects of dust emissions in the air as a result of mining activities. This fact sheet has been prepared to explain the type of dust that is generated from mine sites and the potential risks from mine dust to health.

What is particulate matter?

Commonly called "dust," scientists and regulators refer to the term particulate matter (or PM) to describe the range of particles that exists in the air we breathe.

PM exists naturally in the atmosphere, eg sea-salt spray and pollens. PM can be increased due to human activities such as vehicle exhaust, industrial processes, power stations, mining, farming and wood heaters, or smoke from bushfires.

Exposure to PM can be associated with health and amenity impacts. The likely risk of these impacts depends on a range of factors including the size, structure and composition of the PM and the general health of the person.

Sizes of particulate matter

Just as the size of balls we can see ranges from marbles to basketballs, PM can be thought of as microscopic balls of varying sizes. Instead of measuring PM in centimetres as we do with balls, scientists use micrometres (sometimes called "microns") to measure the diameter of particles. A micrometre is one-millionth of a metre and its symbol is µm.

For environmental health purposes, particles are usually described by their size:

Particle size	Description
TSP	Total Suspended Particulate Matter (TSP) refers to the total of all particles suspended in the air. Even the largest of these particles is barely half the width of a human hair.
"larger than" PM10	A subset of TSP, and refers to all particles of size 10 µm in diameter and greater.

PM10	Also a subset of TSP, and includes all particles smaller than 10 µm in diameter (smaller than 1/7th of a hair width). Particles in the size range 2.5 µm to 10 µm in diameter are referred to as coarse particles (PM 2.5-10).
PM 2.5	A subset of both PM10 and TSP categories and refers to all particles less than 2.5µm in diameter. PM2.5 is referred to as fine particles and is mainly produced from combustion processes such as vehicle exhaust.

Particles levels in air are measured by the weight (micrograms) of particles per cubic metre of air (µg/m3). One (µg/m3) equals one millionth of a gram in a cubic metre of air. TSP can also be measured as the weight of dust falling on a given area over time ("dust deposition").

Particulate matter from mining

The vast majority of dust from mining activities consists of coarse particles (around 40 per cent) and particles larger than PM10, generated from natural activities such mechanical disturbance of rock and soil materials by dragline or shovel, bulldozing, blasting, and vehicles on dirt roads. Particles are also generated when wind blows over bare ground and different types of stockpiles. These larger particles can have amenity impacts as well as health impacts.

Fine particles from vehicle exhausts and mobile equipment are also produced at mine sites, though they only account for about 5 per cent of the particles emitted during the mining process. Fine particles produced at mine sites are manly from vehicle and mobile equipment exhausts.

Potential health impacts from PM

The human body's respiratory system has a number of defence mechanisms to protect against the harmful effects of PM. PM is often trapped in sticky mucus on the walls of the airways and can be removed by cilia, small hair-like objects which line the surface of the airways. This mucus can then be swallowed or coughed up.

PM exposure can leas to a variety of health effects. For example, numerous studies link particle levels to increased hospital admissions and emergency room visits and even to death from heart or lung diseases. Both long (over years) and short term (hours or days) particle exposure have been linked to health problems.

Generally, it is thought that fine particles below 2.5 µm in diameter may be of a greater health concern than larger particles as they can reach the air sacs deep in the lungs. However, coarse particles (PM 2.5-10) could also be associated with adverse health effects.

People who may be more susceptible to the health effects of fine and coarse particles are:

- infants, children and adolescents
- elderly
- people with respiratory conditions such as asthma, bronchitis and emphysema
- people with heart disease

- people with diabetes.

If health effects arise from exposure to coarse particles, such as from mining activities, the symptoms are likely to be:

- cough
- wheeze, or worsening of asthma
- increased need for medications (e.g. puffers, antibiotics)
- increased breathlessness.

Some recent research suggests that heart problems, such as angina and heart attacks may also be associated whith coarse particle pollution.

High levels of TSP may also cause coughing, sneezing or sore eyes.

Potential amenity impacts

Amenity impacts from dust are usually associated with coarse particles and particles larger than PM10. The impact of dust from a nearby mine on local amenity depends on the distance from the mine site and climatic conditions such as wind.

Concerns about amenity from mine site dust often relate to "visibility" of dust plumes and dust sources. Visible dust is usually due to short-term episodes of high emissions, such as from blasting.

Other amenity impacts include dust depositing on fabrics (such as washing) or on house roofs, and the transport of dust from roofs to water tanks, during rain. NSW Health's Rainwater Tanks brochure provides advice on how to maintain water tanks for safe drinking. Strategies to reduce dust in water tanks include first flush devices and desludging.

Government regulations

In New South Wales, outdoor air quality is governed by both State and Commonwealth regulations. The National Environmental Protection Measure (Air NEPM) provides air quality standards that are applied in cities and large towns across Australia. NEPM standards apply to average concentrations across a region.

The NSW Environment Protection Authority (NSW EPA) also has regulatory criteria for assessing ambient air quality. Although consistent with the Air NEPM, these criteria are more comprehensive. NSW EPA Impact Assessment Criteria are used to assess PM in localised areas, close to the mine itself.

The standards imposed by the regulatory authorities take into account what we know about health effects on people with asthma, lung conditions, and heart disease. PM standards and criteria are set to control short (daily) and long term (average) levels. The table below summarises the relevant air quality standards and criteria for mines.

Table 1 - Air Quality Standards and Criteria for Particulate Matter

Pollutant and averaging	Concentration Standard (µg/m3)	Agency

period		
TSP - 1 year	90	NSW EPA Criterion
PM10 - 1 day	50	NSW EPA Criterion and NEPM Standard
PM10 - 1 year	25	NSW EPA Criterion and NEPM Standard
PM2.5 - 1 day	25	NSW EPA Criterion and NEPM Standard
PM2.5 - 1 year	8	NSW EPA Criterion and NEPM Standard
Dust deposition - 1 year	4 grams/m^2/month (maximum total)	NSW EPA Criterion
Dust deposition - 1 year	2 grams/m^2/month (maximum increase)	NSW EPA Criterion

How can you avoid mine dust?

Provided that mines are operated with proper dust controls it is unlikely that healthy adult residents would suffer any serious health effects from the expected exposure to particulate matter.

If you notice that dust levels are high, try to keep your windows and doors closed. People who have asthma or lung conditions should avoid outdoor activities at these times. An air-conditioner can reduce PM levels inside, but it is important to regularly clean the intake filter.

Residents experiencing the health symptoms outlined in this fact sheet should see their local doctor. For further information about potential health effects from PM see the related link on Air Pollution.

Related links

- **Air Pollution**
- **Air quality**
- **Air quality index fact sheet**
- **Bushfire smoke fact sheet**
- **Dust storms fact sheet**
- **Rainwater tanks brochure**

In NSW you can call 1300 066 055 to talk to your NSW Public Health Unit

Page Updated: Thursday 4 May 2017
Contact page owner: **Environmental Health**

Dixon Sand (Penrith) Pty Ltd

umwelt
Environmental & Social Consultants

Proposed Modification to Operations at Haerses Road Quarry

Community Information Sheet No. 2

August 2019

Dixon Sand Pty Limited (Dixon Sand) have engaged Umwelt (Australia) Pty Limited (Umwelt) to prepare a Statement of Environmental Effects (SEE) including a Social Impact Assessment (SIA) for a proposed modification to operations at the Haerses Road Quarry at Maroota, within The Hills Shire Council Local Government Area (LGA).

From April to August 2019 Dixon Sand and Umwelt have consulted with stakeholders proximal to the Haerses Road Quarry to introduce the proposed modification and to identify and document potential impacts and opportunities for consideration within the assessment. This current Community Information Sheet:

- summarises the information collected through consultation with stakeholders
- identifies the perceived issues and impacts of the Proposed Modification
- summarises the outcomes of the environmental assessment process.

What is the Proposed Modification?
The Proposed Modification allows for:

- a small extension in extraction area of approximately 1 ha and modification to the buffer at the northern end of the quarry
- an increase in extraction rate from 250,000 tpa to 495,000 tpa
- an increase in the amount of VENM and ENM to be imported to the quarry from 100,000 tpa to 250,000 tpa
- an increase in the number of trucks permitted to travel to and from the quarry from 56 per day to 180 per day.

Figure 1 shows the current quarry layout and proposed additional extraction area and bund locations.

Assessing the Proposed Modification
Dixon Sand is committed to minimising impacts on both the community and surrounding environment. Dixon Sand has consulted with the NSW Department of Planning, Infrastructure and Environment (DPIE) in relation to the Environmental Assessment Requirements (EARs) for the Proposed Modification. Based on advice from the DPIE, the SEE will:

- outline the key features of the Proposed Modification;
- assess any potential environmental or social impacts; and
- outline recommended measures to minimise and manage potential impacts.

It is intended that the SEE will be lodged with the DPIE in September 2019 and the public will be invited to provide comments and make submissions at that time. The SEE will be available on the DPIE website and hard copies will also be available for viewing at selected locations.

umwelt

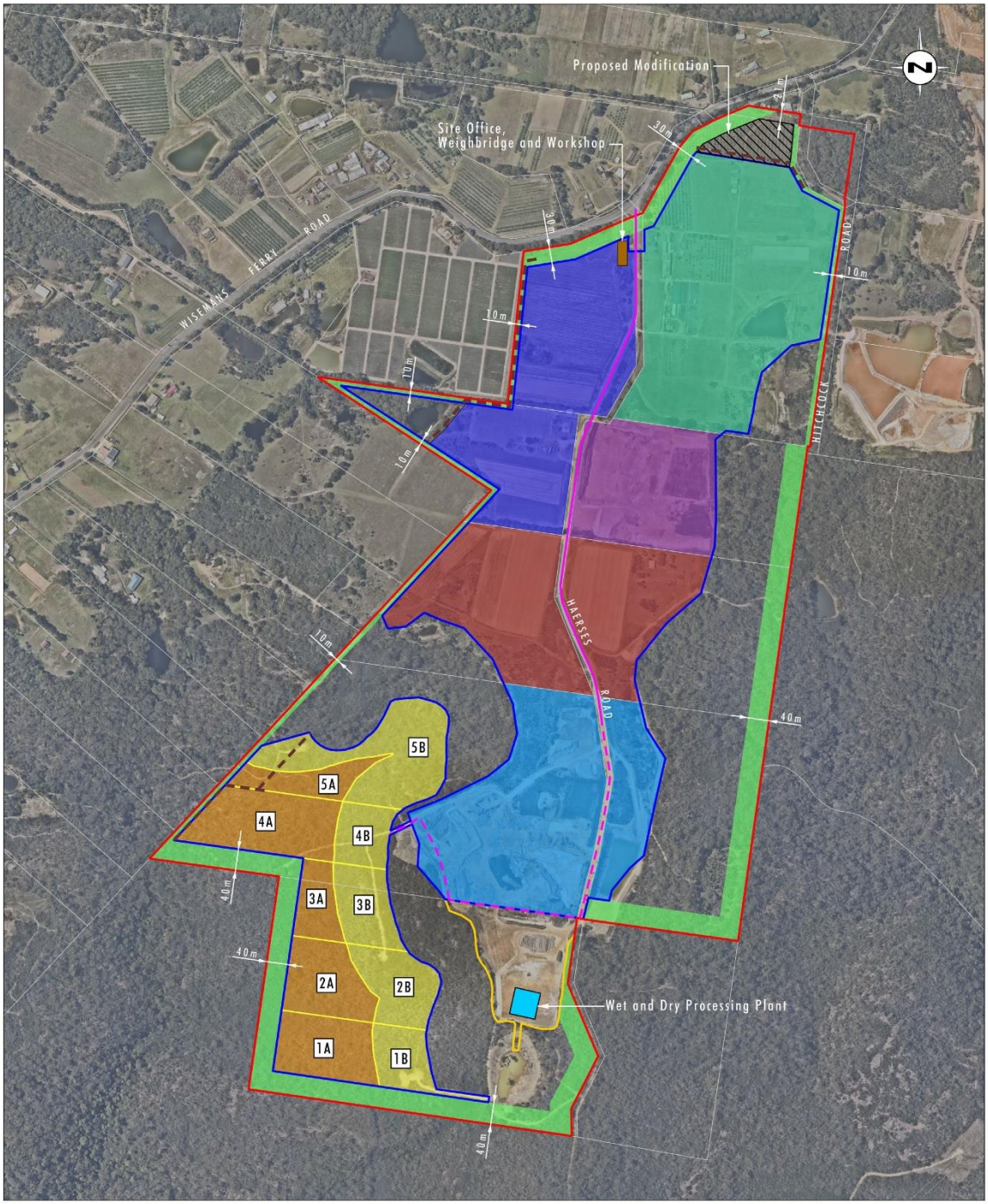

Image Source: Nearmap (Dec 2018)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2019)

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Legend

- Haerses Road Quarry Site
- Processing and Stockpiling Area
- Proposed Extraction Area Extension
- Buffer Zone
- Approved Extraction Area
- Approved Extraction Area A
- Approved Extraction Area B
- [1] Extraction Cell Number
- Approved Extraction Area Stage 1
- Approved Extraction Area Stage 2
- Approved Extraction Area Stage 3
- Approved Extraction Area Stage 4
- Approved Extraction Area Stage 5
- Site Office, Weighbridge and Workshop
- Wet Processing Plant
- Indicative Unsealed Haul Road
- Sealed Haul Road
- Approved Acoustic Bund

FIGURE 1

Quarry Layout and Proposed Modification Area

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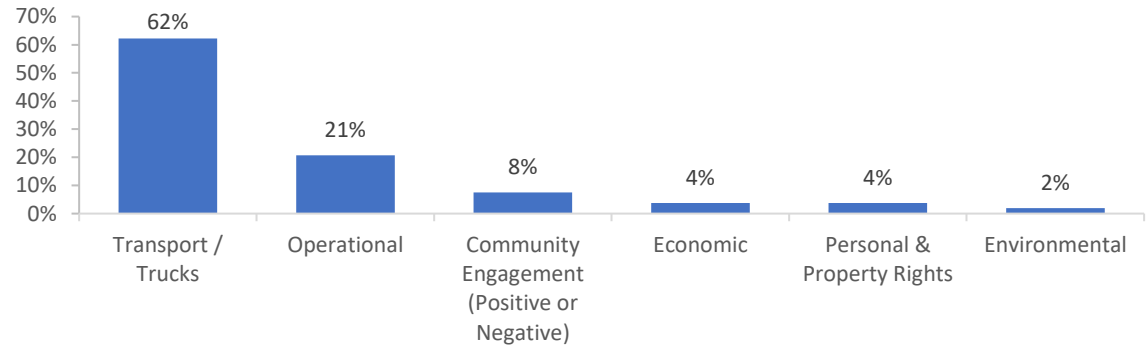
Community Consultation

The SIA considers how the proposed modification has the potential to impact on people – their way of life, culture and community. Over past months, Dixon Sand and Umwelt have been contacting key stakeholders in Maroota to identify their issues, concerns, and aspirations as part of the SIA program. Consultation carried out to date has included the following.

- An initial information sheet (Community Information Sheet 1) – which included a description of the Proposed Modification and an invitation for residents to provide feedback to members of the project team (distributed to approximately 75 local residents in Maroota).
- Further meetings, telephone interviews and information provision (undertaken by Dixon Sand and Umwelt) with residents from Maroota and along the haul route.
- Telephone calls and emails to key government agencies.

As identified above, local residents contacted Umwelt and Dixon Sand in response to Community Information Sheet 1 via email and telephone to outline their concerns with the proposed modification. Umwelt offered additional follow up interviews to these residents to further inform the SIA and confirm concerns and identify potential mitigation strategies.

The concerns raised during discussions were largely those related to the proposed increase in truck movements such as safety concerns, unsuitability of existing roads, truck start times and the potential for cumulative impacts with other industrial and housing developments nearby. Identified impacts on social amenity due to operational activities at the quarry itself included those associated with dust and noise emissions, disruptions to the visual landscape due to stockpiling and minor extension of the quarry. A range of other issues of concern were also identified to a lesser extent (see **Figure 2**).



Note: Multiple responses allowed; proportions based on number of mentions of each theme

FIGURE 1

Perceived Community Impact Themes (n=9 residents)

Community members also suggested several measures to reduce the identified impacts. Key strategies included speed limit reductions, improving the regulation of truck driver behaviour and keeping the local community informed through forums and media.

Assessment of Key Issues

The SEE will provide a detailed assessment of all relevant environmental and social factors which could be affected by the proposed modification. The following provides a summary of the impacts on the key issues identified by as part of consultation.

Traffic and Transport

- On days when the maximum number of truck movements are generated, the proposed modification could see typical daily flows on Wisemans Ferry Road and Old Northern Road (south of Wisemans Ferry Road) increase by 2.7% over the existing average daily traffic flows. The predicted traffic levels would remain well within the capacity of both roads.

- The maximum number of heavy vehicle movements per hour between the hours of 6am and 7am would remain at 20 (as currently approved).

- Dixon Sand will continue to promote and actively implement the Maroota Local Traffic Management Policy. The policy will be reviewed regularly to ensure its effectiveness is maintained.

- Dixon Sand will continue to communicate with truck drivers and their companies to reiterate key safety messages and will maintain a proactive stance towards management of reckless driving and non-compliant vehicle standards.

Noise

- Road traffic noise is predicted to remain compliant with road traffic noise criteria.

- The proposed modification does not introduce any significant noise sources and noises levels received at surrounding residences as a result of the proposed modification are not anticipated to increase perceptibly from those that are generated by the currently approved operations.

- Dixon Sand is committed to implementing all reasonable and feasible mitigation measures to minimise the noise levels received at surrounding residences.

Air Quality

- Dispersion modelling of the proposed modified operations has been undertaken and predicts ongoing compliance with both airborne particulate matter and deposited dust criteria.

- Dixon Sand will continue to monitor operations daily and implement additional dust suppression or modify operations if necessary, to reduce dust emissions.

Visual Amenity

- The minor 1 ha extension of the extraction area (which represents a 1.3% increase in the overall disturbance footprint of the Quarry) would be screened by vegetation and a vegetated earth bund. Council regulations regarding buffers to nearby properties will be maintained.

Next steps

The next step in the assessment process includes the finalisation of the SEE and lodgement with the DPIE. The DPIE will place the SEE on public exhibition at which point the community will be notified and invited to provide comments and make submissions.

Further information

For more information on the assessment process see the DPIE website at https://www.planningportal.nsw.gov.au/development-assessment-and-consent

For further information on the proposed modification or related enquiries contact Dixon Sand on the telephone numbers provided below or use their website www.dixonsand.com.au

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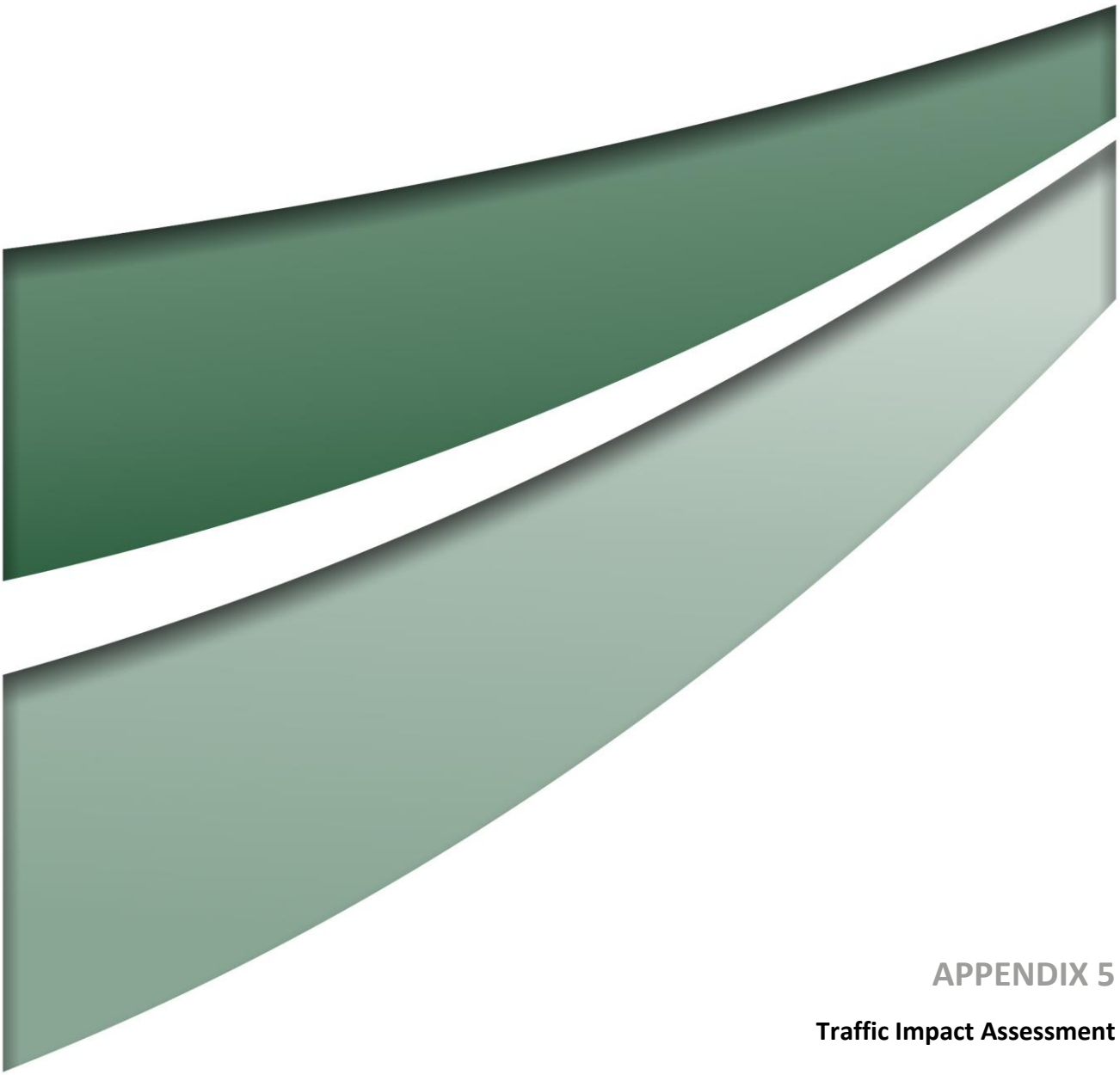

APPENDIX 5

Traffic Impact Assessment

SECAsolution
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Ground Floor, 161 Scott St
Newcastle NSW 2300
Ph. (02) 4032 7979
admin@secasolution.com.au

21 August 2019

P1383 Dixon Sand Haerses Road Quarry Expansion

Dixon Sand Pty Ltd

Attn: Mark Dixon

Dear Mark,

Proposed Modification to Quarry Extraction Rates - Haerses Road Quarry, Maroota, NSW.

Further to your recent email regarding the proposed expansion of Haerses Road Quarry, we have now completed our site work and review of the documentation provided for changes to the existing quarry operations. We have reviewed the impact of the proposed modifications to the Haerses Road Quarry on the local road network and provide the following assessment and advice in relation to traffic, car parking and access to support a modification request to the Department of Planning & Environment (DPE).

The following assessment has been prepared with consideration to the Austroads Guidelines and RMS Guide to Traffic Generating Developments, as well as the relevant planning requirements outlined within The Hills Development Control Plan 2012.

Site Location & Context

The subject site is located at Haerses Road, Maroota, to the south of Wisemans Ferry Road as shown in **Figure 1**.

It comprises lots:

- Lot 170, DP664766;
- Lot 170, DP664767;
- Lot A and Lot B, DP407341
- Lot 176, Lot 177 and Lot 216, DP752039

Development consent for the site (DA 165-7-2005) permits the operation of a sand quarry with the capacity to extract and haul up to 250,000 tonnes of quarry product per annum including the transportation up to 190,000 tonnes per annum to Old Northern Road Quarry for processing off site. The consent also allows for the importation of up to 100,000 tonnes of virgin excavated natural material (VENM) and excavated natural material (ENM). Both Haerses Road Quarry and Old Northern Road Quarry are operated by Dixon Sands.

Truck movements at the site (either arrival or dispatch), including truck movements between the site and Old Northern Road Quarry, must not exceed 56 per day, with no more than 20 truck movements permitted between 6am-7am.

Operating hours for the site are:

- Quarrying Operations: 7am to 6pm, Monday to Saturday
- Truck Arrival, Loading & Dispatch: 6am to 6pm, Monday to Saturday
- No works are permitted to occur on Sundays or public holidays.

Up to 8 full time staff are employed by the existing quarry operations.

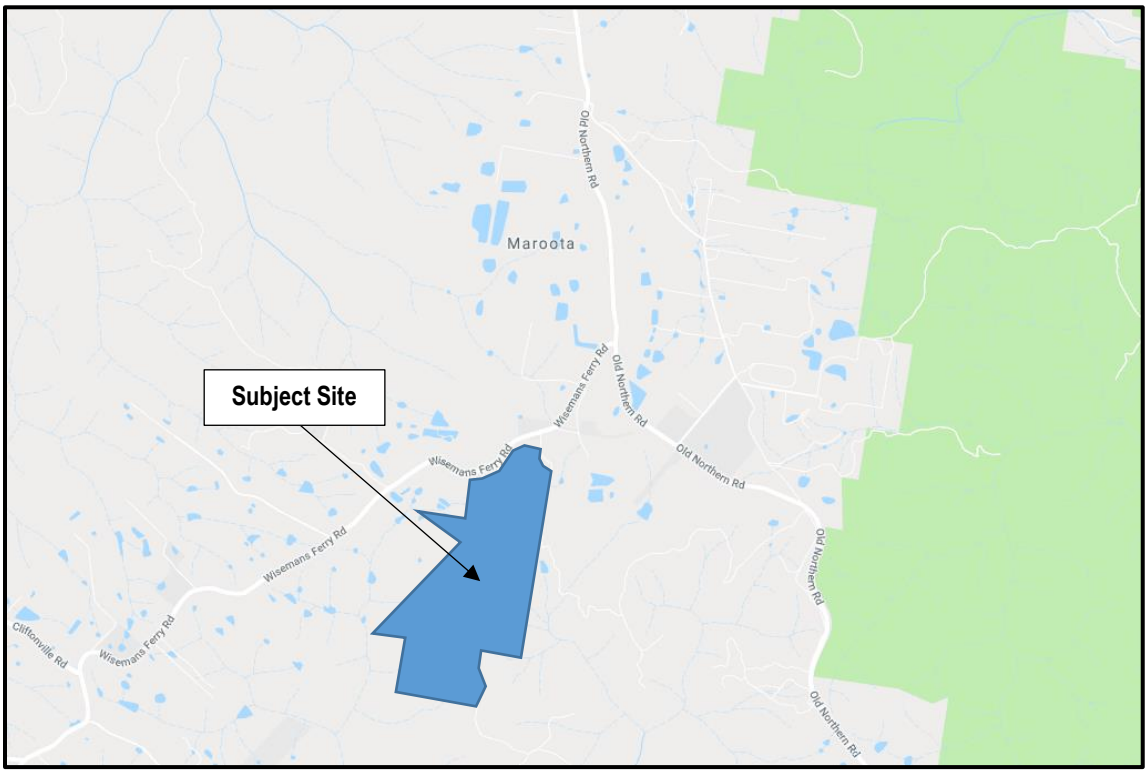


Figure 1 - Location of the subject site in the context of the surrounding road network (Source: Nearmap)

The surrounding land use includes agricultural and extractive industries with several rural residential properties along Wisemans Ferry Road and Old Northern Road. The following quarries are operating within the surrounding area:

- Old Northern Road Quarry (Dixon Sands) - located off Old Northern Road approximately 2 km to the north.
- Laughtondale Gully Road (Dixon Sands) - located off Laughtondale Gully Road, approximately 5 km to the north
- Maroota Sandstone Quarry (Maroota Sandstone) - located off Laughtondale Gully Road approximately 5 km to the north.
- Pit 3 and Pit 5 (PF Formation) - located off Old Northern Road approximately 3.5 km to the north
- Old Telegraph Road Sand Extraction (PF Formation) located off Old Telegraph Road approximately 2.5 km to the north-east.
- Hitchcock Road Sand Extraction (Trig Hill) (PF Formation) - located off Wisemans Ferry Road approximately 700 metres east (between Hitchcock Road and Old Northern Road).
- Roberts Road Quarry (Hodgson Quarries) - located off Roberts Road approximately 1.5 km to the north-east.

Maroota Public School is located to the north of the site off Old Northern Road.

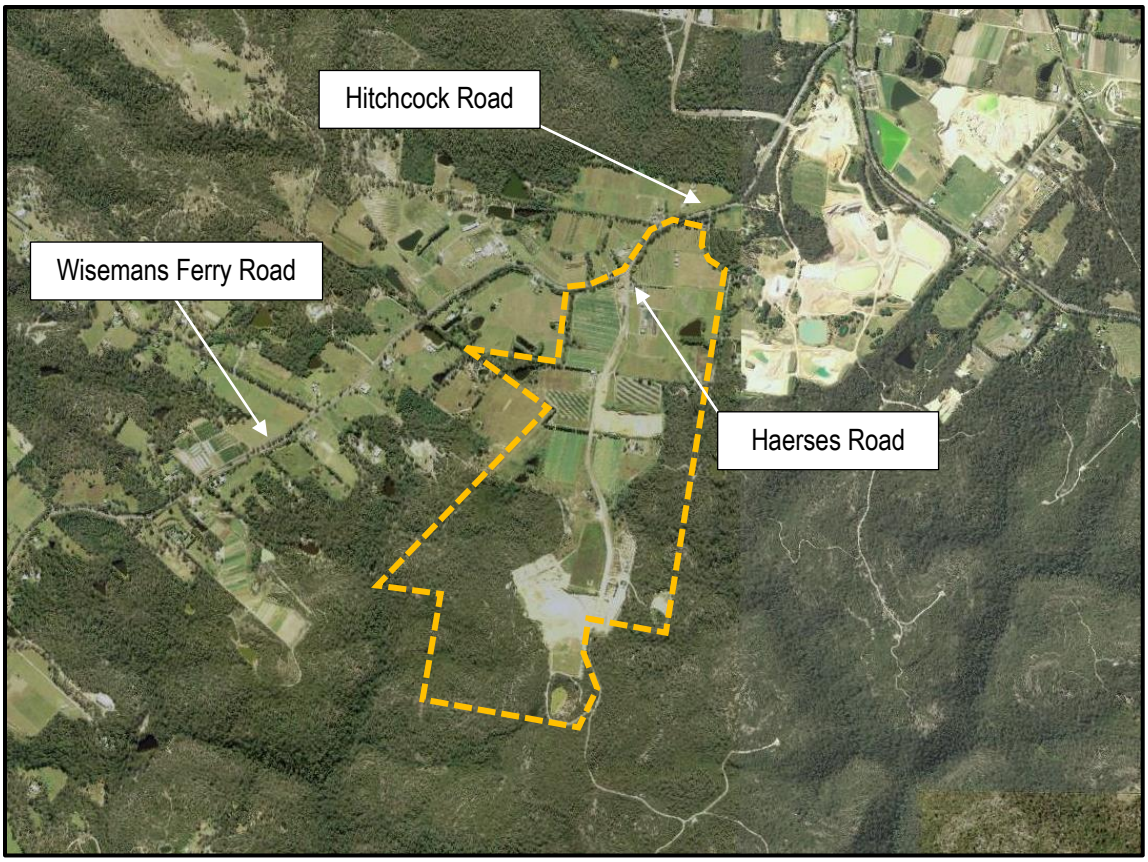


Figure 2 - Location of the subject site in the context of the surrounding road network (Source: Six Maps)

Road Hierarchy

Wisemans Ferry Road forms part of the state road network extending north from McGraths Hill near Windsor to Old Northern Road at Maroota. Near the subject site it provides for a single lane of travel in each direction with narrow shoulders and an unsealed verge, typically bounded by small trees and shrubs. No street lighting is provided and there are no pedestrian nor cycling facilities, consistent with its rural setting. Wisemans Ferry Road operates under the posted speed limit of 80 km/hr.

Wisemans Ferry Road forms a 'Give Way' sign-controlled T-intersection with Old Northern Road which allows for all turning movements, Old Northern Road having priority. There are no dedicated turn lanes provided on Old Northern Road at this intersection.

To the south of this intersection, Wisemans Ferry Road connects with Haerses Road via a 'Give Way' sign-controlled T-intersection which allows for all turning movements with Wisemans Ferry Road having priority. A channelised turn lane is provided on Wisemans Ferry Road to cater for right turns into Haerses Road.

Old Northern Road forms part of the state road network extending west from Baulkham Hills through Maroota to Wisemans Ferry. Similar to Wisemans Ferry Road, Old Northern Road provides for a single lane of travel in each direction with narrow shoulders and an unsealed verge. No street lighting is provided and there are no pedestrian nor cycling facilities, consistent with its rural setting. The posted speed limit on Old Northern Road is 60 km/hr past Wisemans Ferry Road and through the village of Maroota, increasing to 80 km/hr west of Old Northern Road Quarry and 90 km/hr to the east approaching Roberts Road.

Both Wisemans Ferry Road and Old Northern Road are approved B-Double routes, with each of these roads carrying a high percentage of heavy vehicle traffic associated with surrounding agricultural and extractive industries.

Haerses Road is a local street which forms a 'No Through Road' providing access to Haerses Road Quarry and a small number of adjoining properties. It has a width in the order of 8-9 metres along its length allowing for two trucks to pass.

Roadworks & Traffic Management Works

The consent conditions for Haerses Road Quarry (DA165-7-20005-Mod1) requires the construction of a channelised right turn (CHR) treatment at the intersection of Haerses Road and Wisemans Ferry Road in accordance with the Austroads Guide to Road Design, being an extension of the existing right turn lane. Truck turning warning signs are also to be installed to the north of Haerses Road on Wisemans Ferry Road and the existing 'Give Way' control on Haerses Road is to be replaced with a 'Stop' sign. A concept plan for these upgrades is provided in **Attachment B**.

No other roadworks or traffic management works are currently occurring in the immediate locality of the site.

Existing Traffic Volumes

Traffic surveys were undertaken at the intersection of Wisemans Ferry Road / Old Northern Road to observe the current road operation and determine the existing traffic distribution through this intersection. This survey was completed during a typical weekday morning (7:00am to 10:00am) on Tuesday 4th November 2018 with the results for the morning peak (i.e. 8am to 9am) summarised below.

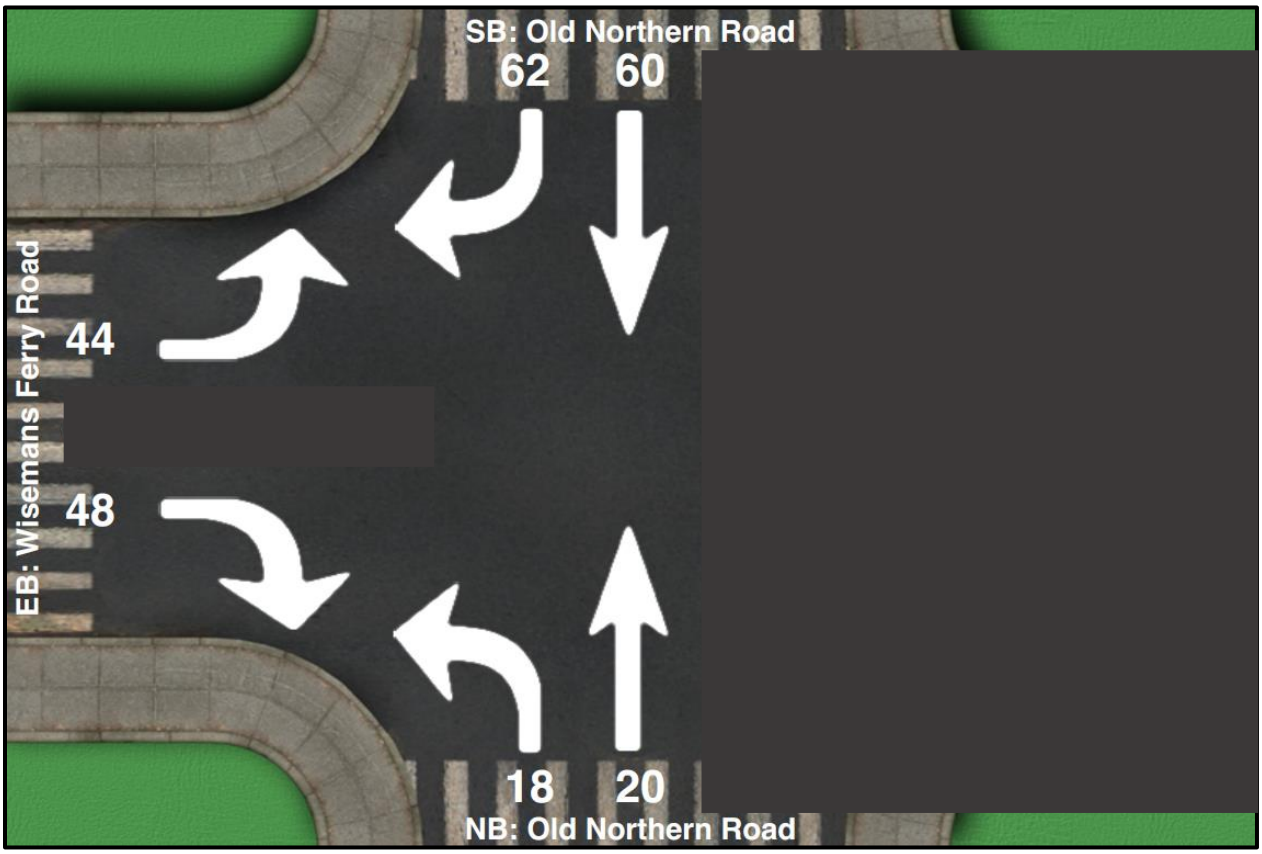


Figure 3 - Hourly traffic volumes at the intersection of Wisemans Ferry/Old Northern roads (8am to 9am).

Automatic tube counters were installed on Wisemans Ferry Road (east of Haerses Road) and Old Northern Road (north of Wisemans Ferry Road) to quantify the average daily traffic volumes in these locations. These surveys were completed over a continuous 7 day period between Monday 6th May 2019 and Sunday 12th May 2019 with the results summarised below.

- The average daily flows on Wisemans Ferry Road (east of Haerses Road) were 2,284 vehicles per day (vpd), two way.
- The average daily flows on Old Northern Road (north of Wisemans Ferry Road) were slightly lower with 2,260 vpd, two way.

The daily flow profiles on each of these roads suggests two distinct peaks during the morning, being the local road peak (i.e. 8am-9am) as well as an earlier peak (6am-7am) coinciding with the various quarry operations, with a more significant peak period in the afternoon (between 3pm-4pm). The two-way traffic volumes on Old Northern Road and Wisemans Ferry Road during the above times are summarised in Table 1 below.

Table 1 -Two-way Peak Hour Flows on Wisemans Ferry Road and Old Northern Road

Peak Period	Time	Wisemans Ferry Road (east of Haerses Road)	Old Northern Road (north of Wisemans Ferry Road)
Quarry	6am - 7am	170	145
AM	8am-9am	167	149
PM	3pm-4pm	189	188

As confirmed by traffic surveys at the intersection of Wisemans Ferry Road and Old Northern Road, the two-way flows on Old Northern Road (south of Wisemans Ferry Road) are lower than those to the north. To provide a robust assessment flows to the south of Wisemans Ferry Road have been assessed at the same volume as to the north.

Flows on Wisemans Ferry Road are reasonably balanced throughout the day with a slight bias in traffic eastbound during the morning peak and the reverse in the afternoon. Similarly, flows on Old Northern Road are reasonably balanced throughout the day with a slight bias in traffic southbound during the morning peak and the reverse in the afternoon.

Haerses Road provides limited access as detailed above and as such flows on this road are minimal (up to 56 truck movements per day associated with the existing quarry operations plus a small number of light vehicle movements).

Background Growth

A traffic impact assessment prepared for a new sand quarry located off Old Northern Road (Lot 1, DP 590937) (Lyle Marshall & Partner Pty Ltd August 2016) details average daily traffic data for Wisemans Ferry Road (west of Old Northern Road). This data was obtained over a continuous period of 7 days in August/September 2016 and reports average daily flows of 2,034 vpd (two-way). Comparing this with the data collected in May 2019, demonstrates growth in traffic along Wisemans Ferry Road in the order of 12%, or the equivalent of 4% per annum.

Average daily traffic for Old Northern Road (south of Old Telegraph Road) is also provided for May 2014, which indicates average daily flows of 2,078 vpd (two-way). Comparing this with the 2019 average daily traffic volumes (north of Wisemans Ferry Road), suggests that Old Northern Road has experienced growth in the order of 9%, or the equivalent of 1.8% per annum.

Heavy Vehicle Flows

Both Wisemans Ferry Road and Old Northern Road carry a high percentage of heavy vehicles, with heavy vehicles representing approximately 20% of day time traffic on Old Northern Road and 21% of day time traffic on Wisemans Ferry Road. Most of these heavy vehicles are associated with quarries in the surrounding area and the surrounding agricultural lands. Several school bus services also operate along Old Northern Road.

Both Wisemans Ferry Road and Old Northern Road are approved routes for B-Double combinations.

Vehicle Speeds

A review of data from the automatic tube counters indicates an 85th percentile vehicle speed of less than 80 km/hr on Wisemans Ferry Road (east of Haerses Road), confirming that the majority of vehicles travel within the posted speed limit of 80km/hr in this location.

The 85th percentile speed on Old Northern Road (north of Wisemans Ferry Road) was in the order of 67 km/hr northbound and 69 km/hr southbound, being approximately 10-15% above the posted speed limit of 60 km/hr. Approximately 10% of vehicles travelled at more than 10 km/hr above the posted speed limit in this location.

Current Road Network Operation

Observations on site indicate that the local road network operates to a high standard during the morning peak period, with very low delays and congestion due to the low traffic volumes on these roads.

The RMS Guide to Traffic Generating Developments provides performance standards for assessing the capacity of a rural road, which is based on Level of Service (LoS) criteria with respect to the traffic volumes during the peak periods. As defined by the Austroads Guide to Traffic Management (Part 3: Traffic Studies and Analysis), Level of Service is a qualitative measure describing the operational conditions within a traffic stream such as the general efficiency and comfort, travel speeds and ability of a driver to select their desired speed and manoeuvre within the traffic stream.

There are six different level of service classifications described in the Austroads Guide with the capacity of a rural road typically accepted as having an upper limit of LoS D. For Wisemans Ferry Road and Old Northern Road, which provide a rolling road alignment with more than 15% heavy vehicles, the RMS Guide to Traffic Generating Developments nominates an hourly capacity in the order of 600 vph (based on a design speed of 80 km/hr).

Table 2 - Level of Service Classifications (interpolated from Table 4.5 of RMS Guide to Traffic Generating Developments)

Level of Service	Peak Hour Flow (two-way)
B	270
C	490
D	600
E	1,290

Current traffic volumes on Wisemans Ferry Road and Old Northern Road are less than 270 vph, and therefore both roads operate well within their capacity, providing an overall Level of Service B.

Crash History

A review of crash data provided by Roads and Maritime Services indicates that there were six crashes recorded on the roads in the general locality of the Haerses Road Quarry over the five year period between October 2013 and September 2018. Of these, four accidents occurred on Wisemans Ferry Road including one fatality to the south of Haerses Road associated with a vehicle losing control on a bend and another involving a vehicle losing control in the vicinity of Haerses Road. For both of these crashes, speed was a factor. The other two accidents occurred further west involving a vehicle completing a U-turn and a head on collision.

Two crashes occurred at the intersection of Wisemans Ferry Road and Old Northern Road involving opposing right turns and a rear end collision. Neither accident resulted in serious injury or fatality.

None of the accidents were associated with quarry activities in this location.

The road network in this location is typically well laid out, however the horizontal alignment and location of vegetation along the edge of the roads can restrict sight lines for drivers approaching driveways or intersections, particularly along Wisemans Ferry Road. Warning signage is provided in a number of locations along the verge to warn drivers of concealed driveways and the potential for trucks to be turning, whilst channelised turn lanes are provided at some intersections to allow vehicles to move clear of the through traffic lane when turning. As such, it is considered that the local road network provides a satisfactory standard of road safety and does not create any significant safety concerns.

Detailed crash data is provided as **Attachment C**.

Other Travel Modes

There are no pedestrian or cyclist facilities provided in the locality, reflective of this rural setting and low demands for walking or cycling.

No public buses operate in this location however several school buses were observed to travel along both Old Northern Road and Wisemans Ferry Road.

Proposed Modification

The proposed modification seeks to increase the extraction rates for Haerses Road Quarry from 250,000 tonnes to 495,000 tonnes per annum (tpa), with an associated increase in the number of daily truck movements permitted to access or depart the site from 56 truck movements per day to 180 movements per day (90 inbound, 90 outbound). No changes are proposed however to the maximum number of trucks permitted to enter or exit the site between the hours of 6am-7am (i.e. 20 truck movements).

The proposed modification also seeks to increase the volume of VENM and ENM imported to the quarry to 250,000 tpa compared with the current consent for 100,000 tpa. Truck movements associated with the transportation of these products shall be included in the above limits of 180 trips per day.

No changes are proposed to the volume of quarry product to be transported between Haerses Road Quarry and Old Northern Road Quarry for processing. Furthermore, no changes are proposed to the approved operating hours for the quarry, nor to the existing access arrangements or transport routes.

Up to 8 additional full-time staff shall be employed at the quarry to support the proposed increase in capacity.

Review of Traffic

Traffic Generation

The proposed modification seeks to allow a maximum of 180 truck movements associated with Haerses Road Quarry per day, representing an increase of 124 truck movements (62 inbound, 62 outbound) over the existing consent. The transportation of quarry products has typically relied on truck and dog combinations, however, may also use larger trucks up to 42 tonne B-Double combinations.

Consistent with the current operations, truck movements would occur throughout the day with the proposed modification having the potential to generate 14-15 trucks per hour (average across the operating hours of the quarry 7am to 6pm). This represents an increase of 11-12 trucks per hour compared with the existing operations (assuming a maximum of 20 trucks entering or exiting between 6am and 7am as per the existing situation).

The demands for vehicles entering and exiting the site would vary throughout the day, however the loading of trucks and operation of the weighbridge shall ensure that these movements are spread out throughout the day with typically no more than 20 trucks entering or exiting the site each hour.

In addition to this, staff arrivals at the beginning of the day and departures at the end of a shift could increase light vehicle movements by up to 16 trips per day (8 inbound, 8 outbound).

Access Route

All vehicles will enter and exit Haerses Road Quarry via Haerses Road onto Wisemans Ferry Road will travel in both directions along Wisemans Ferry Road depending upon market demands. Vehicles can travel south along Wisemans Ferry Road for direct access to Western Sydney or east along Old Northern Road for access to the Greater Sydney Area. The importation of VENM and ENM to the site for processing with extracted quarry products shall also use these routes.

There are no restrictions on the number of trucks permitted to travel along the various haul routes, with truck movements associated with the existing quarry operations being reasonably balanced in both directions along Wisemans Ferry Road.

There shall be no additional trips between Haerses Road Quarry and Old Northern Road Quarry as a result of this modification. Therefore, there shall be no additional trips north along Old Northern Road, passing Maroota Public School.

Origin / Destination Assignment

For the purpose of this assessment it is assumed that truck movements would be equally balanced to the east and west along Wisemans Ferry Road.

i.e. 50% have an origin/destination west via Wisemans Ferry Road.
50% travel origin/destination east via Wisemans Ferry Road to Old Northern Road.

Impact on Road Capacity

Allowing for an equal split of trips to the east and west along Wisemans Ferry Road, the proposed modification could see typical daily flows on Wisemans Ferry Road (east or west of Haerses Road) and Old Northern Road (south of Wisemans Ferry Road) increase by 62 truck movements per day. This is an increase in the order of 2.7% over the existing average daily traffic flows on these roads.

Based on the above assessment of the road network operation, both Wisemans Ferry Road and Old Northern Road (south of Wisemans Ferry Road) currently operate well within their capacity, providing an overall LoS B throughout the day and during the peak periods.

The proposed modification to Haerses Road Quarry has the potential to generate an additional 11-12 truck movements per hour throughout the day, with these trips being distributed in either direction along Wisemans Ferry Road. On the basis that all traffic generated by the quarry could use either route (east or west) at any particular point in time, flows on Wisemans Ferry Road could increase to 201 vph in the afternoon peak hour. Similarly, flows on Old Northern Road (south of Wisemans Ferry Road) could also increase by an equivalent amount to 200 vph in the afternoon peak hour. These traffic volumes shall therefore see these roads operating well within their capacity with no impact to the existing level of service (i.e. LoS B).

Given that there is no increase in haulage volumes to the north, the proposed expansion does not create additional demands for heavy vehicles travel through the village of Maroota nor past Maroota Public School.

Whilst there will be additional trips associated with staff travelling to and from the site each day, these movements are minimal and shall have a negligible impact upon the overall operation and capacity of the surrounding road network.

Impact on Intersections

The key intersection that could be impacted upon by the proposed development is the intersection of Wisemans Ferry Road and Haerses Road. This intersection is proposed to be upgraded to provide an extended channelised right turn lane with changes to the line marking (including chevrons) to guide traffic past right turning vehicles at the intersection, providing improved safety and reducing the potential for rear-end and overtaking crashes.

As detailed above, the proposed modification could see an average of 14-15 heavy vehicles passing through this intersection per hour with the weighbridge operation and time required for the loading and unloading of trucks typically resulting in less than 20 trucks entering or exiting the quarry in any given hour.

The proposed intersection upgrade has been assessed using *Sidra Intersection 8* to determine its capacity to support the increased demands for heavy vehicles turning into and out of Haerses Road. Two following scenarios have been considered:

1. 2019 surveyed traffic volumes plus additional traffic associated with Haerses Road Quarry.
2. 2028 future design year allowing for 40% background growth on Wisemans Ferry Road (4% per annum), consistent with the reported growth between 2016 and 2019, plus additional traffic associated with Haerses Road Quarry.

As demands for heavy vehicles accessing or departing the quarry can vary throughout the day, depending upon market demands, up to 10 vehicles inbound and outbound has been assumed from either direction along Wisemans Ferry Road. This provides a robust assessment of the intersection operation allowing for any distribution of heavy vehicles accessing and departing the quarry, whilst also accounting for additional demands associated with the increased staffing requirements.

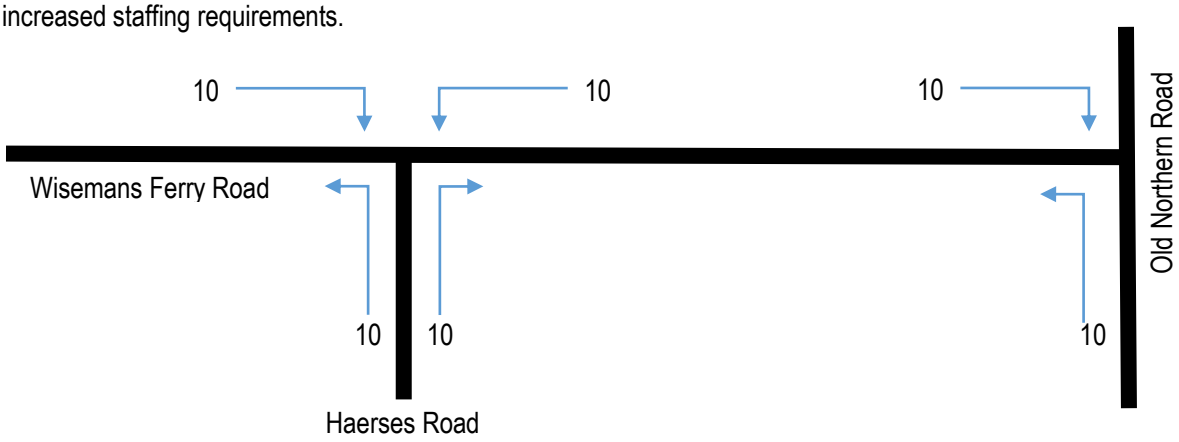


Figure 4 - Distribution of heavy vehicles for Haerses Road Quarry onto the local road network as modelled in Sidra.

The results of this assessment are summarised below.

Table 3 - Sidra Results - Wisemans Ferry Road / Haerses Road - 2019 surveyed flows with quarry traffic (Site/AM/PM peaks).

Approach	Movements	Level of Service	Average Delay (s)	95% Queue (m)
Haerses Road	Left Turn	A / A / A	10.1 / 10.0 / 10.4	1.7 / 1.7 / 1.8
	Right Turn	A / A / A	12.2 / 12.2 / 12.6	
Wisemans Ferry Road (Westbound)	Left Turn	A / A / A	7.9 / 7.9 / 7.9	0.0 / 0.0 / 0.0
	Through	A / A / A	0.0 / 0.0 / 0.0	
Wisemans Ferry Road (Eastbound)	Through	A / A / A	0.0 / 0.0 / 0.0	0.0 / 0.0 / 0.0
	Right Turn	A / A / A	8.3 / 8.2 / 8.5	0.6 / 0.6 / 0.6

Table 4 - Sidra Results - Intersection of Wisemans Ferry Road / Haerses Road - Plus 10 years growth to 2029 (Site/AM/PM peaks).

Approach	Movements	Level of Service	Average Delay (s)	95% Queue (m)
Haerses Road	Left Turn	A / A / A	10.4 / 10.3 / 10.8	1.9 / 1.9 / 2.0
	Right Turn	A / A / A	13.9 / 13.8 / 14.5	
Wisemans Ferry Road (Westbound)	Left Turn	A / A / A	7.9 / 7.9 / 7.9	0.0 / 0.0 / 0.0
	Through	A / A / A	0.0 / 0.0 / 0.0	
Wisemans Ferry Road (Eastbound)	Through	A / A / A	0.0 / 0.0 / 0.0	0.0 / 0.0 / 0.0
	Right Turn	A / A / A	8.5 / 8.4 / 8.8	0.6 / 0.6 / 0.6

The above results confirm that the proposed upgrades at the intersection of Wisemans Ferry Road / Haerses Road provide adequate capacity to support the increased traffic associated with the proposed modification to Haerses Road Quarry together with background growth along Wisemans Ferry Road consistent with recent years.

All movements provide an overall Level of Service A with very minimal delays and queuing for both the existing and future design year.

Sidra modelling has also been completed to assess the impact of the additional traffic on the intersection of Wisemans Ferry Road and Old Northern Road. Three scenarios were considered:

1. 2018 existing situation based on surveyed traffic volumes at this intersection during the morning peak hour.
2. 2018 traffic volumes plus additional traffic associated with Haerses Road Quarry.
3. 2028 future design year allowing for 40% background growth on both Wisemans Ferry Road and Old Northern Road (4% per annum) plus additional traffic associated with Haerses Road Quarry.

The results of this assessment are summarised below.

Table 5 - Sidra Results - Intersection of Wisemans Ferry Road / Old Northern Road - 2018 surveyed flows

Approach	Movements	Level of Service	Average Delay (s)	95% Queue (m)
Old Northern Road (Northbound)	Left Turn	A	6.2	0.0
	Through	A	0.0	
Old Northern Road (Southbound)	Through	A	0.1	2.9
	Right Turn	A	6.0	
Wisemans Ferry Road (Eastbound)	Left Turn	A	7.5	2.7
	Right Turn	A	7.9	

Table 6 - Sidra Results - Intersection of Wisemans Ferry Road / Old Northern Road - 2018 surveyed flows with additional quarry traffic

Approach	Movements	Level of Service	Average Delay (s)	95% Queue (m)
Old Northern Road (Northbound)	Left Turn	A	6.4	0.0
	Through	A	0.0	
Old Northern Road (Southbound)	Through	A	0.2	2.9
	Right Turn	A	6.0	
Wisemans Ferry Road (Eastbound)	Left Turn	A	7.5	3.3
	Right Turn	A	8.4	

Table 7 - Sidra Results - Intersection of Wisemans Ferry Road / Old Northern Road - Plus 10 years growth to 2028 (Site/AM/PM peaks).

Approach	Movements	Level of Service	Average Delay (s)	95% Queue (m)
Old Northern Road (Northbound)	Left Turn	A	6.4	0
	Through	A	0.0	
Old Northern Road (Southbound)	Through	A	0.3	4.3
	Right Turn	A	6.1	
Wisemans Ferry Road (Eastbound)	Left Turn	A	7.6	5.1
	Right Turn	A	8.9	

The above results confirm that the intersection of Wisemans Ferry Road / Old Northern Road provides adequate capacity to support the increased traffic associated with the proposed modification to Haerses Road Quarry together with increases in traffic on both Wisemans Ferry Road and Old Northern Road associated with the surrounding quarry operations.

The additional demands through this intersection associated with the proposed modification do not result in any change to the current level of service for any movement (LoS A), with only minor increases to the average delays and queueing. As such, the proposed modification to Haerses Road Quarry have an acceptable impact upon this intersection.

Background Traffic and Other Developments

The impacts of other developments, including the potential for future expansion of nearby quarry operations has been allowed for through the provision of suitable background growth on both Wisemans Ferry Road and Old Northern Road, through the application of recent historical growth rates for both roads.

Construction Traffic

Haerses Road Quarry is currently operational and as such there is minimal construction activity required on site in association with the proposed modifications to the existing operations.

Upgrades to the intersection of Wisemans Ferry Road and Haerses Road require approval from RMS, with works to be completed under a Works Authorisation Deed (WAD). A construction traffic management plan will be required to support these works, including traffic control plans to provide a safe work zone for these construction works.

These works will create some delays for the through traffic movements on Wisemans Ferry Road however these delays will be temporary and shall not have a significant impact upon road users.

Impacts to Public Transport

No public bus services operate along Wisemans Ferry Road or Old Northern Road. As such, there are no impacts to public transport associated with the proposed modifications to Haerses Road Quarry.

Whilst a number of school buses do operate within the locality, the proposed modifications will not have a direct impact upon these services, with no additional heavy vehicle movements passing Maroota Public School and the overall traffic volumes remain well within the capacity of these roads.

Impacts to Pedestrians and Cyclists

No additional demands for pedestrians or cyclists are anticipated for this development given the nature of the proposed use and its rural setting.

Review of Access and Car Parking

No changes are proposed to the existing access arrangements with all vehicles required to access Haerses Road off Wisemans Ferry Road. This intersection is to be upgraded as required by the conditions of consent for the approved Modification 1 to the Haerses Road Quarry, with a concept layout for these upgrades provided in **Attachment B**. These upgrade shall provide an appropriate level of capacity and safety for the increased movements as assessed above and below.

The proposed upgrades to this intersection have also been designed to accommodate the turning paths of heavy vehicles up to an including B-Double combinations.

Sight Distances

As part of the project work, site distances have been reviewed at the intersection of Wisemans Ferry Road and Haerses Road with the following comments provided:

- Sight distances in both directions along Wisemans Ferry Road are impacted upon by the horizontal road alignment and vegetation bounding the narrow shoulders to each side.
- Sight distance to the west of Haerses Road was measured at 225 metres.
- Sight distance to the east of Haerses Road was measured at 177 metres.

Sight distance requirements from Austroads Guide to Road Design specifies a Safe Intersection Sight Distance (SISD) of 181 metres for the posted speed limit of 80 km/hr on Wisemans Ferry Road.

Whilst sight distances for the existing intersection are slightly less than that specified by the Austroads Guides, there is adequate Stopping Sight Distance for a heavy vehicle approaching along Wisemans Ferry Road at 80 km/hr to observe a potential conflict at the intersection with Haerses Road and slow down or stop as required (131 metres required for posted speed limit of 80 km/h). Given the curvilinear alignment of Wisemans Ferry Road, vehicles approaching this intersection from the east along Wisemans Ferry Road, particularly heavy vehicles, would typically be travelling at speeds below the posted speed limit of 80 km/hr (as confirmed by travel speed data obtained from the automatic tube counters). The available sight distances are therefore considered adequate and do not create any significant safety concerns for vehicles accessing or leaving Haerses Road Quarry.

Whilst the proposed upgrades to this intersection will see the right turn lane extended to the south on Wisemans Ferry Road, the road alignment will remain consistent with the existing situation. A review of sight lines for the proposed realignment indicates that sight lines could be reduced slightly to 170m to the east compared with the existing road alignment, however it will continue to meet the requirements for Stopping Sight Distance.

With the provision of truck turning signs approaching Haerses Road from the east, drivers travelling on Wisemans Ferry Road will have advance warning that trucks may be turning ahead and can anticipate the need to slow down as required. Given the low traffic volumes on Wisemans Ferry Road, very low demands for vehicles turning left into Haerses Road and the availability of adequate stopping sight distances approaching Haerses Road, it is considered that the available sight lines will allow vehicles to safely enter and exit Haerses Road.

It is noted that that sight lines could be improved with the removal of vegetation along the southern side of Wisemans Ferry Road to the east of the proposed works, however this will need to be confirmed as part of the detailed design.

Photo 1 – Sight distance looking east along Wisemans Ferry Road from its intersection with Haerses Road. Trimming of vegetation within the road reserve would improve the visibility for drivers

Photo 2 – Sight distance looking west along Wisemans Ferry Road from its intersection with Haerses Road.

Turn Treatments

The proposed upgrades to the intersection of Wisemans Ferry Road and Haerses Road have been reviewed to allow for this proposed modification.

Warrants determining the minimum treatment for a left or right turn at an unsignalised intersection are provided in Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections. These are based on a quantitative assessment of traffic volumes on the major road and demands for left or right turns into the minor road.

Warrants for the intersection of Wisemans Ferry Road and Haerses Road have been assessed in Figure 4 and Figure 5 (below) allowing for the surveyed traffic demands on Wisemans Ferry Road together with up to 10 vehicles turning left or right into Haerses Road in any given hour (as detailed above).

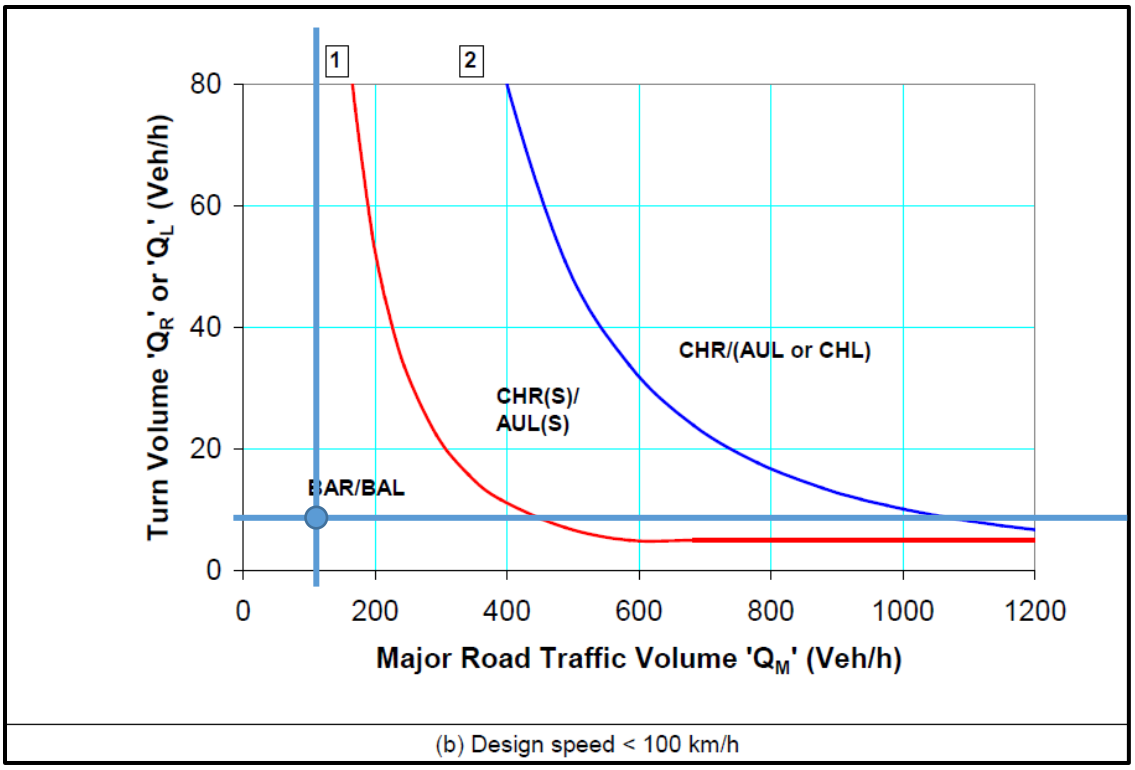


*Figure 5 - Warrants for **left** turn treatment at Wisemans Ferry Road / Haerses Road*

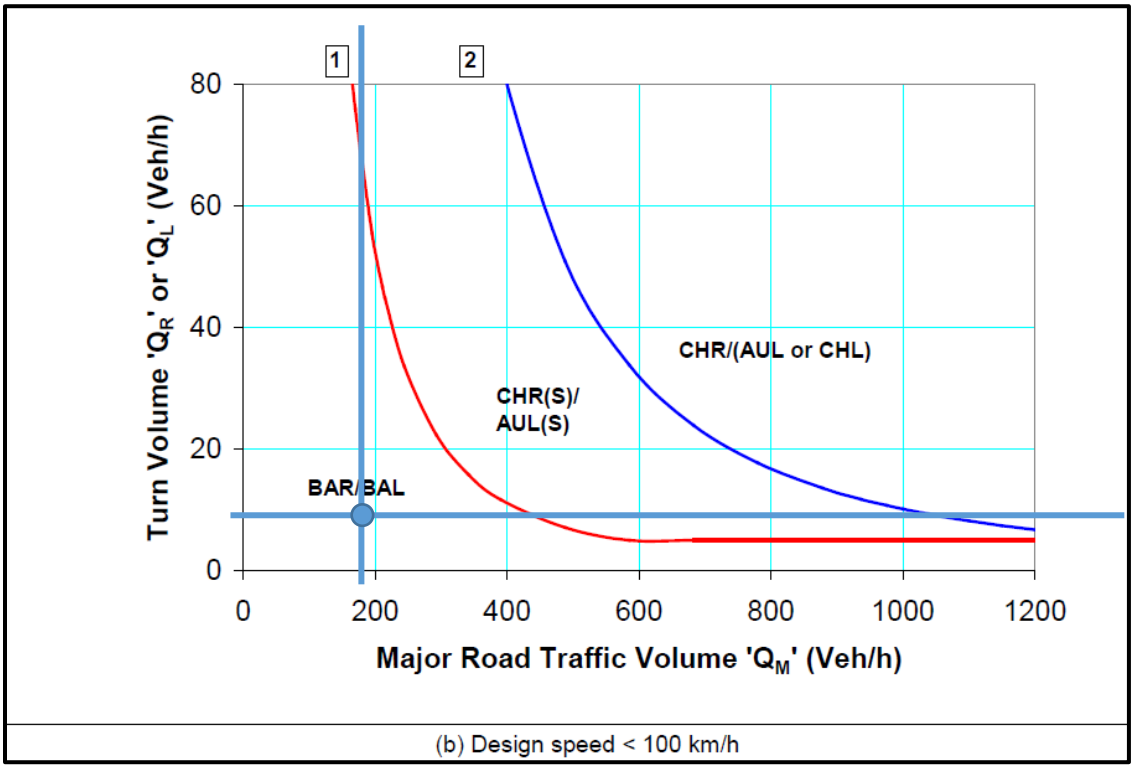


*Figure 6 - Warrants for **right** turn treatment at Wisemans Ferry Road / Haerses Road*

The above warrants show that the proposed upgrades to extend the existing channelised right turn lane at the intersection of Wisemans Ferry Road / Haerses Road is in excess of the minimum turn treatment recommended by the Austroads Guidelines. A left turn deceleration lane is not required, as reflected in the proposed upgrades to this intersection.

Given the low demands for vehicles turning into Haerses Road associated with the proposed quarry expansion, minimal queuing is expected within the channelised right turn lane on Wisemans Ferry Road. This has also supported by the Sidra modelling completed for this intersection (Table 3 and Table 4) which shows 95th percentile queues of less than one vehicle during the morning and afternoon peak periods. As such, the proposed extension of the channelised turn lane is adequate to cater for the potential queues associated with heavy vehicles accessing the site, with minimal risk of queues extending out of this turn lane onto Wisemans Ferry Road.

Overall, it is therefore concluded that the proposed upgrades to this intersection are adequate to support the proposed modification to the quarry extraction rates and associated increase in heavy vehicle traffic.

Car Parking

The Hills Development Control Plan 2012 does not recommend a parking rate for extractive industries.

No formal car park shall be provided for the project, however given the nature of the development and the large site area, all staff parking can be contained within the site as required. This shall therefore satisfy the objectives of The Hills Development Control Plan 2012 in relation to car parking, which seeks to ensure adequate provisions for car parking are available on site.

Conclusion

The above assessment demonstrates that the proposed modification to increase the extraction rates for Haerses Road Quarry will have a minimal and acceptable impact upon the surrounding road network. The number of additional truck movements required to support this modification is low (11-12 trips per hour) and well within the capacity of the surrounding roads and intersections.

Sight lines at the intersection of Haerses Road and Wisemans Ferry Road, which provides access to Haerses Road Quarry, are comparable to the Austroads Guides with adequate stopping sight distance available on both approaches along Wisemans Ferry Road. With the proposed upgrades to this intersection, including the provision of truck turning signs to the north of Haerses Road, it is considered the overall level of road safety at this intersection will be maintained with vehicles being able to safely turn into or out of Haerses Road.

This intersection upgrade is able to accommodate the additional demands associated with the quarry expansion.

Please do not hesitate to contact me on 4032 7979 should you have any queries or concerns.

Yours sincerely,

Shaun Lear
Traffic Engineer

List of Attachments:

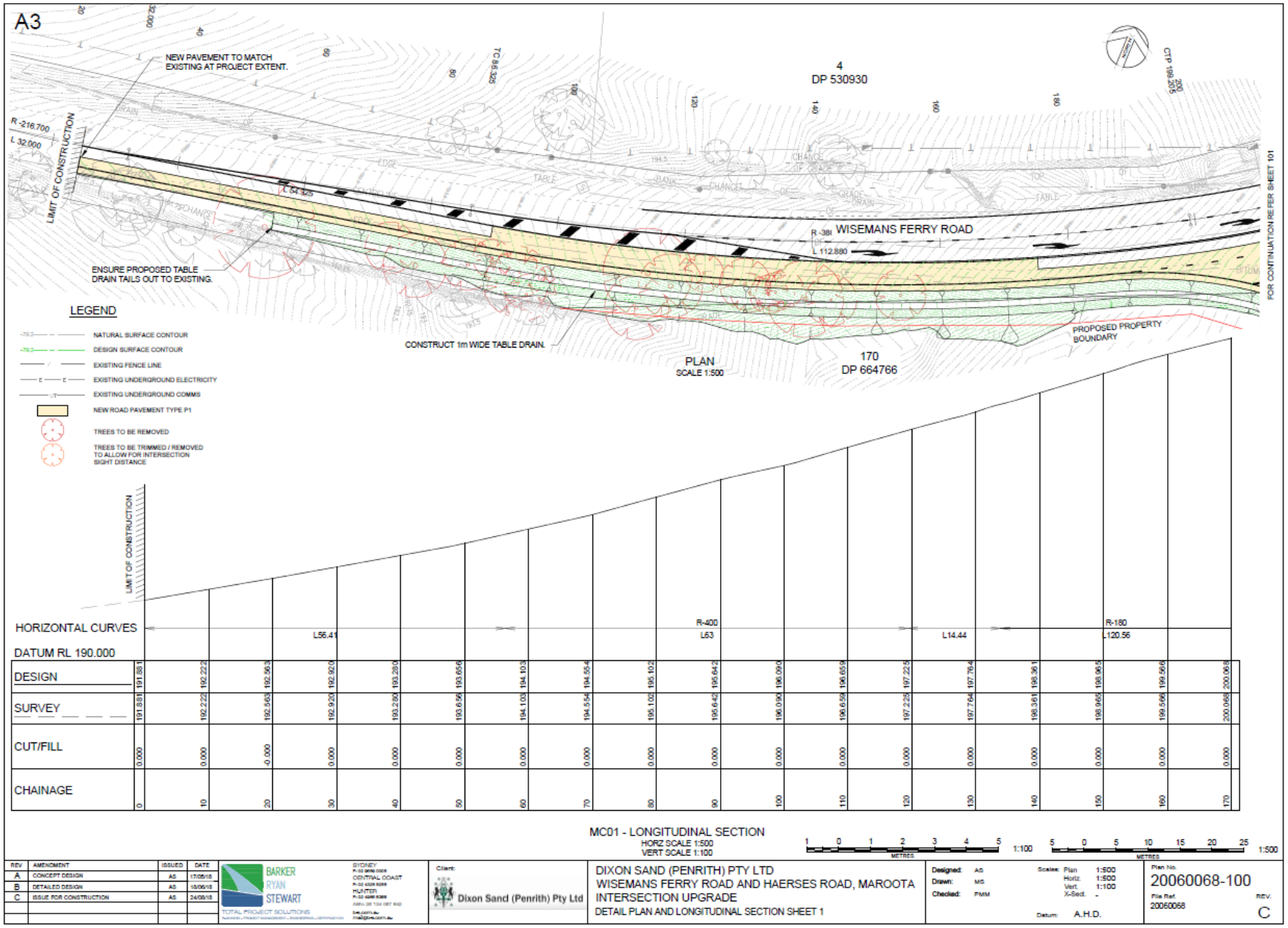
- **Attachment A** - Additional Site Photos
- **Attachment B** - Proposed Upgrades to Haerses Road / Wisemans Ferry Road
- **Attachment C** - RMS Crash Data
  Attachment D - Criteria for Interpreting Sidra Results

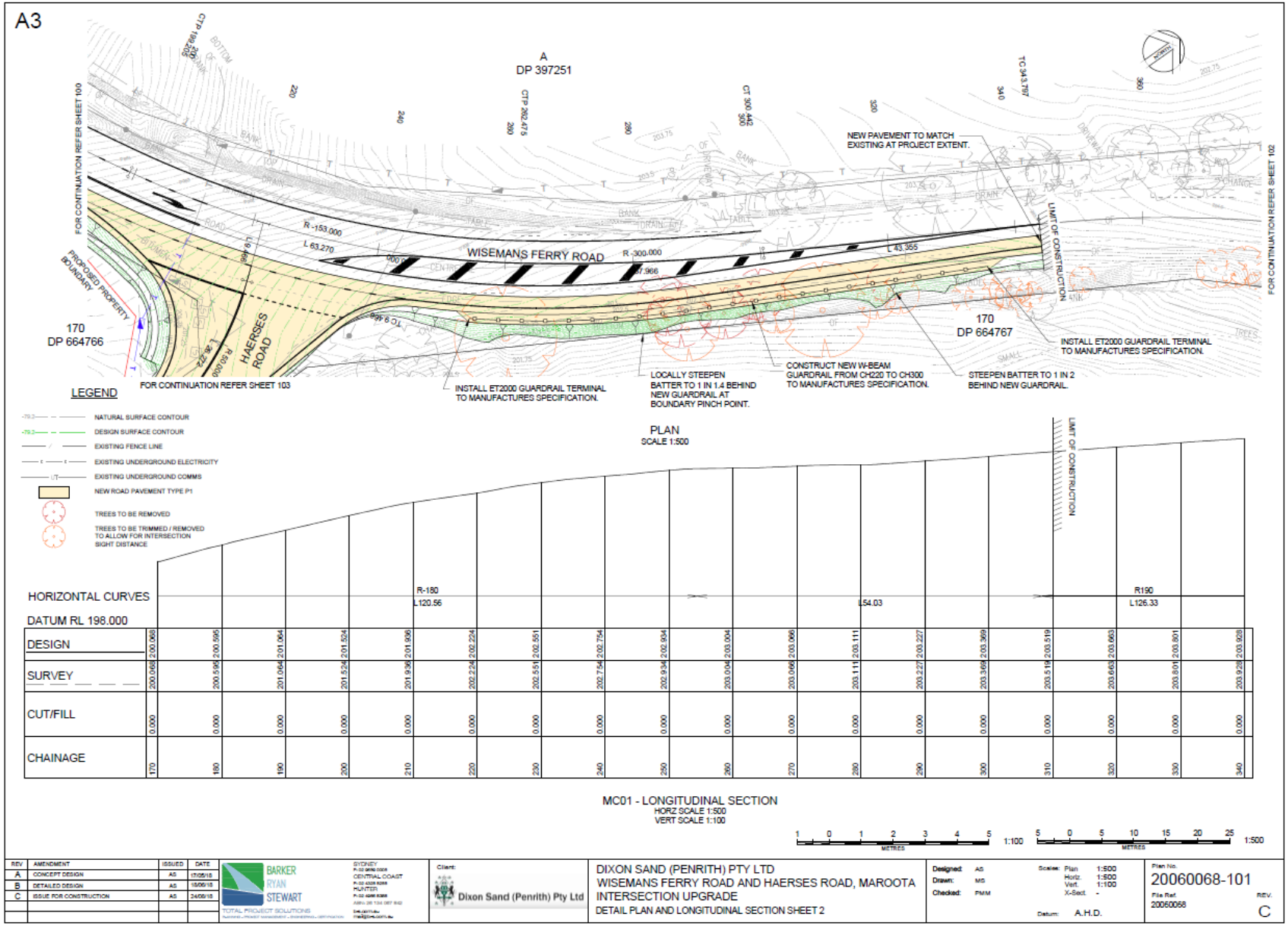
Attachment A: Additional Site Photos

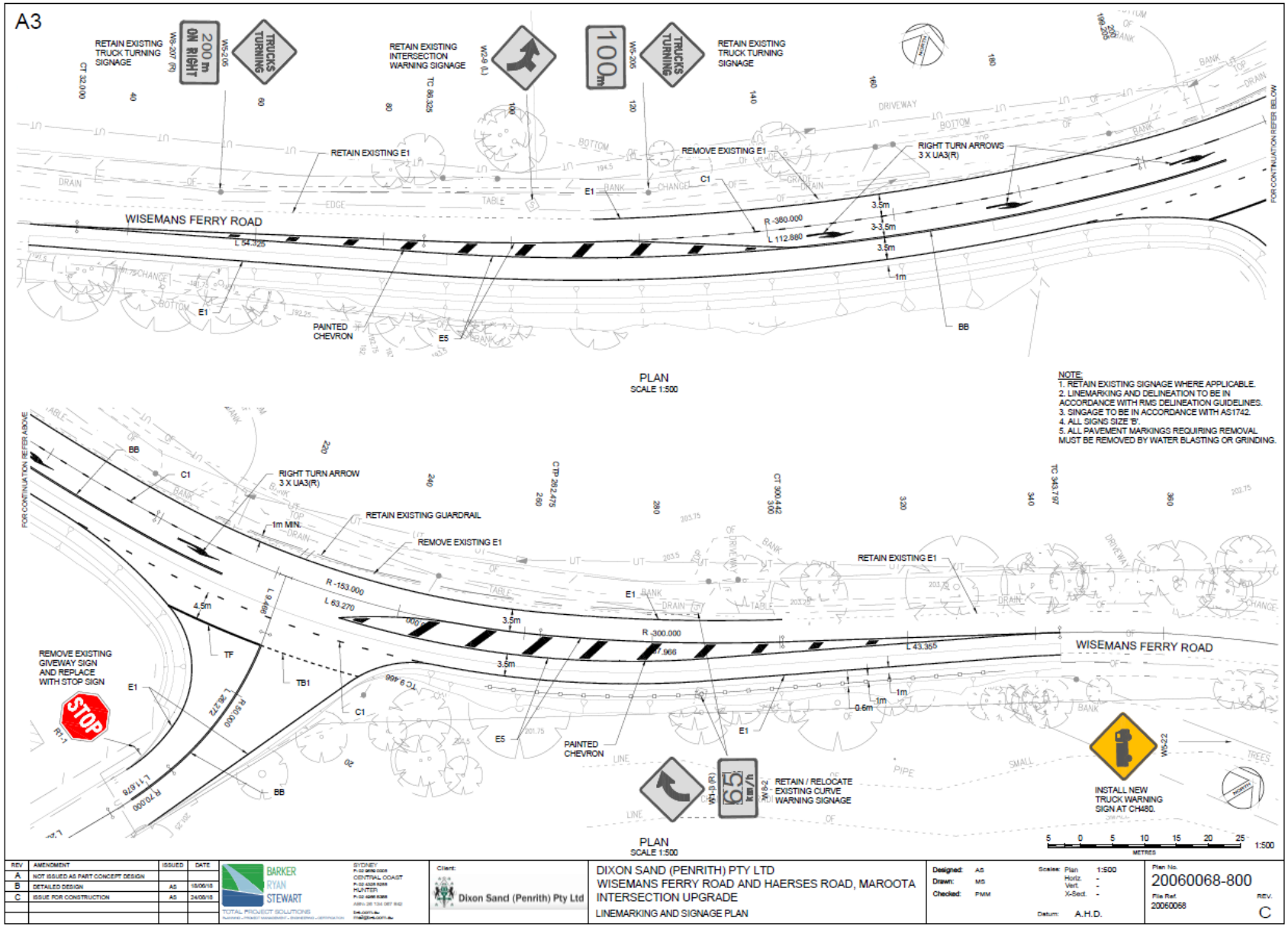
Photo 3 – View looking south along Haerses Road from Wisemans Ferry Road

Photo 4 – View looking north along Old Northern Road to the intersection with Wisemans Ferry Road

Attachment B: Proposed Upgrades to Haerses Road / Wisemans Ferry Road







REV	AMENDMENT	ISSUED	DATE
A	NOT ISSUED AS PART CONCEPT DESIGN		
B	DETAILED DESIGN	AS	15/06/15
C	ISSUE FOR CONSTRUCTION	AS	24/06/15

BARKER RYAN STEWART
TOTAL PROJECT SOLUTIONS

Client: Dixon Sand (Penrith) Pty Ltd

DIXON SAND (PENRITH) PTY LTD
WISEMANS FERRY ROAD AND HAERSES ROAD, MAROOTA
INTERSECTION UPGRADE
LINEMARKING AND SIGNAGE PLAN

Designed: AS
Drawn: MS
Checked: PMM
Scales: Plan 1:500, Horiz. -, Vert. -, X-Sect. -
Datum: A.H.D.

Plan No. 20060068-800
File Ref. 20060068
REV. C

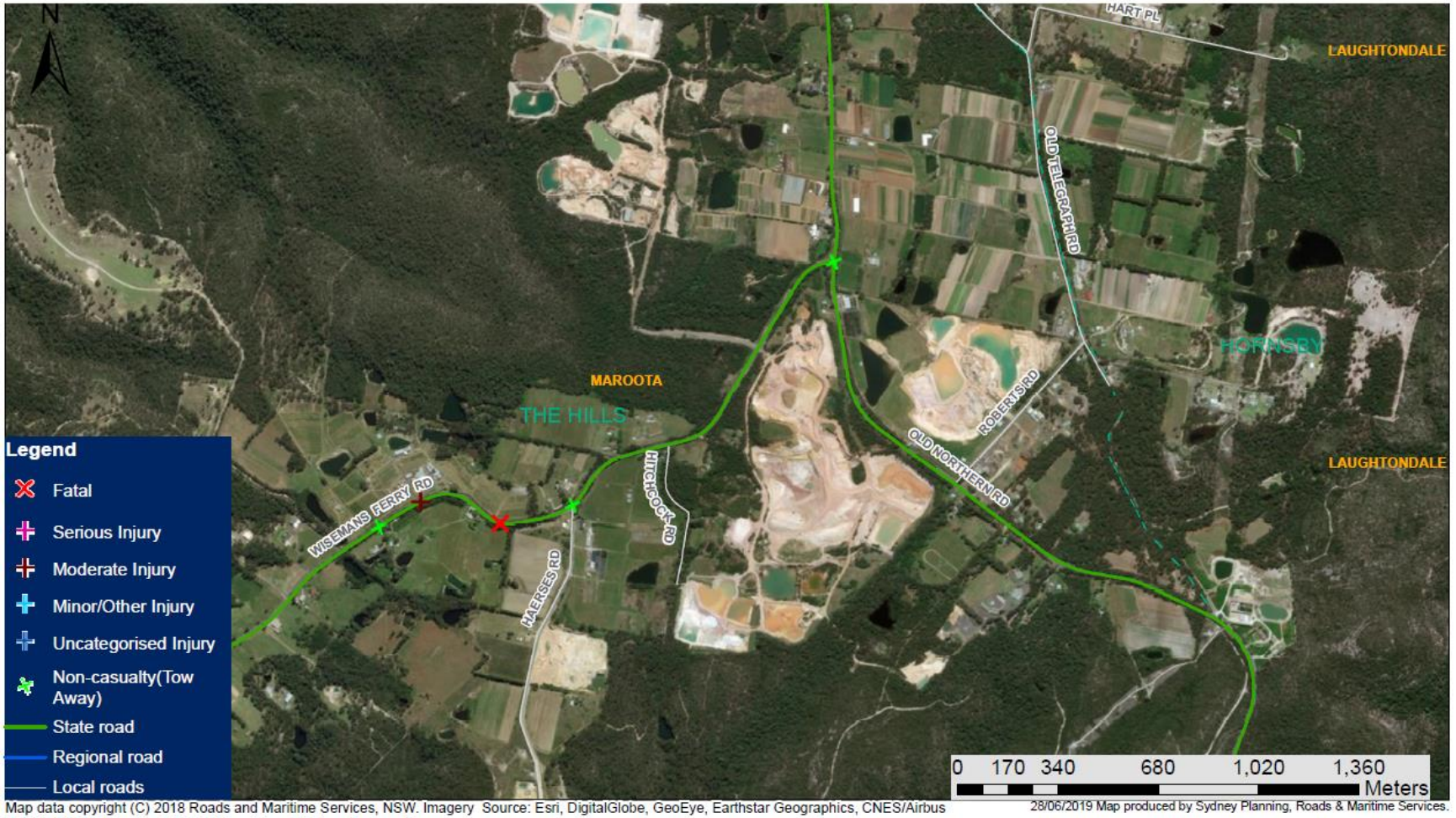
Attachment C: RMS Crash Data

Transport Roads & Maritime Services

NSW GOVERNMENT

Maroota Crash Data

Crash Data Period: 1 October 2013 to 30 September 2018 (2018p)



Map data copyright (C) 2018 Roads and Maritime Services, NSW. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus

28/06/2019 Map produced by Sydney Planning, Roads & Maritime Services.

Detailed Crash Report

Transport for NSW — Centre for Road Safety

NOTES: 9199 - Maroota Crash Data - All reported crashes 1 Oct 2013 to 30 Sep 2018 (2018p)

Crash No.	Data Source	Date	Day of Week	Time	Distance		ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash-Detailed	Killed	Seriously Inj.	Moderately Inj.	Minor/Other Inj.	Uncateg'd Inj.	Factors ASF
Sydney Region																									
The Hills LGA																									
Maroota																									
Old Northern Rd																									
1079624	S	31/08/2015	Mon	09:00		at	WISEMANS FERRY RD	TJN	STR	Fine	Dry	60	2	4WD	F41	S in WISEMANS FERRY RD	Unk	Turning right	NC	0	0	0	0	0	
E59793908								RUM	14	2 right turning				TRK	F U	E in OLD NORTHERN RD	Unk	Turning right							
1152207	S	10/10/2017	Tue	09:30		at	WISEMANS FERRY RD	TJN	STR	Overcast	Wet	60	2	TRK	M49	S in OLD NORTHERN RD	Unk	Proceeding in lane	NC	0	0	0	0	0	
E286112394								RUM	32	Right rear				CAR	F76	S in OLD NORTHERN RD	Unk	Turning right							
Wisemans Ferry Rd																									
1166738	S	02/04/2018	Mon	12:45		at	HAERSES RD	TJN	CRV	Fine	Dry	80	1	LOR	M33	E in WISEMANS FERRY RD	Unk	Proceeding in lane	NC	0	0	0	0	0	S
E67614572								RUM	87	Off lft/lft bnd=>obj				S/Barrier - Guardrail											
1092478	P	13/02/2016	Sat	09:25	260 m	W	HAERSES RD	2WY	CRV	Fine	Dry	80	1	M/C	M60	E in WISEMANS FERRY RD	80	Proceeding in lane	FC	1	0	0	0	0	S
E60308975								RUM	88	Out of cont on bend															
1090014	S	13/01/2016	Wed	09:10	10 m	E	NUMBER 1630 HN	2WY	CRV	Fine	Dry	80	2	TRK	M19	W in WISEMANS FERRY RD	Unk	Perform U-turn	MC	0	0	2	0	0	
E60802863								RUM	40	U turn				4WD	M71	W in WISEMANS FERRY RD	Unk	Proceeding in lane							
1111057	S	12/08/2016	Fri	20:20	2 km	W	OLD NORTHERN RD	2WY	STR	Fine	Dry	80	2	CAR	M28	W in WISEMANS FERRY RD	Unk	Incorrect side	NC	0	0	0	0	0	
E372805592								RUM	20	Head on				CAR	M19	E in WISEMANS FERRY RD	Unk	Proceeding in lane							

Report Totals: Crashes: 6 Fatal Crashes(FC): 1 Serious Injury Crashes(SC):0 Moderate Injury Crashes(MC): 1 Minor/Other Injury Crashes(OC): 0 Uncategorised Injury Crashes(UC): 0 Non-Casualty Crashes(NC): 4

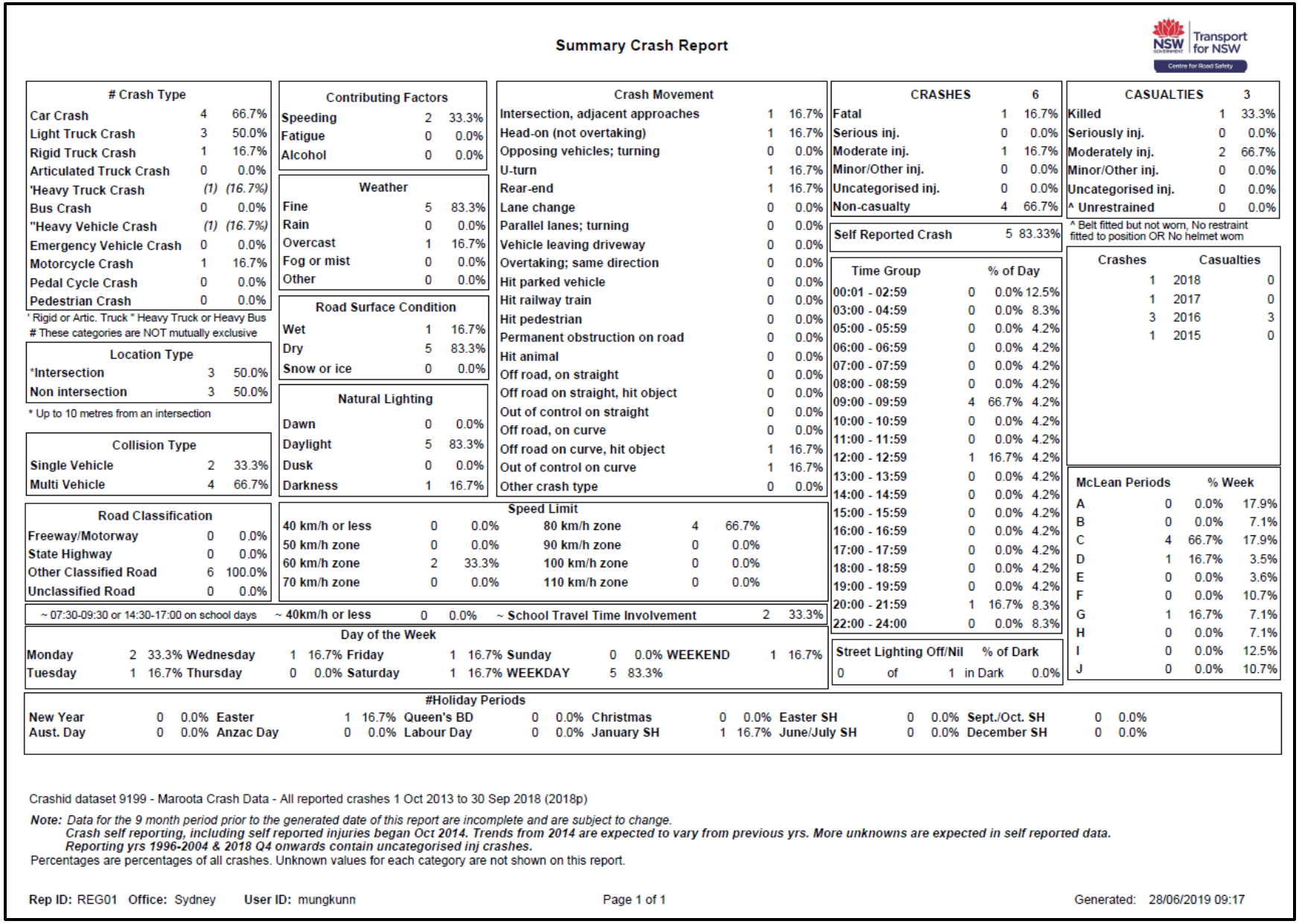
Killed(K): 1 Seriously Injured(S): 0 Moderately Injured(M): 2 Minor/Other Injured(O): 0 Uncategorised Injured(U): 0

Crashid dataset 9199 - Maroota Crash Data - All reported crashes 1 Oct 2013 to 30 Sep 2018 (2018p)

Note: *Data for the 9 month period prior to the generated date of this report are incomplete and are subject to change.*

Crash self reporting, including self reported injuries began Oct 2014. Trends from 2014 are expected to vary from previous yrs. More unknowns are expected in self reported data. Reporting yrs 1996-2004 & 2018 Q4 onwards contain uncategorised inj crashes.

Rep ID: DCR01 **Office:** Sydney **User ID:** mungkunr Page 1 of 1 Generated: 28/06/2019 09:17



Summary Crash Report

Transport for NSW — Centre for Road Safety

# Crash Type		
Car Crash	4	66.7%
Light Truck Crash	3	50.0%
Rigid Truck Crash	1	16.7%
Articulated Truck Crash	0	0.0%
'Heavy Truck Crash	*(1)*	*(16.7%)*
Bus Crash	0	0.0%
"Heavy Vehicle Crash	*(1)*	*(16.7%)*
Emergency Vehicle Crash	0	0.0%
Motorcycle Crash	1	16.7%
Pedal Cycle Crash	0	0.0%
Pedestrian Crash	0	0.0%

' Rigid or Artic. Truck " Heavy Truck or Heavy Bus
These categories are NOT mutually exclusive

Location Type		
*Intersection	3	50.0%
Non intersection	3	50.0%

* Up to 10 metres from an intersection

Collision Type		
Single Vehicle	2	33.3%
Multi Vehicle	4	66.7%

Road Classification		
Freeway/Motorway	0	0.0%
State Highway	0	0.0%
Other Classified Road	6	100.0%
Unclassified Road	0	0.0%

Contributing Factors		
Speeding	2	33.3%
Fatigue	0	0.0%
Alcohol	0	0.0%

Weather		
Fine	5	83.3%
Rain	0	0.0%
Overcast	1	16.7%
Fog or mist	0	0.0%
Other	0	0.0%

Road Surface Condition		
Wet	1	16.7%
Dry	5	83.3%
Snow or ice	0	0.0%

Natural Lighting		
Dawn	0	0.0%
Daylight	5	83.3%
Dusk	0	0.0%
Darkness	1	16.7%

Crash Movement		
Intersection, adjacent approaches	1	16.7%
Head-on (not overtaking)	1	16.7%
Opposing vehicles; turning	0	0.0%
U-turn	1	16.7%
Rear-end	1	16.7%
Lane change	0	0.0%
Parallel lanes; turning	0	0.0%
Vehicle leaving driveway	0	0.0%
Overtaking; same direction	0	0.0%
Hit parked vehicle	0	0.0%
Hit railway train	0	0.0%
Hit pedestrian	0	0.0%
Permanent obstruction on road	0	0.0%
Hit animal	0	0.0%
Off road, on straight	0	0.0%
Off road on straight, hit object	0	0.0%
Out of control on straight	0	0.0%
Off road, on curve	0	0.0%
Off road on curve, hit object	1	16.7%
Out of control on curve	1	16.7%
Other crash type	0	0.0%

Speed Limit					
40 km/h or less	0	0.0%	80 km/h zone	4	66.7%
50 km/h zone	0	0.0%	90 km/h zone	0	0.0%
60 km/h zone	2	33.3%	100 km/h zone	0	0.0%
70 km/h zone	0	0.0%	110 km/h zone	0	0.0%

~ 07:30-09:30 or 14:30-17:00 on school days | ~ 40km/h or less: 0 0.0% | ~ School Travel Time Involvement: 2 33.3%

Day of the Week												
Monday	2	33.3%	Wednesday	1	16.7%	Friday	1	16.7%	Sunday	0	0.0%	WEEKEND	1	16.7%
Tuesday	1	16.7%	Thursday	0	0.0%	Saturday	1	16.7%	WEEKDAY	5	83.3%			

CRASHES	6	
Fatal	1	16.7%
Serious inj.	0	0.0%
Moderate inj.	1	16.7%
Minor/Other inj.	0	0.0%
Uncategorised inj.	0	0.0%
Non-casualty	4	66.7%

Self Reported Crash	5	83.33%

Time Group		% of Day	
00:01 - 02:59	0	0.0%	12.5%
03:00 - 04:59	0	0.0%	8.3%
05:00 - 05:59	0	0.0%	4.2%
06:00 - 06:59	0	0.0%	4.2%
07:00 - 07:59	0	0.0%	4.2%
08:00 - 08:59	0	0.0%	4.2%
09:00 - 09:59	4	66.7%	4.2%
10:00 - 10:59	0	0.0%	4.2%
11:00 - 11:59	0	0.0%	4.2%
12:00 - 12:59	1	16.7%	4.2%
13:00 - 13:59	0	0.0%	4.2%
14:00 - 14:59	0	0.0%	4.2%
15:00 - 15:59	0	0.0%	4.2%
16:00 - 16:59	0	0.0%	4.2%
17:00 - 17:59	0	0.0%	4.2%
18:00 - 18:59	0	0.0%	4.2%
19:00 - 19:59	0	0.0%	4.2%
20:00 - 21:59	1	16.7%	8.3%
22:00 - 24:00	0	0.0%	8.3%

Street Lighting Off/Nil	% of Dark
0 of 1 in Dark	0.0%

CASUALTIES	3	
Killed	1	33.3%
Seriously inj.	0	0.0%
Moderately inj.	2	66.7%
Minor/Other inj.	0	0.0%
Uncategorised inj.	0	0.0%
^ Unrestrained	0	0.0%

^ Belt fitted but not worn, No restraint fitted to position OR No helmet worn

Crashes		Casualties
1	2018	0
1	2017	0
3	2016	3
1	2015	0

McLean Periods		%	% Week
A	0	0.0%	17.9%
B	0	0.0%	7.1%
C	4	66.7%	17.9%
D	1	16.7%	3.5%
E	0	0.0%	3.6%
F	0	0.0%	10.7%
G	1	16.7%	7.1%
H	0	0.0%	7.1%
I	0	0.0%	12.5%
J	0	0.0%	10.7%

#Holiday Periods

New Year	0	0.0%	Easter	1	16.7%	Queen's BD	0	0.0%	Christmas	0	0.0%	Easter SH	0	0.0%	Sept./Oct. SH	0	0.0%
Aust. Day	0	0.0%	Anzac Day	0	0.0%	Labour Day	0	0.0%	January SH	1	16.7%	June/July SH	0	0.0%	December SH	0	0.0%

Crashid dataset 9199 - Maroota Crash Data - All reported crashes 1 Oct 2013 to 30 Sep 2018 (2018p)

Note: Data for the 9 month period prior to the generated date of this report are incomplete and are subject to change.
Crash self reporting, including self reported injuries began Oct 2014. Trends from 2014 are expected to vary from previous yrs. More unknowns are expected in self reported data.
Reporting yrs 1996-2004 & 2018 Q4 onwards contain uncategorised inj crashes.
Percentages are percentages of all crashes. Unknown values for each category are not shown on this report.

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Attachment C: Criteria for interpreting results of SIDRA

1-Level of Service (LoS)

LoS	Traffic Signals and Roundabouts	Give Way and Stop Signs
A	Good	Good
B	Good, with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	Satisfactory	Satisfactory, but requires accident study
D	Operating near capacity	Near capacity and requires accident study
E	At capacity, excessive delay: roundabout requires other control method	At capacity, requires other control mode
F	Unsatisfactory, requires other control mode or additional capacity	Unsatisfactory, requires other control mode

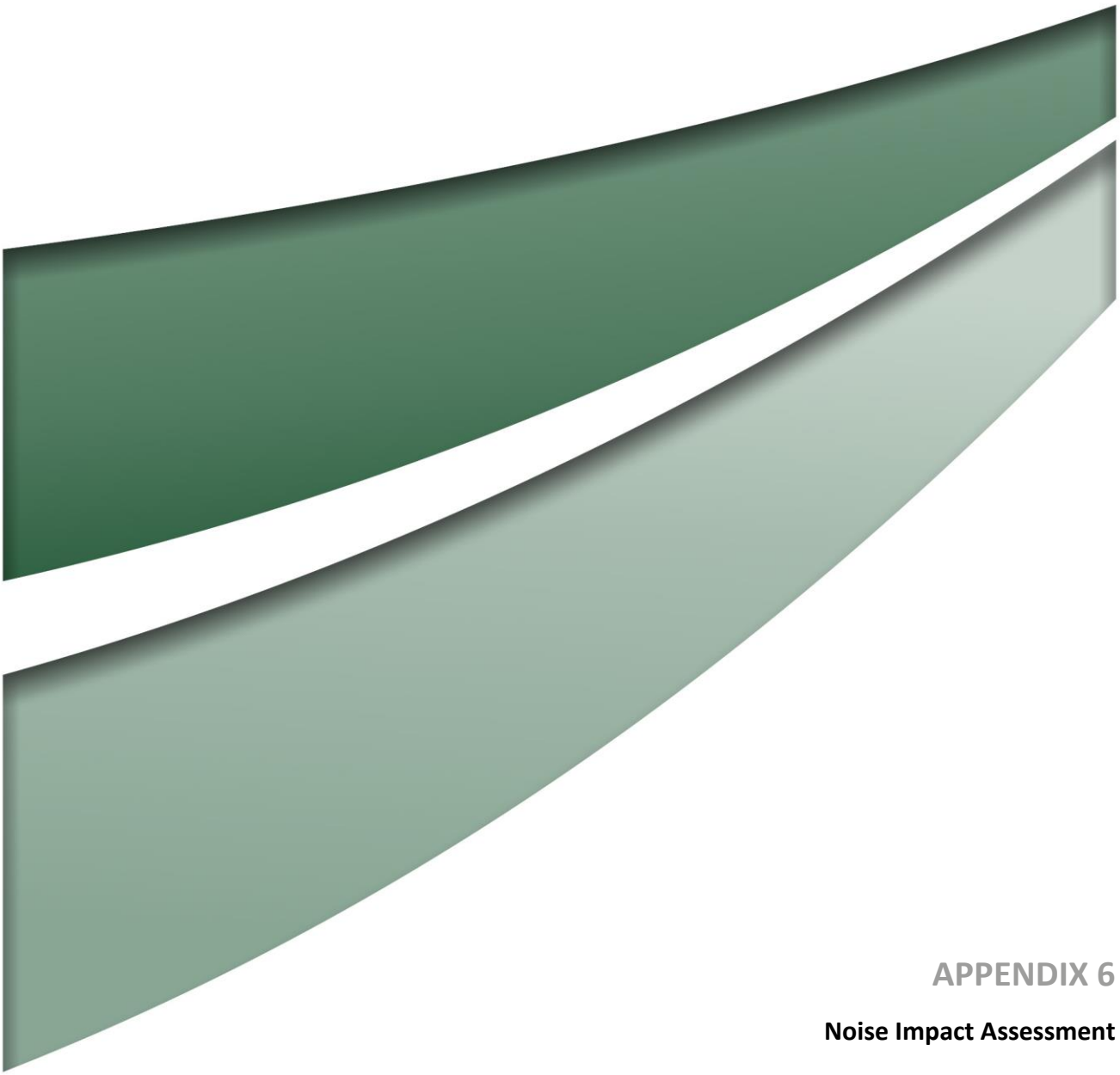
2-Average Vehicle Delay (AVD)

The AVD is a measure of operational performance of an intersection relating to its LoS. The average delay should be taken as a guide only for an average intersection. Longer delays may be tolerated at some intersections where delays are expected by motorists (e.g. those in inner city areas or major arterial roads).

LoS	Average Delay / Vehicle (secs)	Traffic Signals and Roundabouts	Give Way and Stop Signs
A	Less than 15	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	28 to 42	Satisfactory	Satisfactory but accident study required
D	42 to 56	Operating near capacity	Near capacity, accident study required
E	56 to 70	At capacity, excessive delays: roundabout requires other control	At capacity; requires other control mode
F	Exceeding 70	Unsatisfactory, requires additional capacity	Unsatisfactory, requires other control mode

3-Degree of Saturation (D/S)

The D/S of an intersection is usually taken as the highest ratio of traffic volumes on an approach to an intersection compared with the theoretical capacity and is a measure of the utilisation of available green time. For intersections controlled by traffic signals, both queues and delays increase rapidly as DS approaches 1.0. An intersection operates satisfactorily when its D/S is kept below 0.75. When D/S exceeds 0.9, queues are expected.



APPENDIX 6

Noise Impact Assessment

umwelt
Environmental & Social Consultants

DIXON SAND

HAERSES ROAD QUARRY MODIFICATION 3

Noise Impact Assessment

FINAL

December 2019

DIXON SAND

HAERSES ROAD QUARRY MODIFICATION 3

Noise Impact Assessment

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Dixon Sand (No. 1) Pty Limited

Project Director:	Alex Irwin
Project Manager:	Ruth Tapp
Technical Manager:	Dave Davis
Report No.	4607/R06
Date:	December 2019

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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
Final V3	Dave Davis	6 December 2019	Alex Irwin	6 December 2019

Table of Contents

Figures

Tables

Appendices

1.0 Introduction

1.1 Project Overview

Dixon Sand (No.1) Pty Limited (Dixon Sand) operates the Haerses Road Quarry (the Quarry) on land adjoining Haerses Road at Maroota in New South Wales (NSW), within the Hills Shire Council Local Government Area (LGA) (refer to **Figure 1.1**). The Quarry site is approximately 128 hectares (ha) and includes Lot 170 DP 664766, Lot 170 DP 664767, Lots A and B DP 407341, Lots 176, 177 and 216 DP 752039 which adjoin Haerses Road. Haerses Road is a no-through road providing access to the nominated lots of the Quarry, as well as Lot 7308 DP1163424 (Crown Land) and Lot 1 DP1139713 of Deerubbin Local Aboriginal Land Council (LALC) (formerly Maroota State Forest).

The Quarry is located within the small rural community of Maroota which supports several other sand extraction operations, including the Old Northern Road Quarry which is also operated by Dixon Sand. The Quarry supplies concrete sand and specialty sands to the Sydney metropolitan market.

Dixon Sand is proposing a modification to the development to allow for a small extension in extraction area, an increase in extraction and production rate and an associated increase in the amount of Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM) to be imported to the Quarry (the Proposed Modification). Associated with the production and importation increase and included as part of the Proposed Modification is an increase in the number of trucks permitted to travel to and from the Quarry.

1.2 The Proponent

The operator of the Quarry and proponent for the Proposed Modification is Dixon Sand Pty Limited; a family-owned and operated business supplying specialty concrete and mortar sands to the Sydney metropolitan region since 1955. Dixon Sand currently operates three quarries at Maroota (Haerses Road Quarry, Old Northern Road Quarry and Laughtondale Gully Road Quarry) and at Agnes Banks, NSW.

1.3 Planning Approval History

The Quarry operates in accordance with Development Consent DA 165-7-2005 (State Significant Development under the *State Environmental Planning Policy (State and Regional Development) 2011*), originally issued by the Minister for Planning on 14 February 2006 (the development consent). Since commencing operations in 2006, the DA 165-7-2005 has been modified twice.

- The first modification (MOD 1) was issued under (the now repealed) Section 75W of *the Environmental Planning and Assessment Act 1979* (EP&A Act) on 22 January 2018 and approved an extension to the extraction area as well as the importation of VENM and ENM.
- The second modification (MOD 2) was issued under Section 4.55(A) of the EP&A Act on 29 January 2019 to correct an inconsistency between the approved area of disturbance and identified buffers to this disturbance.

The Proposed Modification described in this report will be the third modification to DA 165-7-2005.

1.4 Substantially the Same Development

With respect to the Proposed Modification, no additional development type or activity is proposed. The site would continue to be operated as an extractive industry (sand quarry) targeting the same resource, undertaking the same processing operations and importing VENM/ENM for selective processing and final landform construction (refer to **Figure 1.2**). Quantitatively there are some differences between the development as currently approved and the Proposed Modification. However, increases in extraction and production rates are to be balanced by the implementation of operational and environmental controls which would ensure that these modifications do not to impact on ‘‘material and essential’’ elements of the current development.

On the basis of their being no additional activities proposed, with increases to extraction, production and transportation limits managed to minimise impacts, it is concluded that the modified development will be substantially the same as the current operations, as last modified, for the purpose of Section 4.55 of the EP&A Act.

1.5 Noise Impact Assessment

This Noise Impact Assessment (NIA) forms part of the SEE for Haerses Road Quarry Modification 3, which has been prepared by Umwelt (Australia) Pty Ltd (Umwelt).

Additional proposed noise sources associated with the modification were added to a noise model of the existing approved operations at the Quarry, and these noise predictions were compared to noise assessment levels derived in accordance with the NSW Noise Policy for Industry (2017) (NPfI). All noise sources were considered to be operational noise sources as per the NPfI, rather than construction noise sources.

A road traffic noise assessment was also undertaken to assess the impact of additional trucks on the road network in accordance with the NSW Road Noise Policy (2011). Seca Solution (Seca) undertook the Traffic Impact Assessment (TIA), which was used as the source of traffic volumes used in the road traffic noise assessment.

Noise logging was undertaken at two locations in the vicinity of the quarry to quantify the existing noise environment and to derive assessment noise levels in accordance with legislative requirements.

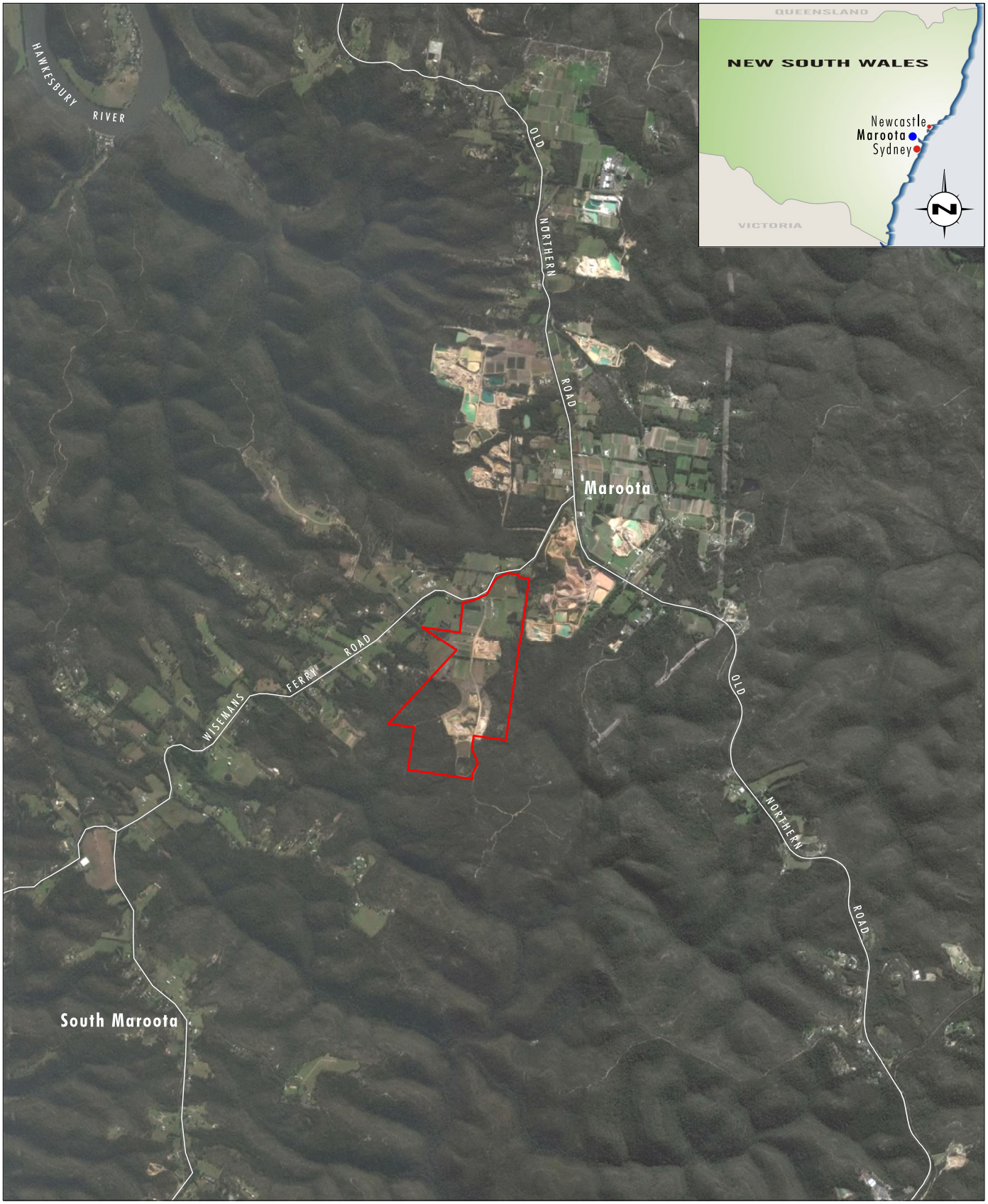

Image Source: Google Earth (2014)

0 0.5 1.0 2.0km
1:50 000

Legend

Haerses Road Quarry Site

FIGURE 1.1

Locality Map

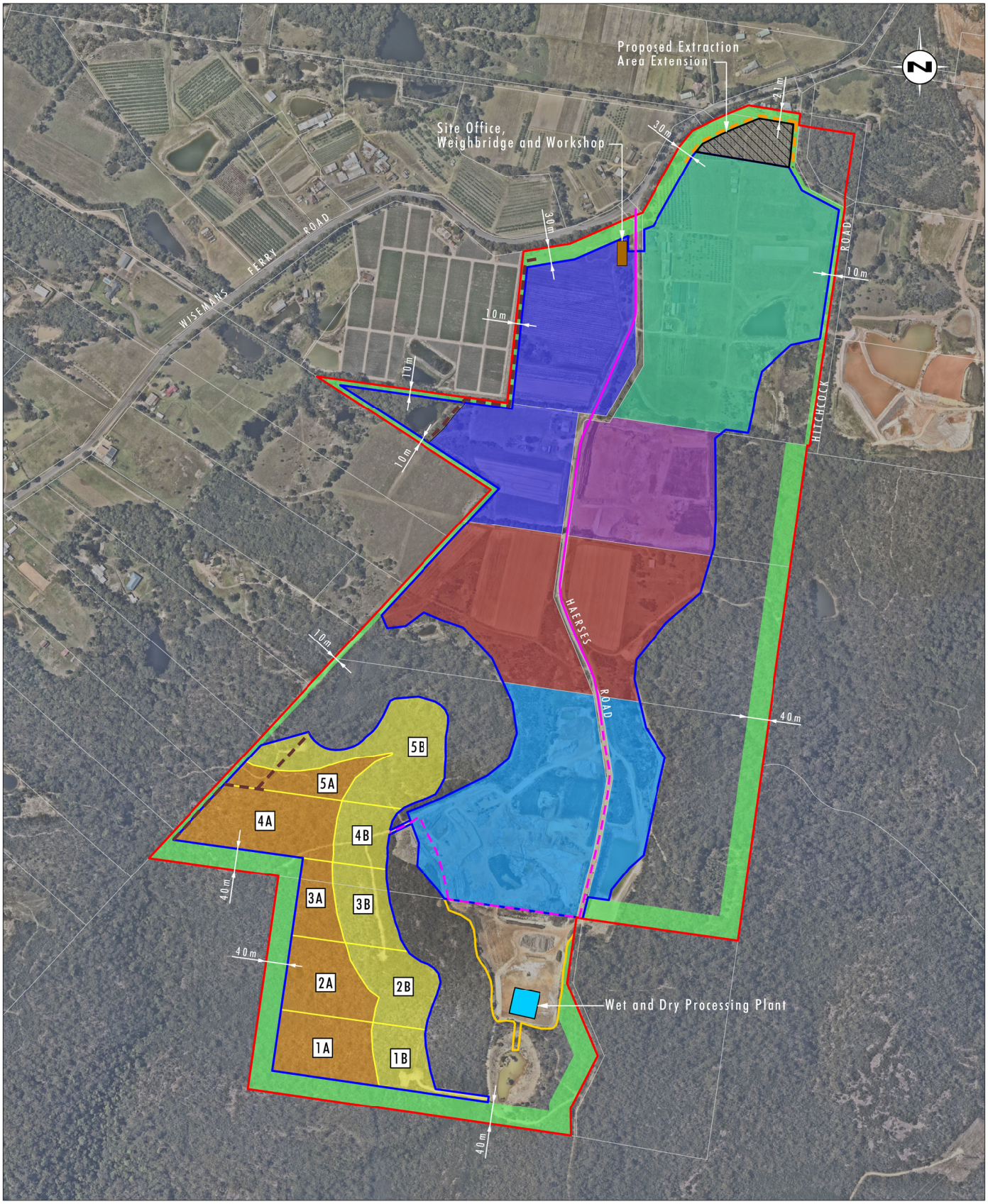

Image Source: Nearmap (Dec 2018)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2019)

0 100 250 500m
1:10 000

Legend

- Haerses Road Quarry Site
- Processing and Stockpiling Area
- Buffer Zone
- Approved Extraction Area
- Approved Extraction Area A
- Approved Extraction Area B
- 1 Extraction Cell Number
- Wet Processing Plant
- Approved Extraction Area Stage 1
- Approved Extraction Area Stage 2
- Approved Extraction Area Stage 3
- Approved Extraction Area Stage 4
- Approved Extraction Area Stage 5
- Site Office, Weighbridge and Workshop
- Indicative Unsealed Haul Road
- Approved Acoustic Bund
- Proposed Acoustic Bund
- Sealed Haul Road
- Proposed Extraction Area Extension

FIGURE 1.2

Site Plan

File Name (A4): R06/4607_040.dgn
20191029 18.03

2.0 Proposed Modification

2.1 Summary

Table 2.1 provides a comparative analysis of the Proposed Modification against DA 165-7-2005, as originally approved and as last modified in January 2018. The most recent modification was to correct a minor discrepancy to the identification and presentation of buffer zones around the Quarry.

Table 2.1 Comparison of the Proposed Modification to the Originally Approved and Modified Haerses Road Quarry

Quarry Component	Originally Approved	As Modified (January 2018) (MOD 1)	Proposed Modification
Quarry life	Quarry operations to cease 14 February 2031	Additional 15 years i.e. quarry operations to cease 2046	No change
Limit on production	250,000 tpa	No change	495,000 tpa
Maximum transport of product	To Old Northern Road Quarry:		
	190,000 tpa	No change	No change
	Direct to market:		
	60,000 tpa	Up to 250,000 tpa	Up to 495,000 tpa
Truck movements	28 truck movements into Haerses Road per day (10 movements allowed between 6am and 7am) 28 truck movements out of Haerses Road per day (0 - 7 left hand turns, 21 - 28 right hand turns)	56 truck movements per day (total in and out) Up to 20 vehicle movements between 6am and 7.00am Removal of restriction on direction of truck movements	Up to 180 truck movements per day (total in and out)
Total disturbance footprint	Approximately 52 ha	Approximately 74.5 ha	Approximately 75.5 ha
Overburden	Used for acoustic barriers or stockpiled and used to fill voids	No change	No change
Importation of material	Not included in approved operations	Receival of up to 100,000 tpa of VENM/ENM Reprocessing of clean recycled sand component of VENM/ENM for sale	Increase to 250,000 tpa of VENM/ENM for landform construction or reprocessing and sale
Infrastructure	Haerses Road is key haul road with existing dams used for water supply	House conversion to site office Construction of site workshop, weighbridge and gravel car parking area	No change

Quarry Component	Originally Approved	As Modified (January 2018) (MOD 1)	Proposed Modification
Equipment	Front end loader (1), 40 t excavator (1), 30 t trucks (2), water cart (1), mobile dry screen, dozer, grader, service vehicle	Additional mobile jaw and rotary crushers and wet processing plant	40 t trucks (2) to replace 30 t trucks (2) Additional excavator Additional front-end loaders (3)
Hours of operation	Monday to Saturday 7am to 6pm Vehicle access and sand loading 6.00am to 7.00am Monday to Saturday No work on Sundays and public holidays	No change	No change
Employment	Equivalent to 2 people full time	Up to 8 people full time	Up to 16 people full time

2.2 Key Modifications

Quarry operations are to continue generally in accordance with the current restrictions imposed by DA 165-7-2005. Modification to the noise limits in DA 165-7-2005 are proposed, in accordance with the *Noise Policy for Industry*. The following provides a description of the key changes to Quarry operations proposed by this modification.

2.2.1 Extraction Area Extension

Dixon Sand propose to extend Stage 5 of the Tertiary Sand Extraction Area, which is currently 80 metres (m) from Lot 3 DP111886 to the north (owned by Dixon Sand) (and 100 m to the private landholding on Lot 11 DP835992):

- 30 m from Wisemans Ferry Road to the northwest,
- the boundary of Lot 3 DP111886 (owned by Dixon Sand), and
- 10 m from Hitchcock Road.

The Proposed Modification provides for the 5 m high acoustic bund, which is currently approved for construction along the northern perimeter of Stage 5, to be relocated to the modified northern perimeter of Stage 5. Based on feedback received from the landowners and residents of properties directly north of the Quarry, the bund would only be constructed and retained for as long as required to maintain the noise levels received at residential receivers to the north below Quarry noise limits (unless requested to be retained by these residents). Dixon Sand will liaise with the landowners and residents to the north of the Quarry Site prior to extraction in Stage 5 for which this bund provides for noise impact mitigation. Subject to agreement with these landowners and residents (who may be different towards the end of the Quarry life when the bund is required), or demonstration of compliance with noise criteria by alternative methods, the bund may not be constructed.

No change to extraction methods are proposed. Furthermore, Dixon Sand would continue to implement the restrictions on equipment usage and other management, mitigation and monitoring measures nominated in the Quarry *Noise Management Plan* and *Acoustic Bund Construction Noise Management Plan*.

2.2.2 Extraction Rate Increase

The Proposed Modification seeks to increase the rate of extraction from the Quarry from 250,000 to 495,000 tpa. The proposed extraction rate increase would better reflect the approved resource available for extraction which includes the additional 15 million tonnes (Mt) approved by MOD 1 in January 2018.

Extraction would continue to be from both the friable sandstone and tertiary sand extraction areas, with current customer demand suggesting a roughly ⅔ : ⅓ proportional split between the two areas respectively. This ratio, which could change over the life of the Quarry subject to customer demand, would result in the completion of extraction within each area at roughly the same time. At the maximum extraction rate, this would require approximately 30 years to exhaust the approved resource.

Extraction is typically undertaken in either the tertiary sand or the friable sandstone deposit to improve efficiency and reduce fuel usage associated with extraction and haulage. Typical operating/rehabilitation scenarios adopted are:

1. Tertiary sand extraction – whilst extraction is undertaken within the tertiary sand extraction area, VENM and ENM placement and profiling would be undertaken within the friable sandstone extraction area.

2. Friable sandstone extraction – whilst extraction is undertaken in the friable sandstone extraction area (requiring the use of the bulldozer to rip the sandstone), land profiling, preparation and rehabilitation would be undertaken in completed sections of the tertiary sand extraction area.

2.2.3 VENM/ENM Importation Increase

The current approved operation extracts and blends friable Hawkesbury sandstone material with tertiary sand to make a wide range of specialty sands, both dry and wet. The type of product varies with market fluctuations and demand.

In order to keep pace with the proposed increase in extraction rate, which would result in the extraction area being developed up to twice as quickly as could currently occur, an increase in VENM or ENM importation is proposed to allow for the extraction area to be backfilled at an equivalently increased rate. The proposed increase in VENM and ENM importation from 100,000 to 250,000 tpa is proportionally larger (150 %) than the increase in extraction and production rate (~100 %), however, this reflects two factors which could influence how much backfill material is required and how much VENM and ENM is imported.

1. A potential reduction in the amount of sand washed at the Quarry and therefore the volume of silt available for placement and consolidation as a backfill material. Recent drilling results have identified that a significant proportion of the sand is more suitable as a mortar (brickies) sand product which relies on less washed sand. With less sand to be washed, less silt will be generated for use in extraction area backfill and progressive final landform construction.

2. A potential increase in the amount of imported VENM and ENM reprocessed and either sold directly or blended and sold from the Quarry.

Market fluctuations and demand for product over the consent period (until 2046) will also impact the amount of each material available for backfilling.

2.2.4 Increase to Traffic Movements

An increase in the number of daily heavy vehicle movements permitted to access or depart the Quarry from 56 truck per day currently to 180 trucks per day is proposed. This will accommodate both the proposed increase in sales direct to market, which are likely to include smaller capacity trucks than those currently operating between the Haerses Road and Old Northern Road quarries, as well as the importation of clean fill.

The Proposed Modification does not seek to increase the volume of quarry product permitted to be transported between Haerses Road Quarry and Old Northern Road (190,000 tpa).

Furthermore, no changes are proposed to:

- the approved operating hours for the Quarry, and/or
- the existing access arrangements and transport routes.

Where possible, Dixon Sand would continue to undertake 'double trucking' whereby an inbound laden truck (carrying VENM or ENM) would unload and then be loaded with quarry product and become an outbound laden truck.

3.0 Existing Noise Environment

The site is located within a rural environment with typically low background noise levels. Existing noise sources include local road traffic, agricultural activities and industrial contributions from other nearby quarries.

3.1 Measured Existing Noise Levels

Existing noise levels were measured at two locations as shown in Figure 3.1. Noise levels were measured in general accordance with Australian Standard 1055-2018 *Acoustics – Description and measurement of environmental noise* and the NPfI (EPA, 2017). Existing ambient noise levels were measured at two properties with frontage to Wisemans Ferry Road, Maroota. Location L1 was at a residence approximately 350 m west of Haerses Road and Location L2 was on the corner of Wisemans Ferry Road and Hitchcock Road to the east of Haerses Road. These monitoring locations were selected to be representative of the potentially affected noise receivers on Wisemans Ferry Road located away from (L1) and closer to Old Northern Road (and associated traffic and other quarry operations).

The results of the noise monitoring are summarised in **Table 3.1**. The values shown in **Table 3.1** are the measured equivalent continuous noise levels (LAeq, period) and the measured rating background levels (RBL) (10th percentile LA90 noise levels). The full noise monitoring results are shown graphically in **Appendix A** and **Appendix B**.

Table 3.1 Noise Monitoring Results dB(A)[1]

Location	LAeq Day 7.00am-6.00pm	LAeq Evening 6.00pm-10.00pm	LAeq Night 10.00pm-7.00am	RBL Day 7.00am-6.00pm	RBL Evening 6.00pm-10.00pm	RBL Night 10.00pm-7.00am
L1 1643 Wisemans Ferry Road, Maroota	60	53	54	36	32	27
L2 5 Hitchcock Road (corner Wisemans Ferry Road), Maroota	60	48	47	34	31	24

Note: 1. noise levels measured during periods of unsuitable meteorological conditions were excluded from the data set

Meteorological data was obtained from the private weather station located at Maroota Public School approximately 1.6 kilometres (km) north-west, and noise data measured during periods of unsuitable weather conditions were excluded from the noise data analysis. Unsuitable weather included periods of rain or when wind speeds exceeded 5 m/s, as defined in the NPfI.

3.2 Noise Receivers

The potentially affected noise receivers in the vicinity of the Project are shown in **Table 3.2** and **Figure 3.1**. There are several other premises near the Project however they are not classified as noise receivers due to their property ownership.

Table 3.2 Noise Receivers

Receiver	Street Address	Property Description	Coordinates (UTM)	
			Easting	Northing
R01	1710 Wisemans Ferry Road	92/DP594889	312924	6295200
R02	1700 Wisemans Ferry Road	A/DP397251	312780	6295033
R03	1643 Wisemans Ferry Road	1/DP230742	312454	6294919
R04	1617 Wisemans Ferry Road	2/DP230742	312177	6294850
R05	1579 Wisemans Ferry Road	10/DP38294	311939	6294631
R06	1543 Wisemans Ferry Road	13/DP38294	311871	6294275
R07	1539 Wisemans Ferry Road	14/DP38294	311600	6294343
R08	1521 Wisemans Ferry Road	15/DP38294	311702	6294162
R09	1517 Wisemans Ferry Road	16/DP38294	311543	6294146
R10	1499 Wisemans Ferry Road	17/DP38294	311283	6294161
R11	1487 Wisemans Ferry Road	1/DP528753	311179	6294076
R12	1725 Wisemans Ferry Road	11/DP835992	313049	6295163
R13	1728 Wisemans Ferry Road	91/DP594889	313018	6295228
R14	1638 Wisemans Ferry Road	4/DP530930	312353	6295030
R15	1630 Wisemans Ferry Road	2/DP808816	312207	6294990
R16	1602 Wisemans Ferry Road	1/DP808816	312103	6295021
R21	1559 Wisemans Ferry Road	12/DP38294	312031	6294320

The noise monitoring locations which are considered to be representative of the receivers, based on their proximity to the Quarry and Old Northern Road (taken to be whether they are located to the east or west of Haerses Road), are:

- Monitoring location L1: Receivers R03, R04, R05, R06, R07, R08, R09, R10, R11, R14, R15, R16, R21
- Monitoring location L2: Receivers R01, R02, R12, R13.

3.3 Meteorological Data Analysis

Meteorological data was collected from a nearby weather station located at Maroota Public School and was analysed to ascertain the prevalence of noise-enhancing conditions in accordance with the NPfI Fact Sheet D *Accounting for noise-enhancing weather conditions* and the guideline *Procedures to estimate the frequency of wind conditions that enhance noise levels* (Department of Climate Change and Water, 2009). The raw meteorological data set used was consistent with the data set used for the Air Quality Impact Assessment for this Modification (Dixon Sand Haerses Road Quarry Modification – Air Quality Assessment (ERM Ref 0508538-R1, 19 September 2019)) (Data set period: 01 January 2017 to 31 December 2017).

The analysis concluded that Noise-enhancing meteorological conditions are a significant feature of the area during the day and the night time periods. During the day time period, wind speeds up to 3 m/s generally from the SSW were found to occur for more than 30 % of the time. During the night period, atmospheric stability class condition “F” was found to occur for more than 30% of the night time period during the winter months.

In accordance with the NPfI, the noise assessment has been undertaken by incorporating these meteorological conditions into the noise predictions. Additionally, noise predictions have also been undertaken assuming Standard meteorological conditions (i.e. calm winds, atmospheric stability class “D”) during the day time period, to include the possible case where this meteorological condition may constitute the worst-case condition at some receivers.

A summary of the meteorological data analysis is presented in **Appendix C**.

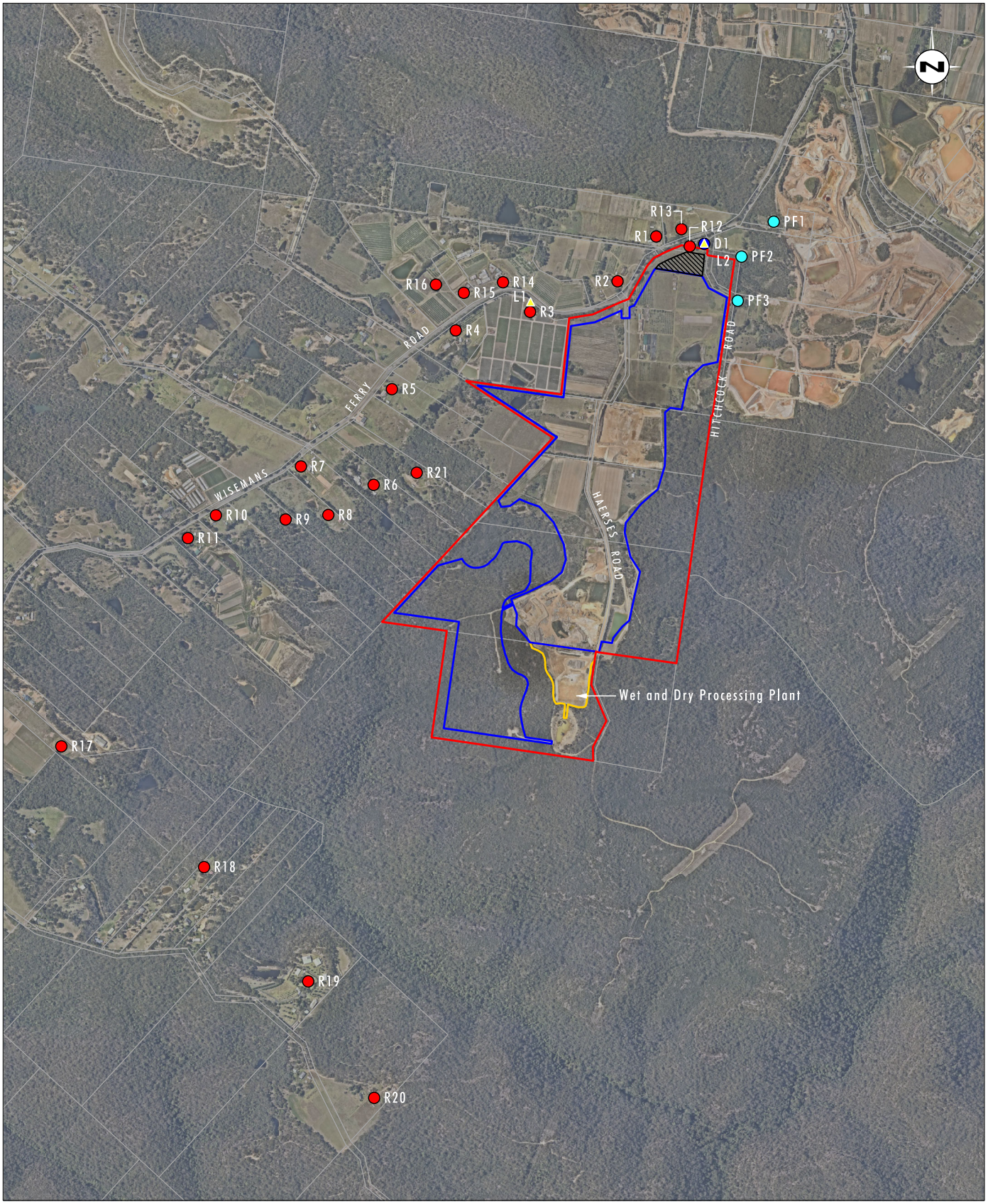

Image Source: Nearmap (Dec 2018)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2019)

0 0.25 0.5 1.0km
1:20 000

Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Processing and Stockpiling Area
- Proposed Extraction Area Extension
- Noise Logging Locations
- Noise Receiver Locations
  - Residential
  - Owned by Dixon Sand
  - Owned by PF Formation

FIGURE 3.1

Background Noise Logging and Noise Receiver Locations

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4.0 Noise Assessment Framework

The potential noise impacts of the Proposed Modification have been assessed against the NPfI (EPA, 2017).

The policy sets out a process for industrial noise management involving the following main steps:

1. Determining the project noise trigger levels (PNTL) for a development (NPfI Section 2); these are the benchmark levels above which noise management measures are required to be considered. They are derived by considering two factors: shorter-term intrusiveness due to changes in the noise environment (NPfI Section 2.3) and maintaining the noise amenity of an area (NPfI Section 2.4). Measurement of existing background levels, using procedures outlined in NPfI Fact Sheets A and B, is required for this step.

2. Predicting or measuring the noise levels produced by the development (NPfI Section 3.3), having regard to the presence of annoying noise characteristics (NPfI Fact Sheet C) and meteorological effects such as temperature inversions and wind (NPfI Fact Sheet D).

3. Comparing the predicted or measured noise level with the PNTL, and assessing impacts and the need for noise mitigation and management measures (NPfI Section 3.4).

4. Considering residual noise impacts, that is, noise levels that exceed the PNTLs after the application of feasible and reasonable noise mitigation measures. This may involve balancing economic, social and environmental costs and benefits from the proposed development against the noise impacts, including consultation with the affected community where impacts are expected to be significant (NPfI Sections 3.2 and 4).

5. Setting statutory compliance levels that reflect the best achievable and agreed noise limits for the development (NPfI Section 5).

6. Monitoring and reporting environmental noise levels from the development (NPfI Section 7).

4.1 Operational Noise Assessment Levels

4.1.1 Noise Policy for Industry Assessment Noise Levels

The PNTLs derived in accordance with the NPfI provide a benchmark or objective for assessing a proposal or site. It is not intended for use as a mandatory requirement. The PNTL is a level that, if exceeded, would indicate a potential noise impact on the community, and so 'trigger' a management response; for example, further investigation of mitigation measures.

The PNTL, feasible and reasonable mitigation, and consideration of residual noise impacts are used together to assess noise impact and manage the noise from a proposal or site.

The PNTL is the lower (that is, the more stringent) value of the project intrusiveness noise level (PINL) and project amenity noise level (PANL) determined in the NPfI Sections 2.3 and 2.4. Neither the intrusiveness noise levels nor the amenity noise levels are used directly as regulatory noise limits.

4.1.2 Project Intrusiveness Noise Level

The PINL ($L_{Aeq(15\ minute)}$) is defined as the rating background noise level (RBL) + 5 dB. The RBL is determined by measurement of the long-term background noise level L_{A90} and calculated in accordance with the NPfI Fact Sheets A and B. However, the PINL for the evening period should not be set at greater than the PINL for the day period, and the PINL for the night period should not be set greater than the PINL for the day or evening periods.

The NPfI (Table 2.1) provides minimum assumed RBLs. If the RBLs derived from site measurements are lower than the minimum assumed RBLs, the PINLs are based on the minimum assumed RBLS, as shown in **Table 4.1**.

Table 4.1 Minimum Assumed RBLs and PINLs (NPfI Table 2.1)

Time of day	Minimum assumed rating background noise level dB(A)	Minimum project intrusiveness noise level $L_{Aeq(15\ minute)}$ dB(A)
Day period (7.00am-6.00pm Monday -Saturday; 8.00am-6.00pm Sunday & Public Holidays)	35	40
Evening period (6.00pm-10.00pm)	30	35
Night period (10.00pm – commencement of day period)	30	35

The project RBLs are derived as the greater of the measured RBLs shown in **Table 3.1** and the minimum assumed RBLs shown in **Table 4.1**.

The derived PINLs based on the RBLs are shown in **Table 4.2**.

Table 4.2 Derived Project Intrusiveness Noise Levels at Receivers $L_{Aeq(15\ minute)}$ dB(A)

Receiver	RBL			PINL		
	Day	Evening	Night	Day	Evening	Night
R01	35	31	35	40	36	35
R02	35	31	35	40	36	35
R03	36	32	35	41	37	35
R04	36	32	35	41	37	35
R05	36	32	35	41	37	35
R06	36	32	35	41	37	35
R07	36	32	35	41	37	35
R08	36	32	35	41	37	35
R09	36	32	35	41	37	35
R10	36	32	35	41	37	35
R11	36	32	35	41	37	35
R12	35	31	35	40	36	35
R13	35	31	35	40	36	35
R14	36	32	35	41	37	35
R15	36	32	35	41	37	35
R16	36	32	35	41	37	35
R21	36	32	35	41	37	35

4.1.3 Project Amenity Noise Levels

The PANLs ($L_{Aeq(period)}$) at receivers are defined as the recommended amenity noise levels in NPfI Table 2.2 minus 5 dB(A). For derivation of the PTNLs, the PANLs $L_{Aeq(period)}$ are converted to $L_{Aeq(15\ minute)}$ by the addition of 3 dB(A). The PANL at a receiver depends on the type of receiver and the noise amenity area of each receiver. All receivers potentially affected by the project are residential, and all are within Rural amenity areas. The project PANLs are shown in **Table 4.3**.

Table 4.3 Project Amenity Noise Levels – Residential Receiver, Rural Noise Amenity Area

Time of day	Recommended amenity noise level $L_{Aeq(period)}$ dB(A)	PANL $L_{Aeq(period)}$ dB(A)	PANL $L_{Aeq(15\ minute)}$ dB(A)
Day period (7.00am-6.00pm Monday -Saturday; 8.00am-6.00pm Sunday & Public Holidays)	50	45	48
Evening Period (6.00pm – 10.00pm)	45	40	43
Night period (10.00pm to commencement of day period)	40	35	38

4.1.4 Project Noise Trigger Levels

The PNTLs are defined as the lower (that is, the more stringent) of the PINL and the PANL in terms of $L_{Aeq(15\ minute)}$ noise levels, given in **Table 4.4**.

Table 4.4 Project Noise Trigger Levels $L_{Aeq(15\ minute)}$ dB(A)

Receivers	Time of day	PINL	PANL	PNTL
R03, R04, R05, R06, R07, R08, R09, R10, R11, R14, R15, R16, R21	Day period (7.00am-6.00pm Monday - Saturday; 8.00am-6.00pm Sunday & Public Holidays)	41	48	41
	Evening Period (6.00pm – 10.00pm)	37	43	37
	Night period (10.00pm to commencement of day period)	35	38	35
R01, R02, R12, R13	Day period (7.00am-6.00pm Monday - Saturday; 8.00am-6.00pm Sunday & Public Holidays)	40	48	40
	Evening Period (6.00pm – 10.00pm)	36	43	36
	Night period (10.00pm to commencement of day period)	35	38	35

4.1.5 Shoulder Period

The measured $L_{A90(15\ minute)}$ background noise levels at both monitoring locations L1 and L2 during the shoulder period 6.00am to 7.00am Monday to Saturday, the period during which the Quarry proposes to continue to operate, were higher than the minimum assumed night time period RBL of 30 dB(A).

The measured $L_{A90(15\ minute)}$ background noise levels during the shoulder period are shown in **Figure 4.1** and **Figure 4.2.**

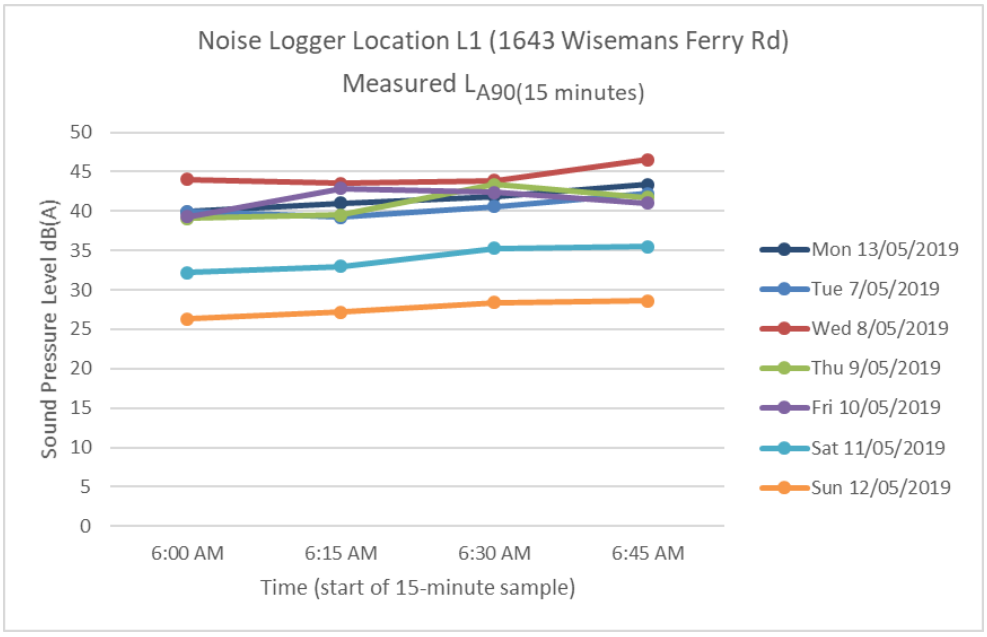

Figure 4.1 Measured $L_{A90(15\ minute)}$ noise levels during Shoulder Period at location L1

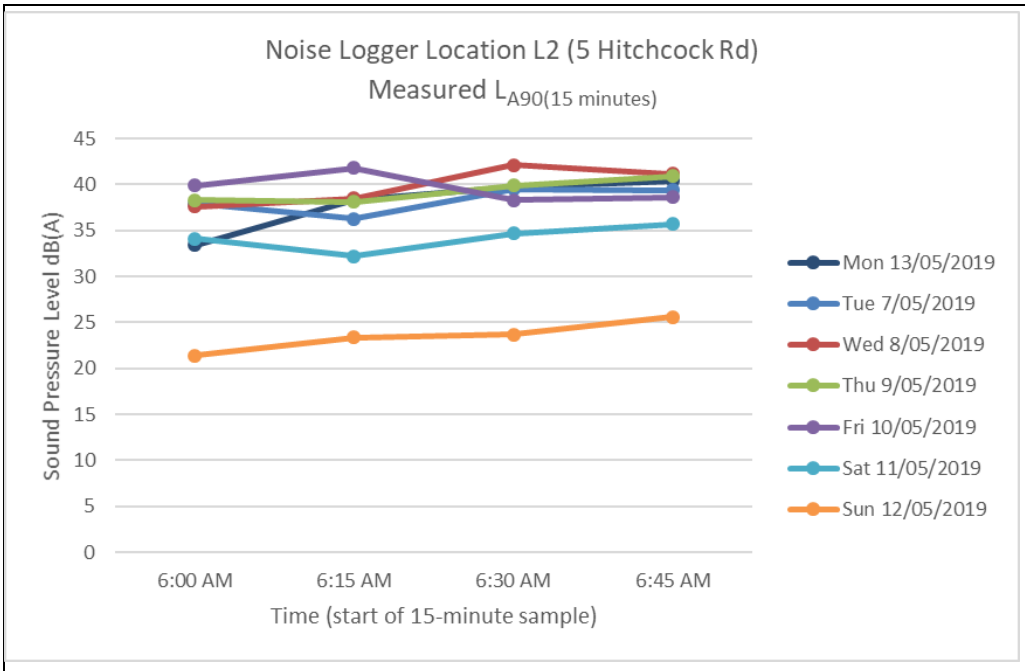

Figure 4.2 Measured $L_{A90(15\ minute)}$ noise levels during Shoulder Period at location L2

The shoulder period rating background noise levels are derived as the 10th Percentile $L_{A90(15\ minute)}$ noise levels during the shoulder period 6am to 7am Monday to Saturday. The corresponding PINL are calculated as 5 dB(A) higher than these values, as shown in **Table 4.5**. The shoulder period PNTL is taken to be the lower of the shoulder period PINL and the PANL during the night time period.

Table 4.5 Derivation of Shoulder Period PNTL

Location	Shoulder Period RBL 10th Percentile LA90 (15 minute) 6.00am – 7.00am Monday to Saturday	Shoulder period Intrusiveness noise level PINL [RBL + 5 dB(A)]	PANL night period LAeq(15 minute)	PNTL shoulder Period LAeq(15 minute)
L1	35	40	38	38
L2	34	39	38	38

4.1.6 Maximum Noise Level Event Assessment

The potential for sleep disturbance from maximum noise level events is assessed by comparison of the predicted noise levels against the screening levels described in the NPfI Section 2.5. The NPfI screening levels are:

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

Based on the project RBL (**Table 4.2**), the screening noise levels at all receivers are:

- $L_{Aeq\ (15\ minute)}$ 40 dB(A), and
- L_{AFmax} 52 dB(A).

4.2 Road Traffic Noise Criteria

The RNP sets out criteria for road traffic noise through the provision of a framework that addresses traffic noise issues associated with new developments, new or upgraded road developments or planned building developments.

The primary haul route for the Quarry will continue to be along Wisemans Ferry Road. Trucks will access or depart the Quarry via either left-turn or right-turn at the intersection of Wisemans Ferry Road and Haerses Road. **Table 4.6** outlines the road traffic noise criteria for residential land uses and the time periods that they apply. Under the road category definitions provided in the RNP, Wisemans Ferry Road is considered a sub-arterial road.

Table 4.6 Road Traffic Noise Assessment Criteria for Residential Land Uses

Road Category	Type of Project / Land Use	Assessment Criteria dB(A)	
		Day 7.00am to 10.00pm	Night 10.00pm to 7.00am
Freeway/arterial/ sub-arterial road	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,\ (15\ hour)}$ 60 (external)	$L_{Aeq,\ (9\ hour)}$ 55 (external)

Road Category	Type of Project / Land Use	Assessment Criteria dB(A)	
		Day 7.00am to 10.00pm	Night 10.00pm to 7.00am
Local road	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq, (1\ hour)}$ 55 (external)	$L_{Aeq, (1\ hour)}$ 50 (external)

Section 3.4 of the RNP notes that where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable measures to meet assessment criteria. A secondary objective is to protect against excessive decreases in amenity as the result of a project by applying the relative increase criteria.

The EPA publication *Applying the NSW Road Noise Policy* states:

"…for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion."

In assessing noise impact, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

4.3 Voluntary Land Acquisition and Mitigation Policy (VLAMP)

Since the Quarry is categorised as a State Significant Development (SSD), the Voluntary Land Acquisition and Mitigation Policy (VLAMP) applies to the Proposed Modification. The relevant criteria are as follows.

A consent authority may apply voluntary mitigation rights where, even with the implementation of best practice management at the site:

- the noise impacts of the development would be characterised as marginal, moderate or significant (refer **Table 4.7**) at any residence on privately owned land, or
- the development would increase the total industrial noise level at any residence on privately owned land by more than 1 dB(A) and noise levels at the residence are already above the recommended amenity noise levels in Table 2.2 of the Noise Policy for Industry.

A consent authority may apply voluntary acquisition rights where, even with the implementation of best practice management at the site:

- the noise impacts of the development would be characterised as significant (refer **Table 4.7**) at any residence on privately owned land, or
- the noise generated by the development would contribute to exceedances of the acceptable noise levels plus 5 dB in Table 2.2 of the NPfI on more than 25% of any privately-owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls.

A summary of the characterisation of impacts in the VLAMP is provided in **Table 4.7**.

Table 4.7 Extract from VLAMP Table 1 – Characterisation of Noise Impacts

If the predicted noise level minus the project noise trigger level is:	And the total cumulative industrial noise level is:	Characterisation of impacts:
All time periods 0-2 dB(A)	Not applicable	Impacts are considered to be **negligible**
All time periods 3-5 dB(A)	• < recommended amenity noise level in Table 2.2 of the NPfI; or • > recommended amenity noise level in Table 2.2 of the NPfI, but the increase in total cumulative industrial noise level resulting from the development is < 1 dB	Impacts are considered to be **marginal**
All time periods 3-5 dB(A)	> recommended amenity noise level in Table 2.2 of the NPfI, and the increase in total cumulative industrial noise level resulting from the development is > 1 dB	Impacts are considered to be **moderate**
Day and evening >5 dB(A)	< recommended amenity noise level in Table 2.2 of the NPfI	Impacts are considered to be **moderate**
Day and evening >5 dB(A)	> recommended amenity noise level in Table 2.2 of the NPfI	Impacts are considered to be **significant**
Night >5 dB(A)	Not applicable	Impacts are considered to be **significant**

5.0 Operational Noise Assessment

The noise impacts associated with the proposed modified project have been assessed by comparing predicted noise levels from project operations against the relevant noise assessment levels in the applicable legislation and guidelines.

5.1 Methodology

Noise levels were predicted using the Cadna/A proprietary environmental noise modelling software package. The noise predictions using the Cadna/A software were undertaken using the CONCAWE noise calculation methodology.

The Cadna/A software is approved for use by the Department of Planning, Industry and Environment (DPIE) and the Environmental Protection Authority (EPA) and takes into account the:

- sound power levels of the noise sources, in octave or 1/3 octave frequency bands
- directivity of noise sources
- topographical shielding of sound propagation
- sound reflections from solid flat objects
- sound absorption due to ground surface covering.

The CONCAWE prediction method accounts for the influence of noise propagation by:

- atmospheric temperature
- atmospheric relative humidity
- atmospheric pressure
- wind speed
- wind direction
- Atmospheric Pasquill Stability Class (for defining the presence and strength of temperature inversions).

The 3-dimensional existing terrain surface was modelled using LIDAR derived topography data.

5.2 Meteorological Conditions

The Standard meteorological parameters used in the noise modelling predictions were as follows:

Day time period 7.00am to 6.00pm, calm winds

- Temperature: 20°C
- Relative Humidity: 70%
- Wind Speed: 0 m/s

- Wind Direction: N/A
- Atmospheric Stability Class: 'D'

The Noise-enhancing meteorological parameters used in the noise modelling predictions were as follows:

Day time period 7.00am to 6.00pm, with significant wind:

- Temperature: 20°C
- Relative Humidity: 70%
- Wind Speed: 3 m/s
- Wind Direction (from): 225° clockwise from N
- Atmospheric Stability Class: 'D'

Night time period 10.00pm to 7.00am, with temperature inversion:

- Temperature: 20°C
- Relative Humidity: 70%
- Wind Speed: 2 m/s
- Wind Direction (from): all (worst case source to receiver)
- Atmospheric Stability Class: 'F'

5.3 Noise Sources and Scenarios

5.3.1 Modelled Plant and Equipment

The sound power levels utilised in the noise modelling are based on data supplied by the client, measurements of similar plant by Umwelt, product specifications, estimated from noise source data in published literature or from published noise impact reports for similar projects.

Plant and equipment currently used on site is as follows:

- 1 x Komatsu 375A, Cat D11 or equivalent dozer
- 1 x Caterpillar 972G front end loader
- 2 x 30 tonne dump trucks
- 1 x water cart
- 1 x Caterpillar 12G grader (irregularly)
- 1 x service vehicle (irregularly)
- 1 x mobile dry screening plant

- two mobile crushers (one rotary and one jaw crusher)
- Wet processing (washing) plant.

The sound power levels of equipment modelled for the amended Project are provided in **Table 5.1**.

Table 5.1 Noise Source Sound Power Levels dB(Z) and dB(A) re 10^{-12}W

Noise Source	Sound Power Level dB(Z)	Sound Power Level dB(A)
1 x Excavator	107	100
4 x Front-End Loader	120	109
2 x 40t dump truck (Replacing 2 x 30t dump trucks)	135	119
Dozer	121	109
Product Trucks	103	102
Water Cart	112	112
Wet Processing Plant	100	96
Dry Processing Plant	122	116
Crushers (jaw and rotary) and Screen Unit	115	110

Note: Wet Processing Plant source height is 4m above local ground level. Source height of all other sources is 2m above local ground level.

The locations of the existing and proposed noise sources are shown in **Figure 5.1**.

It is noted that during the morning shoulder period (6.00am to 7.00am), the only operations on the Quarry are those associated with the loading and transport of road registered trucks, i.e. there is no extraction, processing or VENM/ENM management activities undertaken.

5.3.2 Quarry Stages Assessed for the Proposed Modification

As the Proposed Modification is being assessed in accordance with the NPfI, whereas previous assessment and establishment of criteria was undertaken in accordance with the *Industrial Noise Policy* (INP) (EPA, 1999), life of Quarry operations have been assessed, namely, operations within the Hawkesbury Sandstone extraction area (approved by Mod 1) and Stages 3, 4, 5 and the proposed northern extension to Stage 5 of the originally approved tertiary sand extraction area (refer to **Figure 5.1**).

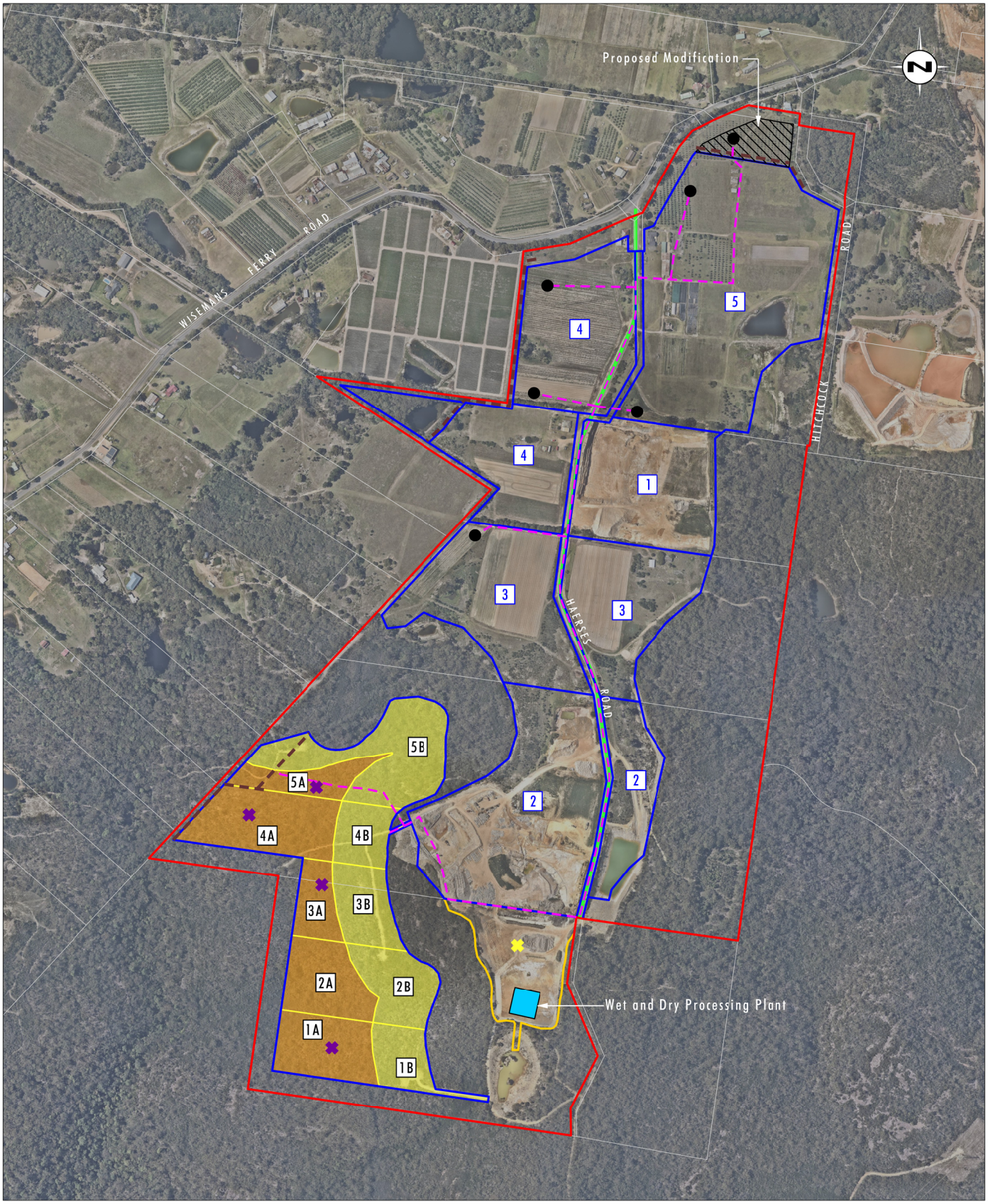

Image Source: Nearmap (Dec 2018)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2019)

0 100 250 500m
1:10 000

Legend

- Haerses Road Quarry Site
- Processing and Stockpiling Area
- Proposed Extraction Area Extension
- Approved Extraction Area
- Approved Extraction Area A
- Approved Extraction Area B
- [1] Approved Extraction Area Stage Number
- 1 Extraction Cell Number
- Approved Acoustic Bund

Noise Source Locations:

- Hawksbury Sandstone Extraction - Dozer
- Tertiary Sands Extraction - Excavator
- Processing and Loading
- Product Trucks
- Haul Trucks on Haul Roads

- Wet & Dry Processing Plant
  - Water Cart
  - Front End Loaders x 4
  - Dry Processing Plant
  - Wet Processing Plant
  - Screen

FIGURE 5.1

Proposed modified quarry stages and locations of noise sources

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5.4 Predicted Noise Levels

5.4.1 Shoulder Period 6am to 7am Monday to Saturday

The predicted noise levels from the truck loading and dispatch operations are shown in **Table 5.2** under the worst-case noise enhancing meteorological conditions applicable during the morning shoulder period.

Table 5.2 Predicted Noise Levels during Morning Shoulder Period 6.00am to 7.00am Monday to Saturday

Receiver	PNTL	Predicted Noise Level
	Shoulder	Current and MOD3
R01	38	33
R02*	38	45
R03	38	37
R04	38	34
R05	38	32
R06	38	27
R07	38	31
R08	38	33
R09	38	31
R10	38	28
R11	38	28
R12	38	28
R13	38	36
R14	38	36
R15	38	35
R16	38	26
R21	38	22

Note * - The Quarry currently has an Agreement with Receiver R02 and it is expected that this Agreement will be updated consistent with the proposed Project Modification.

As shown in **Table 5.2**, the predicted noise levels associated with the Proposed Modification are expected to comply with the PNTL during the shoulder period of 6.00am to 7.00am Monday to Saturday under the worst-case noise enhancing meteorological conditions, at all receivers (except R02).

5.4.2 Day Period 7am to 6pm Monday to Saturday

The predicted noise levels from the proposed Quarry operations under worst-case meteorological conditions are shown in **Table 5.3**. It is noted these represent predicted noise levels without any additional noise mitigation than that provided by the 5 m noise bund.

Table 5.3 Predicted Noise Levels for the Proposed Modification

Receiver	PNTL	Quarry Stage (Tertiary Sands Extraction Area)[1]			
		3	4	5	MOD3 Extension Area
R01	40	35	39	41	**42**
R02[2]	40	**45**	**49**	**51**	**51**
R03	41	38	**43**	**43**	**43**
R04	41	37	39	39	39
R05	41	41	**42**	**42**	**42**
R06	41	41	41	41	41
R07	41	39	39	39	39
R08	41	41	**42**	**42**	**42**
R09	41	40	40	40	40
R10	41	37	37	37	37
R11	41	36	36	36	36
R12	40	32	37	39	**43**
R13	40	37	**42**	**43**	**45**
R14	41	37	41	40	40
R15	41	40	41	41	41
R16	41	34	35	35	35
R21	41	37	37	37	37

Note 1 – refer to **Figure 1.2**

Note 2 - Dixon Sand expects to obtain an Agreement with Receiver R02 for noise levels exceeding the PTNLs.

As shown in **Table 5.3**, without additional mitigation the Proposed Modification is predicted to result in exceedances of the PTNL at receiver R02 over the life of the Quarry. Dixon Sand has a negotiated a Noise Agreement with the owner of Receiver R02 to accept elevated noise levels and expects an updated agreement reflecting the Proposed Modification to be agreed to. Commencing in Stage 4, the modelling results of **Table 5.3** also predict exceedances of the PTNL at several Receivers R03, R05, R08, R12 and R13 in future Stages of the quarry life. The detailed noise modelling results indicate that the dominant noise sources contributing to the received noise levels in the cases where are exceedances are predicted, are the proposed new 40 t haul trucks.

Dixon Sand has advised that the Quarry would be able to modify the proposed haul trucks with the addition of noise control treatments if required to reduce noise levels.

In Umwelt's experience and knowledge of industry practices at similar sites with similar equipment, it is expected that noise mitigation treatments could be readily obtained and installed on the proposed 40 t haul trucks that would reduce their sound power levels by at least 6 dB(A).

If noise mitigation treatments were applied to the haul trucks to reduce their sound emissions by 6 dB(A) before the commencement of quarrying in Stage 4 of the tertiary sand s extraction area, the predicted total noise levels from the Modified project would be as shown in **Table 5.4.**

Table 5.4 Predicted Noise Levels from Proposed Modified Project including 6 dB(A) noise reduction to 40t haul trucks

Receiver	PNTL	Quarry Stage		
		4	5	MOD3 Extension Area
R01	40	36	37	38
R02*	40	46	47	47
R03	41	39	39	39
R04	41	37	37	37
R05	41	41	41	41
R06	41	41	40	40
R07	41	37	37	37
R08	41	40	40	40
R09	41	39	39	39
R10	41	35	35	35
R11	41	34	34	34
R12	40	33	36	39
R13	40	38	39	40
R14	41	37	37	37
R15	41	39	39	39
R16	41	33	33	33
R21	41	37	37	37

Note * - Dixon Sand expects to obtain an Agreement with Receiver R02 for noise levels exceeding the PTNLs

As shown in **Table 5.4**, with the addition of noise control treatments to the 40 t haul trucks to reduce their noise emissions by at least 6 dB(A), the predicted noise levels of the Quarry are expected to comply at all receivers for all quarry stages under worst-case meteorological conditions (except R02). The installation of noise mitigation to the hauls trucks to reduce noise emissions by at least 6 dB(A) is considered to be reasonable and feasible.

As the noise levels shown in **Table 5.4** are based on worst-case meteorological conditions, and since the noise sources have been conservatively modelled as operating in close proximity to receivers, Dixon Sand is confident that noise emissions can be managed to maintain compliance with the PNTL throughout the Quarry's life. Dixon Sand will be able to implement on-site noise management strategies such as:

- the construction of strategically located noise bunds,
- developing the extraction such that the excavator works behind a 6 to 7 m advancing face,
- application of noise reducing modifications to haul trucks (of up to 6 dB(A) as required as extraction progresses to Stage 4 and 5).

5.5 Maximum Noise Level Event Assessment

The only proposed noise emissions during the night time (morning shoulder) period are due to the arrival, loading and departure of product trucks via the site access at the intersection of Haerses Road and Wisemans Ferry Road. The predicted noise levels from these operations under worst-case meteorological conditions are less than 38 dB(A) $L_{Aeq(15\ minute)}$ as shown in **Table 5.2**. The predicted noise levels are therefore also compliant with the $L_{Aeq(15\ minute)}$ screening level of 40 dB(A) for the assessment of sleep disturbance at receivers. In regard to the screening level of 52 dB(A) L_{Amax}, it is expected that the noise levels of light and heavy vehicles travelling at typical speeds along Wisemans Ferry Road during the shoulder period 6am to 7am would be significantly higher than the L_{Amax} noise levels due to product trucks accessing and egressing the site entrance as they would be travelling at significantly lower speeds. As shown in **Appendix A** and **Appendix B**, the measured L_{Amax} noise levels at both locations L1 and L2 were substantially higher than 52 dB(A) and it expected that the majority of these noise events were due to traffic on Wisemans Ferry Road.

5.6 VLAMP Assessment

The predicted noise levels do not exceed any of the VLAMP criteria at any stage of the quarry life at any receivers except R02 where the quarry currently has an Agreement and would seek to renew the agreement in accordance with the proposed Modification.

6.0 Road Traffic Noise Assessment

6.1 Methodology

The road traffic noise levels have been predicted using the Calculation of Road Traffic Noise (CoRTN) algorithms. This model has been specifically validated under Australian conditions by the NAASRA Working Group (Saunders, Samuels, Leach & Hall, 1983).

The traffic noise impacts from the proposed project modification have been assessed based on traffic data provided by Seca Solution which was measured for the traffic impact assessment undertaken for the project (ref. Seca Solution report P1383 Aug 2019) (refer **Appendix D**).

Traffic noise levels have been estimated at varying distances from the road, based on several assumptions including simplified geometry (flat ground, long-straight road), standard road pavement surface, acoustically reflective ground surface, no shielding, no opposite acoustic reflections, etc. The relative increase in road traffic noise levels have been estimated based on the difference in road traffic noise level contribution from the existing and proposed daily volume of quarry trucks, combined with the other road traffic.

The posted speed limits at the locations where the traffic counts were undertaken and the noise levels are predicted were 60 km/hr on Old Northern Road and 80 km/hr on Wisemans Ferry Road.

The relative increase in quarry truck noise due to the Proposed Modification has been estimated assuming that all additional trucks will occur during the day time period (7.00am to 10.00pm).

6.2 Traffic volumes

The traffic volumes used in the noise assessment are shown in **Table 6.1** and **Table 6.2**. The existing traffic volumes were measured by Seca Solution in 2019 and the projected 10-year future volumes were based on an annual growth rate of 4% on Wisemans Ferry Road and 1.8% on Old Northern Road as advised by Seca Solution. The measured existing traffic volumes included the existing (currently approved) quarry trucks.

Table 6.1 Traffic Volumes with Existing Approved Project Quarry Trucks

Time period	Road	Current year		10 year projection	
		Light	Heavy	Light	Heavy
Day 7.00am – 10.00pm	Old Northern Road - North of Wisemans Ferry Rd	1828	251	2185	300
	Wisemans Ferry Road - East of Haerses Road	1629	290	2411	429
Night 10.00pm – 7.00am	Old Northern Road - North of Wisemans Ferry Road	228	58	273	69
	Wisemans Ferry Road - East of Haerses Road	252	55	373	81

Table 6.2 Traffic Volumes with Proposed Modified Project Quarry Trucks

Time period	Road	Current year		10 year projection	
		Light	Heavy	Light	Heavy
Day 7.00am – 10.00pm	Old Northern Road - North of Wisemans Ferry Road	1828	375	2185	424
	Wisemans Ferry Road - East of Haerses Road	1629	414	2411	553
Night 10.00pm – 7.00am	Old Northern Road - North of Wisemans Ferry Road	228	58	273	69
	Wisemans Ferry Road - East of Haerses Road	252	55	373	81

6.3 Results

The estimated traffic noise levels at several example distances from the road with the existing approved project quarry truck volumes are shown in **Table 6.3.**

The estimated traffic noise levels at several example distances from the road with the modified project quarry truck volumes are shown in **Table 6.4.**

Table 6.3 Estimated Traffic Noise Levels with Existing Approved Project Quarry Trucks

Time period	RNP criteria dB(A) (Period)	Road	Current Year					10-Year projection				
			10m	20m	30m	40m	50m	10m	20m	30m	40m	50m
Day 7.00am – 10.00pm	60	Old Northern Road - North of Wisemans Ferry Road	62	60	58	57	56	63	60	59	58	57
		Wisemans Ferry Road - East of Haerses Road	64	61	60	59	58	65	63	61	60	59
Night 10.00pm – 7.00am	55	Old Northern Road - North of Wisemans Ferry Road	57	54	53	52	51	58	55	54	53	52
		Wisemans Ferry Road - East of Haerses Road	58	56	54	53	52	60	58	56	55	54

As shown in **Table 6.3**, the estimated traffic noise levels either already exceed or are within 2 dB(A) of RNP noise criteria for the day period for receivers within 30 m of Old Northern Road and within 50 m of Wisemans Ferry Road. For the 10 year future projection, traffic noise levels are forecast to either exceed or be within 2 dB(A) of RNP noise criteria for the day period for receivers within 40 m of Old Northern Road and within 50 m of Wisemans Ferry Road.

The estimated traffic noise levels at several example distances from the road with the modified project quarry truck volumes are shown in **Table 6.4.**

Table 6.4 Estimated Traffic Noise Levels with Increased Truck Movements

Time period	Road	Current Year					10-Year projection				
		10m	20m	30m	40m	50m	10m	20m	30m	40m	50m
Day 7.00am – 10.00pm	Old Northern Road - North of Wisemans Ferry Road	63	61	59	58	57	64	61	61	59	58
	Wisemans Ferry Road - East of Haerses Road	65	62	60	60	59	66	64	62	61	60
Night 10.00pm – 7.00am	Old Northern Road - North of Wisemans Ferry Road	57	54	53	52	51	58	55	54	53	52
	Wisemans Ferry Road - East of Haerses Road	58	56	54	53	52	60	58	56	55	54

As shown in **Table 6.4** the estimated traffic noise levels either already exceed or are within 2 dB(A) of RNP noise criteria for the day period for receivers within 30 m of Old Northern Road and within 50 m of Wisemans Ferry Road.

The relative increase in noise levels due to the proposed project modification are shown in **Table 6.5.**

Table 6.5 Estimated Increase in Traffic Noise Levels Due to the Proposed Modification dB(A)

Time period	Road	Current Year	10-Year projection
Day 7.00am – 10.00pm	Old Northern Road - North of Wisemans Ferry Road	1	1
	Wisemans Ferry Road - East of Haerses Road	1	1
Night 10.00pm – 7.00am	Old Northern Road - North of Wisemans Ferry Road	0	0
	Wisemans Ferry Road - East of Haerses Road	0	0

As shown in **Table 6.5**, the relative increase in road traffic noise levels due to the project modification is predicted to be 1 dB(A) or less at all receivers.

An increase of 1 dB(A) from road traffic noise levels would not typically be noticeable by receivers.

7.0 Conclusion

Without the application of additional noise mitigation treatments, exceedances of the Quarry PTNLs are predicted at Receivers R02, R03, R05, R08, R12 and R13. Dixon Sand has a negotiated a Noise Agreement with the owner of Receiver R02 to accept these elevated noise levels which are predicted for all stages of Quarry operation. The noise modelling has identified that if noise mitigation treatments are applied to the haul trucks to reduce their sound emissions by 6 dB(A) before the commencement of quarrying in Stage 4 of the tertiary sands extraction area, the predicted total noise levels from the Quarry are expected to comply at all other receivers (including Receivers R03, R05, R08, R12 and R13) for all stages under worst-case meteorological conditions. Noting alternative noise mitigation measures may be identified during the life of the Quarry making the adoption of these noise reducing modifications to the haul trucks unnecessary, the implementation of such noise mitigation treatments to reduce the noise emissions of the haul trucks by at least 6 dB(A) are considered to be reasonable and feasible.

Dixon Sand is confident that noise emissions can be managed to maintain compliance with the PNTL at all receivers at all times through the implementation of the following (or other measures which provide for an equivalent reduction in the noise level generated by Quarry noise sources or received at residences surrounding the Quarry Site).

- Construction of 5 m high noise bunds at strategic locations surrounding the extraction area (including at the northern perimeter of the extended Stage 5 Extraction Area).
- Extraction to be undertaken behind a 6 to 7 m advancing face.
- Application of noise reducing modifications to the Quarry haul trucks as extraction progresses into Stages 4 and 5 of the tertiary sand extraction area.

The predicted $L_{Aeq(15\ minute)}$ noise levels during the night time period comply with the screening level for potential sleep disturbance. The L_{Amax} noise levels from the current and proposed quarry operations during the night period (6am to 7am Monday to Saturday) are expected to be significantly lower than the L_{Amax} noise levels at all receivers from typical traffic on Wisemans Ferry Road.

The road traffic noise impacts as a result of the project modification are expected to comply with the Road Noise Policy for the relative increase in road noise levels due to the development.

8.0 References

Australian Standard 1055-2018. *Acoustics – Description and measurement of environmental noise.*

Department of Environment and Climate Change (NSW DECC), 2011. *Road Noise Policy (RNP)*.

Applying the NSW Road Noise Policy Application notes, NSW EPA

Environment Protection Authority (NSW EPA), 2017. *Noise Policy for Industry (NPfI).*

Dixon Sand Haerses Road Quarry Modification – Air Quality Assessment, ERM Ref 0508538-R1, 19 September 2019

Proposed Modification to Quarry Extraction Rates – Haerses Road Quarry, Maroota, NSW (Letter Report P1383, Seca Solution 21 August 2019)

Voluntary Land acquisition and mitigation policy for State Significant Mining, Petroleum and Extractive Industry Developments, NSW Government, September 2018.

9.0 Glossary of Terms and Abbreviations

Table 9.1 provides descriptions of terms and abbreviations which may be used in this report.

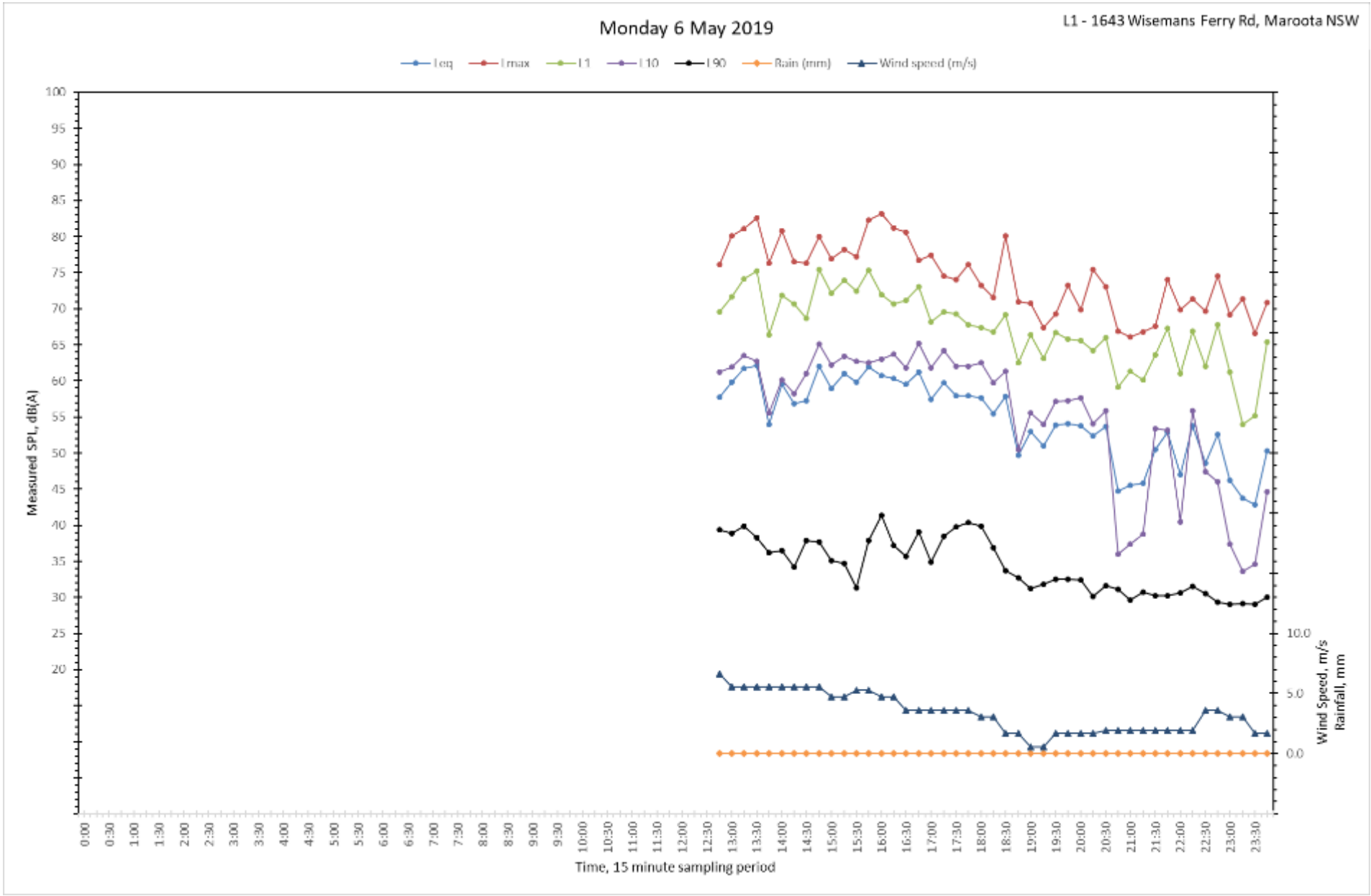
Table 9.1 Glossary of Terms and Abbreviations

Term	Description
1/3 Octave	Single octave bands divided into three parts.
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment background level – A single-figure background noise level representing each assessment period – day, evening and night (that is, three assessment background levels are determined for each 24-hr period of the monitoring period). It is determined by taking the lowest 10th percentile of the L90 level for each assessment period.
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dB(A), dBA	Decibels A-weighted.
dB(Lin), dB(Z)	Decibels Linear or decibels Z-weighted.
Decibel (dB)	The units of sound level and noise exposure measurement where a step of 10 dB is a ten-fold increase in intensity or sound energy and actually sounds a little more than twice as loud.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second – 1 oscillation per second equals 1 Hertz.
L_{A10}	The percentile sound pressure level exceeded for 10 per cent of the measurement period with 'A' frequency weighting calculated by statistical analysis. Typically used to assess the impact of an existing operation on a receiver area and is referred to as the cumulative noise levels at the receiver attributable to the noise source.
L_{A90}	Background Noise Level. The percentile sound pressure level exceeded for 90 per cent of the measurement period with 'A' frequency weighting calculated by statistical analysis.
L_{Amax}	The maximum of the sound pressure levels recorded during the measurement.
$L_{A1,1minute}$	The measure of the short duration high-level noises that cause sleep arousal. The noise level is measured as the percentile sound pressure level that is exceeded 1 per cent of measurement period with 'A' frequency weighting calculated by statistical analysis during a measurement time interval of 1 minute.
$L_{Aeq,t}$	Equivalent continuous sound pressure level – The value of the sound pressure level of a continuous steady noise that, a measurement interval of time (t), has the same mean square sound pressure as the sound under consideration whose level varies with time. Usually measured in dB with 'A' weighting.
L_{An}	Percentile level – A measure of the fluctuation of the sound pressure level which is exceeded 'n' per cent of the observation time.
PNTL	Project noise trigger levels – The target noise levels for a particular noise generating facility based on the most stringent of the intrusive criteria or amenity criteria.
RBL	Rating background level – The overall single figure background level representing each assessment period over the whole monitoring period determined by taking the median of the ABLs found for each assessment period.

Term	Description
SPL (dBA)	Noise: Sound pressure level – The basic measure of noise loudness. The level of the root-mean-square sound pressure in decibels given by: $SPL = 10 \log_{10} (p/p_0)^2$ where p is the rms sound pressure in pascals and p_0 is the reference sound pressure at 20 μPa. decibels.
SWL	Sound power level - a measure of the energy emitted from a source as sound and is given by: $SWL = 10 \log_{10} (W/W_0)$ where W is the sound power in watts and W_0 is the reference sound power at 10^{-12} watts.

APPENDIX A

Noise Monitoring Data -
L1 – 1643 Wisemans Ferry Road, Maroota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Lmax
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L10
L90
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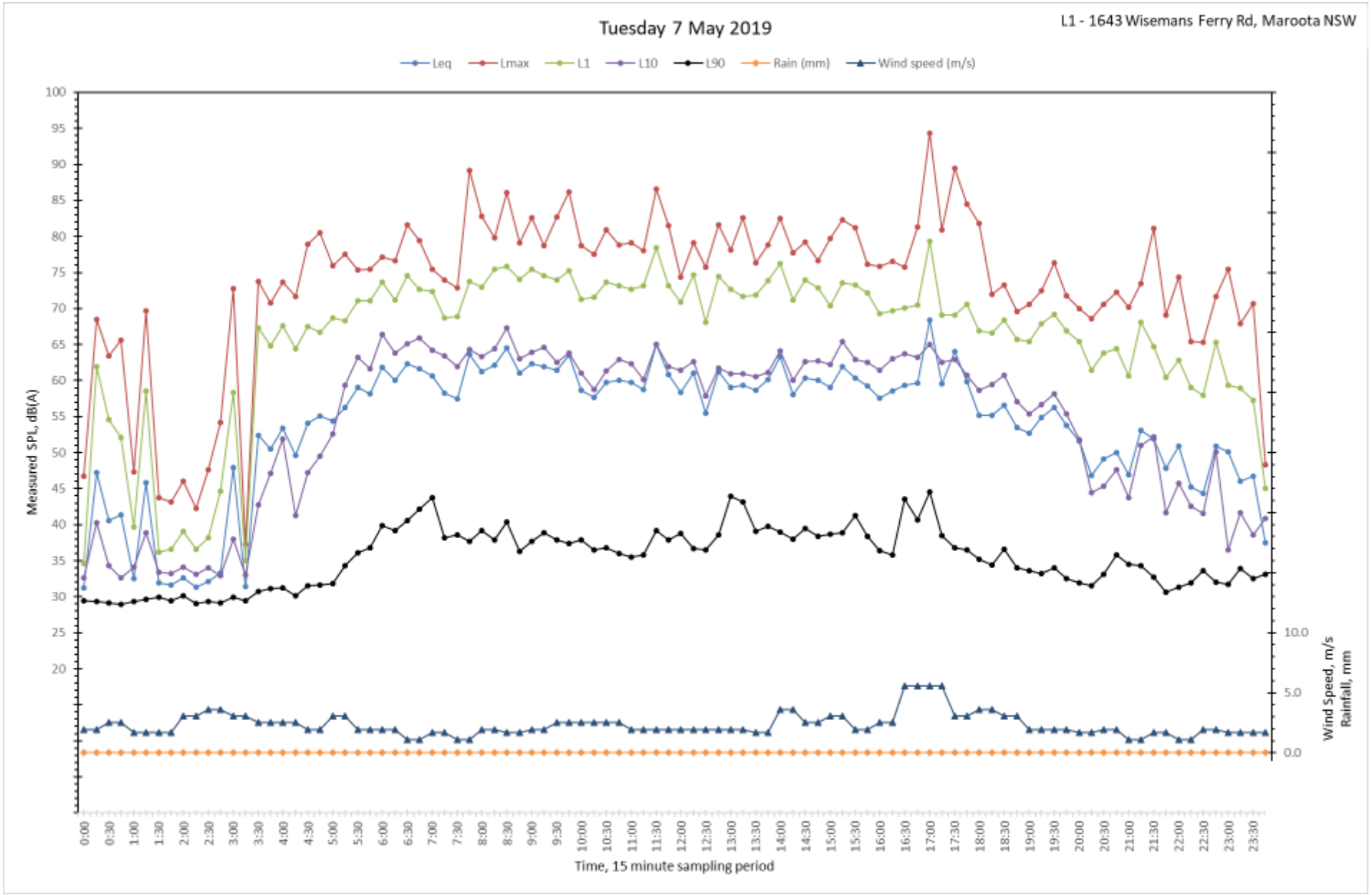
Wind speed (m/s)
Measured SPL, dB(A)
Wind Speed, m/s
Rainfall, mm
Time, 15 minute sampling period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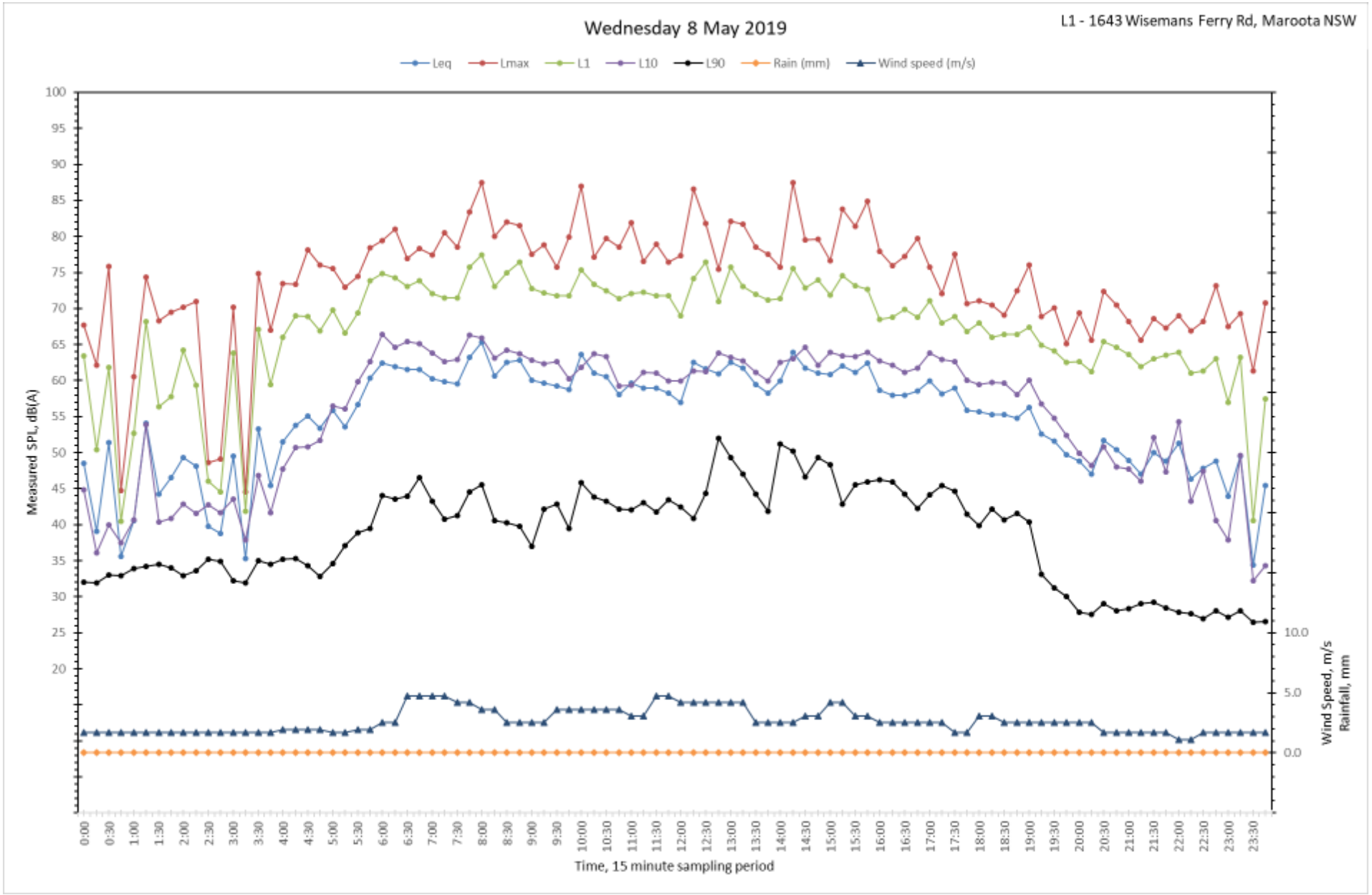
Wind Speed, m/s
Rainfall, mm
Time, 15 minute sampling period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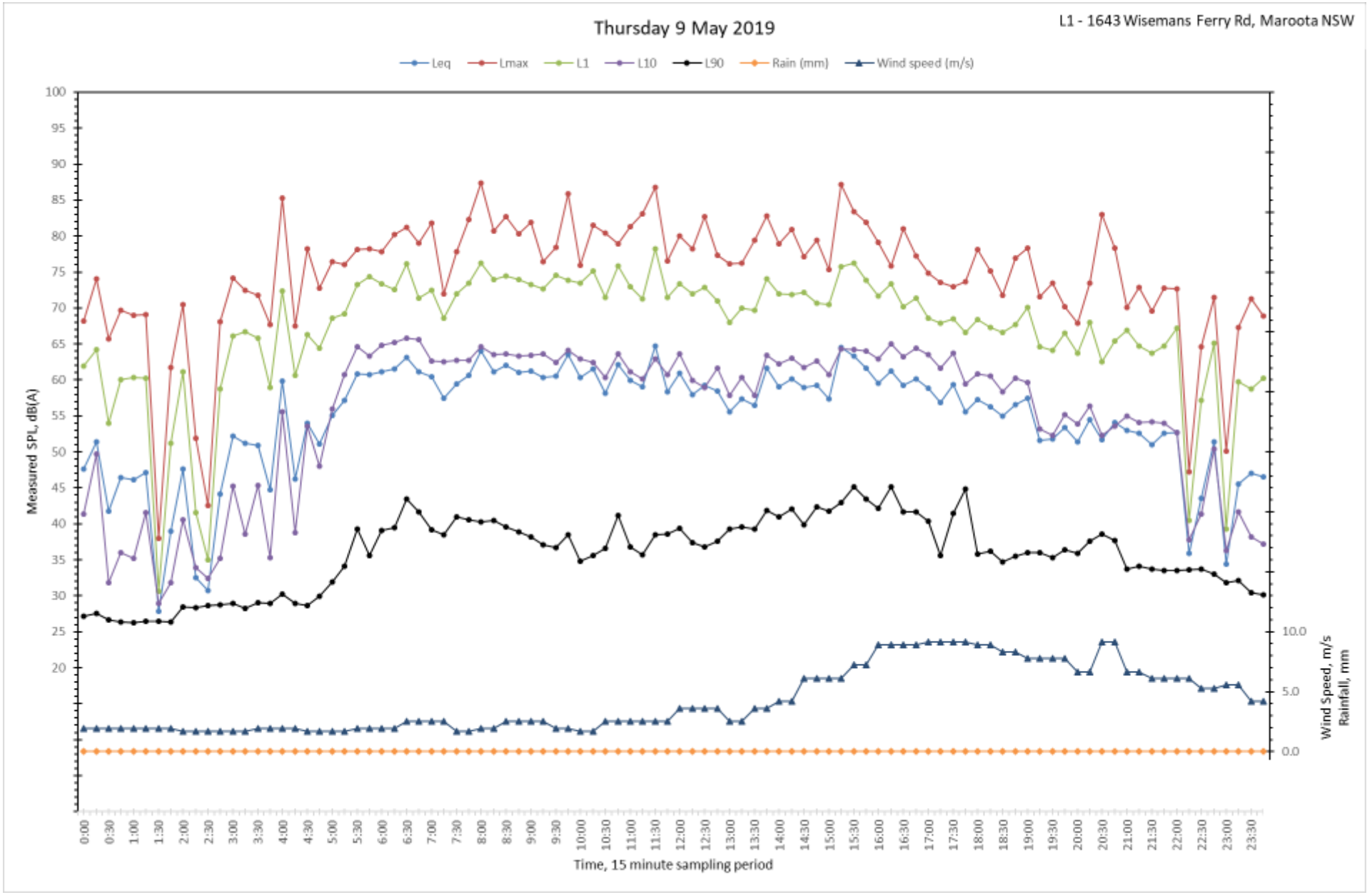
Measured SPL, dB(A)
Wind Speed, m/s
Rainfall, mm
Time, 15 minute sampling period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Wind speed (m/s)
Measured SPL, dB(A)
Wind Speed, m/s
Rainfall, mm
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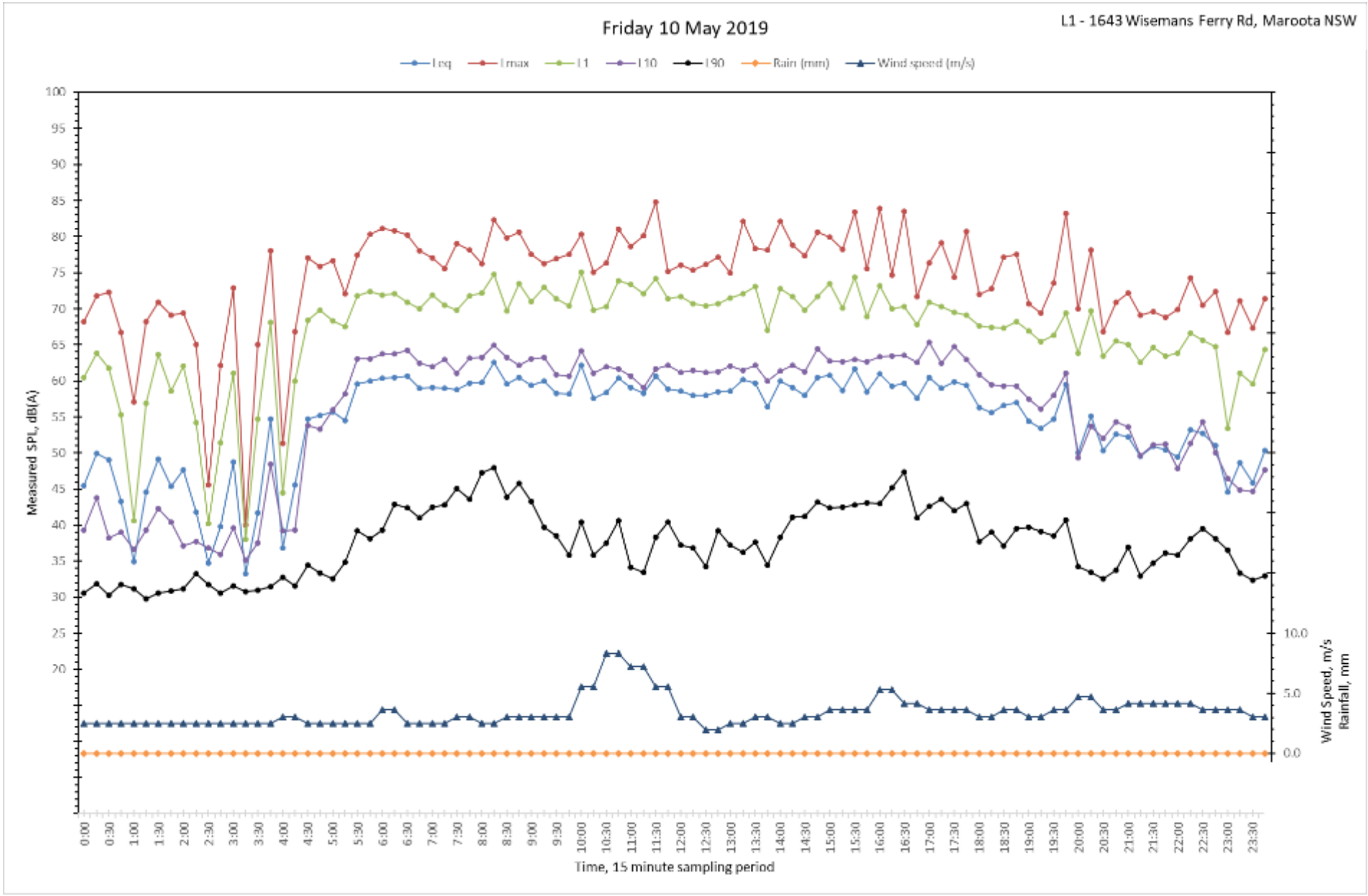
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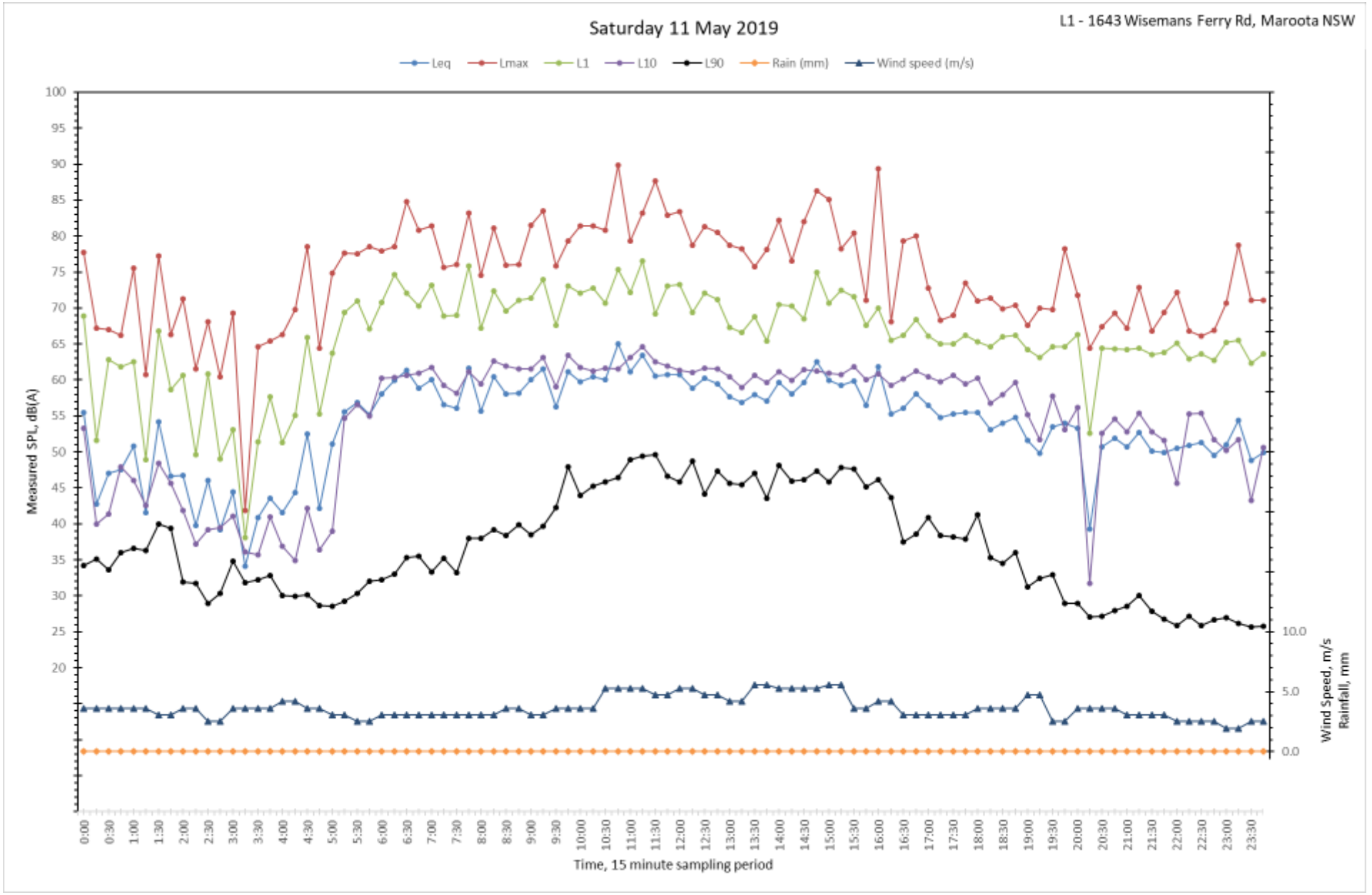
Wind speed (m/s)
Measured SPL, dB(A)
Wind Speed, m/s
Rainfall, mm
Time, 15 minute sampling period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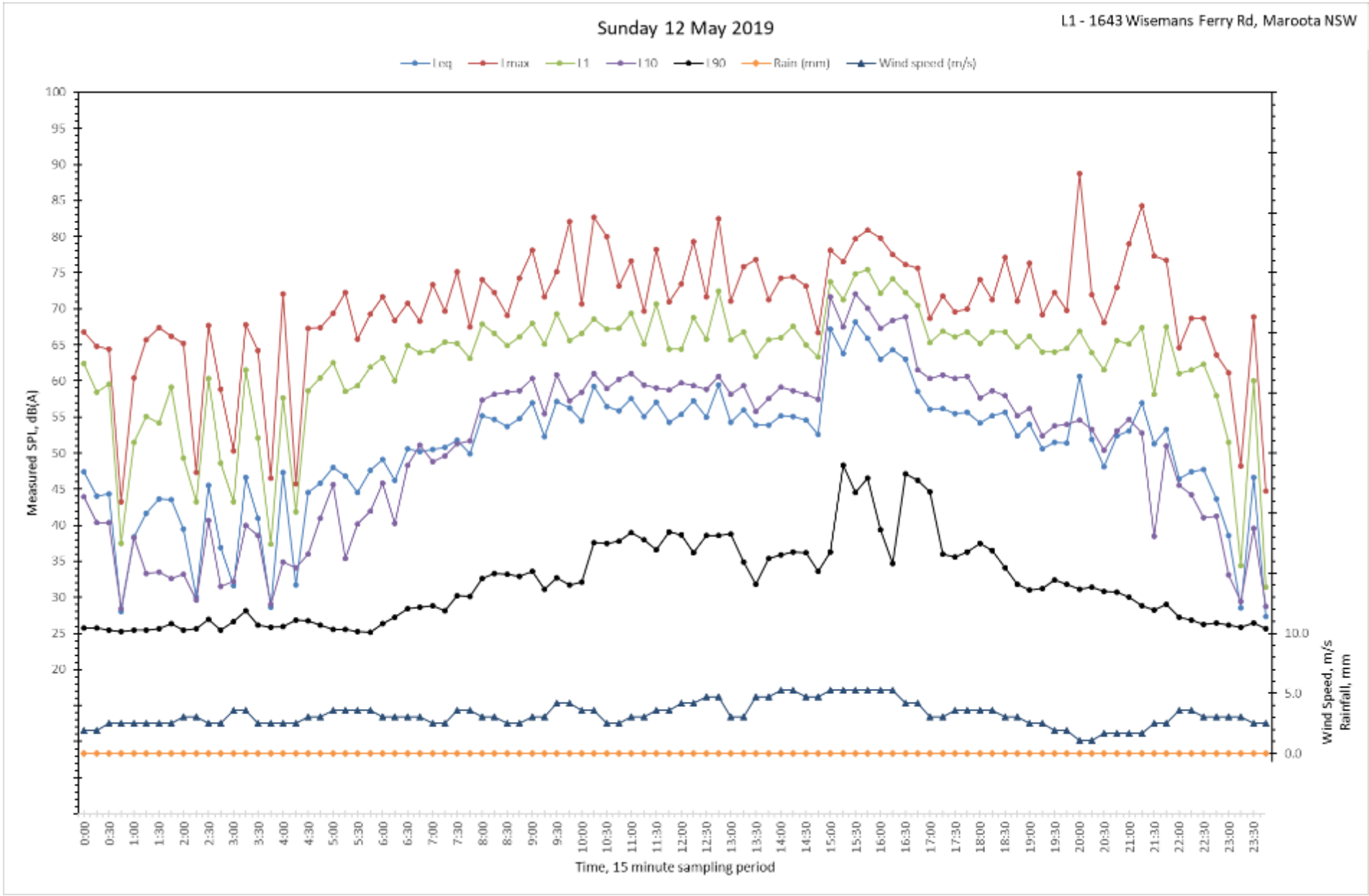
Rainfall, mm
Time, 15 minute sampling period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Wind speed (m/s)
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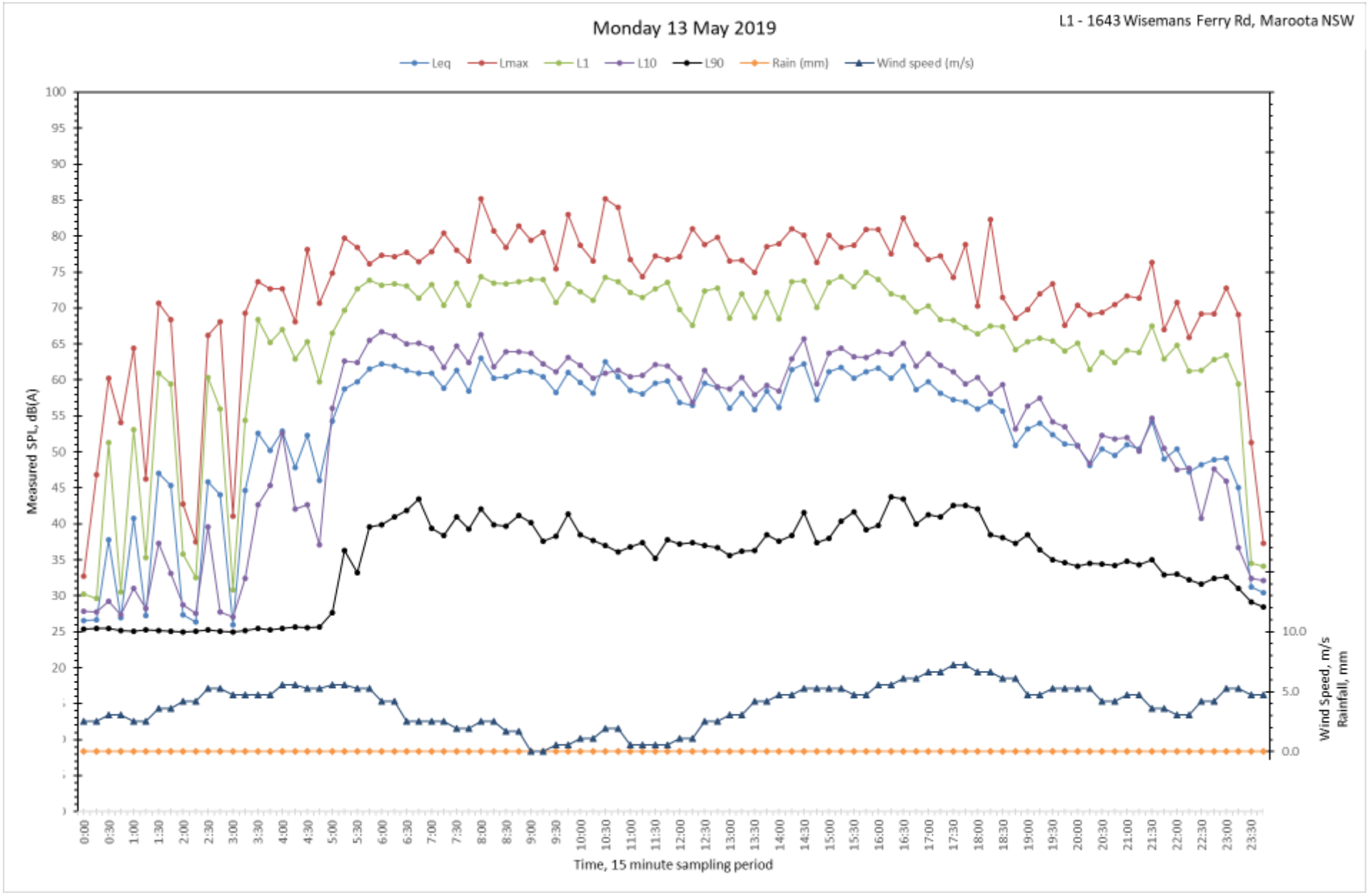
Wind Speed, m/s
Rainfall, mm
Time, 15 minute sampling period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Wind speed (m/s)
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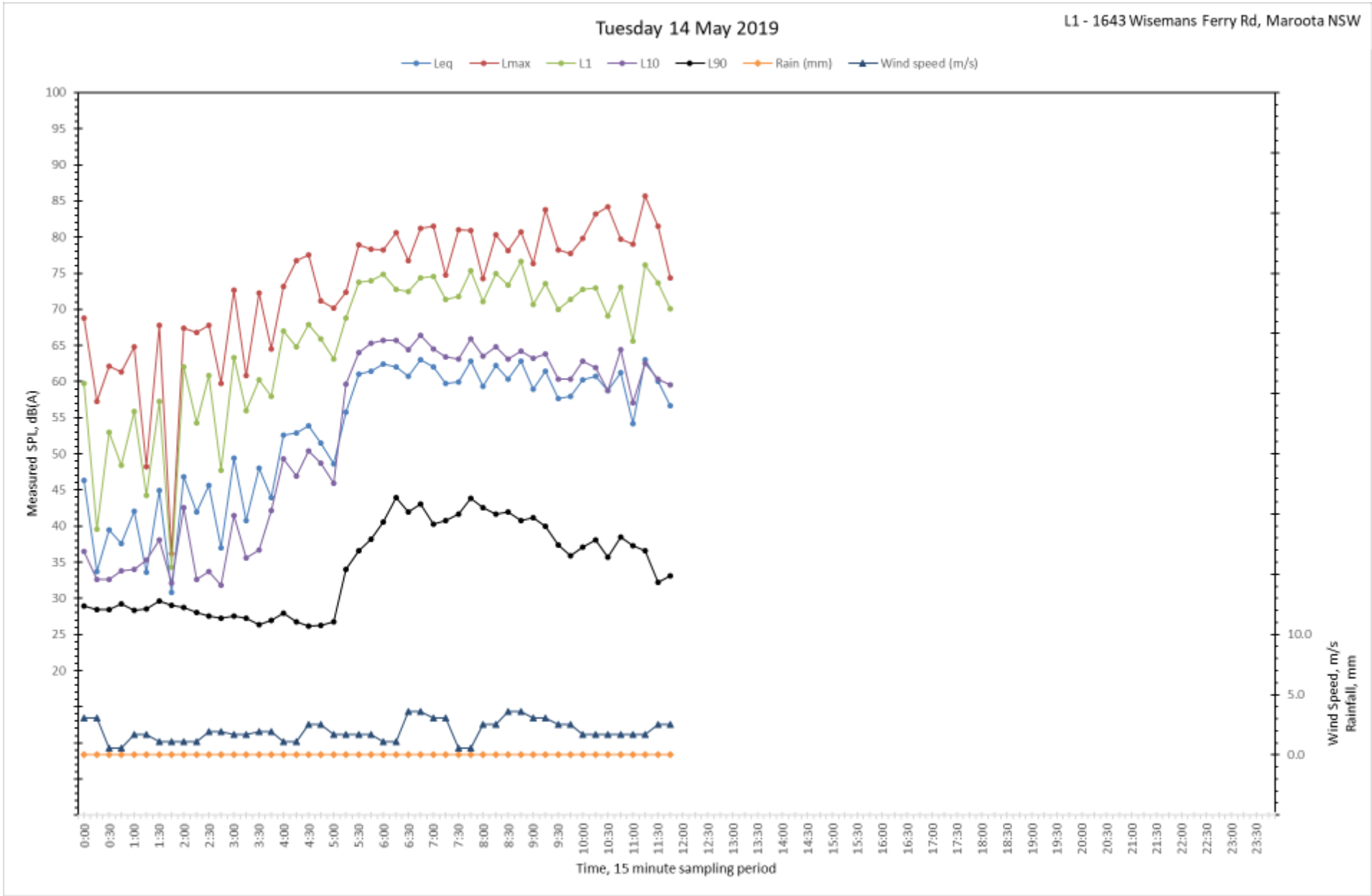
Wind Speed, m/s
Rainfall, mm
Time, 15 minute sampling period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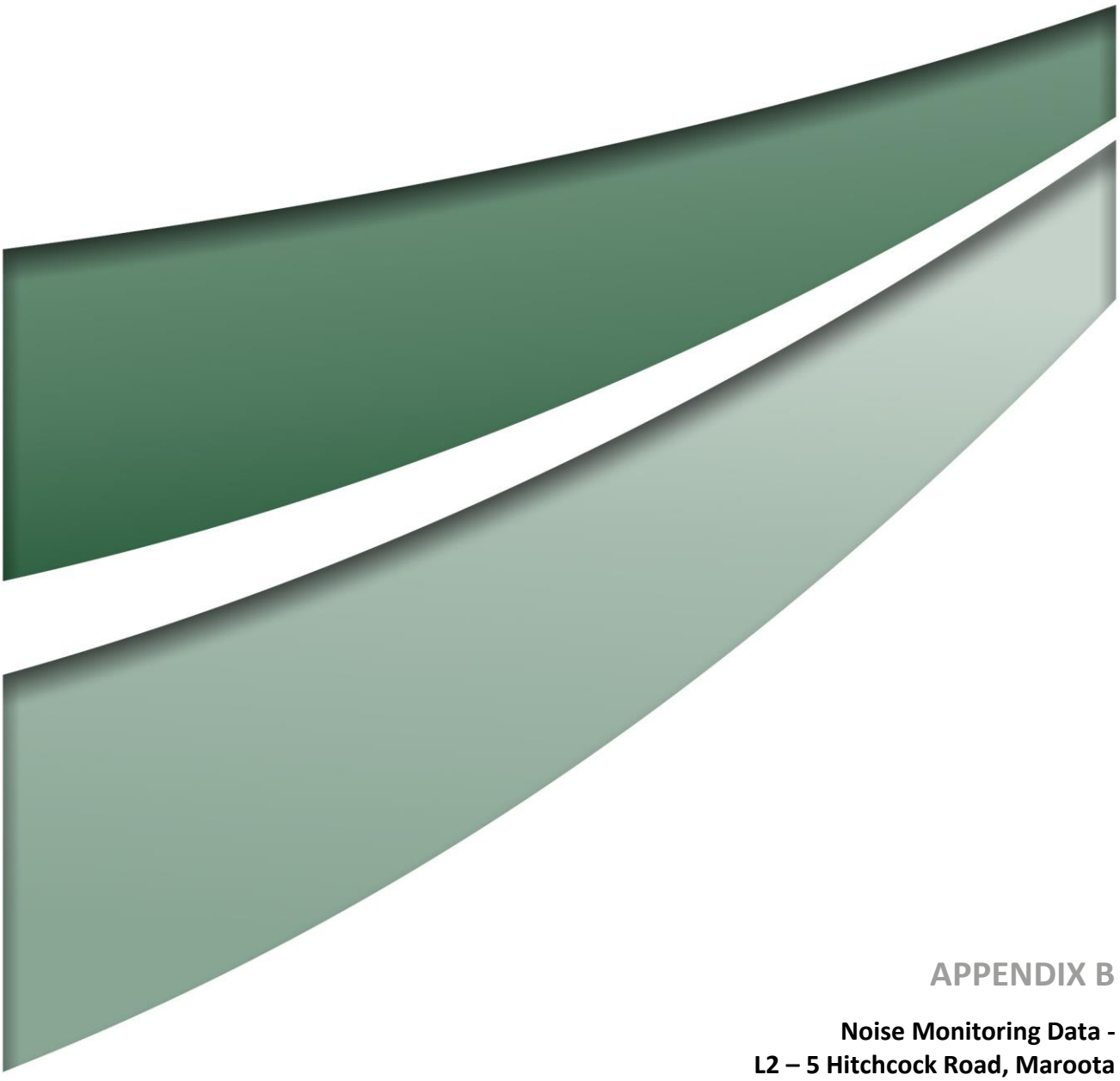
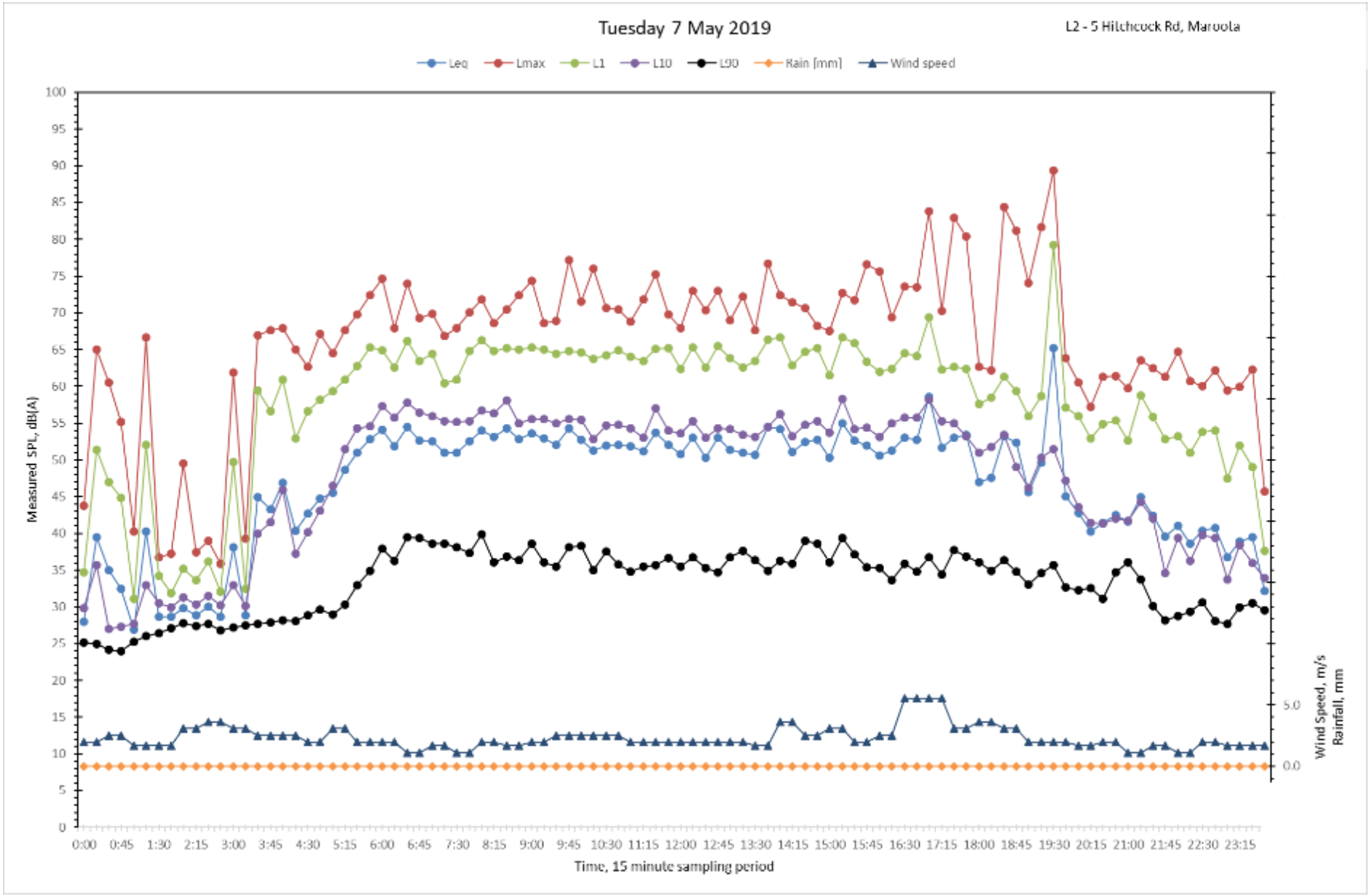
Wind Speed, m/s
Rainfall, mm
Time, 15 minute sampling period



APPENDIX B

Noise Monitoring Data -
L2 – 5 Hitchcock Road, Maroota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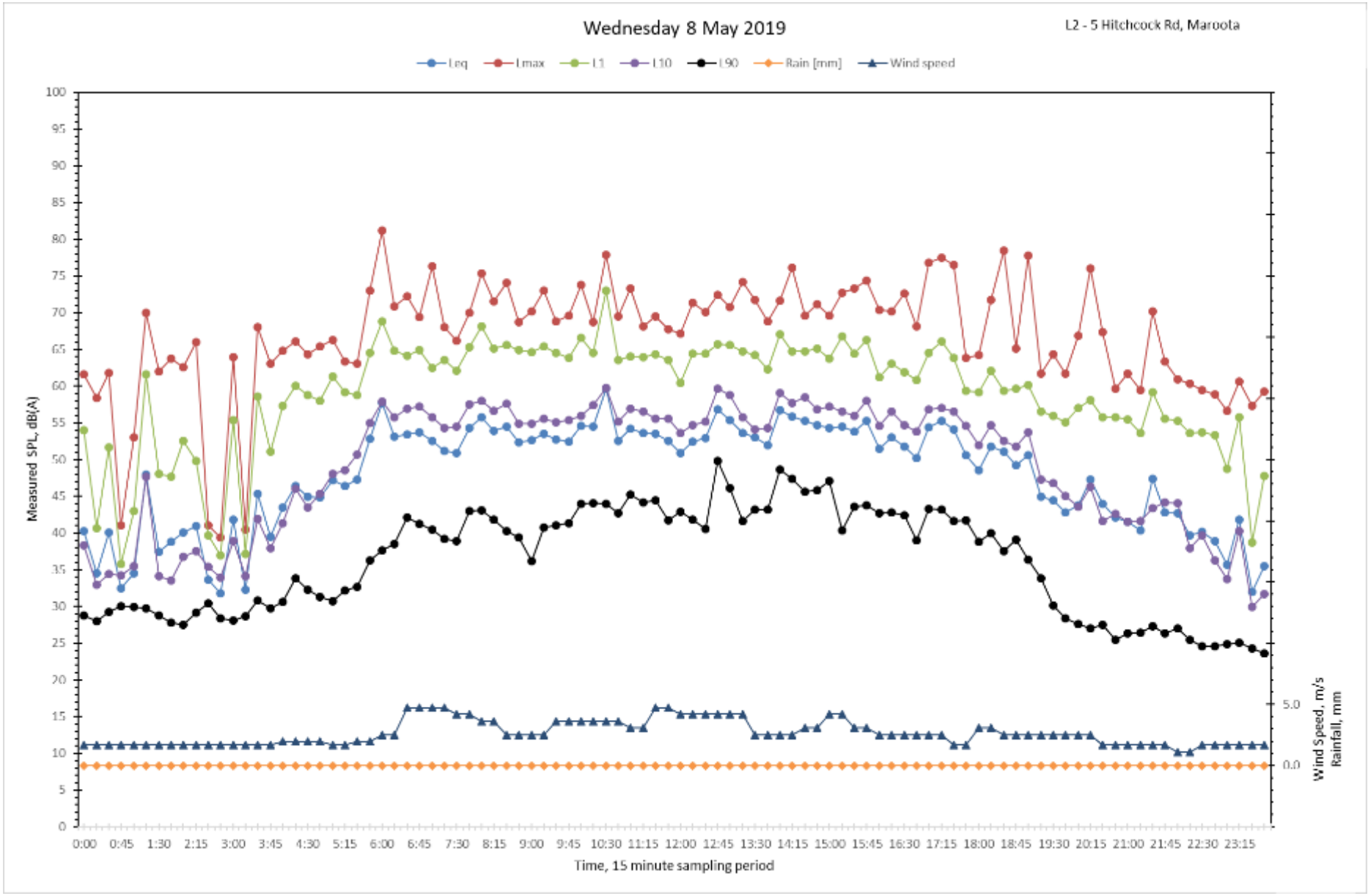
Lmax
L1
L10
L90
Rain [mm]
Wind speed
Measured SPL, dB(A)
Wind Speed, m/s
Rainfall, mm
Time, 15 minute sampling period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L10
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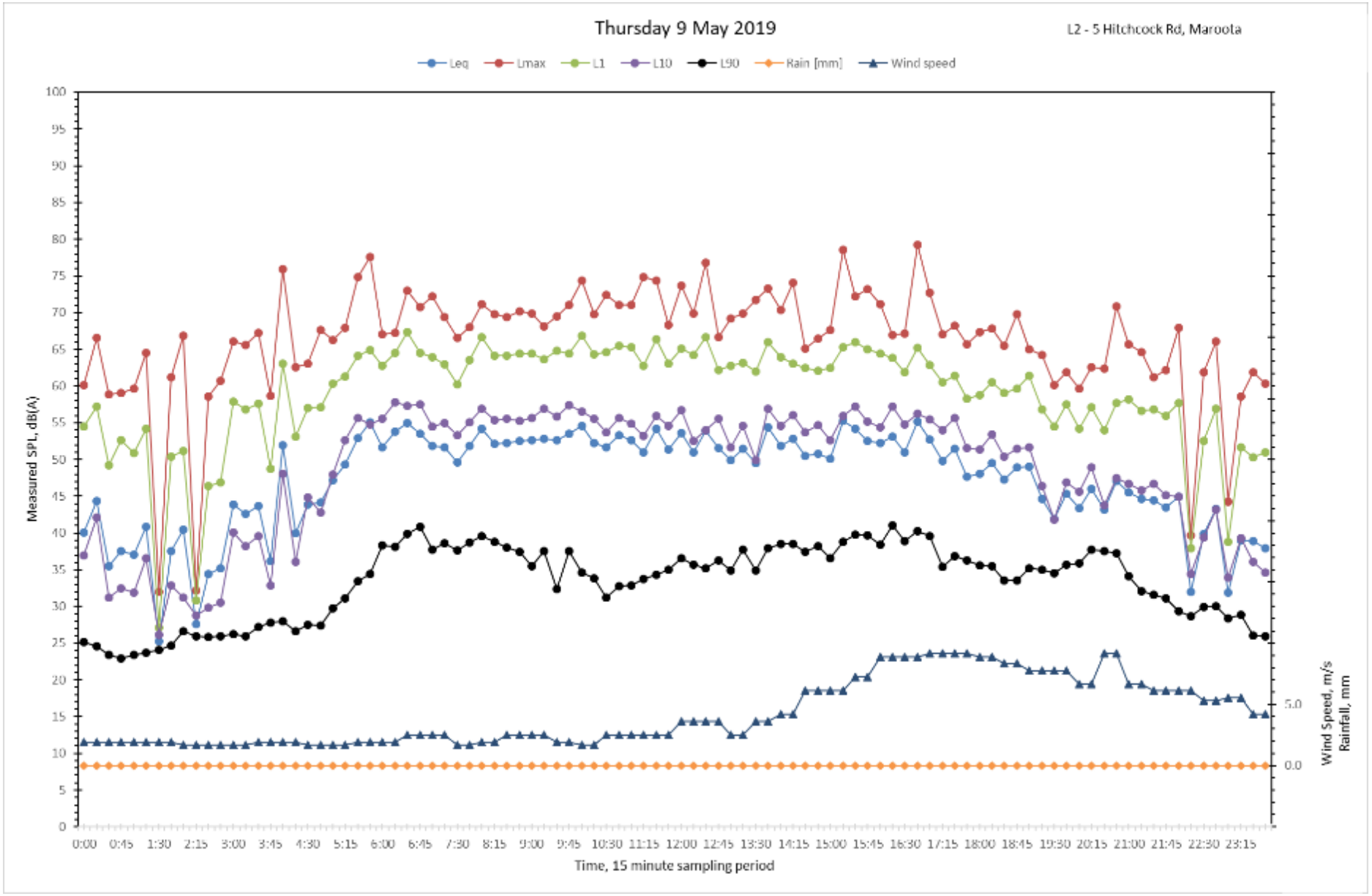
Rain [mm]
Wind speed
Measured SPL, dB(A)
Wind Speed, m/s
Rainfall, mm
Time, 15 minute sampling period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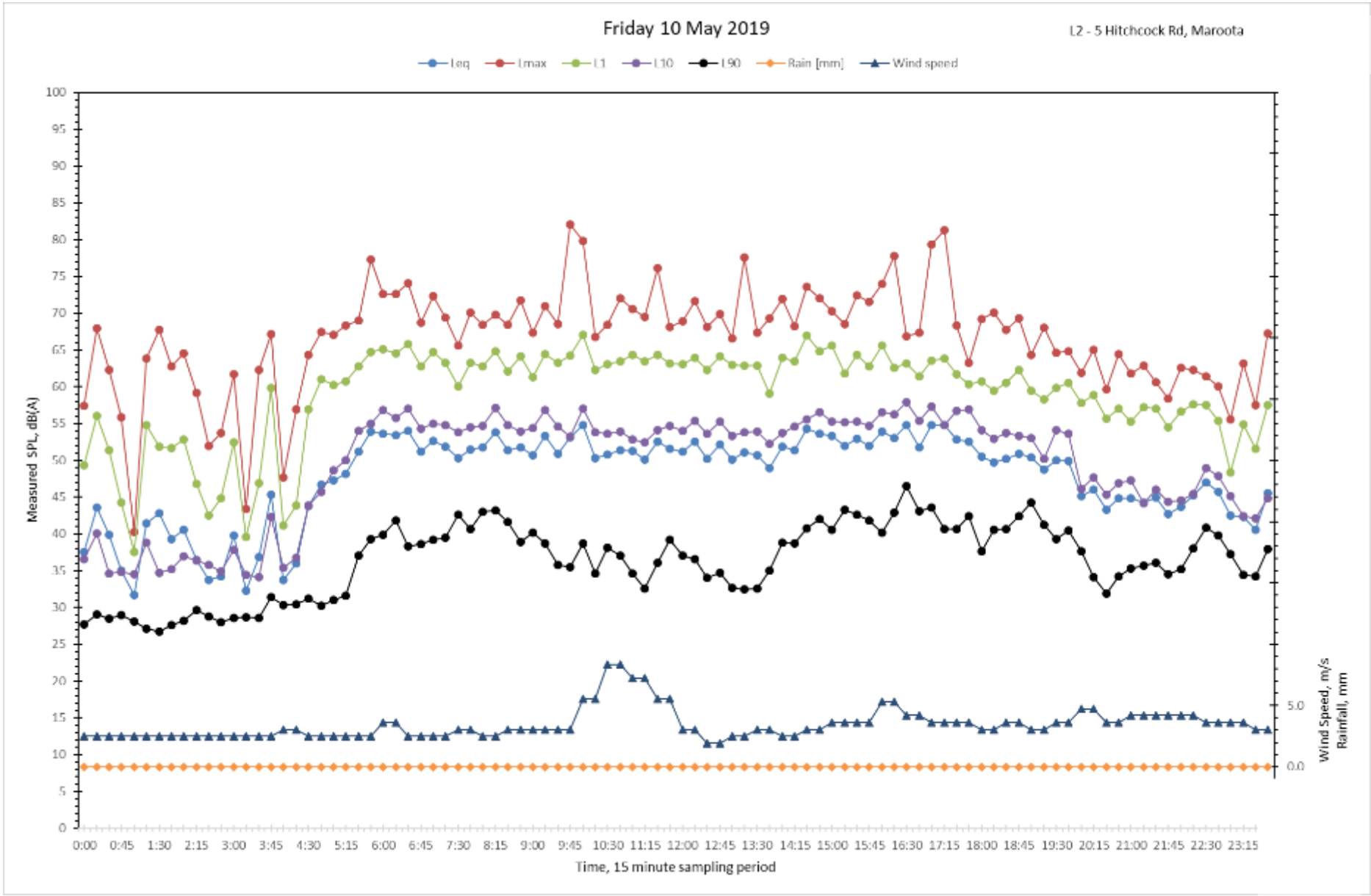
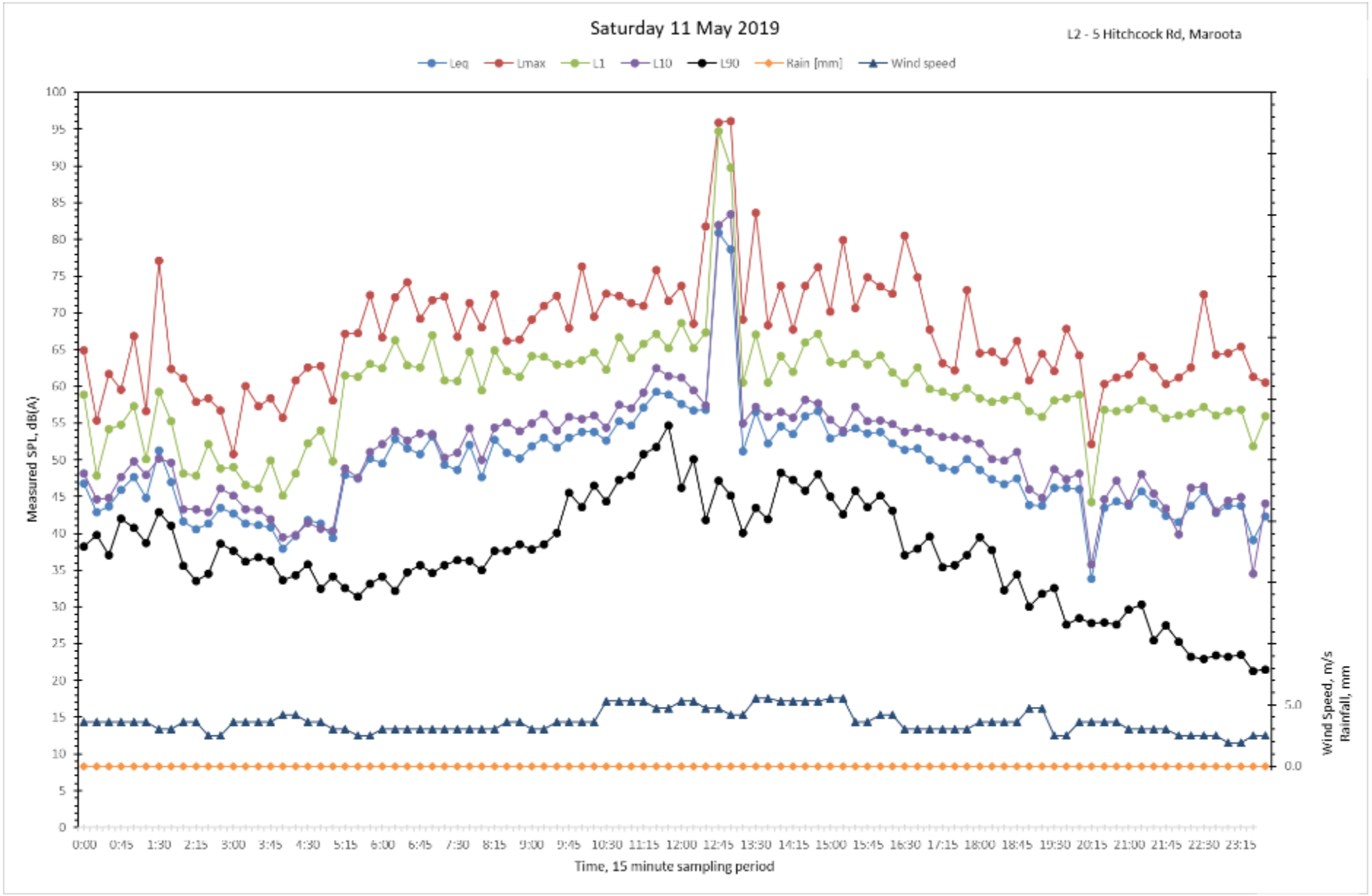
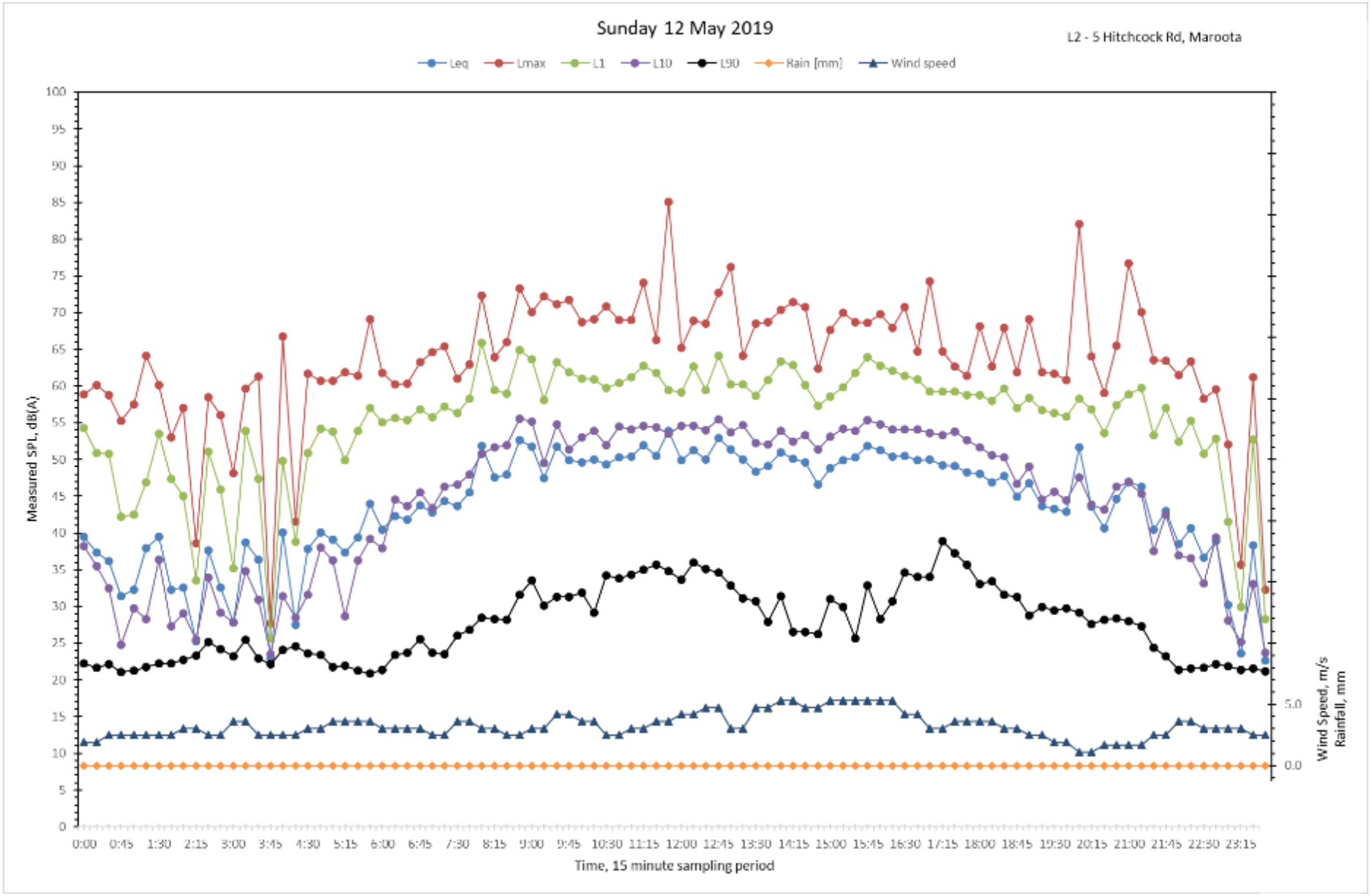
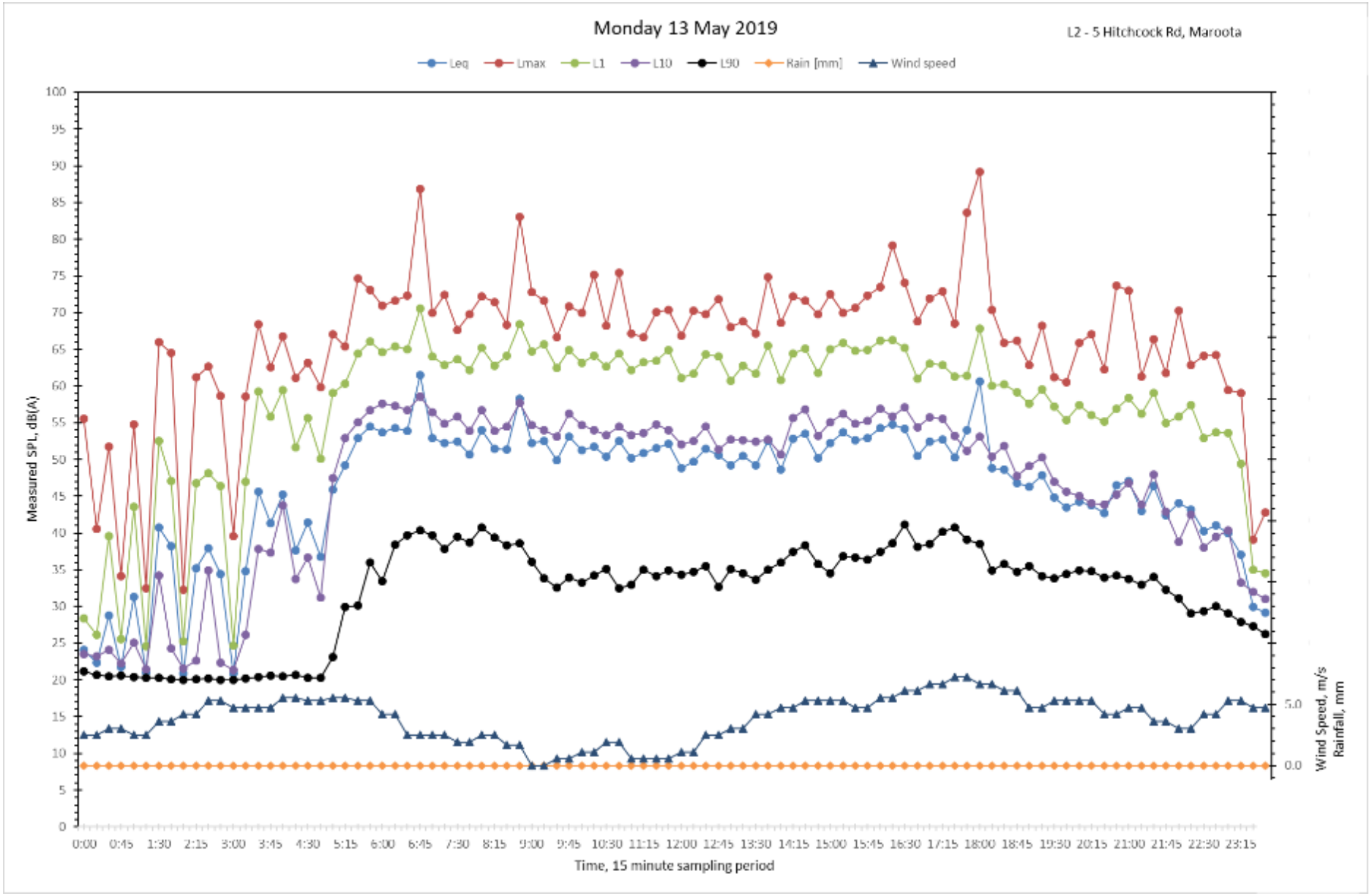
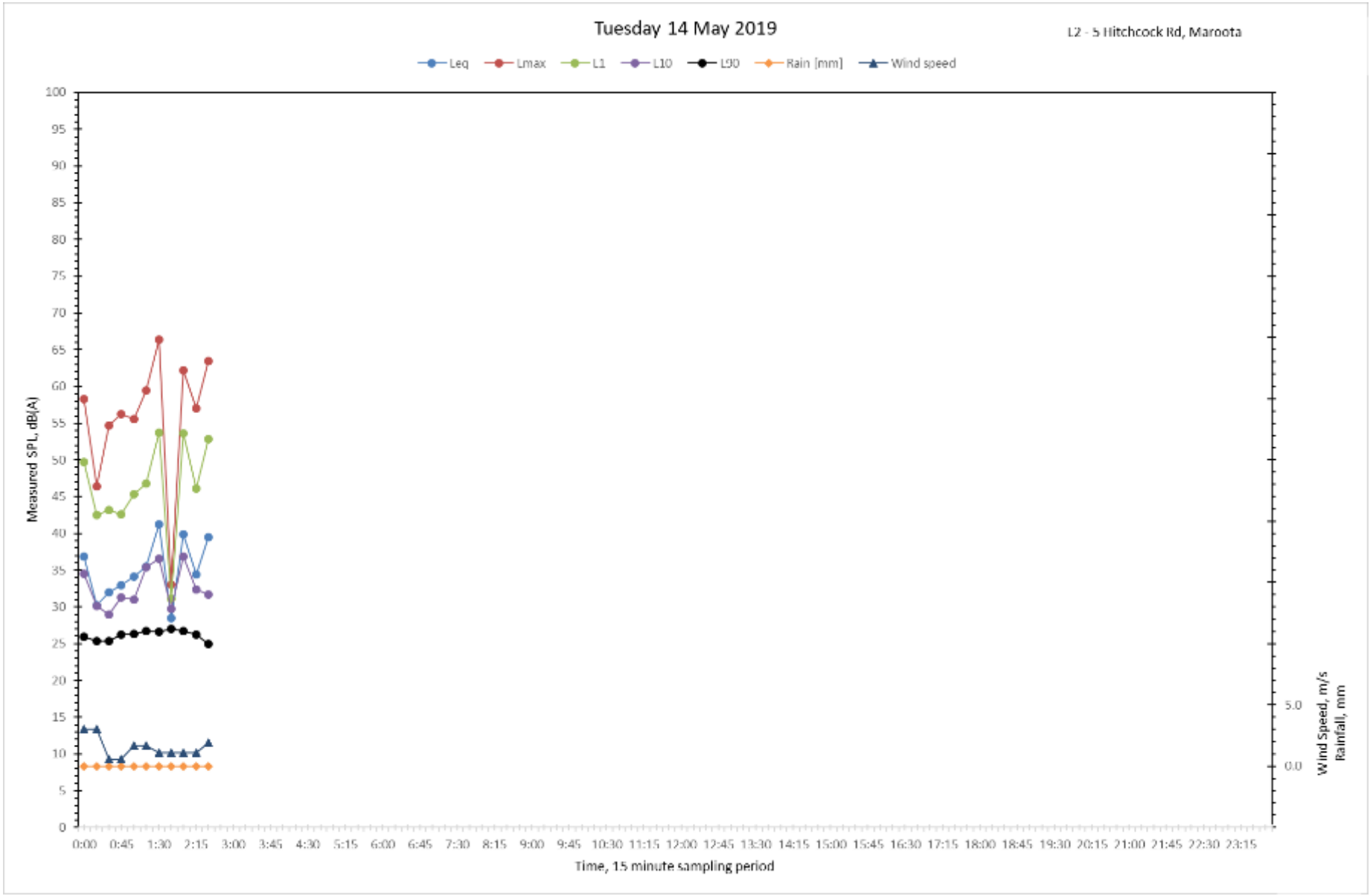
Lmax
L1
L10
L90
Rain [mm]
Wind speed
Measured SPL, dB(A)
Wind Speed, m/s
Rainfall, mm
5.0
0.0
Time, 15 minute sampling period

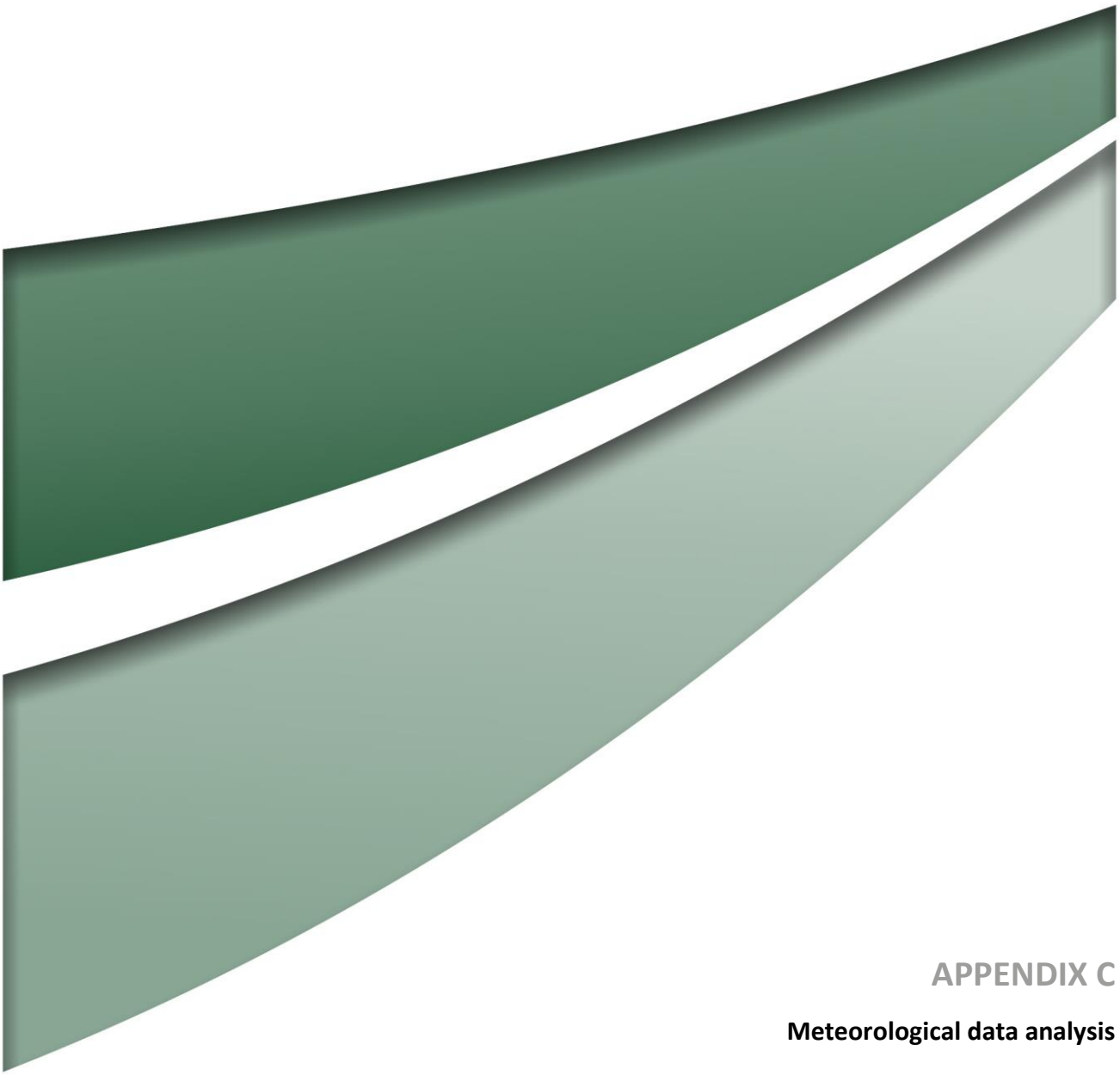

Friday 10 May 2019
L2 - 5 Hitchcock Rd, Maroota
Leq
Lmax
L1
L10
L90
Rain [mm]
Wind speed
Measured SPL, dB(A)
Wind Speed, m/s
Rainfall, mm
Time, 15 minute sampling period


Saturday 11 May 2019
L2 - 5 Hitchcock Rd, Maroota
Leq
Lmax
L1
L10
L90
Rain [mm]
Wind speed
Measured SPL, dB(A)
Wind Speed, m/s
Rainfall, mm
Time, 15 minute sampling period


Sunday 12 May 2019
L2 - 5 Hitchcock Rd, Maroota
Leq
Lmax
L1
L10
L90
Rain [mm]
Wind speed
Measured SPL, dB(A)
Wind Speed, m/s
Rainfall, mm
Time, 15 minute sampling period

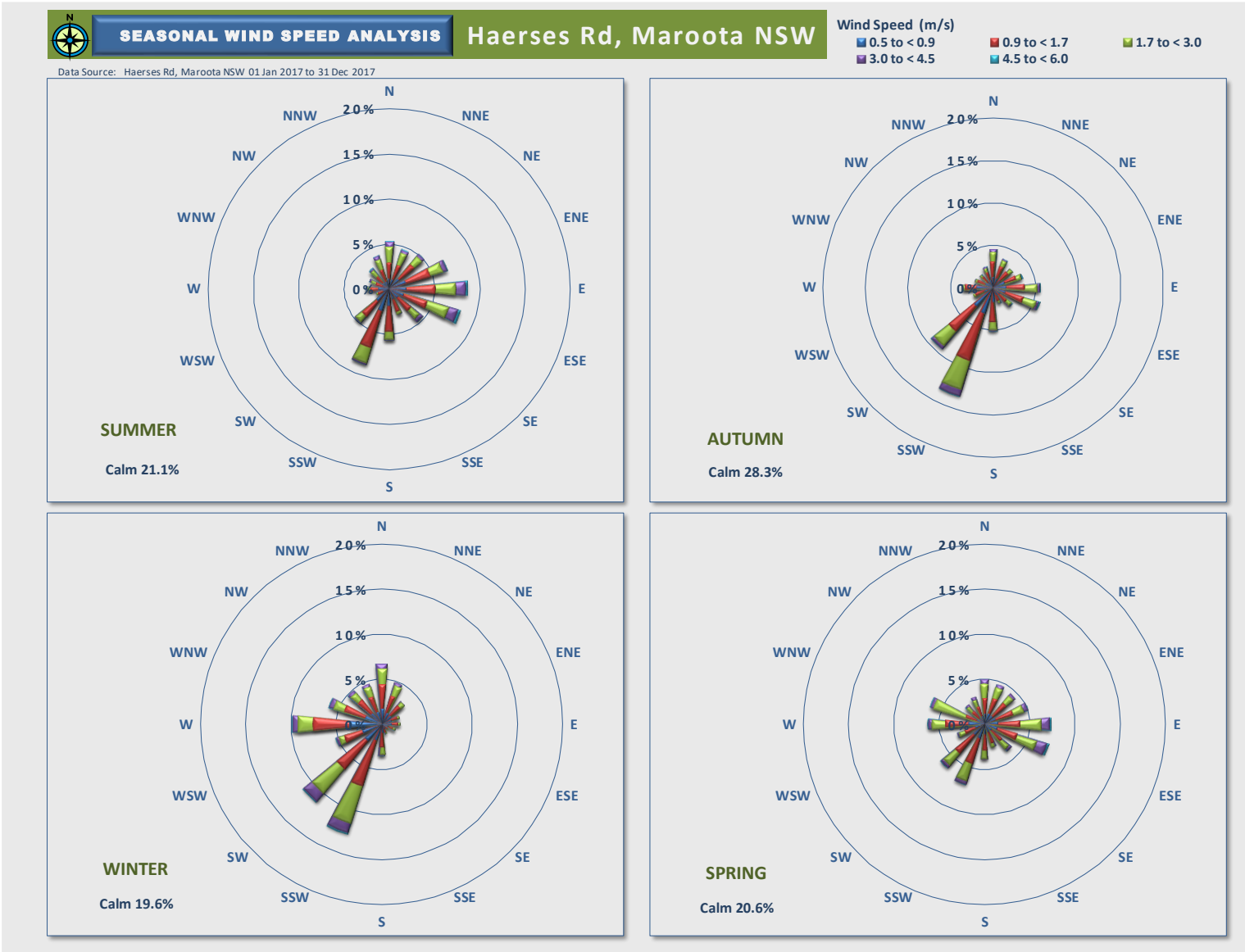

Monday 13 May 2019
L2 - 5 Hitchcock Rd, Maroota
Leq
Lmax
L1
L10
L90
Rain [mm]
Wind speed
Measured SPL, dB(A)
Wind Speed, m/s
Rainfall, mm
Time, 15 minute sampling period

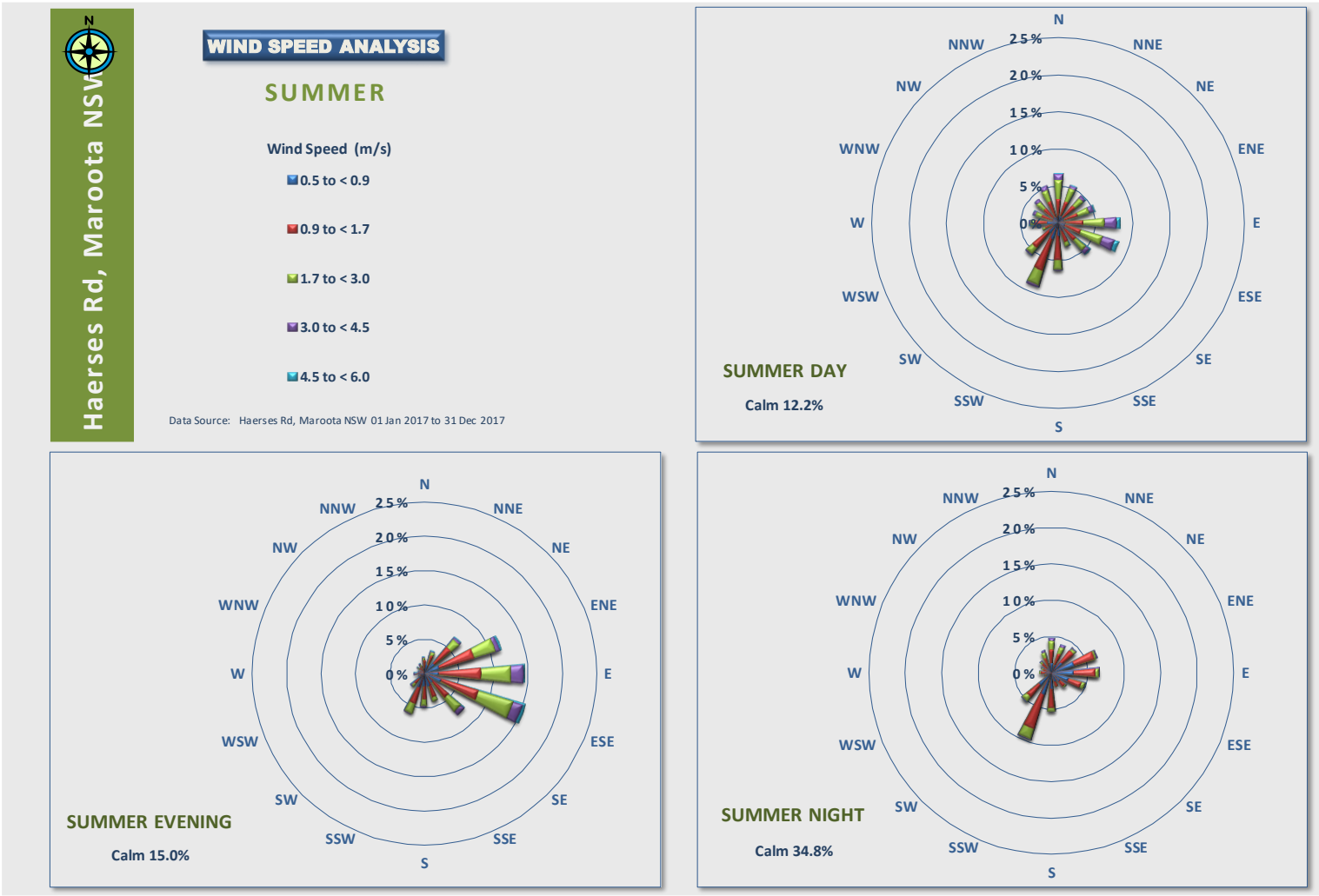

Tuesday 14 May 2019
L2 - 5 Hitchcock Rd, Maroota
Leq
Lmax
L1
L10
L90
Rain [mm]
Wind speed
Measured SPL, dB(A)
Wind Speed, m/s
Rainfall, mm
Time, 15 minute sampling period

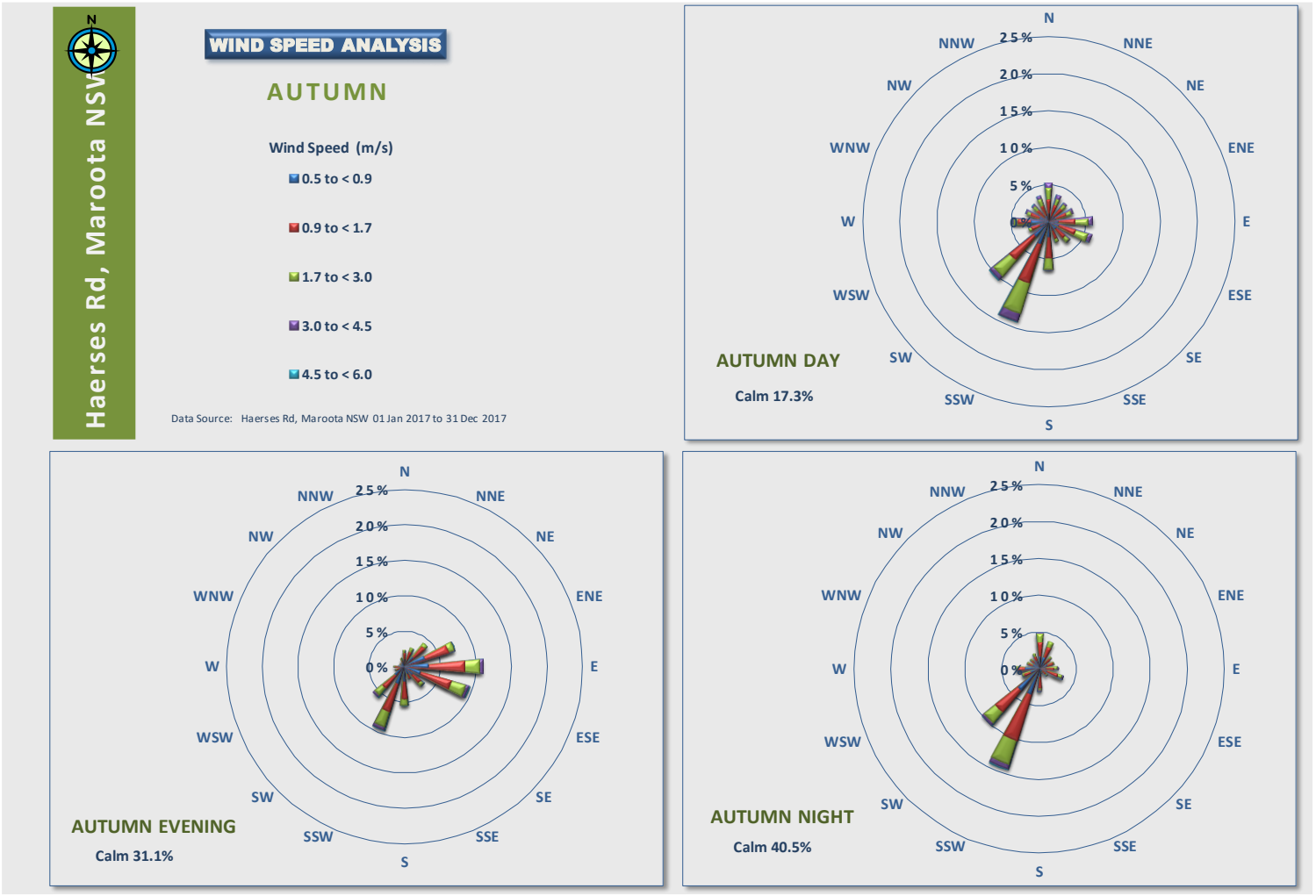


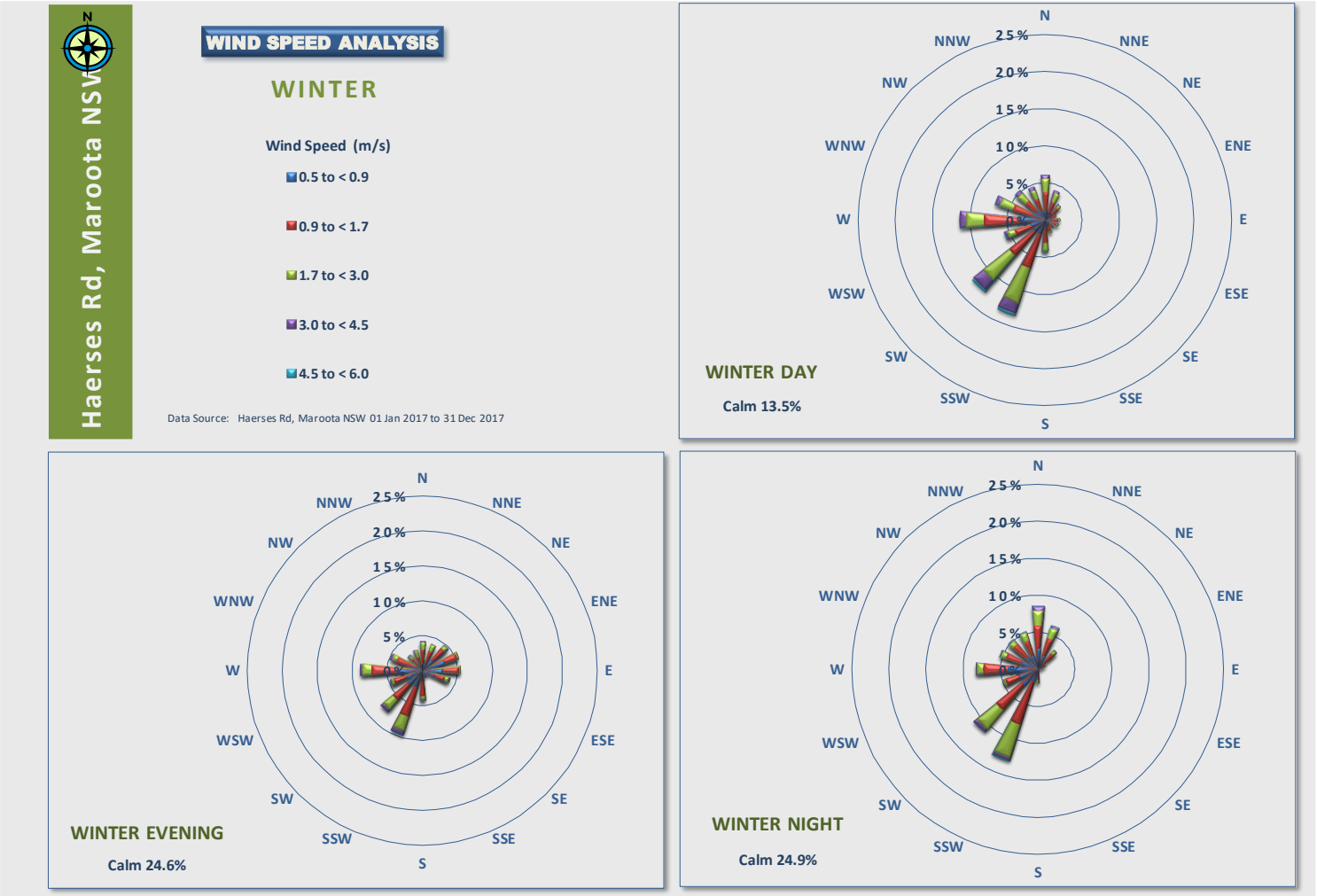
APPENDIX C

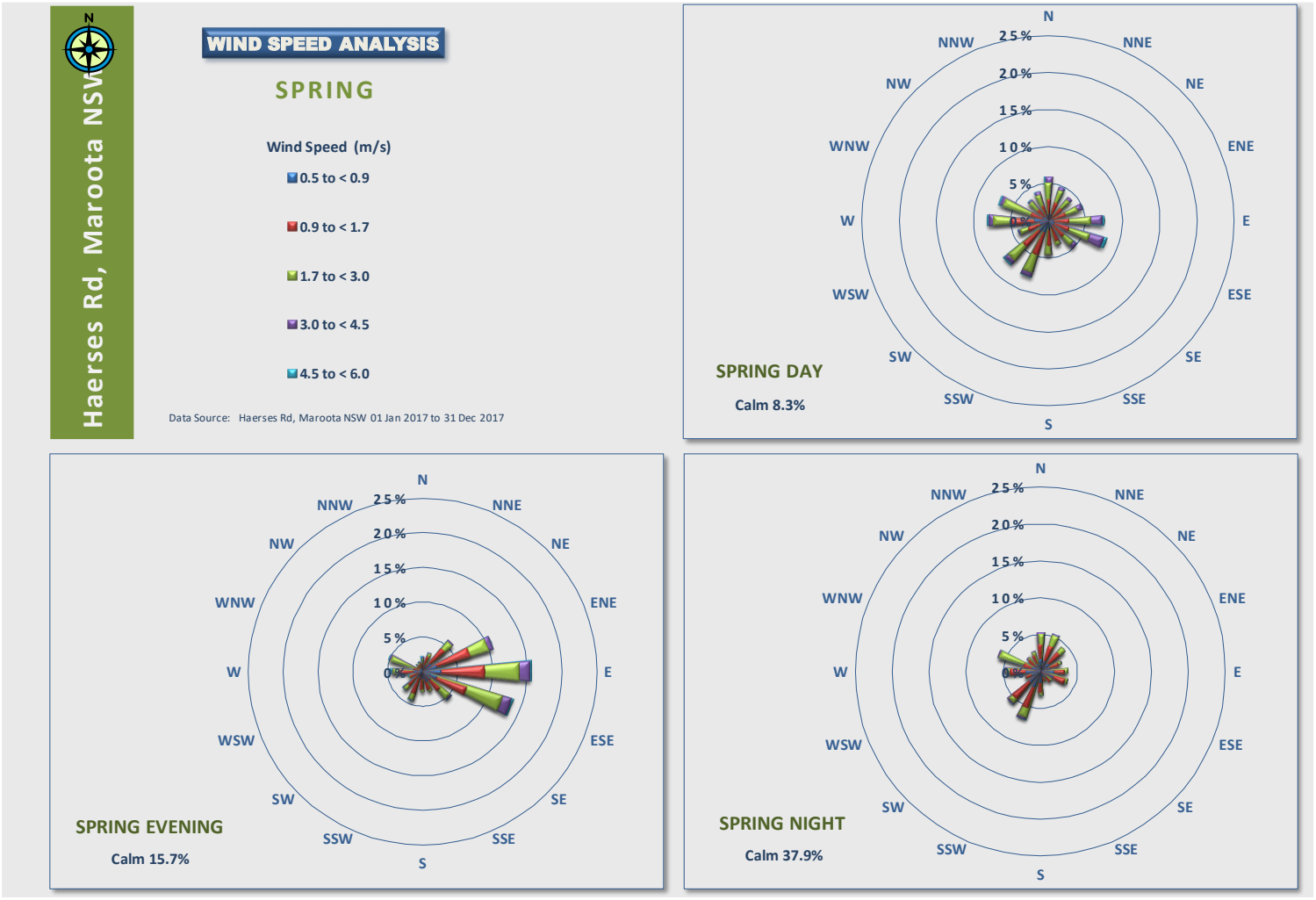
Meteorological data analysis

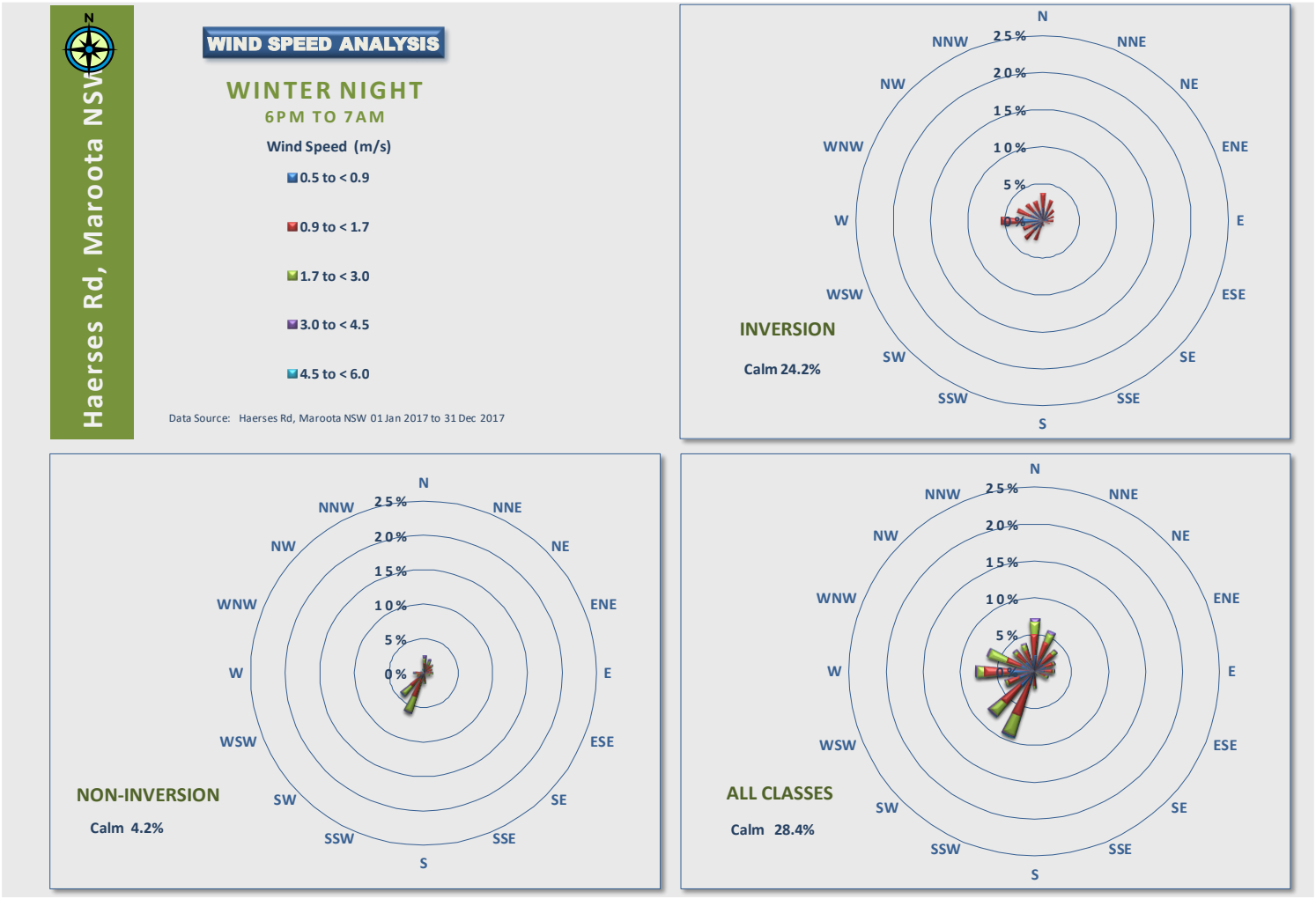

SEASONAL WIND SPEED ANALYSIS
Haerses Rd, Maroota NSW
Wind Speed (m/s)
0.5 to < 0.9
0.9 to < 1.7
1.7 to < 3.0
3.0 to < 4.5
4.5 to < 6.0
Data Source: Haerses Rd, Maroota NSW 01 Jan 2017 to 31 Dec 2017
SUMMER
Calm 21.1%
AUTUMN
Calm 28.3%
WINTER
Calm 19.6%
SPRING
Calm 20.6%
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
20%
15%
10%
5%
0%

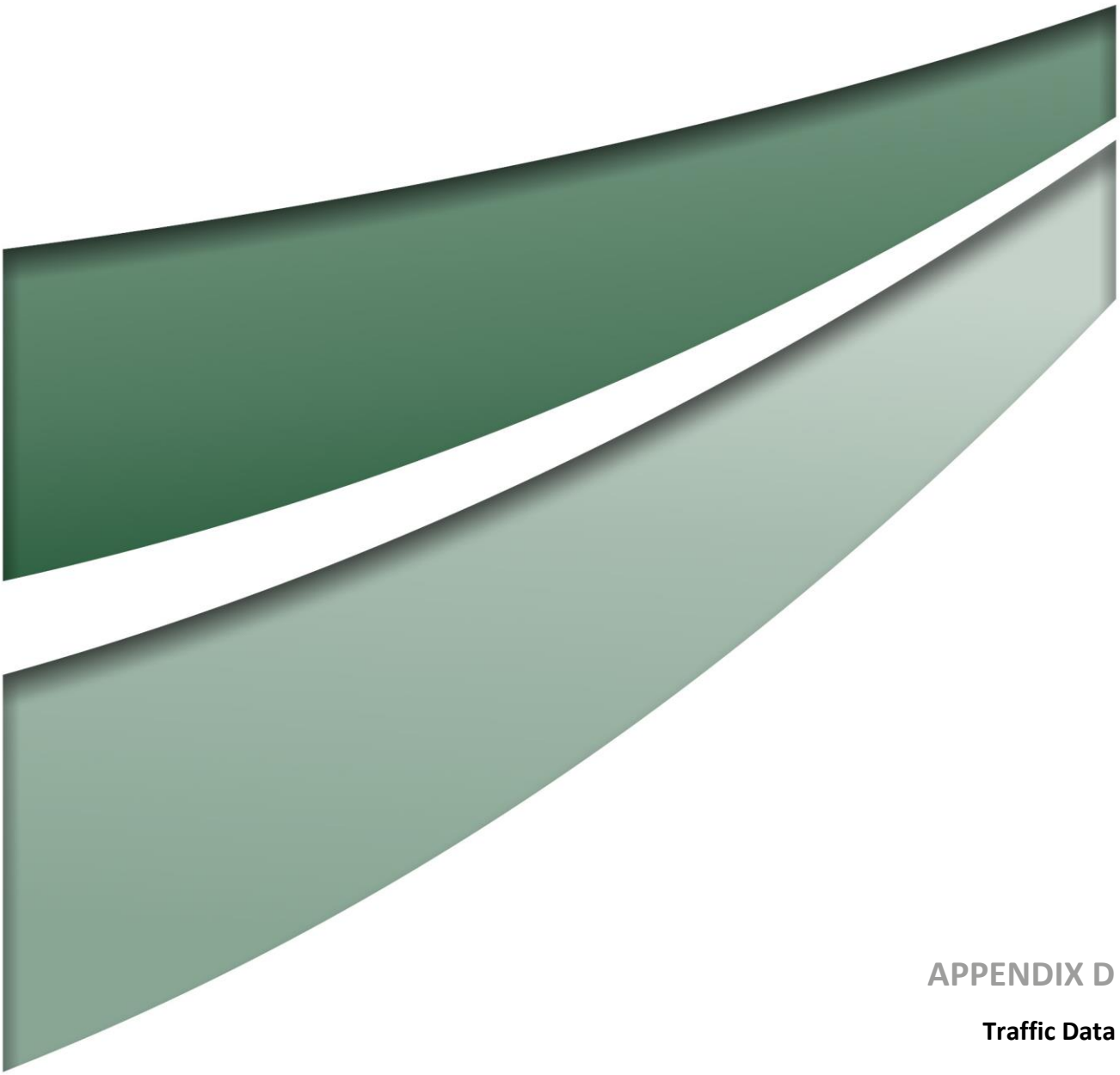

Haerses Rd, Maroota NSW
WIND SPEED ANALYSIS
SUMMER
Wind Speed (m/s)
0.5 to < 0.9
0.9 to < 1.7
1.7 to < 3.0
3.0 to < 4.5
4.5 to < 6.0
Data Source: Haerses Rd, Maroota NSW 01 Jan 2017 to 31 Dec 2017
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
25%
20%
15%
10%
5%
0%
SUMMER DAY
Calm 12.2%
SUMMER EVENING
Calm 15.0%
SUMMER NIGHT
Calm 34.8%


Haerses Rd, Maroota NSW
WIND SPEED ANALYSIS
AUTUMN
Wind Speed (m/s)
0.5 to < 0.9
0.9 to < 1.7
1.7 to < 3.0
3.0 to < 4.5
4.5 to < 6.0
Data Source: Haerses Rd, Maroota NSW 01 Jan 2017 to 31 Dec 2017
AUTUMN DAY
Calm 17.3%
AUTUMN EVENING
Calm 31.1%
AUTUMN NIGHT
Calm 40.5%
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
25%
20%
15%
10%
5%
0%


Haerses Rd, Maroota NSW
N
WIND SPEED ANALYSIS
WINTER
Wind Speed (m/s)
0.5 to < 0.9
0.9 to < 1.7
1.7 to < 3.0
3.0 to < 4.5
4.5 to < 6.0
Data Source: Haerses Rd, Maroota NSW 01 Jan 2017 to 31 Dec 2017
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
25%
20%
15%
10%
5%
WINTER DAY
Calm 13.5%
WINTER EVENING
Calm 24.6%
WINTER NIGHT
Calm 24.9%


Haerses Rd, Maroota NSW
WIND SPEED ANALYSIS
SPRING
Wind Speed (m/s)
0.5 to < 0.9
0.9 to < 1.7
1.7 to < 3.0
3.0 to < 4.5
4.5 to < 6.0
Data Source: Haerses Rd, Maroota NSW 01 Jan 2017 to 31 Dec 2017
SPRING DAY
Calm 8.3%
SPRING EVENING
Calm 15.7%
SPRING NIGHT
Calm 37.9%
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
25%
20%
15%
10%
5%
0%


Haerses Rd, Maroota NSW
WIND SPEED ANALYSIS
WINTER NIGHT
6PM TO 7AM
Wind Speed (m/s)
0.5 to < 0.9
0.9 to < 1.7
1.7 to < 3.0
3.0 to < 4.5
4.5 to < 6.0
Data Source: Haerses Rd, Maroota NSW 01 Jan 2017 to 31 Dec 2017
INVERSION
Calm 24.2%
NON-INVERSION
Calm 4.2%
ALL CLASSES
Calm 28.4%
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
25%
20%
15%
10%
5%
0%



APPENDIX D

Traffic Data

Job No	N4950 - Maroota ATC
Client	SECA Solution
Site	ATC 4 - Old Northern Road - north of Wisemans Ferry Road
Location	Maroota
Site No	4
Start Date	6-May-19
Day	7 Day Ave
Description	Class Summary
Classification	AustRoads94

Select Site

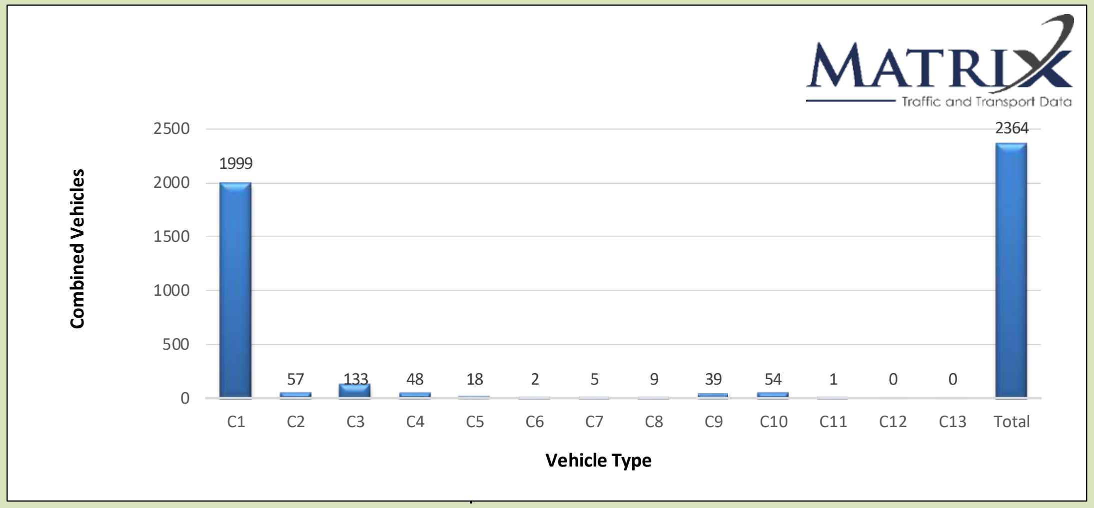
4. ATC 4 - Old Northern Road - north of Wisemans Ferry Road

Select Day

7 Day Ave

Menu

Class Summary		C	NB	SB
Light	C1	**85%**	85%	84%
	C2	**2%**	2%	2%
Medium	C3	**6%**	5%	6%
	C4	**2%**	2%	2%
	C5	**1%**	1%	1%
Heavy	C6	**0%**	0%	0%
	C7	**0%**	0%	0%
	C8	**0%**	0%	0%
	C9	**2%**	2%	2%
	C10	**2%**	2%	2%
	C11	**0%**	0%	0%
	C12	**0%**	0%	0%
Unclassified	C13	**0%**	0%	0%



NB

Hour Starting	C1 Short	C2 Short Towing	C3 2 axle Truck or bus	C4 3 Axle Truck or Bus	C5 4 or 5 Axle Truck	C6 3 axle Articulated	C7 4 Axle Articulated	C8 5 Axle Articulated	C9 6 Axle Articulated	C10 B Double	C11 Double Road Train	C12 Triple Road Train	C13 Unclassifiable	Total
0:00	5	0	0	0	0	0	0	0	0	0	0	0	0	**6**
1:00	2	0	0	0	0	0	0	0	0	0	0	0	0	**3**
2:00	2	0	0	0	0	0	0	0	0	0	0	0	0	**3**
3:00	2	0	0	0	0	0	0	0	0	0	0	0	0	**3**
4:00	3	0	0	1	0	0	0	0	0	0	0	0	0	**5**
5:00	21	1	2	1	1	0	0	0	1	4	0	0	0	**32**
6:00	30	1	5	1	0	0	0	0	2	2	0	0	0	**42**
7:00	28	1	6	2	1	0	1	0	1	2	0	0	0	**42**
8:00	49	2	5	2	1	0	0	0	2	2	0	0	0	**62**
9:00	52	2	5	2	1	0	0	1	2	4	0	0	0	**68**
10:00	64	2	4	2	1	0	0	0	3	2	0	0	0	**80**
11:00	94	3	5	3	1	0	0	0	2	2	0	0	0	**110**
12:00	83	2	5	2	1	0	0	1	1	3	0	0	0	**98**
13:00	80	2	4	2	1	0	0	1	2	2	0	0	0	**93**
14:00	82	2	4	1	0	0	0	0	2	2	0	0	0	**94**
15:00	82	2	5	2	0	0	0	0	1	1	0	0	0	**94**
16:00	89	3	6	1	0	0	0	0	1	0	0	0	0	**101**
17:00	85	2	2	0	0	0	0	0	0	0	0	0	0	**90**
18:00	61	1	2	0	0	0	0	0	0	0	0	0	0	**64**
19:00	35	1	1	0	0	0	0	0	0	0	0	0	0	**37**
20:00	22	0	0	0	0	0	0	0	0	0	0	0	0	**23**
21:00	18	1	0	0	0	0	0	0	0	0	0	0	0	**19**
22:00	13	0	1	0	0	0	0	0	0	0	0	0	0	**14**
23:00	9	0	0	0	0	0	0	0	0	0	0	0	0	**9**
Total	1011	29	62	24	9	1	2	4	21	25	0	0	0	**1189**

SB

Hour Starting	C1 Short	C2 Short Towing	C3 2 axle Truck or bus	C4 3 Axle Truck or Bus	C5 4 or 5 Axle Truck	C6 3 axle Articulated	C7 4 Axle Articulated	C8 5 Axle Articulated	C9 6 Axle Articulated	C10 B Double	C11 Double Road Train	C12 Triple Road Train	C13 Unclassifiable	Total
0:00	3	0	0	0	0	0	0	0	0	0	0	0	0	**3**
1:00	2	0	1	0	0	0	0	0	0	0	0	0	0	**3**
2:00	2	0	0	0	0	0	0	0	0	0	0	0	0	**3**
3:00	2	0	1	0	0	0	0	0	1	0	0	0	0	**5**
4:00	12	0	1	0	0	0	0	0	0	0	0	0	0	**13**
5:00	40	1	4	0	1	0	1	0	1	0	0	0	0	**48**
6:00	59	1	3	2	1	0	0	0	2	7	0	0	0	**76**
7:00	59	1	5	1	0	0	0	0	0	2	0	0	0	**70**
8:00	69	2	3	3	1	0	0	0	1	2	0	0	0	**81**
9:00	62	2	4	3	1	0	0	0	2	3	0	0	0	**76**
10:00	58	2	4	2	1	0	0	0	1	3	0	0	0	**73**
11:00	61	2	4	3	1	0	0	0	2	2	0	0	0	**76**
12:00	74	3	5	2	1	0	0	1	1	1	0	0	0	**89**
13:00	68	3	5	2	2	0	0	0	1	3	0	0	0	**84**
14:00	76	2	6	2	1	0	0	1	2	2	0	0	0	**90**
15:00	99	2	7	2	0	0	0	0	1	2	0	0	0	**114**
16:00	83	2	8	1	0	0	0	0	1	0	0	0	0	**96**
17:00	71	1	5	0	0	0	0	0	1	0	0	0	0	**78**
18:00	28	1	2	0	0	0	0	0	0	0	0	0	0	**31**
19:00	19	1	1	0	0	0	0	0	0	0	0	0	0	**21**
20:00	15	0	0	0	0	0	0	0	0	0	0	0	0	**15**
21:00	11	0	0	0	0	0	0	0	0	0	0	0	0	**12**
22:00	11	0	1	0	0	0	0	0	0	0	0	0	0	**12**
23:00	4	0	1	0	0	0	0	0	0	0	0	0	0	**6**
Total	988	28	71	24	9	1	3	4	18	29	0	0	0	**1175**

COMBINED

Hour Starting	C1 Short	C2 Short Towing	C3 2 axle Truck or bus	C4 3 Axle Truck or Bus	C5 4 or 5 Axle Truck	C6 3 axle Articulated	C7 4 Axle Articulated	C8 5 Axle Articulated	C9 6 Axle Articulated	C10 B Double	C11 Double Road Train	C12 Triple Road Train	C13 Unclassifiable	Total
0:00	8	0	0	0	0	0	0	0	0	0	0	0	0	**9**
1:00	3	0	2	0	0	0	0	0	0	0	0	0	0	**6**
2:00	4	0	1	1	0	0	0	0	1	0	0	0	0	**6**
3:00	4	0	2	0	0	0	0	0	1	0	0	0	0	**7**
4:00	15	0	1	1	0	0	0	0	0	0	0	0	0	**17**
5:00	62	2	6	1	1	0	1	1	2	4	0	0	0	**80**
6:00	89	3	8	3	1	0	0	1	4	9	0	0	0	**119**
7:00	87	3	11	3	2	0	1	0	1	4	0	0	0	**112**
8:00	118	4	8	5	2	0	0	0	2	3	0	0	0	**143**
9:00	114	4	8	5	1	0	0	1	4	6	0	0	0	**144**
10:00	123	4	8	4	2	0	0	1	4	5	0	0	0	**152**
11:00	155	5	9	7	2	0	0	0	4	4	0	0	0	**186**
12:00	157	4	10	5	2	0	1	1	2	4	0	0	0	**186**
13:00	148	5	8	4	2	0	0	1	3	6	0	0	0	**177**
14:00	157	4	10	3	1	0	0	1	3	4	0	0	0	**184**
15:00	180	4	12	4	1	0	0	0	2	3	0	0	0	**207**
16:00	172	6	14	2	0	0	0	1	1	1	0	0	0	**197**
17:00	156	3	7	0	0	0	0	0	1	0	0	0	0	**168**
18:00	89	2	4	0	0	0	0	0	0	0	0	0	0	**95**
19:00	55	2	1	0	0	0	0	0	0	0	0	0	0	**58**
20:00	37	0	1	0	0	0	0	0	0	0	0	0	0	**38**
21:00	29	1	1	0	0	0	0	0	0	0	0	0	0	**30**
22:00	24	0	2	0	0	0	0	0	0	0	0	0	0	**26**
23:00	13	0	1	0	0	0	0	0	0	0	0	0	0	**15**
Total	1999	57	133	48	18	2	5	9	39	54	1	0	0	**2364**

Day	
Sum of Light Vehicles	1828
Sum of Heavy Vehicles	251

Night	
Sum of Light Vehicles	228
Sum of Heavy Vehicles	58

Job No	N4950 - Maroota ATC
Client	SECA Solution
Site	ATC 3 - Wisemans Ferry Road - east of Haerses Road
Location	Maroota
Site No	3
Start Date	6-May-19
Day	7 Day Ave
Description	Class Summary
Classification	AustRoads94

Select Site

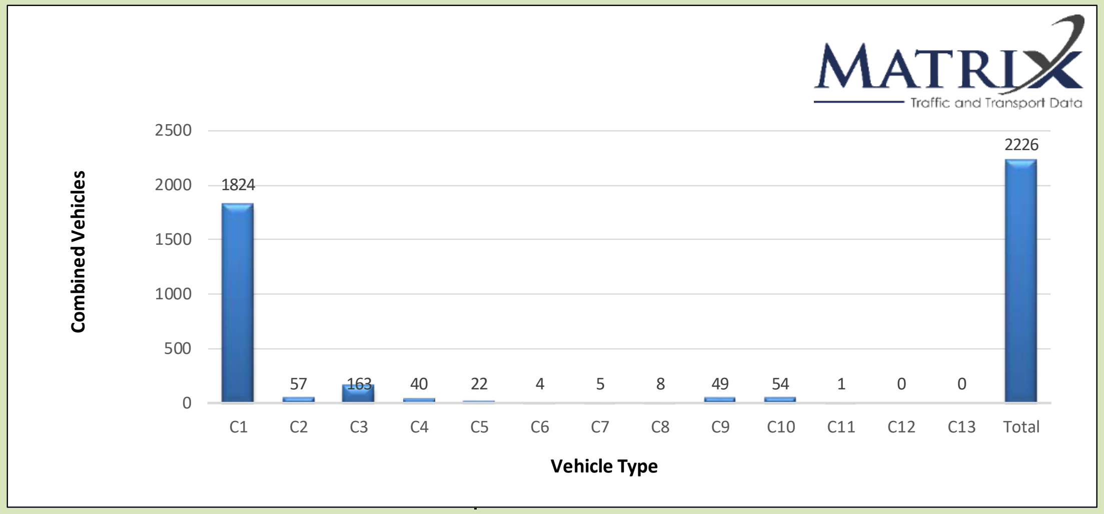
3. ATC 3 - Wisemans Ferry Road - east of Haerses Road

Select Day

7 Day Ave

Menu

Class Summary		C	NB	SB
Light	C1	**82%**	83%	81%
	C2	**3%**	3%	2%
Medium	C3	**7%**	5%	10%
	C4	**2%**	2%	2%
	C5	**1%**	1%	1%
Heavy	C6	**0%**	0%	0%
	C7	**0%**	0%	0%
	C8	**0%**	0%	0%
	C9	**2%**	3%	2%
	C10	**2%**	3%	2%
	C11	**0%**	0%	0%
	C12	**0%**	0%	0%
Unclassified	C13	**0%**	0%	0%



NB

Hour Starting	C1 Short	C2 Short Towing	C3 2 axle Truck or bus	C4 3 Axle Truck or Bus	C5 4 or 5 Axle Truck	C6 3 axle Articulated	C7 4 Axle Articulated	C8 5 Axle Articulated	C9 6 Axle Articulated	C10 B Double	C11 Double Road Train	C12 Triple Road Train	C13 Unclassifiable	Total
0:00	3	0	0	0	0	0	0	0	0	0	0	0	0	**3**
1:00	2	0	0	0	0	0	0	0	0	0	0	0	0	**3**
2:00	2	0	0	0	0	0	0	0	0	0	0	0	0	**2**
3:00	5	0	0	0	0	0	0	0	0	0	0	0	0	**6**
4:00	9	0	1	1	0	0	0	0	0	0	0	0	0	**12**
5:00	47	1	3	1	1	0	0	0	1	5	0	0	0	**59**
6:00	64	2	5	1	1	0	0	0	3	2	0	0	0	**77**
7:00	54	2	5	2	1	0	1	0	2	3	0	0	0	**69**
8:00	67	2	5	2	2	0	0	0	3	4	0	0	0	**86**
9:00	59	3	4	2	1	0	0	1	3	4	0	0	0	**76**
10:00	58	2	5	2	1	0	0	0	3	4	0	0	0	**76**
11:00	75	2	4	2	1	0	0	0	3	2	0	0	0	**89**
12:00	66	2	4	3	1	0	0	0	3	2	0	0	0	**81**
13:00	59	2	5	1	1	0	0	0	3	2	0	0	0	**73**
14:00	73	2	4	1	1	0	0	0	3	2	0	0	0	**87**
15:00	75	2	3	1	0	0	0	0	1	2	0	0	0	**85**
16:00	66	3	6	1	0	0	0	0	1	0	0	0	0	**77**
17:00	56	3	2	0	0	0	0	0	0	0	0	0	0	**61**
18:00	39	1	1	0	0	0	0	0	0	0	0	0	0	**42**
19:00	25	1	1	0	0	0	0	0	0	0	0	0	0	**26**
20:00	12	0	0	0	0	0	0	0	0	0	0	0	0	**13**
21:00	12	0	0	0	0	0	0	0	0	0	0	0	0	**13**
22:00	9	0	0	0	0	0	0	0	0	0	0	0	0	**10**
23:00	6	0	0	0	0	0	0	0	0	0	0	0	0	**7**
Total	943	31	58	22	12	1	2	2	30	31	0	0	0	**1133**

SB

Hour Starting	C1 Short	C2 Short Towing	C3 2 axle Truck or bus	C4 3 Axle Truck or Bus	C5 4 or 5 Axle Truck	C6 3 axle Articulated	C7 4 Axle Articulated	C8 5 Axle Articulated	C9 6 Axle Articulated	C10 B Double	C11 Double Road Train	C12 Triple Road Train	C13 Unclassifiable	Total
0:00	3	0	0	0	0	0	0	0	0	0	0	0	0	**3**
1:00	4	0	1	0	0	0	0	0	0	0	0	0	0	**6**
2:00	2	0	0	0	0	0	0	0	0	0	0	0	0	**3**
3:00	3	0	1	0	0	0	0	0	1	0	0	0	0	**5**
4:00	7	0	0	0	0	0	0	0	0	0	0	0	0	**7**
5:00	23	1	3	1	1	0	0	0	0	0	0	0	0	**28**
6:00	44	1	4	1	1	0	0	0	2	6	0	0	0	**61**
7:00	42	2	7	1	1	0	0	0	0	1	0	0	0	**55**
8:00	54	3	5	3	1	0	0	1	1	2	0	0	0	**70**
9:00	58	2	6	2	1	0	0	0	1	2	0	0	0	**74**
10:00	51	2	8	1	1	0	0	1	2	3	0	0	0	**69**
11:00	64	1	6	1	1	0	0	1	2	2	0	0	0	**78**
12:00	57	2	8	1	1	0	1	1	2	0	0	0	0	**72**
13:00	62	1	6	1	0	0	0	1	1	2	0	0	0	**75**
14:00	64	2	8	2	0	0	0	1	2	1	0	0	0	**80**
15:00	84	3	11	1	0	0	0	1	2	1	0	0	0	**104**
16:00	77	2	13	1	0	0	0	0	1	1	0	0	0	**97**
17:00	76	1	8	0	0	0	0	0	0	0	0	0	0	**87**
18:00	39	1	4	0	0	0	0	0	0	0	0	0	0	**44**
19:00	23	1	2	0	0	0	0	0	0	0	0	0	0	**26**
20:00	18	0	1	0	0	0	0	0	0	0	0	0	0	**19**
21:00	13	0	2	0	0	0	0	0	0	0	0	0	0	**15**
22:00	9	0	0	0	0	0	0	0	0	0	0	0	0	**10**
23:00	4	0	0	0	0	0	0	0	0	0	0	0	0	**5**
Total	881	26	106	17	10	3	3	5	19	22	1	0	0	**1093**

COMBINED

Hour Starting	C1 Short	C2 Short Towing	C3 2 axle Truck or bus	C4 3 Axle Truck or Bus	C5 4 or 5 Axle Truck	C6 3 axle Articulated	C7 4 Axle Articulated	C8 5 Axle Articulated	C9 6 Axle Articulated	C10 B Double	C11 Double Road Train	C12 Triple Road Train	C13 Unclassifiable	Total
0:00	6	0	0	0	0	0	0	0	0	0	0	0	0	**6**
1:00	6	0	1	0	0	0	0	0	0	0	0	0	0	**8**
2:00	4	0	0	0	0	0	0	0	0	0	0	0	0	**5**
3:00	8	0	1	0	0	0	0	0	1	0	0	0	0	**11**
4:00	15	0	1	1	1	0	0	0	0	0	0	0	0	**19**
5:00	69	2	6	2	2	0	0	0	1	5	0	0	0	**88**
6:00	108	3	9	2	2	1	0	0	5	8	0	0	0	**138**
7:00	96	3	12	3	1	1	1	0	3	4	0	0	0	**124**
8:00	120	5	10	5	3	0	0	1	5	6	0	0	0	**155**
9:00	117	5	10	4	2	0	0	1	5	6	0	0	0	**150**
10:00	109	5	13	3	3	0	0	1	6	6	0	0	0	**145**
11:00	139	3	10	3	2	0	0	1	5	3	0	0	0	**167**
12:00	123	4	12	4	2	0	1	1	4	3	0	0	0	**153**
13:00	121	3	11	3	1	0	0	1	4	4	0	0	0	**148**
14:00	137	4	12	3	1	0	0	1	5	3	0	0	0	**167**
15:00	158	5	14	2	1	0	0	1	3	3	0	0	0	**189**
16:00	143	5	19	3	0	0	0	0	2	1	0	0	0	**174**
17:00	131	4	10	0	0	0	0	0	0	1	0	0	0	**147**
18:00	78	2	5	0	0	0	0	0	0	0	0	0	0	**86**
19:00	48	1	3	0	0	0	0	0	0	0	0	0	0	**52**
20:00	30	0	1	0	0	0	0	0	0	0	0	0	0	**32**
21:00	26	1	2	0	0	0	0	0	0	0	0	0	0	**28**
22:00	18	0	1	0	0	0	0	0	0	0	0	0	0	**20**
23:00	10	1	1	0	0	0	0	0	0	0	0	0	0	**12**
Total	1824	57	163	40	22	4	5	8	49	54	1	0	0	**2226**

Day	
Sum of Light Vehicles	1629
Sum of Heavy Vehicles	290

Night	
Sum of Light Vehicles	252
Sum of Heavy Vehicles	55

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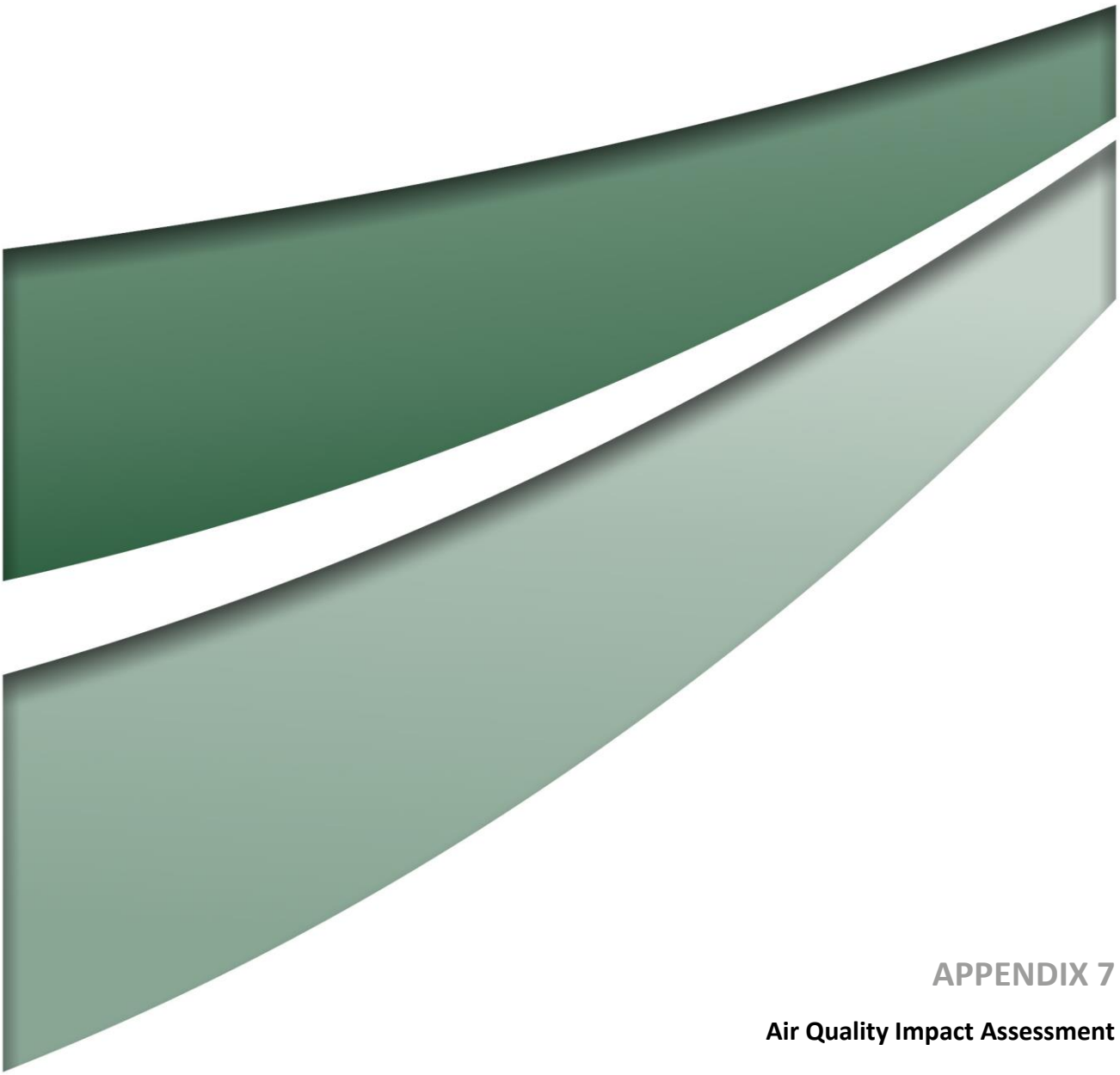
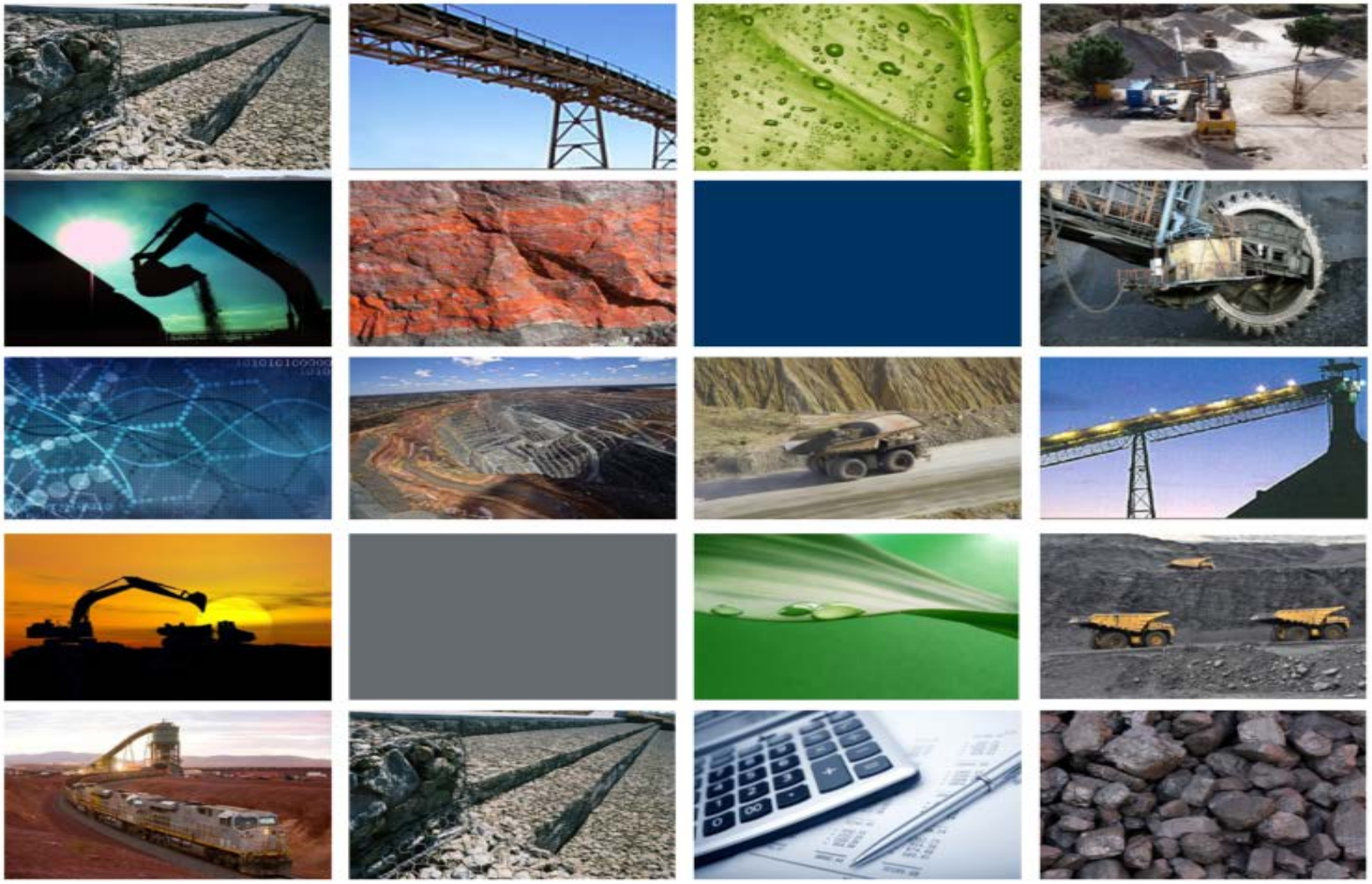


APPENDIX 7

Air Quality Impact Assessment



Dixon Sand Haerses Road Quarry Modification - Air Quality Assessment

Dixon Sand Quarry

19 September 2019

Project No.: 0508538

The business of sustainability

ERM

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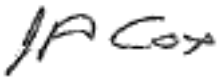
19 September 2019

Dixon Sand Haerses Road Quarry Modification - Air Quality Assessment

Dixon Sand Quarry



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CONTENTS

List of Tables

List of Figures

1. INTRODUCTION

Dixon Sand Pty Limited (Dixon Sand) operates the Haerses Road Quarry (the quarry) on land adjoining Haerses Road at Maroota in New South Wales (NSW), within the Hills Shire Council Local Government Area (LGA) in accordance with Development Consent DA 165-7-2005.

ERM has prepared this air quality assessment for Dixon Sand (the Proponent) to assess the air quality impacts associated with the proposed additional extraction area and other changes to the existing sand quarrying activities at the Haerses Road Quarry. The additional extraction area relates to an area of land to the north of the existing tertiary sand resource (the Proposal).

The assessment has been prepared in general accordance with the NSW EPA "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW", hereafter referred to as the *Approved Methods* (NSW EPA, 2017).

2. PROPOSAL DESCRIPTION

The locality of the quarry is shown on Figure 2-1. The quarry site is approximately 128 hectares (ha) and includes Lot 170 DP 664766, Lot 170 DP 664767, Lots A and B DP 407341, Lots 176, 177 and 216 DP 752039, and Part Lot 3 DP 111886 which adjoin Haerses Road (refer to Figure 2-2).

The quarry is located within the small rural community of Maroota which supports several other sand extraction operations, including the Old Northern Road Quarry which is also operated by Dixon Sand. The quarry supplies concrete sand and specialty sands to the Sydney metropolitan market.

The quarry operates in accordance with Development Consent DA 165-7-2005 (State Significant Development under the *State Environmental Planning Policy (State and Regional Development) 2011*) (the development consent).

The proposed modification to the development is as follows:

- a small extension in extraction area of approximately 1 ha and modification to the buffer at the northern end of the quarry (see Figure 2-2);
- an increase in extraction rate from 250,000 tpa to 495,000 tpa;
- an increase in the amount of VENM and ENM to be imported to the quarry from 100,000 tpa to 250,000 tpa; and
- an increase in the number of trucks permitted to travel to and from the quarry from 56 per day to 180 per day.

Associated with these changes will be some minor modifications to the on-site fleet of mobile equipment and water management system. There is to be no change to the quarry's hours of operation, existing access arrangements and transport routes, nor to the maximum number of vehicle movements per hour (20) between 6am and 7am.

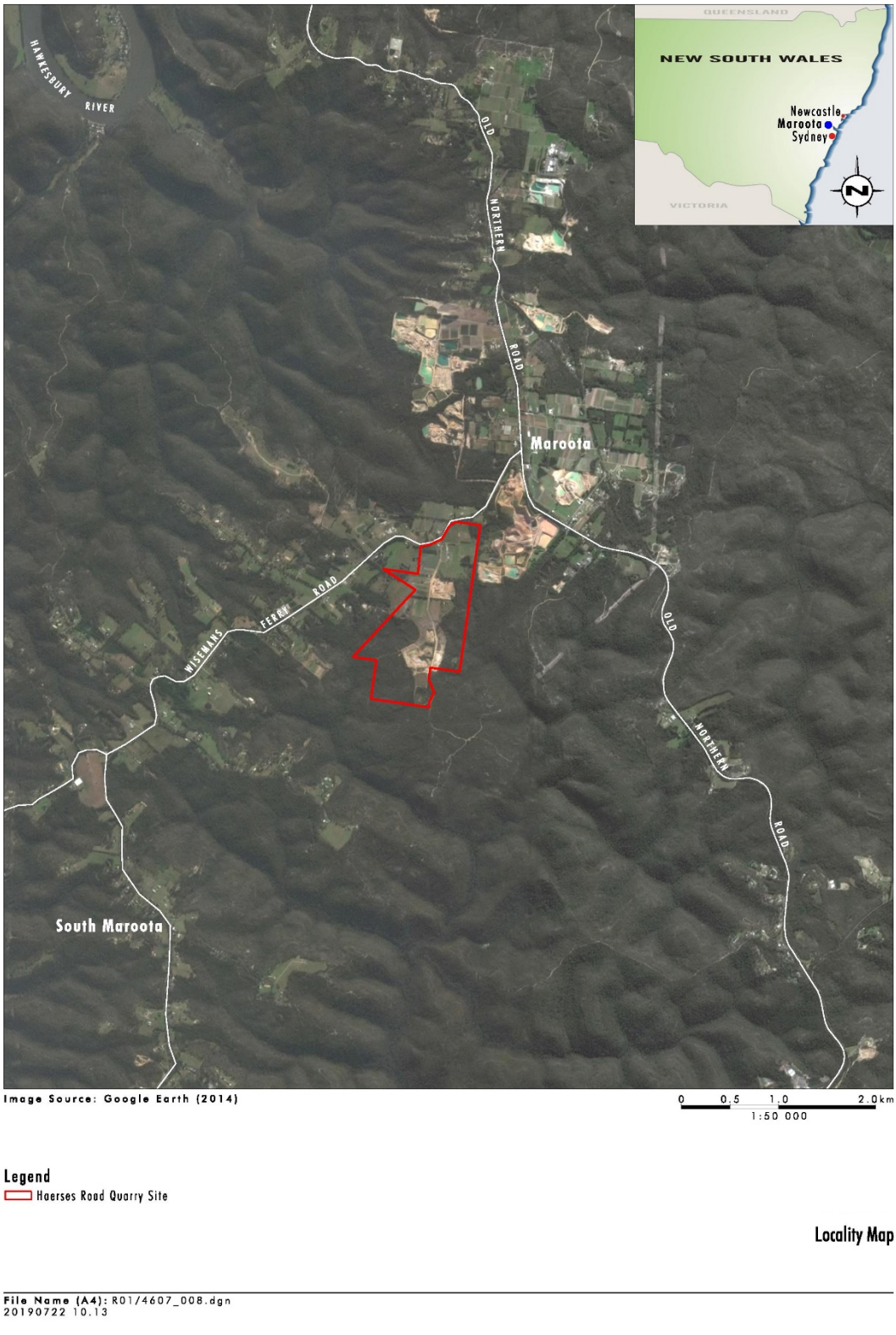


Figure 2-1: Locality Map

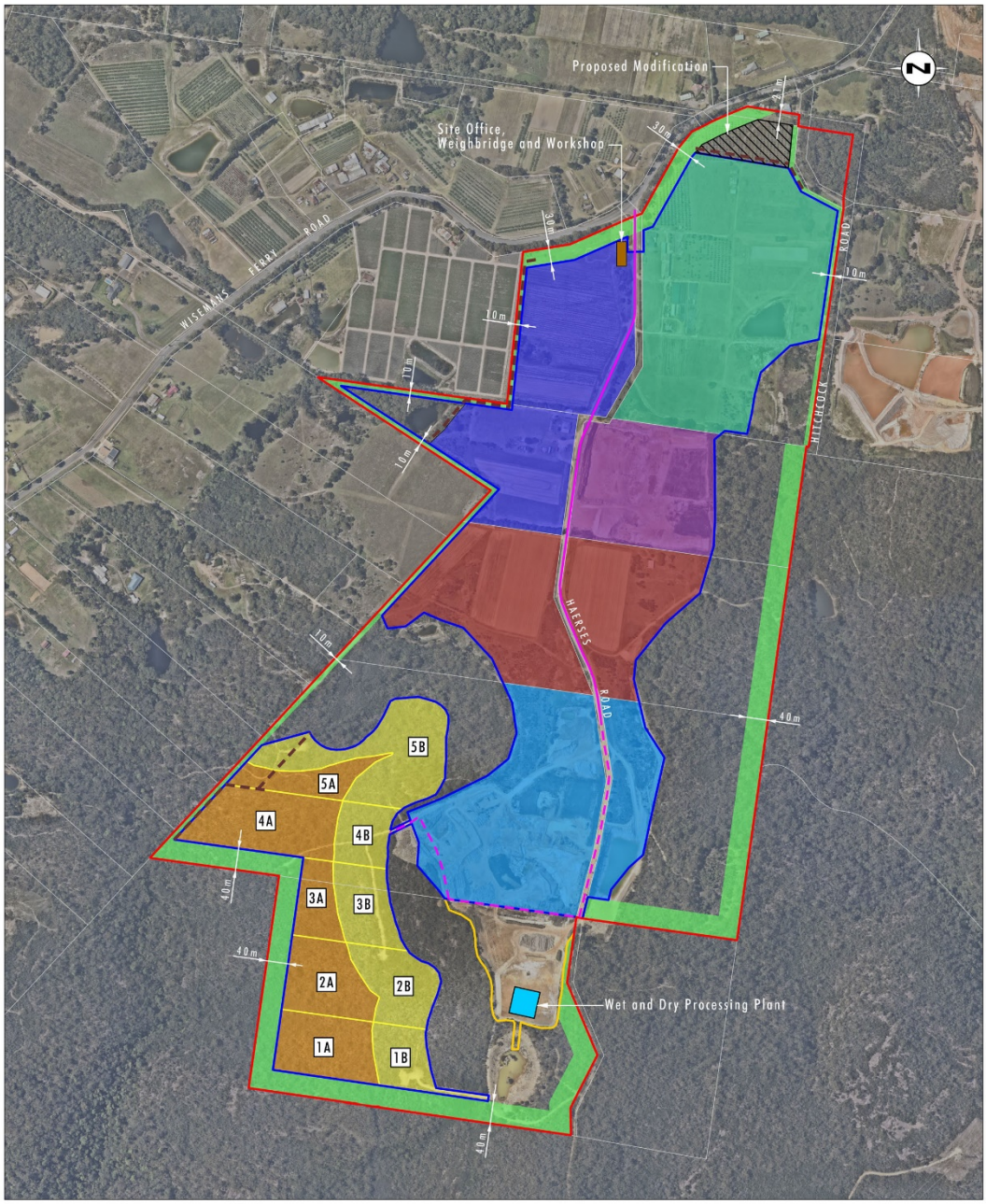


Figure 2-2: Site Plan

3. LOCAL SETTING

The land use in the area surrounding the proposed development is primarily rural, although there is significant sand extraction activity in the area, both by Dixon Sand and other companies. The closest discrete receptor locations are presented in Table 3-1. These residential receivers (some of which are owned by Dixon Sand and PF Formation, as stated) represent assessment locations in close proximity to the Proposal (see Figure 3-1).

Figure 3-1 also shows the location of the Dixon Sand dust deposition gauges.

Table 3-1: Receptor Locations

ID	Type	MGA Zone 56	
		Easting (m)	Northing (m)
R1	Residential	312924	6295200
R2	Residential	312780	6295033
R3	Residential	312454	6294919
R4	Residential	312177	6294850
R5	Residential	311939	6294631
R6	Residential	311871	6294275
R7	Residential	311600	6294343
R8	Residential	311702	6294162
R9	Residential	311543	6294146
R10	Residential	311283	6294161
R11	Residential	311179	6294076
R12	Residential	313049	6295163
R13	Residential	313018	6295228
R14	Residential	312353	6295030
R15	Residential	312207	6294990
R16	Residential	312103	6295021
R17	Residential	310707	6293300
R18	Residential	311239	6292850
R19	Residential	311627	6292424
R20	Residential	311873	6291990
R21	Residential	312031	6294320
D1	Owned by Dixon Sand	313103	6295173
PF1	Owned by PF Formation	313362	6295255
PF2	Owned by PF Formation	313242	6295125
PF3	Owned by PF Formation	313228	6294961

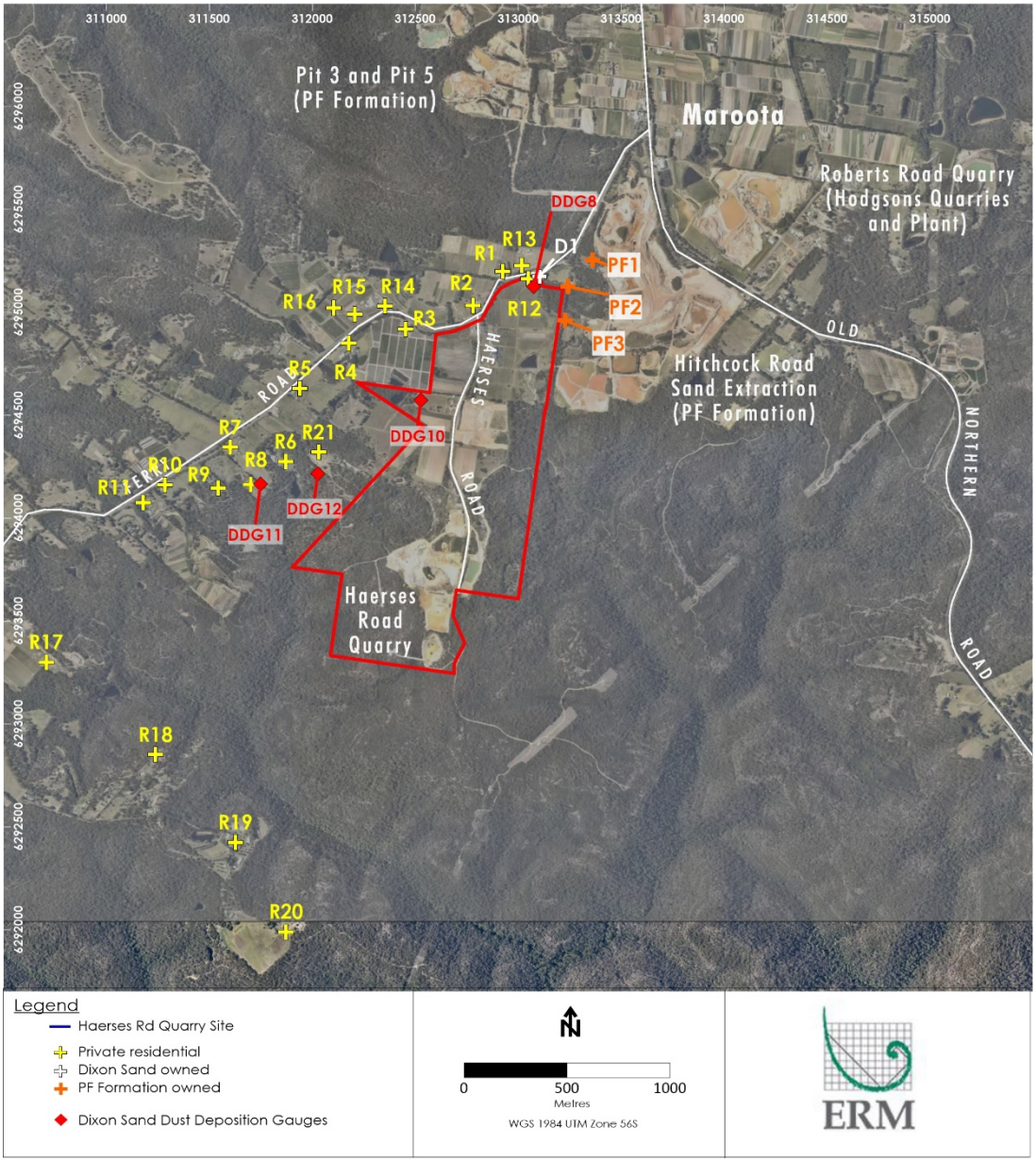


Figure 3-1: Location of the Haerses Road Quarry, sensitive receptors and dust deposition gauges

4. AIR QUALITY CRITERIA

The potential emissions to air from the Proposal are summarised as follows.

- Modification activities described in Section 2 have the potential to generate fugitive dust emissions, particularly from sand extraction, hauling, processing and site rehabilitation.
- Combustion of diesel in quarrying equipment will result in emissions of fine fractions of particulate matter (PM_{10} and $PM_{2.5}$), oxides of nitrogen (NO_x), carbon monoxide (CO), sulfur dioxide (SO_2) and organic compounds. This assessment focuses on the key pollutants of PM_{10} and $PM_{2.5}$.

4.1 NSW EPA Impact Assessment Criteria

The Approved Methods specifies air quality assessment criteria relevant for assessing impacts from air pollution (NSW EPA, 2017). The impact assessment criteria for pollutants relevant to this assessment refer to the total pollutant load in the environment and impacts from new sources of these pollutants must be added to existing background levels for compliance assessment. In other words, consideration of background pollutant levels needs to be made when using the goals outlined in the Approved Methods to assess potential impacts.

These criteria are health-based (i.e. they are set at levels to protect against health effects) and for PM_{10} and $PM_{2.5}$ are consistent with the National Environment Protection Measure for Ambient Air Quality (Ambient Air-NEPM) (NEPC, 2016). In addition, the Approved Methods include other measures of air quality, namely dust deposition and total suspended particulates (TSP) which are not stated in the Ambient Air-NEPM.

Table 4-1 summarises the air quality criteria for concentrations of particulate matter that are relevant to this study. It is important to note that these criteria are applied to the cumulative impacts due to the Proposal and other sources.

Table 4-1 NSW EPA impact assessment criteria for particulate matter concentrations

Pollutant	Criteria	Averaging period	Source
TSP	90 µg/m^3	Annual	NSW EPA (2017)
PM_{10}	50 µg/m^3	24-Hour	NSW EPA (2017)
	25 µg/m^3	Annual	
$PM_{2.5}$	25 µg/m^3	24-Hour	NSW EPA (2017)
	8 µg/m^3	Annual	

Notes: µg/m^3 – micrograms per cubic metre.

Airborne dust also has the potential to cause nuisance dust effects by depositing on surfaces, including vegetation. Larger particles do not tend to remain suspended in the atmosphere for long periods of time and will fallout relatively close to source. Dust fallout can soil materials and generally degrade aesthetic elements of the environment, and are assessed for nuisance amenity impacts.

Table 4-2 shows the maximum acceptable increase in dust deposition over the existing dust levels from an amenity perspective. These criteria for dust deposition levels are set to protect against nuisance impacts (NSW EPA, 2017).

Table 4-2 NSW EPA impact assessment criteria for deposited dust

Pollutant	Averaging period	Maximum increase (due to Proposal)	Maximum total deposited dust level	Source
Deposited dust (Insoluble Solids)	Annual	2 g/m^2/month	4 g/m^2/month	NSW EPA (2017)

4.2 Crystalline Silica

Whilst dust generated from the Proposal may contain silica dust, and long-term inhalation of silica dust may lead to the formation of scar tissue in the lungs, which can result in silicosis, a serious lung disease, silicosis is a work place issue associated with long-term exposure to high levels of respirable crystalline silica (RCS).

The World Health Organization's Concise International Chemical Assessment Document on Crystalline Silica, Quartz (CICAD, 2000) states that "there are no known adverse health effects associated with the non-occupational exposure to quartz". In addition, an Australian Government Senate Committee (2005) report identified that there are no reports in the international literature of individuals developing silicosis as a result of exposure to non-occupational levels (i.e. levels outside the work place) of silica dust, and an expert appearing before the committee confirmed the potential for such an occurrence as being very remote.

A literature review on the potential impacts to health from exposure to crustal material in Port Hedland, WA, states "*exposure to airborne quartz carries the risk of silicosis, but only with prolonged exposure to concentrations greater than 200 µg/m^3*" (Department of Health, 2007). As detailed in Section 7.2 the maximum cumulative annual average PM_{10} concentrations (of which RCS would be a small fraction) at the most affected residence is predicted to be 19 µg/m^3 (of which 13.8 µg/m^3 is due to existing background levels), significantly below levels that may be of concern. For this reason, RCS has not been considered further in this assessment.

4.3 NSW Department of Planning and Environment Voluntary Land Acquisition and Mitigation Policy

In December 2014, the NSW Department of Planning and Environment (DPE) released a policy relating to Mining, Petroleum Production and Extractive Industries and including the identification of voluntary mitigation and land acquisition criteria for air quality and noise (NSW Government, 2014). This is reflected in State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (the Mining SEPP) at Clause 12A.

The voluntary land acquisition and mitigation policy (VLAMP) sets out voluntary mitigation and land acquisition rights where it is not possible to comply with the NSW EPA impact assessment criteria even with the implementation of all reasonable and feasible avoidance and/or mitigation measures.

A revised VLAMP was issued by DPE in February 2018 and formally adopted in September 2018 (NSW Government, 2018) to align the criteria with the NEPM and NSW EPA impact assessment criteria.

The DPE voluntary mitigation and acquisition criteria are summarised in Table 4-3 and Table 4-4, respectively. The Proposal has been assessed against these criteria, in addition to the NSW EPA impact assessment criteria discussed in Section 4.1.

Table 4-3 DPE particulate matter mitigation criteria

Pollutant	Averaging period	Mitigation criterion	Impact type	Application[(a)]
$PM_{2.5}$	Annual	8 µg/m^3	Human health	Cumulative impact[(b)]
	24-Hour	25 µg/m^3	Human health	Incremental impact[(c)]
PM_{10}	Annual	25 µg/m^3	Human health	Cumulative impact[(b)]
	24-Hour	50 µg/m^3	Human health	Incremental impact[(c)]
TSP	Annual	90 µg/m^3	Amenity	Cumulative impact[(b)]
Deposited dust	Annual	2 g/m^2/month 4 g/m^2/month	Amenity	Incremental impact[(c)] Cumulative impact[(b)]

a) Voluntary mitigation rights may be applied where the Proposal contributes to exceedances of the mitigation criteria at any residence on privately-owned land and in some circumstances a workplace on privately-owned land.

b) Cumulative impact (i.e. increase in concentrations due to the development plus background concentrations due to all other sources).

c) Incremental impact (i.e. increase in concentrations due to the development alone), with zero allowable exceedances of the criteria over the life of the development

Table 4-4 DPE particulate matter acquisition criteria

Pollutant	Averaging period	Mitigation criterion	Impact type	Application[(a)]
$PM_{2.5}$	Annual	8 µg/m^3	Human health	Cumulative impact[(b)]
	24-Hour	25 µg/m^3	Human health	Incremental impact[(c)]
PM_{10}	Annual	25 µg/m^3	Human health	Cumulative impact[(b)]
	24-Hour	50 µg/m^3	Human health	Incremental impact[(c)]
TSP	Annual	90 µg/m^3	Amenity	Cumulative impact[(b)]
Deposited dust	Annual	2 g/m^2/month 4 g/m^2/month	Amenity	Incremental impact[(c)] Cumulative impact[(b)]

(a) Voluntary mitigation rights may be applied where the Proposal contributes to exceedances of the mitigation criteria at any residence on privately-owned land and in some circumstances a workplace on privately-owned land, or on more than 25% of any privately-owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls.

(b) Cumulative impact (i.e. increase in concentrations due to the development plus background concentrations due to all other sources).

(c) Incremental impact (i.e. increase in concentrations due to the development alone), with up to five allowable exceedances of the criteria over the life of the development

4.4 Other Legislative Requirements

4.4.1 Protection of the Environment Operations (POEO) Act, 1997

If approved, the current Environmental Protection Licence (EPL) would be varied by NSW EPA. Relevant to air quality, the EPL would outline the Proposal's requirements to minimise dust emissions and specify air quality monitoring requirements. The Protection of the Environment Operations (Clean Air) Regulations 2010 (POEO (Clean Air) Regulation) sets out standards of concentration for emissions to air from scheduled activities. The maximum pollution levels allowed under the regulations for general activities are provided in Table 4-5.

Table 4-5 Maximum Allowable Emission Levels

Air Impurity	Activity or Plant	Standard of Concentration
Solid Particles	Any process emitting solid particles	50 mg/m^3

5. EXISTING ENVIRONMENT

5.1 Local Climatic Conditions

Table 5-1 presents the temperature, humidity and rainfall data for the Bureau of Meteorology site located at Peats Ridge (Site number 061351), approximately 25.2 km northeast of the site. Humidity data consist of monthly averages of 9 am and 3 pm readings. Also presented are monthly averages of maximum and minimum temperatures. Rainfall data consist of mean monthly rainfall and the average number of rain days per month.

The annual average maximum and minimum temperatures recorded at the Peats Ridge station are 21.8°C and 11.3 °C respectively. On average, January is the hottest month, with an average maximum temperature of 27.0°C. July is the coldest month, with average minimum temperature of 6.1°C. The annual average relative humidity reading collected at 9 am from the Peats Ridge station is 75% and at 3 pm the annual average is 62%. The months with the highest relative humidity on average are February and March with 9 am averages of 82% and the month with the lowest relative humidity is September with a 3 pm average of 54%.

Rainfall data collected at the Peats Ridge station shows that February is the wettest month, with an average rainfall of 154.3 mm over an average of 14.1 rain days. The average annual rainfall is 1248.6 mm with an average of 137 rain days per year.

Table 5-1 Climate Averages for the Peats Ridge Station

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
9am Mean Dry-bulb and Wet-bulb Temperatures (ºC) and Relative Humidity (%)													
Dry-bulb	21.1	20.5	19.0	17.2	14.1	11.3	10.5	12.1	15.2	17.6	18.4	20.2	16.4
Humidity	78.0	82.0	82.0	78.0	79.0	78.0	75.0	69.0	65.0	65.0	72.0	74.0	75.0
3pm Mean Dry-bulb and Wet-bulb Temperatures (ºC) and Relative Humidity (%)													
Dry-bulb	25.3	24.8	23.1	20.4	17.5	15.0	14.4	16.3	18.7	20.8	22.1	24.1	20.2
Humidity	64.0	66.0	66.0	66.0	67.0	66.0	60.0	55.0	54.0	58.0	61.0	63.0	62.0
Daily Maximum Temperature (ºC)													
Mean	27.0	26.4	24.6	22.0	19.1	16.4	15.8	17.7	20.5	22.8	24.1	25.8	21.8
Daily Minimum Temperature (ºC)													
Mean	16.3	16.4	14.6	12.0	9.5	7.2	6.1	6.6	8.7	10.9	13.0	14.8	11.3
Rainfall (mm)													
Mean	113.3	154.3	135.9	123.0	89.7	99.5	62.7	74.0	69.1	85.3	100.7	92.4	1248.6
Rain days (Number)													
Mean	13.8	14.1	14.1	11.3	11.4	10.5	9.7	8.4	8.3	10.6	12.4	12.7	137.3

Source: BOM (2019) Climate averages for Station: 061351; Commenced: 1981 – Last Record 05/05/2015; Latitude: 33.31°S; Longitude: 151.24 °E

5.2 Local Meteorology

5.2.1 Wind Speed and Direction

Air quality impacts are influenced by meteorological conditions, primarily in the form of gradient wind flow regimes, and by local conditions that are generally driven by topographical features and interactions with coastal influences, such as the sea breeze. Wind speed, wind direction, temperature and relative humidity all affect the potential dispersion and transport of plumes and are basic input retirements for dispersion modelling.

Wind speed and direction data have been collected locally at the Maroota Public School, approximately 3 km north of the Haerses Road site. The air quality assessment completed for the Site used meteorological data from Maroota Public School for the period 2017. This year was selected on the basis that, as discussed below, there is little variation year-on-year, but as detailed in Section 5.3, 2017 is most representative with respect to existing air quality in the area.

The annual and seasonal 2017 windroses of the data collected at Maroota Public School are presented in Figure 5-1. The wind speeds recorded at the site are very light with an average wind speed for the period of 1.2 m/s. The percentage of calms (wind speeds below 0.5 m/s) for the station are relatively high at 17.3%.

On an annual basis, the predominant winds are from the south-south-west, east and north quadrants. Summer and spring winds are predominantly from the east while for winter the winds are mainly from the south-south-west, west-north-west and north, and for autumn the winds are primarily from the south-south-west and south -west.

Figure 5-2 presents windroses of the data collected at Maroota Public School for 2014, 2015, 2016 and 2018. Whilst there are minor variations year-on-year, the prevailing winds are similar between years.

Given the lack of cloud data available from the closest BoM weather station at Richmond RAAF, data was produced using The Air Pollution Model (TAPM), through an integration of the onsite wind speed and direction available. This data, along with the other appropriate meteorological parameters were used in the modelling (see Section 6.2).

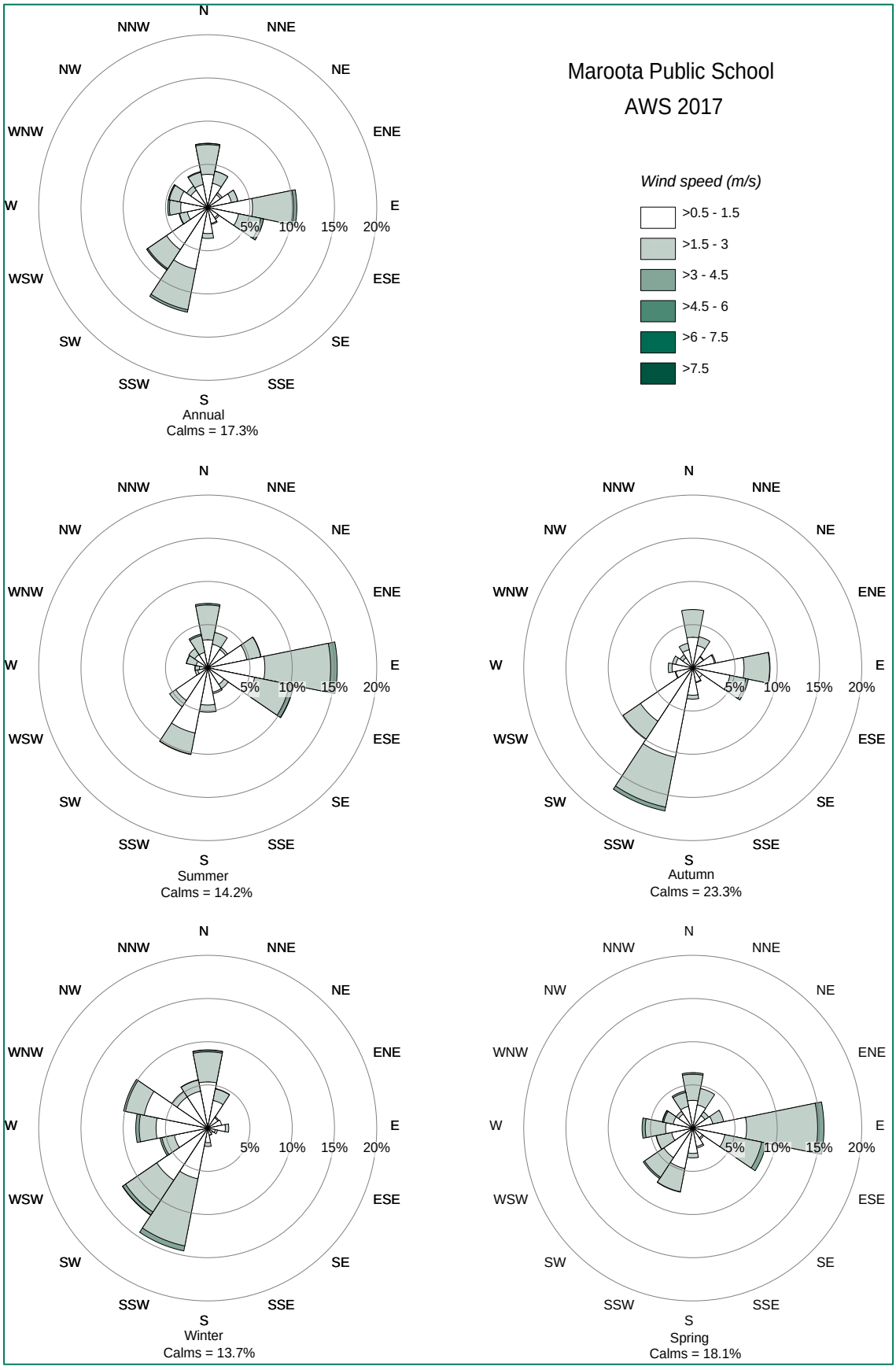
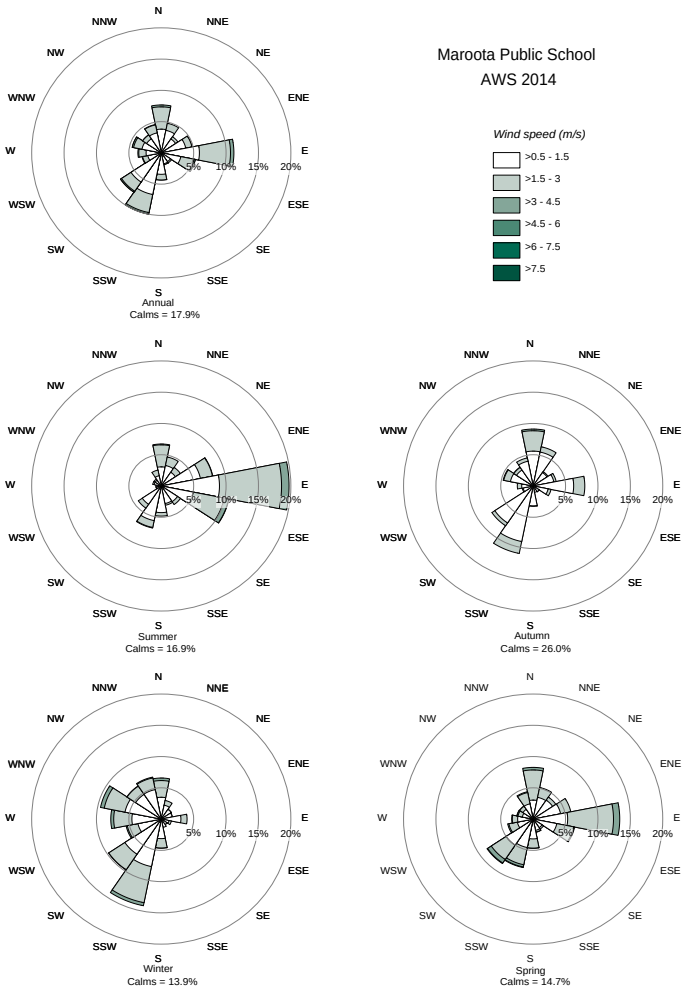
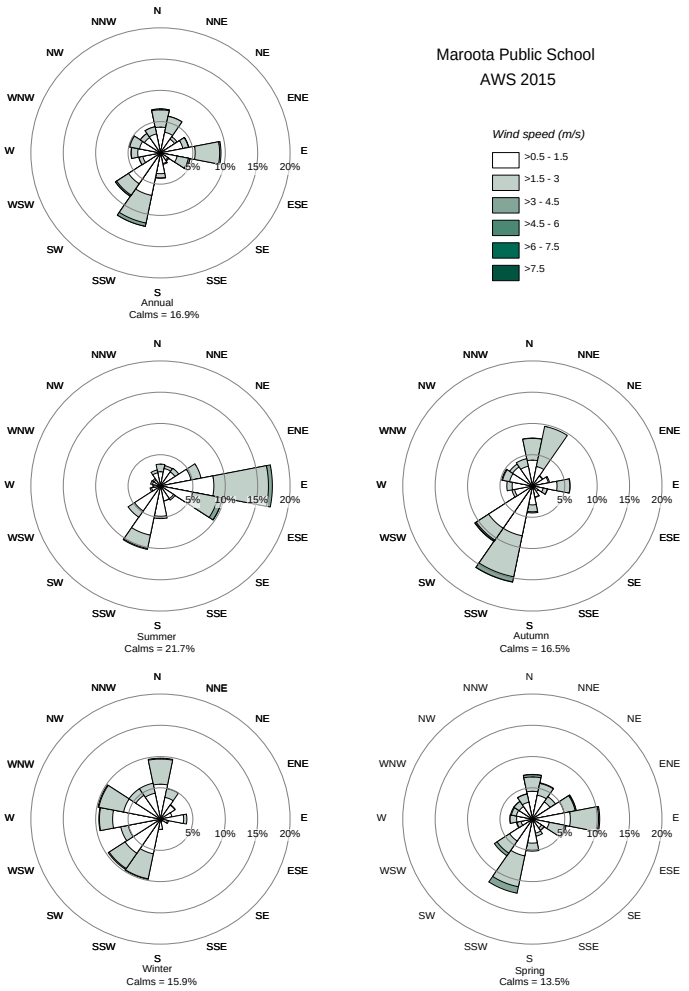


Figure 5-1 Annual and seasonal windroses for Maroota Public School (2017)


Maroota Public School
AWS 2014
Wind speed (m/s)
>0.5 - 1.5
>1.5 - 3
>3 - 4.5
>4.5 - 6
>6 - 7.5
>7.5
Annual
Calms = 17.9%
Summer
Calms = 16.9%
Autumn
Calms = 26.0%
Winter
Calms = 13.9%
Spring
Calms = 14.7%
2014


Maroota Public School
AWS 2015
Wind speed (m/s)
>0.5 - 1.5
>1.5 - 3
>3 - 4.5
>4.5 - 6
>6 - 7.5
>7.5
Annual
Calms = 16.9%
Summer
Calms = 21.7%
Autumn
Calms = 16.5%
Winter
Calms = 15.9%
Spring
Calms = 13.5%
2015

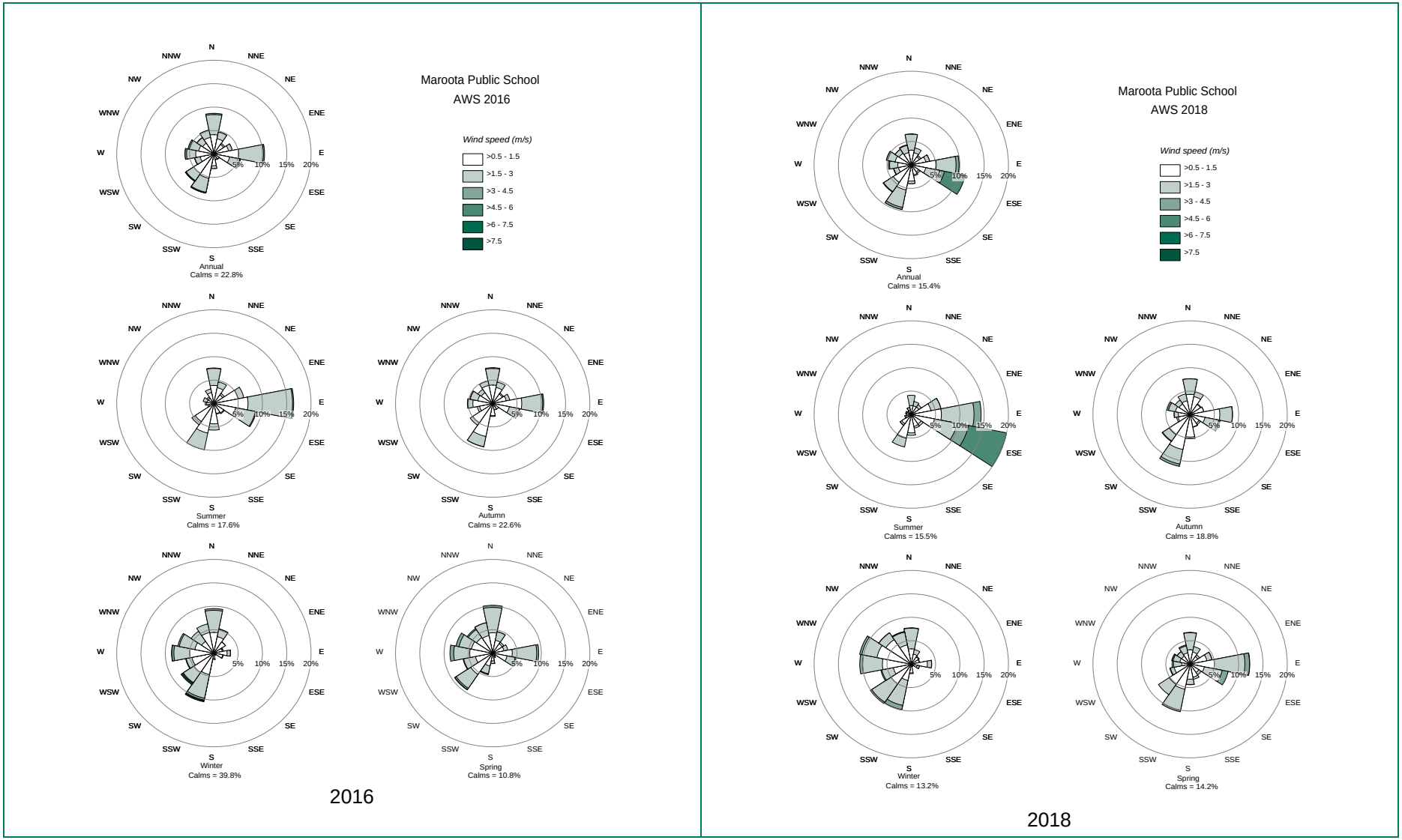


Figure 5-2 Annual and seasonal windroses for Maroota Public School (2014, 2015, 2016 & 2018)

5.2.2 Atmospheric Stability

An important aspect of pollutant dispersion is the level of turbulence in the lowest 1 km of the atmosphere, known as the planetary boundary layer (PBL). Turbulence controls how effectively a plume is diffused into the surrounding air and hence diluted. It acts by increasing the cross-sectional area of the plume due to random motions. With stronger turbulence, the rate of plume diffusion increases. Weak turbulence limits diffusion and contributes to high plume concentrations downwind of a source.

Turbulence is generated by both thermal and mechanical effects to varying degrees. Thermally driven turbulence occurs when the surface is being heated, in turn transferring heat to the air above by convection. Mechanical turbulence is caused by the frictional effects of wind moving over the earth's surface, and depends on the roughness of the surface as well as the flow characteristics.

Turbulence in the boundary layer is influenced by the vertical temperature gradient, which is one of several indicators of stability. Plume models use indicators of atmospheric stability in conjunction with other meteorological data to estimate the dispersion conditions in the atmosphere.

Stability can be described across a spectrum ranging from highly unstable through neutral to highly stable. A highly unstable boundary layer is characterised by strong surface heating and relatively light winds, leading to intense convective turbulence and enhanced plume diffusion. At the other extreme, very stable conditions are often associated with strong temperature inversions and light winds, which commonly occur under clear skies at night and in the early morning. Under these conditions plumes can remain relatively undiluted for considerable distances downwind. Neutral conditions are linked to windy and/or cloudy weather, and short periods around sunset and sunrise, when surface rates of heating or cooling are very low.

The stability of the atmosphere plays a large role in determining the dispersion of a plume and it is important to have it correctly represented in dispersion models. Current air quality dispersion models (such as AERMOD and CALPUFF) use the Monin-Obukhov Similarity Theory (MOST) to characterise turbulence and other processes in the PBL. One of the measures of the PBL is the Monin-Obukhov length (L), which approximates the height at which turbulence is generated equally by thermal and mechanical effects (Seinfeld and Pandis, 2006). It is a measure of the relative importance of mechanical and thermal forcing on atmospheric turbulence.

Because values of L diverge to + and - infinity as stability approaches neutral from the stable and unstable sides, respectively, it is often more convenient to use the inverse of L (i.e., 1/L) when describing stability.

Figure 5-3 shows the hourly averaged 1/L for the site computed from all data in the AERMET extract file. Based on Table 5.2 this plot indicates that, as to be expected, the PBL is stable overnight and becomes unstable as radiation from the sun heats the surface layer of the atmosphere and drives convection. The changes from positive to negative occur at the shifts between day and night. This indicates that the diurnal patterns of stability are realistic.

Table 5.2 Inverse of the Monin-Obukhov length L with respect to Atmospheric Stability

1/L	Atmospheric Stability
Negative	Unstable
Zero	Neutral
Positive	Stable

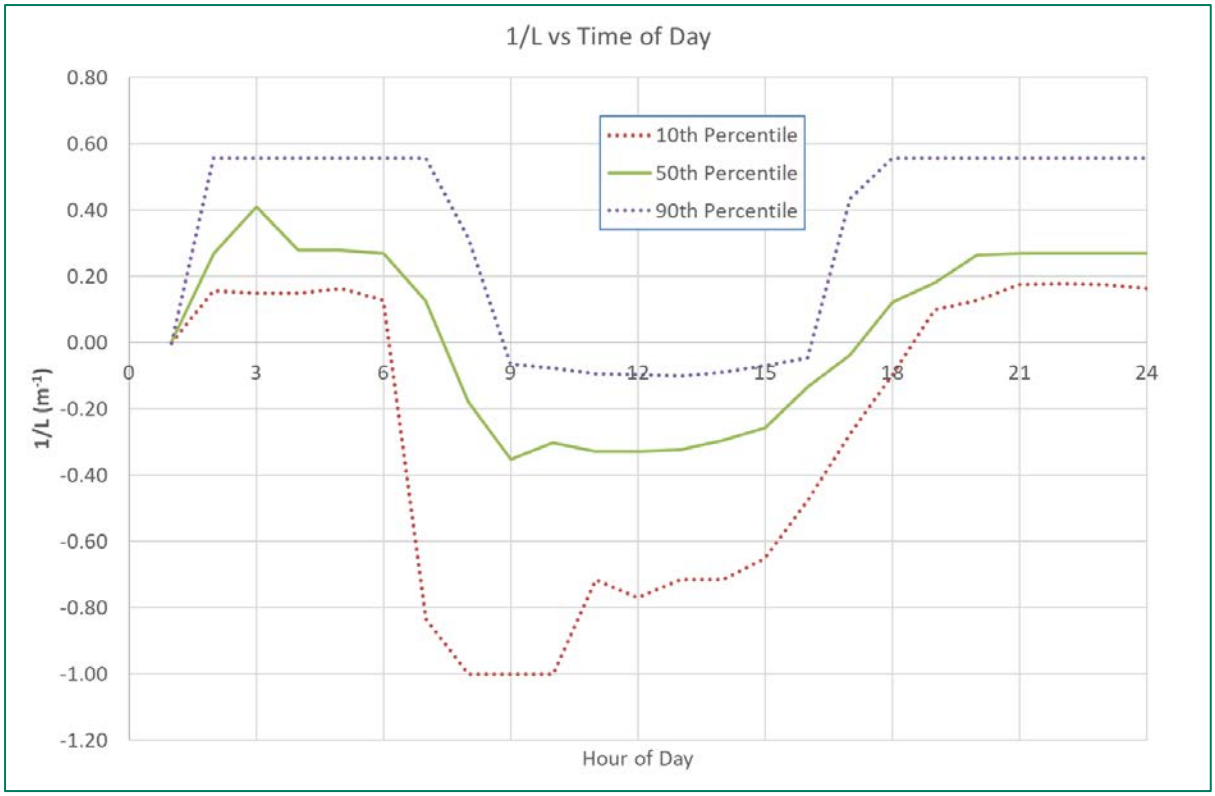


Figure 5-3 Annual Statistics of 1/L by Hour of the Day

5.3 Existing Air Quality

Air quality standards and goals refer to pollutant levels which include the contribution from proposed Proposals as well as other sources. To fully assess impacts against all the relevant air quality standards and goals it is necessary to have information or estimates on existing dust concentration and deposition levels in the area in which the Proposal is likely to contribute to these levels.

5.3.1 PM_{10} Concentrations

As part of Dixon Sand Environmental Protection Licence (EPL) No 12513, PM_{10} concentrations are measured at Maroota Public School located approximately 3 km north of the Haerses Road site.

Figure 5-4 shows the PM_{10} concentrations measured by a Tapered Element Oscillating Microbalance (TEOM) at Maroota Public School, the annual and 24-hour average assessment criterion (see Section 4).

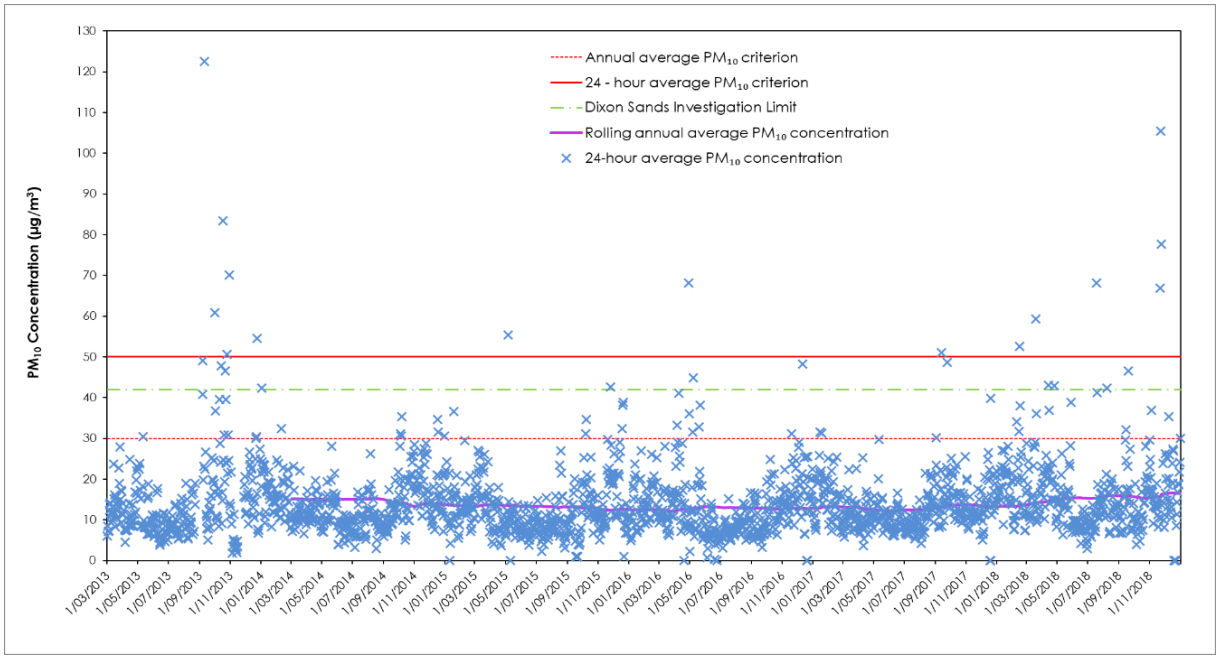


Figure 5-4 Measured PM_{10} concentration at Maroota Public School TEOM

The 24-hour average PM_{10} impact assessment criterion of 50 µg/m^3 has been exceeded on fifteen occasions since September 2013 as shown in Table 5-3 below.

Table 5-3 24-hour average PM_{10} concentrations exceedances for Maroota Public School TEOM

Exceedance	Date	Reason	Source
122.5 µg/m^3	10/09/2013	There was widespread and severe bushfire activity across eastern NSW during this period which saw 19 areas declared as natural disaster areas and will have contributed significantly to measured dust levels at that time	BoM (2013)
60.8 µg/m^3	01/10/2013		
87.4 µg/m^3	17/10/2013		
50.6 µg/m^3	25/10/2013		
70.1 µg/m^3	29/10/2013		
54.5 µg/m^3	23/12/2013		
55.5 µg/m^3	06/05/2015	Dust storm event from fires at nearby residents	Dixon (2015)
68.2 µg/m^3	29/04/2016	Hazard reduction burning	OEH (2016)
51.1 µg/m^3	13/09/2017	Local dust sources	OEH (2017)
52.6 µg/m^3	15/02/2018	Agricultural burning	OEH (2018)
59.3 µg/m^3	19/03/2018	Dust storm	OEH (2018)
68.2 µg/m^3	18/07/2018	Agricultural burning	OEH (2018)
66.9 µg/m^3	21/11/2018	Dust storm	OEH (2018)
105.5 µg/m^3	22/11/2018		
77.7 µg/m^3	23/11/2018		

Table 5-4 shows the annual average of PM_{10} concentrations at Maroota Public School for the period 2014 to 2018. It is noted that the measured concentrations in 2018 are substantially higher than the other years. An increase was observed at all the NSW Office of Environment and Heritage (OEH) monitoring stations during 2018 and per the NSW Annual Air Quality Statement for 2018 (OEH, 2018) this is predominately due to more frequent exceptional events, such as dust storms, bushfires and hazard reduction burning.

The assessment completed in 2016 (Pacific Environment, 2016) assumed the existing annual average PM_{10} concentration was 13 µg/m^3. The selected meteorological year (2017) has the second-highest annual average of the 5-year period. For this assessment, the 5-year average of 13.8 µg/m^3 is assumed. This is considered to be a conservative assumption as the measured concentrations already include the contribution from the approved activities at the site.

Table 5-4 Annual average PM_{10} concentrations at Maroota Public School

2014	2015	2016	2017	2018	5-year average
PM_{10}					
13.8	12.5	12.9	13.2	16.6	**13.8**

5.3.2 $PM_{2.5}$ Concentrations

There are no $PM_{2.5}$ data collected near the site and the closest OEH sites are at Vineyard, Richmond and Wyong which are all located between 25 km and 45 km from the site, and are also located in more urban areas.

Table 5-5 presents the annual averages of both the PM_{10} and $PM_{2.5}$ concentrations measured at these sites between 2014 and 2018. The selected meteorological year (2017) has the second-highest annual average of the 5-year period.

The average PM_{10} concentrations recorded across the three sites is 15.8 µg/m^3 and the average $PM_{2.5}$ concentration is 6.6 µg/m^3. The $PM_{2.5}$ to PM_{10} ratio is approximately 0.41.

Given that the PM_{10} concentrations measured at the OEH stations are similar to the measured concentrations at Maroota School, this ratio has been applied to the assumed PM_{10} background level of 13.8 µg/m^3 to give an assumed annual average background $PM_{2.5}$ concentration of 5.7 µg/m^3.

Table 5-5 PM_{10} and $PM_{2.5}$ concentrations at OEH monitoring sites

OEH site	2014	2015	2016	2017	2018	Average all data
Annual average PM_{10} concentration (µg/m^3)						
Wyong	15.1	14.9	15.2	16.1	18.0	16.0
Richmond	15.4	12.8	16.0	16.0	18.7	
Vineyard	16.3	15.9	17.0	No data		
Annual average $PM_{2.5}$ concentration (µg/m^3)						
Wyong	5.5	5.2	5.7	5.8	6.8	6.6
Richmond	6.7	7.7	7.9	7	8.1	

5.3.3 TSP Concentrations

There are no measurements of TSP available for the site. Estimates of annual average TSP concentrations can be made from the PM_{10} measurements by assuming that 40% of the TSP is PM_{10}.

This relationship was obtained from data collected by co-located TSP and PM_{10} monitors operated for long periods of time in the Hunter Valley (NSW Minerals Council, 2000). Although this ratio is based on Hunter Valley data, in the absence of site specific data this provides an indicative estimate of the ambient TSP.

Use of this relationship on the adopted PM_{10} annual average of 13.8 µg/m^3 gives an existing annual average TSP concentration of approximately 34.5 µg/m^3.

5.3.4 Dust Deposition

Table 5-6 shows annual average insoluble solids deposition rates from Dixon Sand's dust deposition gauges near Haerses Road Quarry and Maroota Public School for the period 2015 to 2018. The locations of the dust deposition gauges are presented in Figure 3-1.

An annual average dust deposition level above 4 g/m^2/month indicates a level of air quality unsuitable for residential purposes. Levels measured are affected by dust from other sand extraction activities in the area as well as other sources of dust such as agricultural activities normally expected in rural areas.

Using a conservative estimate, the background dust deposition level for the modelling year of 1.5 g/m^2/month was determined using the average of the data from the four Haerses Road sites presented in Table 5-6.

Table 5-6 Annual Average Dust Deposition Data (g/m^2/month)

Year	DDG6 (Maroota School)	DDG8	DDG10	DDG11	DDG12
2015	0.9	0.5	2.9	No data	
2016	0.7	0.6	2.0		
2017	1.3	0.6	3.5*		
2018	1.9	1.1	1.1	1.0	1.4

*Samples results from April, May, August and September excluded form average due to contaminations

5.3.5 Background Values

In summary, for the purposes of assessing potential air quality impacts, the following existing air quality levels are assumed for assessment against the long-term criteria. PM_{10} and $PM_{2.5}$ are also assessed against a short-term (24-hour average) criteria.

- Annual average PM_{10} concentration of 13.8 µg/m^3 based on the 5-year average of data collected at Maroota School.
- Annual average $PM_{2.5}$ concentration of 5.7 µg/m^3 calculated by applying the $PM_{2.5}$:PM_{10} ratio of data collected at OEH sites to the 5-year average PM_{10} concentration.
- Annual average TSP concentration of 34.5 µg/m^3 calculated based on the assumption that 40% of TSP is PM_{10}.
- Annual average dust deposition of 1.5 g/m^2/month.
- 24-hour average PM_{10} concentration – varies daily (Maroota School 2017 daily data)
- 24-hour average $PM_{2.5}$ concentration – varies daily ($PM_{2.5}$:PM_{10} ratio of 0.41 applied to Maroota School 2017 daily data)

6. EMISSIONS TO AIR

6.1 Dust Control Measures

Table 6-1 provides an overview of the relevant applicable best practice management measures recommended to be implemented for the Proposal. In the absence of specific best practice guidance for sand quarrying, these controls are compared to recommendations of the *NSW Coal Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining* (Donnelly et al, 2011), a study that was commissioned by the EPA, hereafter referred to as “the Best Practice Report”.

Table 6-1 Best Practice Measures

OEH Best Practice Report reference		Mining Activity	Best Practice Control		Applied at site (Y/N/Not applicable)	Level of control applied to emission calculations	Comments
Section	Table						
9.2	66	Hauling on Unsealed Roads	Vehicle restrictions	Speed reduction from 75 km/h to 50 km/h	N		
				Speed reduction from 65 km/h to 30 km/h	Y		20km/h truck speed limit on unsealed haul road and all quarry areas
				Grader speed reduction from 16 km/h to 8 km/h	N		
			Surface improvements	Pave the surface	N		
				Low silt aggregate	Y	N/A	Emission equation contains parameter for silt content of road. Conservative value of 6.4% used.
				Oil and double chip surface	N		
			Surface treatments	Watering (standard procedure)	Y	75%	
				Watering Level 1 (2 L/m^2/h)	N		
				Watering Level 2 (>2 L/m^2/h)	N		
				Watering grader routes	Y		
				Watering twice a day for industrial unpaved road	Y		
				Dust suppressants (please specify)	N		
			Other	Use of larger vehicles	N		
				Conveyors	N		

OEH Best Practice Report reference		Mining Activity	Best Practice Control		Applied at site (Y/N/Not applicable)	Level of control applied to emission calculations	Comments
Section	Table						
9.3	71	Wind Erosion on Exposed Areas & Overburden Emplacements	Avoidance	Minimise pre-strip	Y		
			Surface stabilisation	Watering	Y	50%	Extraction areas
				Chemical suppressants	N		
				Paving and cleaning	N		
				Application of gravel to stabilise disturbed open areas	N		
				Rehabilitation goals	Y		
			Wind speed reduction	Fencing, bunding, shelterbelts or in-pit dump	Y	55%	Extraction areas
				Vegetative ground cover	Y	70%	
9.3	72	Wind Erosion and Maintenance - Coal Stockpiles	Avoidance	Bypassing stockpiles	N		
			Surface stabilisation	Water sprays	N		
				Chemical wetting agents	Y	85%	Stockpiles NB: It was advised post-modelling that this control will not be in place. See Section 6.4 for further detail
				Surface crusting agent	N		
				Carry over wetting from load in	N		
			Enclosure	Silo with bag house	N		
				Cover storage pile with a tarp during high winds	N		
			Wind speed reduction	Vegetative windbreaks	Y	30%	Stockpiles
				Reduced pile height	Y	30%	Stockpiles
				Wind screens/fences	Y	-	Not quantifiable in emission calculations
				Pile shaping/orientation	Y	50%	Not quantifiable in emission calculations

OEH Best Practice Report reference		Mining Activity	Best Practice Control		Applied at site (Y/N/Not applicable)	Level of control applied to emission calculations	Comments
Section	Table						
				Erect 3-sided enclosure around storage piles	N		
9.4	76	Bulldozers on OB	Minimise travel speeds and distance		N		
			Travel routes and material kept moist		N		
9.5	81	Blasting and drilling	Blasting	Delay shot to avoid unfavourable weather conditions	N		
				Minimise area blasted	N		
	82		Drilling	Fabric filters	N		
				Cyclone	N		
				Water injection while drilling	N		
9.6	85	Draglines	Minimise drop height		N		
			Minimising drop height		N		
			Modify activities in windy conditions		N		
			Water sprays		N		
			Minimise side casting		N		
9.7	90	Loading and dumping overburden	Excavator	Minimise drop height	N		
			Truck dumping	Minimise drop height	N		
				Water application	N		
				Modify activities in windy conditions	N		

OEH Best Practice Report reference		Mining Activity	Best Practice Control		Applied at site (Y/N/Not applicable)	Level of control applied to emission calculations	Comments
Section	Table						
9.8	95	Loading and dumping ROM coal	Avoidance	Bypass ROM stockpiles	N		
			Truck or loader dumping coal	Minimise drop height	N		
				Water sprays on ROM pad	N		
			Truck or loader dumping to ROM bin	Water sprays on ROM bin or ROM pad	N		
				Three sided and roofed enclosure of ROM bin	N		
				Three sided and roofed enclosure of ROM bin + water sprays	N		
				Enclosure with control device	N		
9.9	96	Conveyors and transfers	Conveyors	Application of water at transfers	N	50%	Control from boom tip water sprays. Note washed products are already saturated.
				Wind shielding - roof OR side wall	N		
				Wind shielding - roof AND side wall	N		
				Belt cleaning and spillage minimisation	Y		
			Transfers	Enclosure	N		
9.1	97	Stacking and reclaiming product coal	Avoidance	Bypass coal stockpiles	N		
			Loading coal stockpiles	Variable height stack	N		
				Boom tip water sprays	Y	50%	
				Telescopic chute with water sprays	N		
			Unloading coal stockpiles	Bucket-wheel, portal or bridge reclaimer with water application	N		

OEH Best Practice Report reference		Mining Activity	Best Practice Control		Applied at site (Y/N/Not applicable)	Level of control applied to emission calculations	Comments
Section	Table						
9.11	-	Train and truck load out and transportation	Limit load size to ensue coal is below sidewalls		N		
			Maintain a consistent profile		N		
			Water sprays		N		
			Use bed liners to minimise seepage		N		
			Cover load with tarpaulin		N		
			Utilise truck wheel wash		N		

6.2 Modelling Approach

The overall approach to the assessment follows the Approved Methods which specify how assessments based on the use of air dispersion models should be completed. They include guidelines for the preparation of meteorological data to be used in dispersion models and the relevant air quality criteria for assessing the significance of predicted concentrations from the Proposal.

6.2.1 Modelling System

The air dispersion modelling conducted for this assessment is based on an advanced modelling system using the AERMET/AERMOD model. AERMOD was chosen as the most suitable model due to the source types, location of nearest receptors and nature of local topography. AERMOD is the US-EPA's recommended steady-state plume dispersion model for regulatory purposes. AERMOD replaced the Industrial Source Complex (ISC) model for regulatory purposes in the US in December 2006 as it incorporates more recent, and potentially more accurate, algorithms to represent both meteorological interactions and air quality dispersion.

A significant feature of AERMOD is that the Pasquill-Gifford stability based dispersion is replaced with a turbulence-based approach that uses the Monin-Obukhov length scale to account for the effects of atmospheric turbulence based dispersion.

The AERMOD system includes AERMET, used for the preparation of meteorological input files and AERMAP, used for the preparation of terrain data. Terrain data were sourced from NASA's Shuttle Radar Topography Mission (SRTM) Data (3 arc-second (~90m) resolution) and processed within AERMAP to create the necessary input files.

AERMET requires surface and upper air meteorological data as inputs. Surface data were sourced from the Bureau of Meteorology (BoM) meteorological station at Maroota Public School Weather Station, approximately 3 km north of the Haerses Road site.

Given the lack of cloud data available from the closest BoM weather station at Maroota Public School Weather Station, data was produced using The Air Pollution Model (TAPM) for use in the development of the AERMET file.

Appropriate values for three surface characteristics are required for AERMET as follows:

- Surface roughness, which is the height at which the mean horizontal wind speed approaches zero, based on a logarithmic profile.
- Albedo, which is an indicator of reflectivity of the surface.
- Bowen ratio, which is an indicator of surface moisture.

Values of surface roughness, albedo and Bowen ratio were determined based on a review of aerial photography for a radius of 3 km centred on the site. Default values for cultivated land use were chosen to represent the surrounding area.

A summary of the model set-up is presented in Appendix A.

6.3 Operational Scenario

A worst-case operating scenario has been assessed, based on the assumption that all the potential activities occur simultaneously, namely:

- Sand extraction and processing of material from both the approved and proposed tertiary sand extraction area.
- Sand extraction and processing of material from the friable sandstone extraction area
- Rehabilitation in tertiary and friable areas.
- Placement of VENM/ENM in the friable sandstone extraction area.

This is considered a conservative assessment as, in reality, due to equipment limitations, only one of the following scenarios could occur:

1. Sand extraction and rehabilitation in tertiary sand extraction area plus VENM / ENM profiling and management in friable area. OR
2. Sand extraction in friable sandstone extraction area plus rehabilitation in tertiary sand extraction area for rehabilitation. OR
3. Sand extraction in friable sandstone extraction area plus VENM / ENM profiling and management in friable sandstone area.

6.4 Emissions Summary

The operations of the Proposal have been analysed and estimates of dust emissions for the key dust generating activities have been made.

Emission rates of TSP, PM_{10} and $PM_{2.5}$ have been calculated using emission factors developed both within NSW and by the US EPA. Modelling of TSP, PM_{10} and $PM_{2.5}$ was undertaken using the particle size specific inventories and was assumed to emit and deposit from the plume in accordance with the deposition rate appropriate for particles with an aerodynamic diameter equal to the geometric mass of the particle size range.

Estimates of emissions for each source were developed on an hourly time step taking into account activities that would take place at that location. Thus, for each source, for each hour, an emission rate was determined which depended on the level of activity and the wind speed. Dust generating activities were represented by a series of volume sources situated according to the location of activities.

The locations of the volume sources, used to represent the quarry, are shown in Appendix B together with detailed emission inventories.

The information used for developing the inventories has been based on the operational descriptions and drawings and used to determine haul road distances and routes, activity operating hours, truck sizes and other details that are necessary to estimate dust emissions (summarised in Table 6-2).

It is noted that the dispersion modelling was completed assuming that chemical wetting agents would be applied to the stockpiles. As shown in Table 6-2, the increase in TSP, PM_{10} and $PM_{2.5}$ emissions without the use of a chemical wetting agent are 4.1%, 6.7% and 2.7%, respectively. Experience has shown that this minor experience will have little to no effect on the predicted concentrations.

Table 6-2 Estimated TSP, PM_{10} and $PM_{2.5}$ annual emissions for the Proposal (kg/y)

ACTIVITY	TSP (kg/y)	PM_{10} (kg/y)	$PM_{2.5}$ (kg/y)
Tertiary Sand Extraction Area - Approved			
Dozer stripping topsoil - approved Stage 5	233	57	24
Excavator loading tertiary sand to trucks for transfer to Processing Area (from Approved Stage 5)	19	9	1
Hauling from Approved Stage 5 to Processing Area (unsealed - extraction to sealed road)	1,663	449	45
Hauling from Approved Stage 5 to Processing Area (sealed to processing area)	382	73	18
Hauling of Approved Stage 5 to and in Processing Area (unsealed)	1,774	479	48
Tertiary Sand Extraction Area - Proposed			
Dozer stripping topsoil - Proposed	233	57	24
Excavator loading tertiary sand to trucks for transfer to Processing Area (from proposed extension)	19	9	1
Hauling from proposed to Processing Area (unsealed - extraction to sealed road)	1,663	449	45
Hauling from proposed to Processing Area (sealed to processing area)	382	73	18
Hauling of proposed to and in Processing Area (unsealed)	1,774	479	48
Friable sandstone Extraction Area			
Dozer stripping topsoil/ripping friable sandstone (from Cell 5A & 5B)	4,137	974	434
Excavator loading friable sandstone to trucks for transfer to Processing Area (from Cell 5A & 5B)	71	33	5
Hauling from Cell 5A & 5B to Processing Area (unsealed)	8,110	2,189	219
VENM/ENM placement in Friable area			
Hauling VENM/ENM on-site from entrance to friable extraction area (Cells 4A & 4B) (sealed)	1,090	209	51
Hauling of VENM/ENM to placement area (unsealed)	5,069	1,368	137
Unloading VENM/ENM to cell	55	26	4
Dozer spreading/compacting VENM/ENM	3,036	732	319
Processing Area			
Friable sandstone processing			
Unloading friable sandstone to stockpile at Processing Area	71	33	5
Loading friable sandstone from stockpile at Processing Area	71	33	5
Unloading friable sandstone to Dry Processing at Processing Area	71	33	5
Crushing friable sandstone (uncontrolled) at Processing area	6,240	2,400	2,400
Transfer friable sandstone (Crusher to Screen) [conveyor transfer point]	35	17	3
Screen friable sandstone (uncontrolled)	4,000	1,376	1,376
Transfer friable processed at plant to product stockpile	35	17	3
Tertiary Sand processing			
Unloading tertiary sand to stockpile at Processing Area	39	18	3

ACTIVITY	TSP (kg/y)	PM_{10} (kg/y)	$PM_{2.5}$ (kg/y)
Loading tertiary sand from stockpile at Processing Area	39	18	3
Unloading tertiary sand to Dry Processing at Processing Area	39	18	3
Screen tertiary sand (uncontrolled)	2,188	753	753
Transfer (Screen to Wet Processing) [conveyor transfer point]	19	9	1
Wet Processing (no expected emissions)	-	-	-
Transfer tertiary processed at plant to product stockpile	19	9	1
Product Sand			
Loading sand from Product Stockpile to haul trucks	65	31	5
Hauling out of Site (unsealed)	10,036	2,709	271
Hauling out of Site (sealed)	2,159	414	100
Wind Erosion			
WE - Extraction Area (Tertiary - Stage 5)	708	354	53
WE - Extraction Area (Tertiary - proposed)	205	102	15
WE - Extraction Area (Tertiary - Stage 5 part rehabilitated)	1,395	698	105
WE - Extraction Area (Friable - 5A & 5B)	942	471	71
WE - Extraction Area (Friable - 4A & 4B plus VENM/ENM)	1,061	531	80
WE - Extraction Area (Friable - 3A & 3B partly rehabilitated)	677	338	51
WE - Processing Area including Stockpile (values in brackets are excluding use of chemical wetting agent on stockpiles)	431 (677)	215 (338)	32 (51)
TOTAL (including chemical wetting of stockpiles)	**60,252**	**18,265**	**6,783**
TOTAL (excluding chemical wetting of stockpiles)	**62,694**	**19,486**	**6,966**

Notes: WE – wind erosion, kg/year – kilograms per year

7. OPERATIONAL PHASE IMPACT ASSESSMENT

7.1 Introduction

Dispersion model predictions made for the Proposal are presented in the sections below.

Contour plots of particulate concentrations show the areas that are predicted to be affected by dust at different levels. It is important to note that the contour figures are presented to provide a visual representation of the predicted impacts. To produce the contours, it is necessary to make interpolations, and as a result the contours will not always match exactly with predicted concentration at any specific location. They are nevertheless useful to establish indicative particulate concentrations from the Proposal.

The actual predicted particulate concentrations/levels at the surrounding residences/receptors are also presented in tabular form.

In the case of maximum 24-hour average concentrations, it is important to note that individual contour plots do not represent one moment in time, but rather they show the maximum 24-hour average concentration that could potentially occur at a sensitive receptor over the period of a year.

7.2 Annual Average Concentrations

Table 7-1 presents the predicted annual average concentrations and levels at each of the sensitive receptor locations for both the Proposal alone and when including background concentrations. The assumed background concentrations have been outlined previously in Section 5.3.5.

There are no predicted exceedances of any of the relevant assessment criteria detailed in Section 4.

Contour plots of the predicted annual average concentrations due to the Proposal alone and cumulatively are presented in Figure 7-1 to Figure 7-6.

Table 7-1 Predicted annual average concentrations and levels due to the Proposal alone and cumulatively

				Pollutant	**TSP**		**PM_{10}**		**$PM_{2.5}$**		**Dust deposition**	
				Averaging period	**Annual**							
				Receptor IDs	*Assessment criteria*							
					Proposal-only	*Cumulative*	*Proposal-only*	*Cumulative*	*Proposal-only*	*Cumulative*	*Proposal-only*	*Cumulative*
ID	**Type**	**X**	**Y**		*N/A*	*NSW EPA & DPE VLAMP = 90 µg/m³*	*N/A*	*NSW EPA & DPE VLAMP = 25 µg/m³*	*N/A*	*NSW EPA & DPE VLAMP = 8 µg/m³*	*NSW EPA & DPE VLAMP = 2 g/m2/month*	*NSW EPA & DPE VLAMP = 4 g/m2/month*
R1	Residential	312924	6295200		3.2	38	2.4	16	0.5	6	0.17	1.7
R2	Residential	312780	6295033		5.8	40	4.3	18	0.8	6	0.33	1.8
R3	Residential	312454	6294919		1.3	36	2.6	16	0.8	6	0.08	1.6
R4	Residential	312177	6294850		0.8	35	1.4	15	0.5	6	0.04	1.5
R5	Residential	311939	6294631		0.6	35	1.2	15	0.5	6	0.03	1.5
R6	Residential	311871	6294275		1.0	35	1.8	16	0.7	6	0.06	1.6
R7	Residential	311600	6294343		0.6	35	1.0	15	0.5	6	0.04	1.5
R8	Residential	311702	6294162		1.1	36	1.7	16	0.7	6	0.07	1.6
R9	Residential	311543	6294146		1.0	36	1.6	15	0.7	6	0.06	1.6
R10	Residential	311283	6294161		0.8	35	1.2	15	0.5	6	0.05	1.5
R11	Residential	311179	6294076		0.8	35	1.2	15	0.6	6	0.05	1.6
R12	Residential	313049	6295163		7.2	42	4.0	18	0.8	6	0.41	1.9
R13	Residential	313018	6295228		4.0	39	2.5	16	0.5	6	0.23	1.7
R14	Residential	312353	6295030		1.0	36	1.8	16	0.7	6	0.06	1.6
R15	Residential	312207	6294990		0.8	35	1.5	15	0.5	6	0.04	1.5
R16	Residential	312103	6295021		0.6	35	1.1	15	0.4	6	0.04	1.5
R17	Residential	310707	6293300		0.2	35	0.5	14	0.3	6	0.01	1.5
R18	Residential	311239	6292850		0.2	35	0.5	14	0.3	6	0.01	1.5
R19	Residential	311627	6292424		0.2	35	0.4	14	0.3	6	0.01	1.5
R20	Residential	311873	6291990		0.2	35	0.4	14	0.3	6	0.01	1.5
R21	Residential	312031	6294320		1.1	36	2.2	16	0.9	7	0.06	1.6
D1	Owned by Dixon Sand	313103	6295173		5.7	40	3.2	17	0.6	6	0.32	1.8
PF1	Owned by PF Formation	313362	6295255		1.4	36	0.6	14	0.2	6	0.08	1.6
PF2	Owned by PF Formation	313242	6295125		2.4	37	1.2	15	0.3	6	0.15	1.6
PF3	Owned by PF Formation	313228	6294961		4.2	39	5.1	19	1.1	7	0.24	1.7

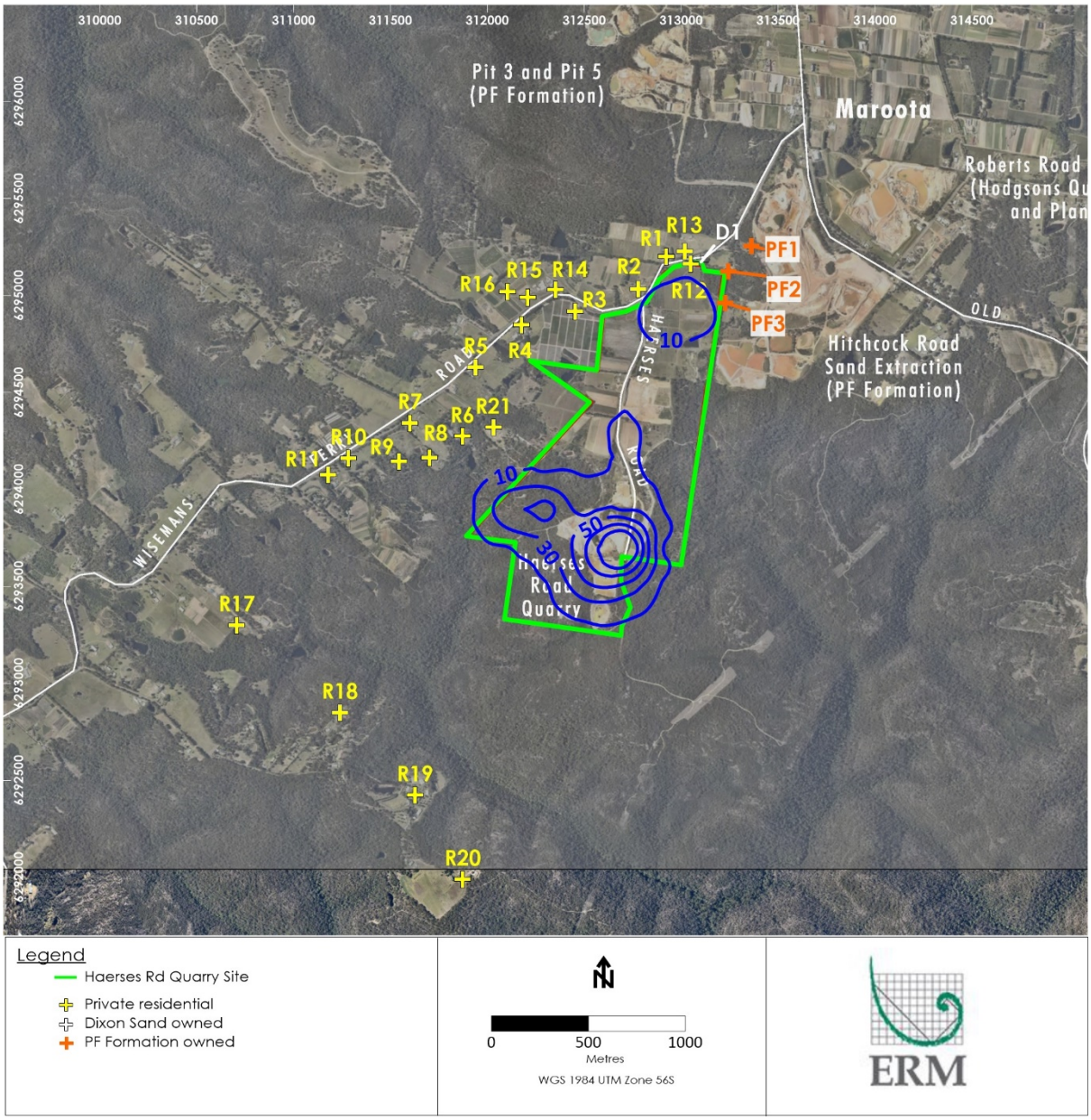


Figure 7-1: Predicted annual average TSP concentrations - Proposal alone (µg/m^3)

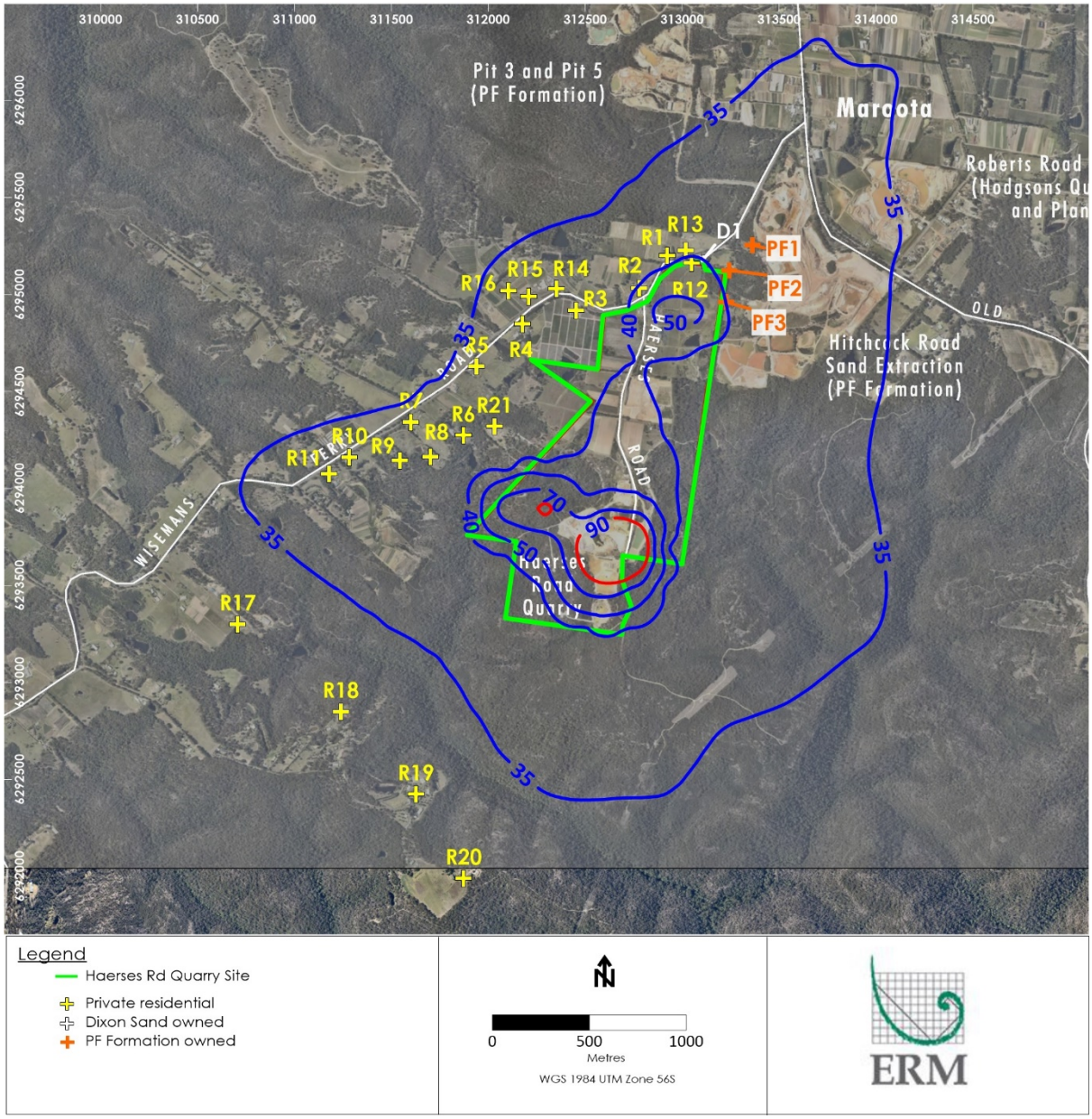


Figure 7-2: Predicted annual average TSP concentrations - cumulative (µg/m^3)

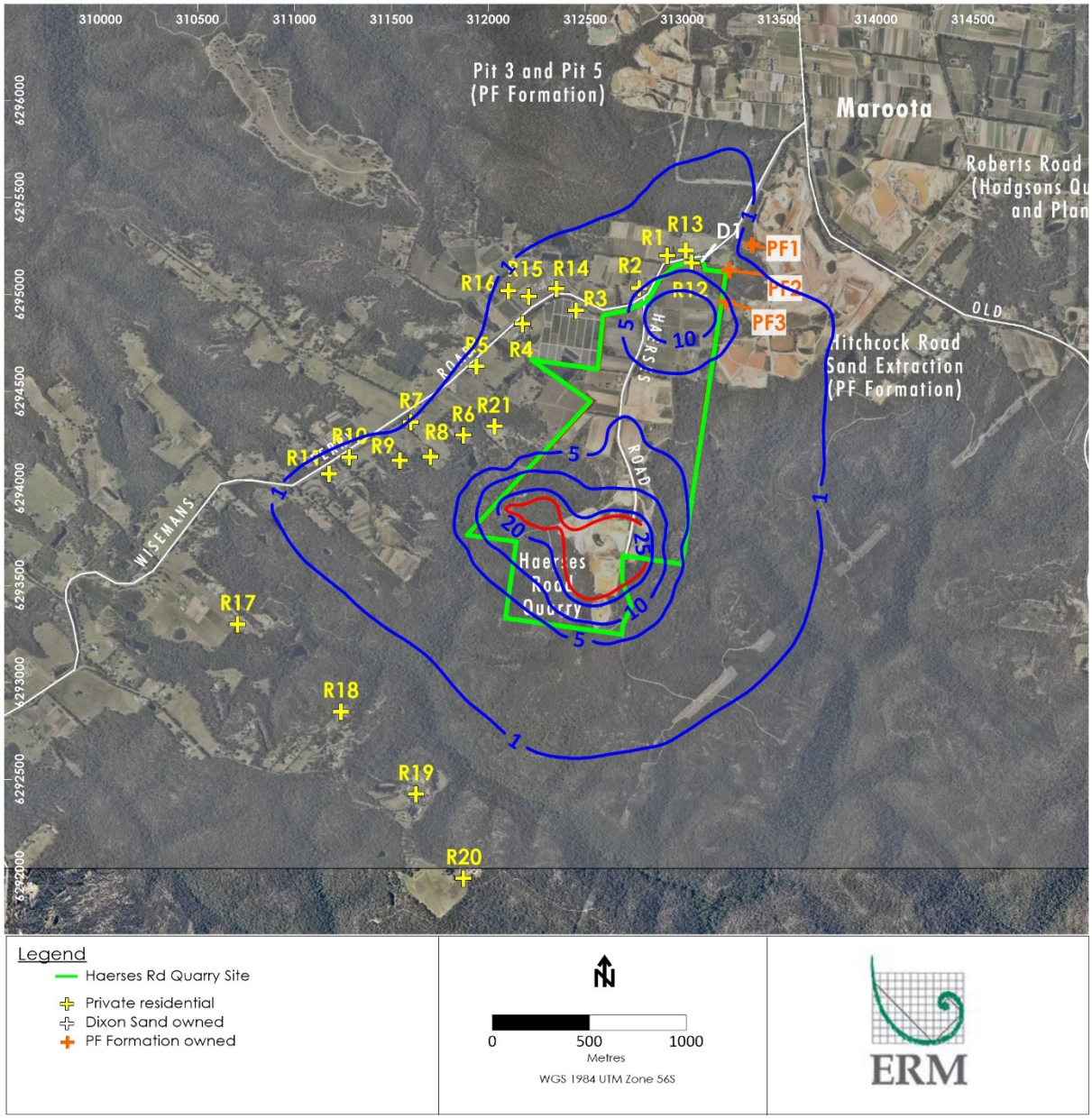


Figure 7-3: Predicted annual average PM_{10} concentrations - Proposal alone ($\mu g/m^3$)

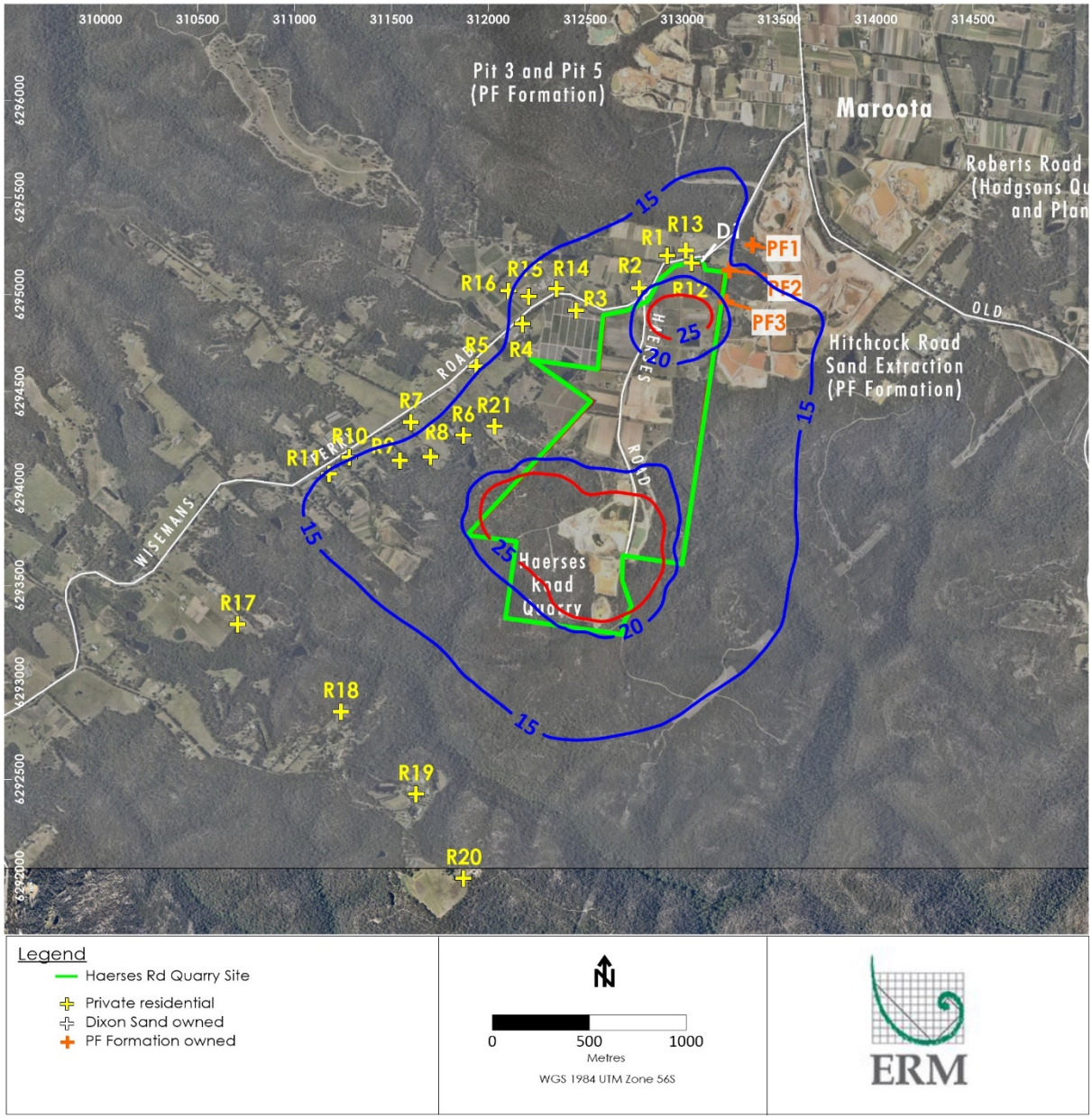


Figure 7-4: Predicted annual average PM_{10} concentrations - cumulative (µg/m^3)

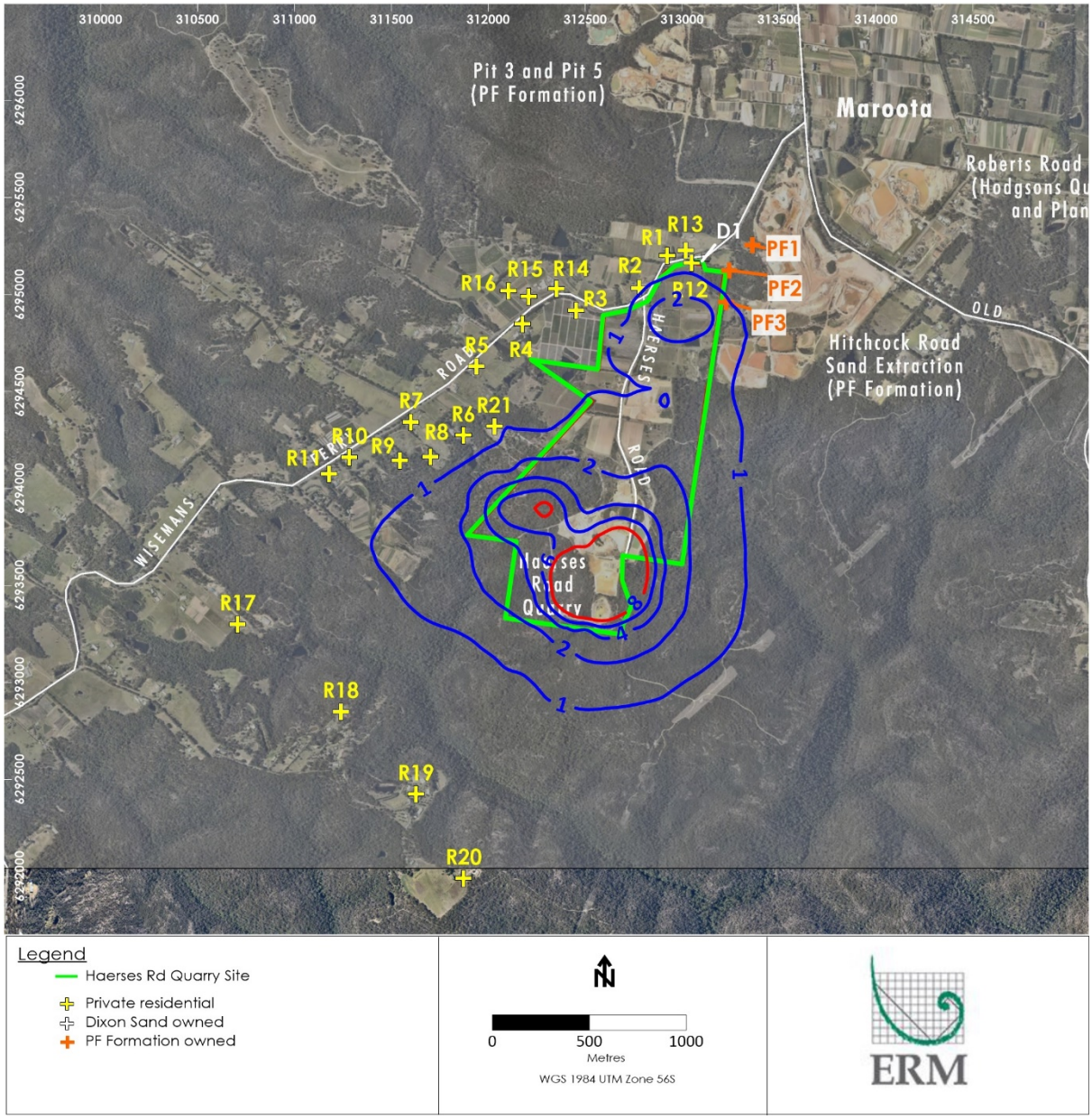


Figure 7-5: Predicted annual average $PM_{2.5}$ concentrations - Proposal alone ($\mu g/m^3$)

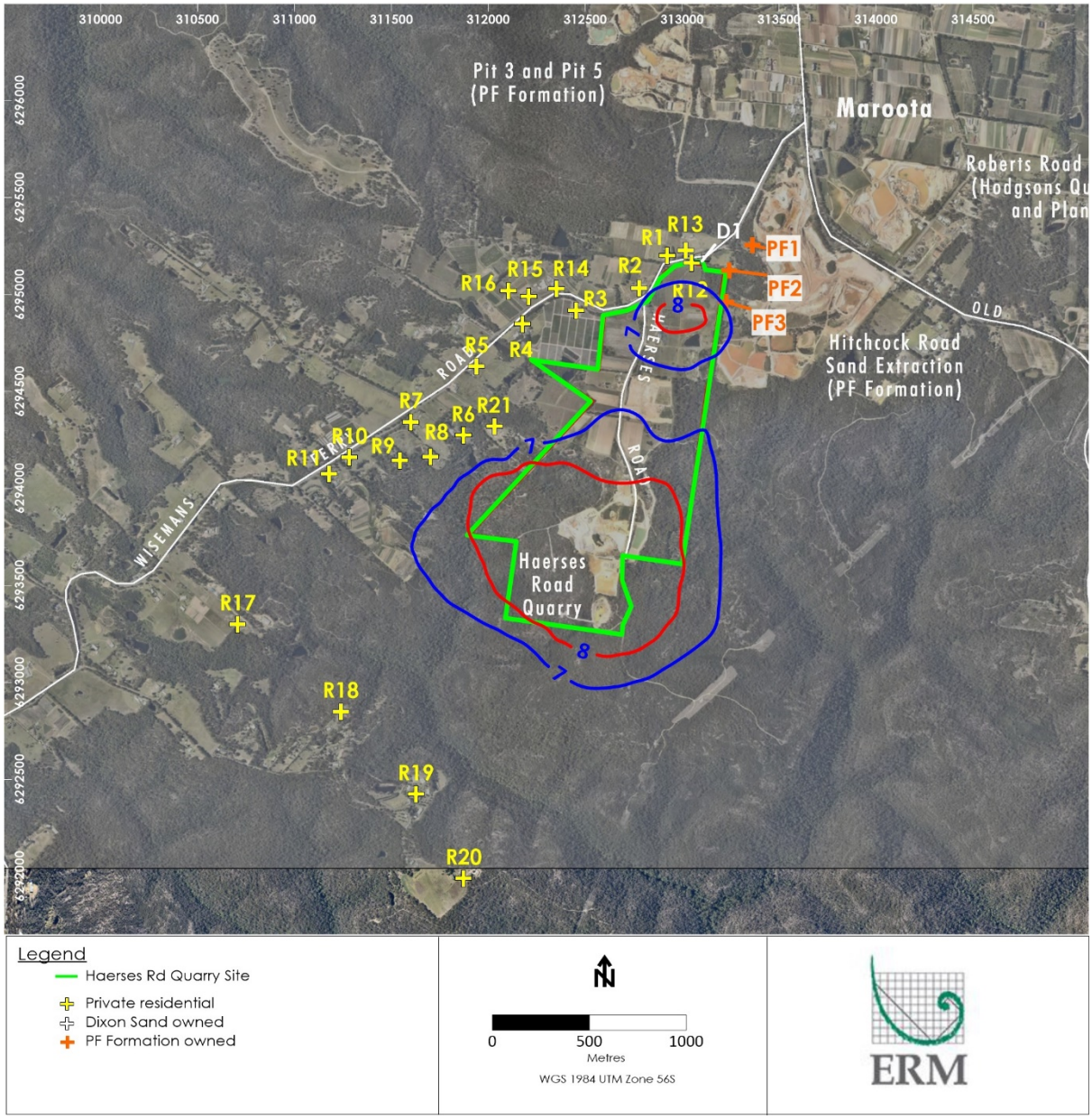


Figure 7-6: Predicted annual average $PM_{2.5}$ concentrations - cumulative ($\mu g/m^3$)

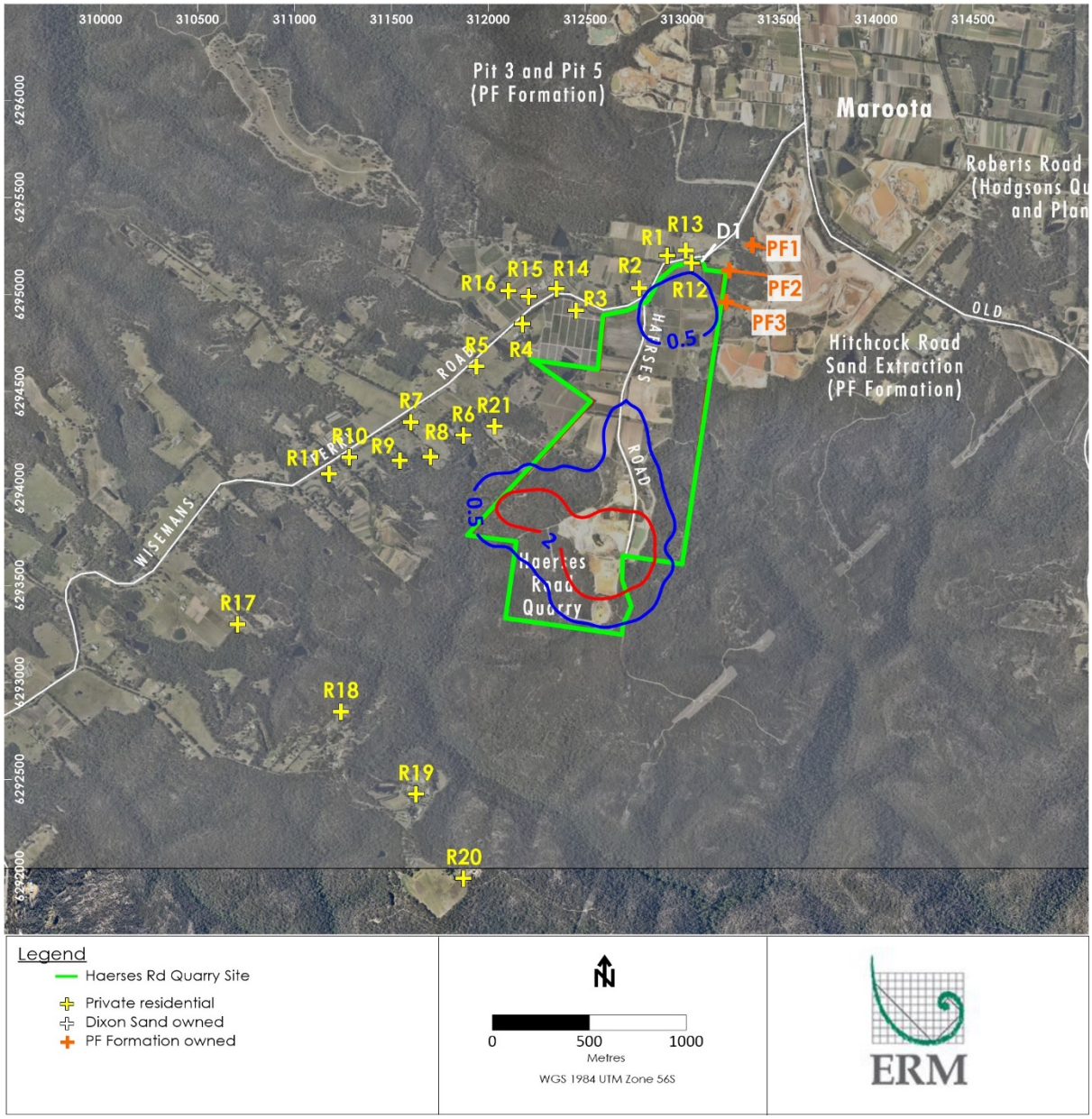


Figure 7-7: Predicted annual average dust deposition levels – Proposal alone (g/m^2/month)

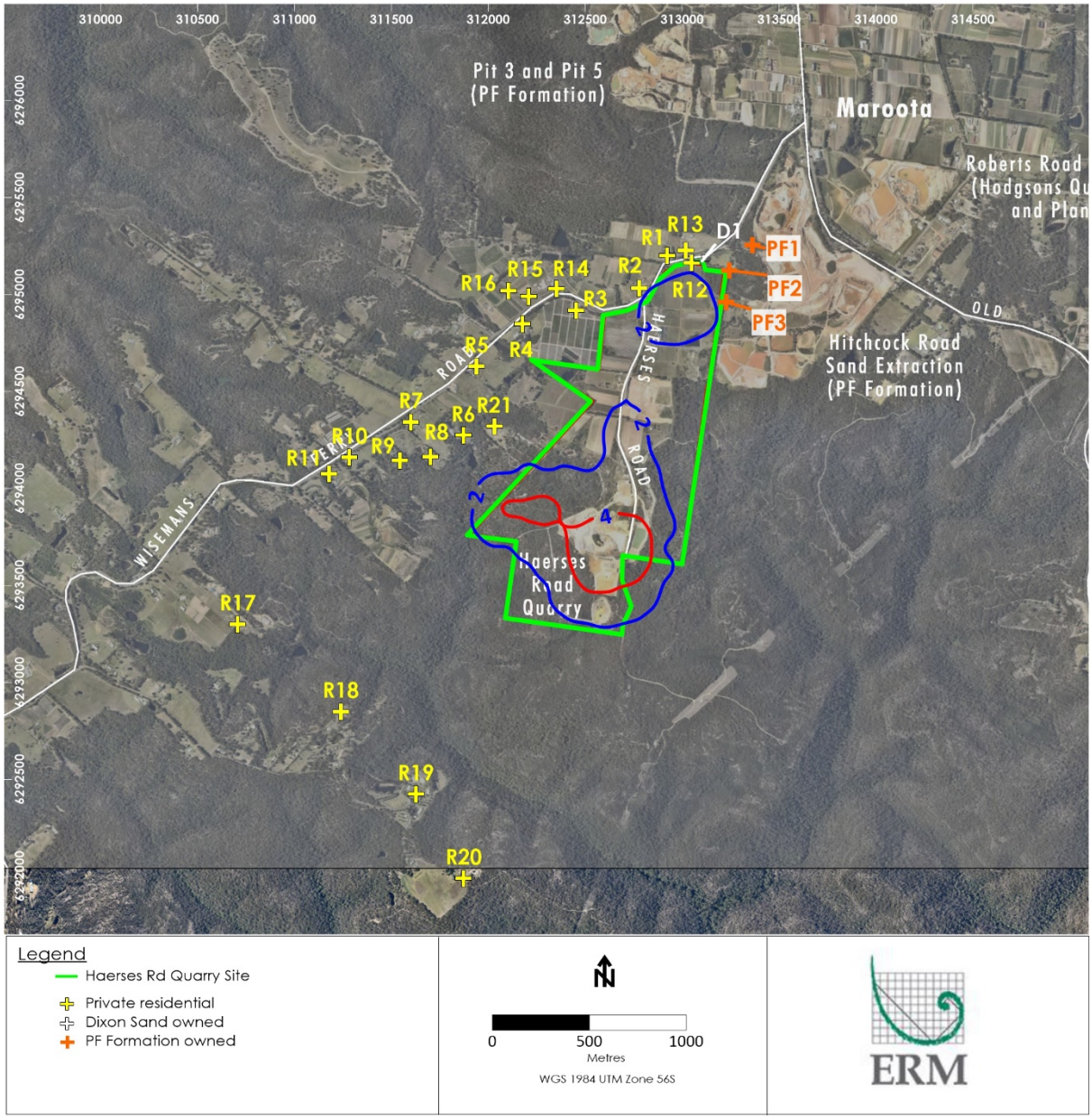


Figure 7-8: Predicted annual average dust deposition levels –cumulative (g/m^2/month)

7.3 24-hour Average Concentrations

7.3.1 Introduction

It is important to note the difficulty in accurately predicting both the Proposal-only contribution, and the cumulative, maximum 24-hour average concentrations. This is due to a combination of the day-to-day variability in existing ambient dust levels, and the spatial and temporal variation in any other anthropogenic activity in the vicinity e.g. agricultural activity, bushfires, and other dust-generating activity in the future. As the existing air quality data showed (see Section 5.3), the worst-case 24-hour PM_{10} concentrations measured at Maroota School have been strongly influenced by other sources in the area, such as bushfires and dust storms, which are essentially unpredictable.

The following sections present maximum 24-hour average predictions for of PM_{10} and $PM_{2.5}$ due to the Proposal alone and cumulatively.

7.3.2 24-hour Average PM_{10}

Table 7-2 presents the maximum predicted 24-hour average PM_{10} concentrations due to the Proposal alone and cumulatively.

The cumulative concentrations were calculated by adding the predicted 24-hour average concentration due to the Proposal, to the corresponding concentration measured at Maroota Public on the same day for the representative year (2017).

Contour plots of the maximum predicted 24-hour average PM_{10} concentrations due to the Proposal alone are presented in Figure 7-9.

There was one day during 2017 when the 24-hour average PM_{10} concentrations at Maroota Public School exceeded 50 µg/m^3 (see Section 5.3.1 for further details). As the maximum contribution from the Proposal alone does not occur on the same day as this, the maximum predicted cumulative concentration is the same at most of the receptors.

There are no predicted exceedances due to the Proposal alone of the DPE VLAMP criterion of 50 µg/m^3.

When considering cumulative concentrations, there is one receptor (ID PF3, owned by PF Formation), that is predicted to experience one additional day over the EPA cumulative criterion of 50 µg/m^3.

Figure 7-10 presents the predicted 24-hour average contributions at PF3 for each day due to the Proposal alone (orange bars), matched with the measured 24-hour concertation at Maroota School for the same day (blue bars). The figure shows that the day of the predicted additional exceedance occurs on 24 September when the background concentration was 48.6 µg/m^3. The Proposal is predicted to add 6.8 µg/m^3.

As detailed in Section 6.3, the operational scenario assessed is considered conservative as in reality not all activities can occur simultaneously. When combined with the uncertainty around what the actual background concentrations will be (as discussed in Section 7.3.1) it considered that the potential for any additional exceedances to occur because of the Proposal is minimal.

Table 7-2 Maximum predicted 24-hour average PM_{10} concentrations due to the Proposal and cumulatively

Pollutant				PM_{10}				
Averaging period				Maximum 24-hour				
Receptor IDs				*Assessment criteria*		*No. of days > 50 µg/m³*		
				Proposal-only	*Cumulative*			
ID	**Type**	**Easting (m)**	**Northing (m)**	*DPE VLAMP = 50 µg/m³*	*NSW EPA = 50 µg/m³*	*Total no. of days > 50 µg/m³*	*Monitoring data no. of days > 50 µg/m³*	*No. of additional days > 50 µg/m³*
R1	Residential	312924	6295200	16	**51**	1	1	0
R2	Residential	312780	6295033	11	**51**	1	1	0
R3	Residential	312454	6294919	9	**51**	1	1	0
R4	Residential	312177	6294850	6	**51**	1	1	0
R5	Residential	311939	6294631	9	**51**	1	1	0
R6	Residential	311871	6294275	13	**51**	1	1	0
R7	Residential	311600	6294343	9	**51**	1	1	0
R8	Residential	311702	6294162	10	**51**	1	1	0
R9	Residential	311543	6294146	9	**51**	1	1	0
R10	Residential	311283	6294161	9	**51**	1	1	0
R11	Residential	311179	6294076	9	**51**	1	1	0
R12	Residential	313049	6295163	17	**51**	1	1	0
R13	Residential	313018	6295228	13	**51**	1	1	0
R14	Residential	312353	6295030	7	**51**	1	1	0
R15	Residential	312207	6294990	5	**51**	1	1	0
R16	Residential	312103	6295021	5	**51**	1	1	0
R17	Residential	310707	6293300	4	**51**	1	1	0
R18	Residential	311239	6292850	4	**51**	1	1	0
R19	Residential	311627	6292424	5	**51**	1	1	0
R20	Residential	311873	6291990	3	**51**	1	1	0
R21	Residential	312031	6294320	14	**51**	1	1	0
D1	Dixon Sand	313103	6295173	14	**51**	1	1	0
PF1	PF Formation	313362	6295255	3	**51**	1	1	0
PF2	PF Formation	313242	6295125	5	**51**	1	1	0
PF3	PF Formation	313228	6294961	19	**55**	2	1	1

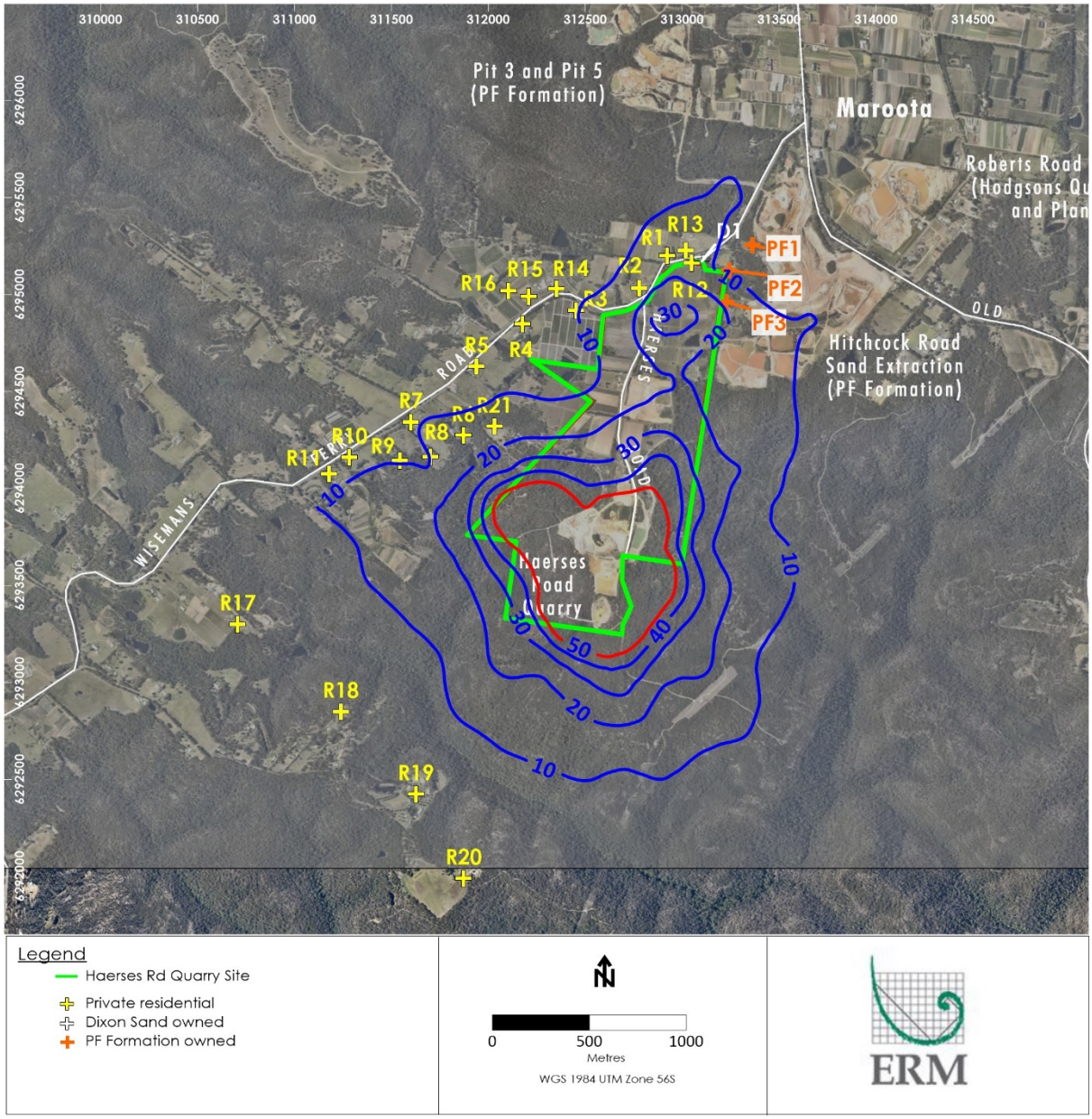


Figure 7-9: Maximum predicted 24-hour average PM_{10} concentrations – Proposal only

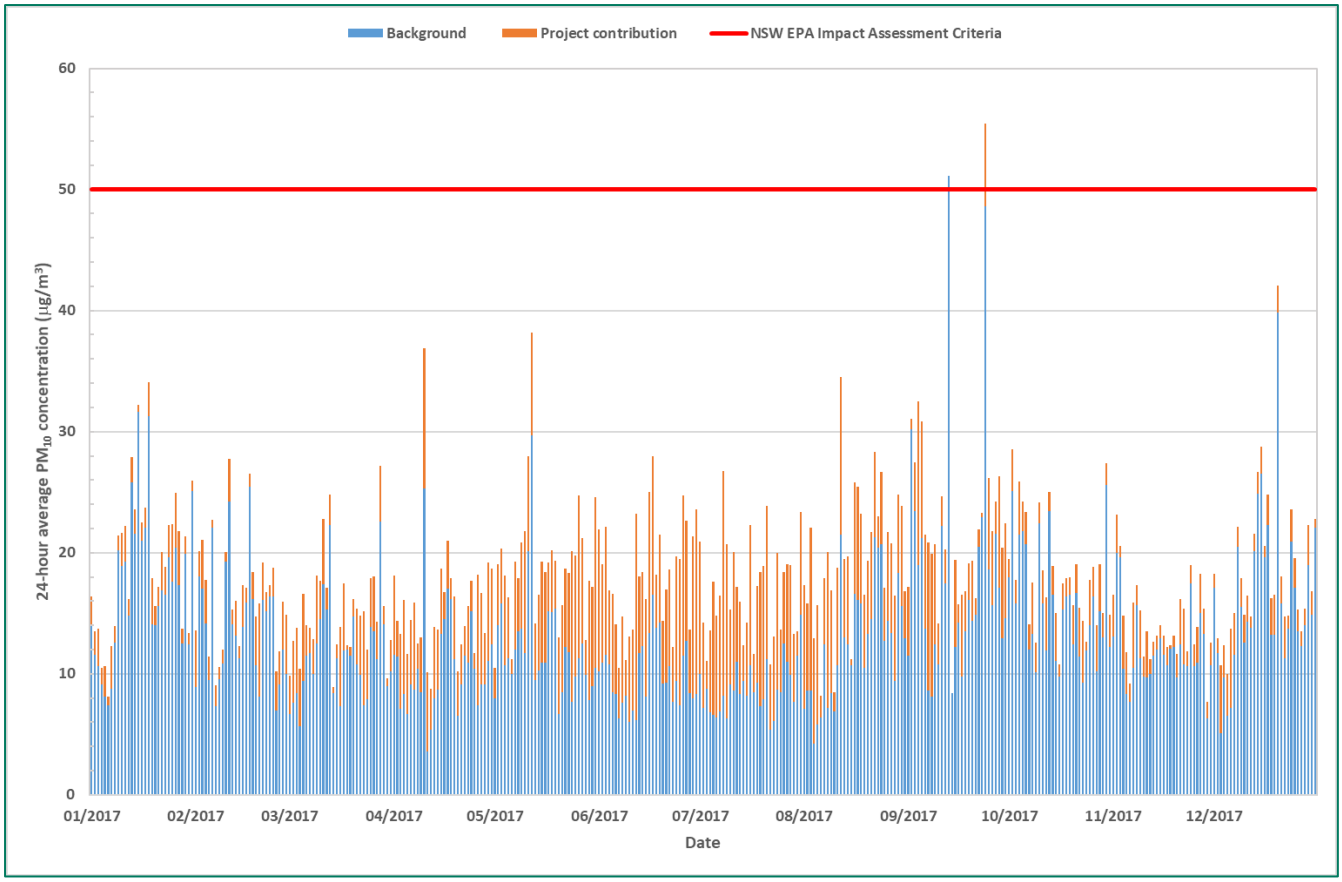


Figure 7-10: Predicted 24-hour average concentration due to Proposal alone and cumulatively – PF3

7.3.3 24-Hour Average $PM_{2.5}$

Table 7-3 presents the maximum predicted 24-hour average $PM_{2.5}$ concentrations due to the Proposal alone and cumulatively.

The cumulative concentrations were calculated by adding the predicted 24-hour average concentration due to the Proposal-alone, to the corresponding concentration determined by applying the $PM_{2.5}$:PM_{10} ratio of 0.41 (see section 5.3.2) to the measured PM_{10} concentrations at Maroota Public School on the same day for the representative year (2017).

Contour plots of the maximum predicted 24-hour average $PM_{2.5}$ concentrations due to the Proposal alone are presented in Figure 7-11.

There are no predicted exceedances due to the Proposal alone or cumulatively of the DPE VLAMP and EPA criterion of 25 µg/m^3.

Table 7-3 Maximum predicted 24-hour average $PM_{2.5}$ concentrations due to the Proposal and cumulatively

Pollutant				$PM_{2.5}$				
Averaging period				Maximum 24-hour				
Receptor IDs				Assessment criteria		No. of days > 25 µg/m^3		
				Proposal-only	Cumulative			
ID	Type	Easting (m)	Northing (m)	DPE VLAMP = 25 µg/m^3	NSW EPA = 25 µg/m^3	Total no. of days > 25 µg/m^3	Monitoring data no. of days > 25 µg/m^3	No. of additional days > 25 µg/m^3
R1	Residential	312924	6295200	7	21	0	0	0
R2	Residential	312780	6295033	4	21	0	0	0
R3	Residential	312454	6294919	6	21	0	0	0
R4	Residential	312177	6294850	7	21	0	0	0
R5	Residential	311939	6294631	12	21	0	0	0
R6	Residential	311871	6294275	11	21	0	0	0
R7	Residential	311600	6294343	13	21	0	0	0
R8	Residential	311702	6294162	10	21	0	0	0
R9	Residential	311543	6294146	11	21	0	0	0
R10	Residential	311283	6294161	5	21	0	0	0
R11	Residential	311179	6294076	9	21	0	0	0
R12	Residential	313049	6295163	3	21	0	0	0
R13	Residential	313018	6295228	3	21	0	0	0
R14	Residential	312353	6295030	12	21	0	0	0
R15	Residential	312207	6294990	3	21	0	0	0
R16	Residential	312103	6295021	8	21	0	0	0
R17	Residential	310707	6293300	4	21	0	0	0
R18	Residential	311239	6292850	4	21	0	0	0
R19	Residential	311627	6292424	7	21	0	0	0
R20	Residential	311873	6291990	3	21	0	0	0
R21	Residential	312031	6294320	8	21	0	0	0
D1	Dixon Sand	313103	6295173	3	21	0	0	0
PF1	PF Formation	313362	6295255	1	21	0	0	0
PF2	PF Formation	313242	6295125	2	21	0	0	0
PF3	PF Formation	313228	6294961	7	21	0	0	0

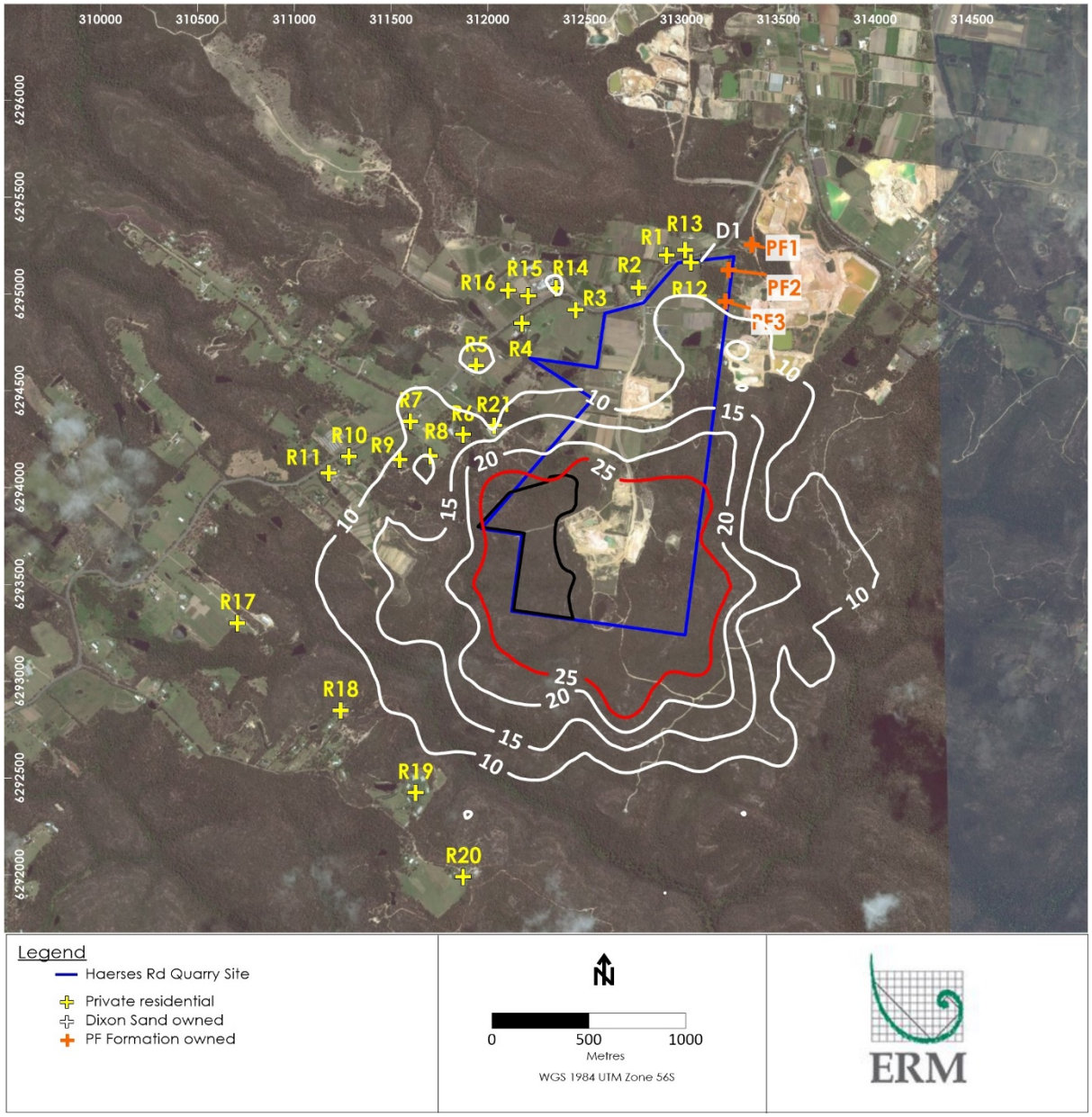


Figure 7-11: Maximum predicted 24-hour average $PM_{2.5}$ concentrations – Proposal only

8. CONCLUSION

ERM has completed an air quality assessment for Dixon Sand for the proposed Modification of the existing sand quarry at the Haerses Road site in Maroota NSW.

The worst-case operational stage has been modelled based on proposed maximum annual production.

The results of the modelling indicate that the predicted annual average PM_{10}, $PM_{2.5}$, TSP and dust deposition at the closest sensitive receivers due to both the Proposal alone and cumulatively all comply with the impact assessment criteria.

When considering 24-hour averages, there are no predicted exceedances of the relevant assessment criteria for $PM_{2.5}$ (either due to both the Proposal alone or cumulatively).

There are no predicted exceedances of the 24-hour average DPE VLAMP criterion due to the Proposal alone. When considering cumulative concentrations, there is one receptor (ID PF3, owned by PF Formation), that is predicted to experience one additional day over the EPA cumulative criterion. The day of the predicted additional exceedance occurs on 24 September when the background concentration was 48.6 µg/m^3. The Proposal is predicted to add 6.8 µg/m^3. As detailed in Section 6.3, the operational scenario assessed is considered conservative as in reality not all activities can occur simultaneously. When combined with the uncertainty around what the actual background concentrations will be (as discussed in Section 7.3.1) it considered that the potential for any additional exceedances to occur because of the Proposal is minimal.

9. REFERENCES

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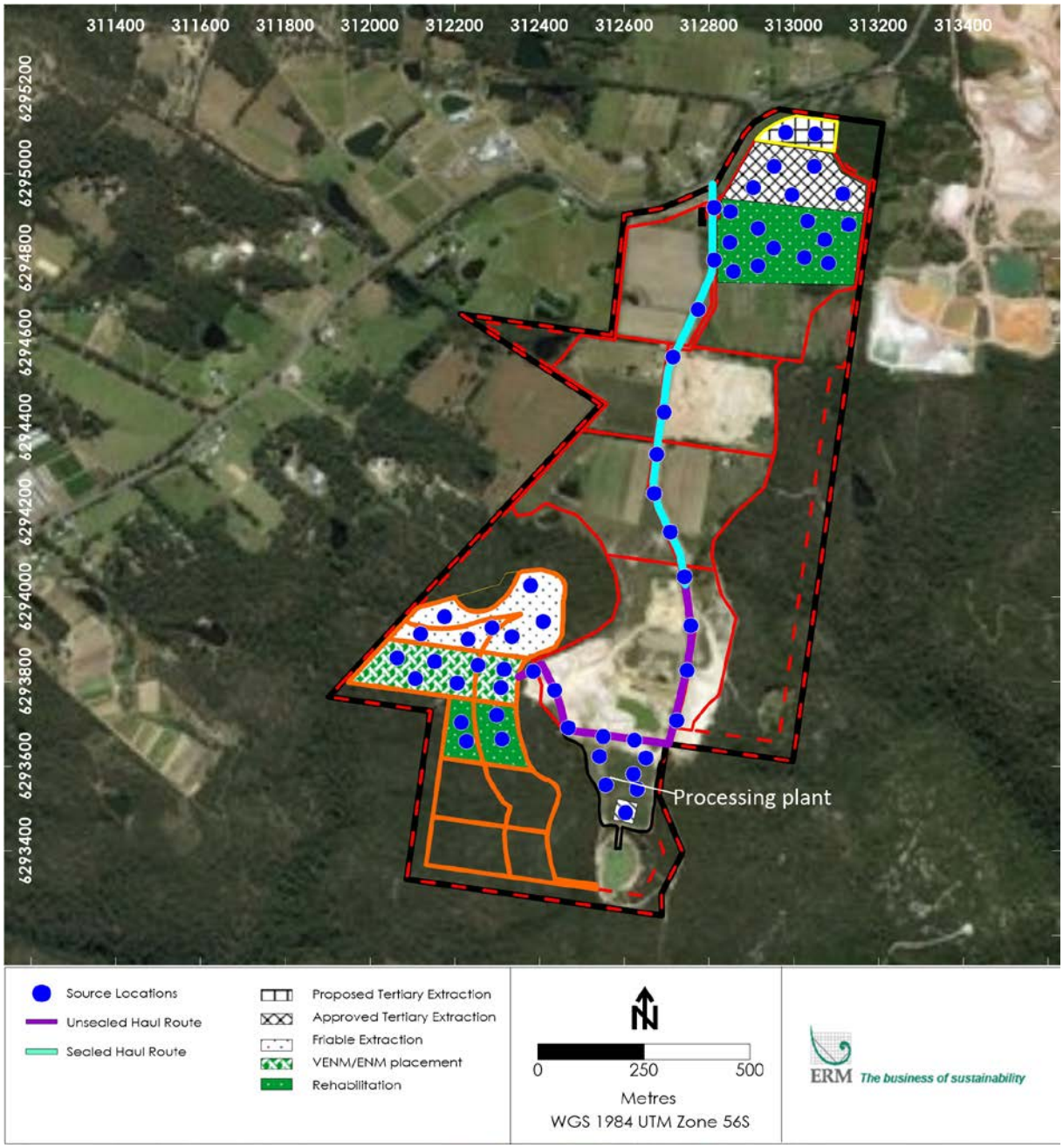
APPENDIX A MODEL SETUP

Meteorology				
Meteorological data for Surface (Samson) File	Maroota School Meteorological Station • Air temperature • Relative Humidity • Wind speed • Wind direction • Station Pressure TAPM: • Cloud cover • Cloud height			
Land Use	• Cultivated Land (Albedo – 0.28, Bowen ratio – 0.75 and Surface roughness – 0.0725)			
AERMET PFL	Upper Air Estimator			
Year of analysis	January 2017 - December 2017			
Model Set up				
South-west corner of domain (easting, northing)	309500, 6291700			
MGA coordinate zone	56 H			
Grid domain size	5.6 km x 6.8 km			
Grid spacing	200 m			
Number of grid points	29 x 35			
Terrain data	SRTM3 at 30m resolution			
Rural/Urban Mode	Rural			
Particle parameters				
Particle type	**TSP**	**PM_{10}**	**$PM_{2.5}$**	**Dust deposition**
Particle Method	Method 1	Method 1	Method 1	Selected
Particle diameter (microns)	17	5	1	17
Mass Fraction	1	1	1	1
Particle Density	2.5	2.5	2.5	2.5
Dry depletion	Selected	Selected	Selected	Selected

APPENDIX B SOURCE LOCATIONS AND EMISSION INVENTORIES

The location of the sources for the modelling are as shown below:



TSP Emission Inventory

ACTIVITY	TSP (kg/y)	Intensity	Units	Emission factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 3	Units	Variable 4	Units	Control	Units	Assumed control
Tertiary Sand Extraction Area - Approved																		
Dozer stripping topsoil - approved Stage 5	233	25	h/y	9.3	kg/h	13	silt content in %	4.0	moisture content (%)									
Excavator loading tertiary sand to trucks for transfer to Processing Area (from Approved Stage 5)	19	87,500	t/y	0.00022	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Hauling from Approved Stage 5 to Processing Area (unsealed - extraction to sealed road)	1,663	87,500	t/y	0.076	kg/t	40	t/load	52.8	Vehicle mean mass (t)	0.9	km/return trip	3.38	kg/VKT	6.4	% silt content	75	% control	Level 2 watering
Hauling from Approved Stage 5 to Processing Area (sealed to processing area)	382	87,500	t/y	0.004	kg/t	40	t/load	52.8	Vehicle mean mass (t)	1.968	km/return trip	0.09	kg/VKT	0.4	g/m2 silt loading	0	% control	
Hauling of Approved Stage 5 to and in Processing Area (unsealed)	1,774	87,500	t/y	0.081	kg/t	40	t/load	52.8	Vehicle mean mass (t)	0.96	km/return trip	3.38	kg/VKT	6.4	% silt content	75	% control	Level 2 watering
Tertiary Sand Extraction Area - Proposed																		
Dozer stripping topsoil - Proposed	233	25	h/y	9.3	kg/h	13	silt content in %	4.0	moisture content (%)									
Excavator loading tertiary sand to trucks for transfer to Processing Area (from proposed extension)	19	87,500	t/y	0.00022	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Hauling from proposed to Processing Area (unsealed - extraction to sealed road)	1,663	87,500	t/y	0.076	kg/t	40	t/load	52.8	Vehicle mean mass (t)	0.9	km/return trip	3.38	kg/VKT	6.4	% silt content	75	% control	Level 2 watering
Hauling from proposed to Processing Area (sealed to processing area)	382	87,500	t/y	0.004	kg/t	40	t/load	52.8	Vehicle mean mass (t)	1.968	km/return trip	0.09	kg/VKT	0.4	g/m2 silt loading	0	% control	
Hauling of proposed to and in Processing Area (unsealed)	1,774	87,500	t/y	0.081	kg/t	40	t/load	52.8	Vehicle mean mass (t)	0.96	km/return trip	3.38	kg/VKT	6.4	% silt content	75	% control	Level 2 watering
Friable Sand Extraction Area																		
Dozer stripping topsoil/ripping friable sandstone (from Cell 5A & 5B)	4,137	570	h/y	7.3	kg/h	12	silt content in %	4.5	moisture content (%)									
Excavator loading friable sand to trucks for transfer to Processing Area (from Cell 5A & 5B)	71	320,000	t/y	0.00022	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Hauling from Cell 5A & 5B to Processing Area (unsealed)	8,110	320,000	t/y	0.101	kg/t	40	t/load	52.8	Vehicle mean mass (t)	1.2	km/return trip	3.38	kg/VKT	6.4	% silt content	75	% control	
VENM/ENM placement in Friable area																		
Hauling VENM/ENM on-site from entrance to friable extraction area (Cells 4A & 4B) (sealed)	1,090	250,000	t/y	0.004	kg/t	40	t/load	52.8	Vehicle mean mass (t)	2.0	km/return trip	0.09	kg/VKT	0.4	g/m2 silt loading	0	% control	
Hauling of VENM/ENM to placement area (unsealed)	5,069	250,000	t/y	0.1	kg/t	40	t/load	52.8	Vehicle mean mass (t)	1.0	km/return trip	3.38	kg/VKT	6.4	% silt content	75	% control	Level 2 watering
Unloading VENM/ENM to cell	55	250,000	t/y	0.00022	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Dozer spreading/compacting VENM/ENM	3,036	380	h/y	8.0	kg/h	13	silt content in %	4.5	moisture content (%)									
Processing Area																		
Friable Sand processing																		
Unloading friable sand to stockpile at Processing Area	71	320,000	t/y	0.00022	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Loading friable sand from stockpile at Processing Area	71	320,000	t/y	0.00022	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Unloading friable sand to Dry Processing at Processing Area	71	320,000	t/y	0.00022	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Crushing friable sand (uncontrolled) at Processing area	6,240	320,000	t/y	0.0195	kg/t													
Transfer friable sand (Crusher to Screen) [conveyor transfer point]	35	320,000	t/y	0.00022	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)							50	% control	Application of water at transfers - boom tip water sprays
Screen friable sand (uncontrolled)	4,000	320,000	t/y	0.0125	kg/t													
Transfer friable processed at plant to product stockpile	35	320,000	t/y	0.00022	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)							50	% control	Application of water at transfers - boom tip water sprays
Tertiary Sand processing																		
Unloading tertiary sand to stockpile at Processing Area	39	175,000	t/y	0.00022	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Loading tertiary sand from stockpile at Processing Area	39	175,000	t/y	0.00022	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Unloading tertiary sand to Dry Processing at Processing Area	39	175,000	t/y	0.00022	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Screen tertiary sand (uncontrolled)	2,188	175,000	t/y	0.0125	kg/t													
Transfer (Screen to Wet Processing) [conveyor transfer point]	19	175,000	t/y	0.0002	kg/t	0.6	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)							50	% control	Application of water at transfers - boom tip water sprays
Wet Processing (no expected emissions)	-																	
Transfer tertiary processed at plant to product stockpile	19	175,000	t/y	0.00022	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)							50	% control	Application of water at transfers - boom tip water sprays
Product Sand																		
Loading sand from Product Stockpile to haul trucks	65	495,000	t/y	0.000	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	6.5	moisture content (%)									
Hauling out of Site (unsealed)	10,036	495,000	t/y	0.081	kg/t	40	t/load	52.84	Vehicle mean mass (t)	1	km/return trip	3.38	kg/VKT	6.4	% silt content	75	% control	Level 2 watering
Hauling out of Site (sealed)	2,159	495,000	t/y	0.004	kg/t	40	t/load	52.84	Vehicle mean mass (t)	2	km/return trip	0.09	kg/VKT	0.4	g/m2 silt loading	0	% control	
Wind Erosion																		
WE - Extraction Area (Tertiary - Stage 5)	708	3.7	ha	850	kg/ha/y											77.5	% control	50% control from watering plus 55% control from fencing, bunding or shelterbelts
WE - Extraction Area (Tertiary - proposed)	205	1.1	ha	850	kg/ha/y											77.5	% control	
WE - Extraction Area (Tertiary - Stage 5 part rehabilitated)	1,395	5.5	ha	850	kg/ha/y											70	% control	vegetative cover
WE - Extraction Area (Friable - 5A & 5B)	942	4.9	ha	850	kg/ha/y											77.5	% control	50% control from watering plus 55% control from fencing, bunding or shelterbelts
WE - Extraction Area (Friable - 4A & 4B plus VENM/ENM)	1,061	4.2	ha	850	kg/ha/y											70	% control	vegetative cover
WE - Extraction Area (Friable - 3A & 3B partly rehabilitated)	677	2.7	ha	850	kg/ha/y											70	% control	vegetative cover
WE - Processing Area including Stockpile	431	3.4	ha	850	kg/ha/y											85	% control	Chemical wetting agent
TOTAL TSP EMISSIONS	**60,252**																	

PM_{10} Emission Inventory

ACTIVITY	PM10 (kg/y)	Intensity	Units	Emission factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 3 (hauling)	Units	Variable 4	Units	Control	Units	Assumed control
Tertiary Sand Extraction Area - Approved																		
Dozer stripping topsoil - approved Stage 5	57	25	h/y	2.3	kg/h	13	silt content in %	4.0	moisture content (%)									
Excavator loading tertiary sand to trucks for transfer to Processing Area (from Approved Stage 5)	9	87,500	t/y	0.00010	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Hauling from Approved Stage 5 to Processing Area (unsealed - extraction to sealed road)	449	87,500	t/y	0.021	kg/t	40	t/load	52.8	Vehicle mean mass (t)	0.9	km/return trip	0.91	kg/VKT	6.4	% silt content	75	% control	Level 2 watering
Hauling from Approved Stage 5 to Processing Area (sealed to processing area)	73	87,500	t/y	0.001	kg/t	40	t/load	52.8	Vehicle mean mass (t)	1.968	km/return trip	0.02	kg/VKT	0.4	g/m2 silt loading	0	% control	
Hauling of Approved Stage 5 to and in Processing Area (unsealed)	479	87,500	t/y	0.022	kg/t	40	t/load	52.8	Vehicle mean mass (t)	0.96	km/return trip	0.91	kg/VKT	6.4	% silt content	75	% control	Level 2 watering
Tertiary Sand Extraction Area - Proposed																		
Dozer stripping topsoil - Proposed	57	25	h/y	2.3	kg/h	13	silt content in %	4.0	moisture content (%)									
Excavator loading tertiary sand to trucks for transfer to Processing Area (from proposed extension)	9	87,500	t/y	0.00010	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Hauling from proposed to Processing Area (unsealed - extraction to sealed road)	449	87,500	t/y	0.021	kg/t	40	t/load	52.8	Vehicle mean mass (t)	0.9	km/return trip	0.91	kg/VKT	6.4	% silt content	75	% control	Level 2 watering
Hauling from proposed to Processing Area (sealed to processing area)	73	87,500	t/y	0.001	kg/t	40	t/load	52.8	Vehicle mean mass (t)	1.968	km/return trip	0.02	kg/VKT	0.4	g/m2 silt loading	0	% control	
Hauling of proposed to and in Processing Area (unsealed)	479	87,500	t/y	0.022	kg/t	40	t/load	52.8	Vehicle mean mass (t)	0.96	km/return trip	0.91	kg/VKT	6.4	% silt content	75	% control	Level 2 watering
Friable Sand Extraction Area																		
Dozer stripping topsoil/ripping friable sandstone (from Cell 5A & 5B)	974	570	h/y	1.7	kg/h	12	silt content in %	4.5	moisture content (%)									
Excavator loading friable sand to trucks for transfer to Processing Area (from Cell 5A & 5B)	33	320,000	t/y	0.00010	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Hauling from Cell 5A & 5B to Processing Area (unsealed)	2,189	320,000	t/y	0.027	kg/t	40	t/load	52.8	Vehicle mean mass (t)	1.2	km/return trip	0.91	kg/VKT	6.4	% silt content	75	% control	
VENM/ENM placement in Friable area																		
Hauling VENM/ENM on-site from entrance to friable extraction area (Cells 4A & 4B) (sealed)	209	250,000	t/y	0.001	kg/t	40	t/load	52.8	Vehicle mean mass (t)	2.0	km/return trip	0.02	kg/VKT	0.4	g/m2 silt loading	0	% control	
Hauling of VENM/ENM to placement area (unsealed)	1,368	250,000	t/y	0.0	kg/t	40	t/load	52.8	Vehicle mean mass (t)	1.0	km/return trip	0.91	kg/VKT	6.4	% silt content	75	% control	Level 2 watering
Unloading VENM/ENM to cell	26	250,000	t/y	0.00010	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Dozer spreading/compacting VENM/ENM	732	380	h/y	1.9	kg/h	13	silt content in %	4.5	moisture content (%)									
Processing Area																		
Friable Sand processing																		
Unloading friable sand to stockpile at Processing Area	33	320,000	t/y	0.00010	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Loading friable sand from stockpile at Processing Area	33	320,000	t/y	0.00010	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Unloading friable sand to Dry Processing at Processing Area	33	320,000	t/y	0.00010	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Crushing friable sand (uncontrolled) at Processing area	2,400	320,000	t/y	0.0075	kg/t													
Transfer friable sand (Crusher to Screen) [conveyor transfer point]	17	320,000	t/y	0.00010	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)							50	% control	Application of water at transfers - boom tip water sprays
Screen friable sand (uncontrolled)	1,376	320,000	t/y	0.0043	kg/t													
Transfer friable processed at plant to product stockpile	17	320,000	t/y	0.00010	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)							50	% control	Application of water at transfers - boom tip water sprays
Tertiary Sand processing																		
Unloading tertiary sand to stockpile at Processing Area	18	175,000	t/y	0.00010	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Loading tertiary sand from stockpile at Processing Area	18	175,000	t/y	0.00010	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Unloading tertiary sand to Dry Processing at Processing Area	18	175,000	t/y	0.00010	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Screen tertiary sand (uncontrolled)	753	175,000	t/y	0.0043	kg/t													
Transfer (Screen to Wet Processing) [conveyor transfer point]	9	175,000	t/y	0.0001	kg/t	0.6	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)							50	% control	Application of water at transfers - boom tip water sprays
Wet Processing (no expected emissions)	-																	
Transfer tertiary processed at plant to product stockpile	9	175,000	t/y	0.00010	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)							50	% control	Application of water at transfers - boom tip water sprays
Product Sand																		
Loading sand from Product Stockpile to haul trucks	31	495,000	t/y	0.000	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	6.5	moisture content (%)									
Hauling out of Site (unsealed)	2,709	495,000	t/y	0.022	kg/t	40	t/load	52.84	Vehicle mean mass (t)	1	km/return trip	0.91	kg/VKT	6.4	% silt content	75	% control	Level 2 watering
Hauling out of Site (sealed)	414	495,000	t/y	0.001	kg/t	40	t/load	52.84	Vehicle mean mass (t)	2	km/return trip	0.02	kg/VKT	0.4	g/m2 silt loading	0	% control	
Wind Erosion																		
WE - Extraction Area (Tertiary - Stage 5)	354	3.7	ha	425	kg/ha/y											77.5	% control	50% control from watering plus 55% control from fencing, bunding or shelterbelts
WE - Extraction Area (Tertiary - proposed)	102	1.1	ha	425	kg/ha/y											77.5	% control	
WE - Extraction Area (Tertiary - Stage 5 part rehabilitated)	698	5.5	ha	425	kg/ha/y											70	% control	vegetative cover
WE - Extraction Area (Friable - 5A & 5B)	471	4.9	ha	425	kg/ha/y											77.5	% control	50% control from watering plus 55% control from fencing, bunding or shelterbelts
WE - Extraction Area (Friable - 4A & 4B plus VENM/ENM)	531	4.2	ha	425	kg/ha/y											70	% control	vegetative cover
WE - Extraction Area (Friable - 3A & 3B partly rehabilitated)	338	2.7	ha	425	kg/ha/y											70	% control	vegetative cover
WE - Processing Area including Stockpile	215	3.4	ha	425	kg/ha/y											85	% control	Chemical wetting agent
TOTAL PM10 EMISSIONS	**18,265**																	

$PM_{2.5}$ Emission Inventory

ACTIVITY	PM2.5 (kg/y)	Intensity	Units	Emission factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 3 (hauling)	Units	Variable 4	Units	Control	Units	Assumed control
Tertiary Sand Extraction Area - Approved																		
Dozer stripping topsoil - approved Stage 5	24	25	h/y	1.0	kg/h	13	silt content in %	4.0	moisture content (%)									
Excavator loading tertiary sand to trucks for transfer to Processing Area (from Approved Stage 5)	1	87,500	t/y	0.00002	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Hauling from Approved Stage 5 to Processing Area (unsealed - extraction to sealed road)	45	87,500	t/y	0.002	kg/t	40	t/load	52.8	Vehicle mean mass (t)	0.9	km/return trip	0.09	kg/VKT	6.4	% silt content	75	% control	Level 2 watering
Hauling from Approved Stage 5 to Processing Area (sealed to processing area)	18	87,500	t/y	0.0002	kg/t	40	t/load	52.8	Vehicle mean mass (t)	1.968	km/return trip	0.004	kg/VKT	0.4	g/m2 silt loading	0	% control	
Hauling of Approved Stage 5 to and in Processing Area (unsealed)	48	87,500	t/y	0.002	kg/t	40	t/load	52.8	Vehicle mean mass (t)	0.96	km/return trip	0.09	kg/VKT	6.4	% silt content	75	% control	Level 2 watering
Tertiary Sand Extraction Area - Proposed																		
Dozer stripping topsoil - Proposed	24	25	h/y	1.0	kg/h	13	silt content in %	4.0	moisture content (%)									
Excavator loading tertiary sand to trucks for transfer to Processing Area (from proposed extension)	1	87,500	t/y	0.00002	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Hauling from proposed to Processing Area (unsealed - extraction to sealed road)	45	87,500	t/y	0.002	kg/t	40	t/load	52.8	Vehicle mean mass (t)	0.9	km/return trip	0.09	kg/VKT	6.4	% silt content	75	% control	Level 2 watering
Hauling from proposed to Processing Area (sealed to processing area)	18	87,500	t/y	0.000	kg/t	40	t/load	52.8	Vehicle mean mass (t)	1.968	km/return trip	0.004	kg/VKT	0.4	g/m2 silt loading	0	% control	
Hauling of proposed to and in Processing Area (unsealed)	48	87,500	t/y	0.002	kg/t	40	t/load	52.8	Vehicle mean mass (t)	0.96	km/return trip	0.09	kg/VKT	6.4	% silt content	75	% control	Level 2 watering
Friable Sand Extraction Area																		
Dozer stripping topsoil/ripping friable sandstone (from Cell 5A & 5B)	434	570	h/y	0.8	kg/h	12	silt content in %	4.5	moisture content (%)									
Excavator loading friable sand to trucks for transfer to Processing Area (from Cell 5A & 5B)	5	320,000	t/y	0.00002	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Hauling from Cell 5A & 5B to Processing Area (unsealed)	219	320,000	t/y	0.003	kg/t	40	t/load	52.8	Vehicle mean mass (t)	1.2	km/return trip	0.09	kg/VKT	6.4	% silt content	75	% control	
VENM/ENM placement in Friable area																		
Hauling VENM/ENM on-site from entrance to friable extraction area (Cells 4A & 4B) (sealed)	51	250,000	t/y	0.0002	kg/t	40	t/load	52.8	Vehicle mean mass (t)	2.0	km/return trip	0.004	kg/VKT	0.4	g/m2 silt loading	0	% control	
Hauling of VENM/ENM to placement area (unsealed)	137	250,000	t/y	0.002	kg/t	40	t/load	52.8	Vehicle mean mass (t)	1.0	km/return trip	0.09	kg/VKT	6.4	% silt content	75	% control	Level 2 watering
Unloading VENM/ENM to cell	4	250,000	t/y	0.00002	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Dozer spreading/compacting VENM/ENM	319	380	h/y	0.8	kg/h	13	silt content in %	4.5	moisture content (%)									
Processing Area																		
Friable Sand processing																		
Unloading friable sand to stockpile at Processing Area	5	320,000	t/y	0.00002	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Loading friable sand from stockpile at Processing Area	5	320,000	t/y	0.00002	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Unloading friable sand to Dry Processing at Processing Area	5	320,000	t/y	0.00002	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Crushing friable sand (uncontrolled) at Processing area	2,400	320,000	t/y	0.0075	kg/t													
Transfer friable sand (Crusher to Screen) [conveyor transfer point]	3	320,000	t/y	0.00002	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)							50	% control	Application of water at transfers - boom tip water sprays
Screen friable sand (uncontrolled)	1,376	320,000	t/y	0.0043	kg/t													
Transfer friable processed at plant to product stockpile	3	320,000	t/y	0.00002	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)							50	% control	Application of water at transfers - boom tip water sprays
Tertiary Sand processing																		
Unloading tertiary sand to stockpile at Processing Area	3	175,000	t/y	0.00002	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Loading tertiary sand from stockpile at Processing Area	3	175,000	t/y	0.00002	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Unloading tertiary sand to Dry Processing at Processing Area	3	175,000	t/y	0.00002	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)									
Screen tertiary sand (uncontrolled)	753	175,000	t/y	0.0043	kg/t													
Transfer (Screen to Wet Processing) [conveyor transfer point]	1	175,000	t/y	0.00002	kg/t	0.6	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)							50	% control	Application of water at transfers - boom tip water sprays
Wet Processing (no expected emissions)	-																	
Transfer tertiary processed at plant to product stockpile	1	175,000	t/y	0.00002	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	4.5	moisture content (%)							50	% control	Application of water at transfers - boom tip water sprays
Product Sand																		
Loading sand from Product Stockpile to haul trucks	5	495,000	t/y	0.00001	kg/t	0.58	average of (wind speed/2.2)^1.3 in m/s	6.5	moisture content (%)									
Hauling out of Site (unsealed)	271	495,000	t/y	0.002	kg/t	40	t/load	52.84	Vehicle mean mass (t)	1	km/return trip	0.09	kg/VKT	6.4	% silt content	75	% control	Level 2 watering
Hauling out of Site (sealed)	100	495,000	t/y	0.0002	kg/t	40	t/load	52.84	Vehicle mean mass (t)	2	km/return trip	0.004	kg/VKT	0.4	g/m2 silt loading	0	% control	
Wind Erosion																		
WE - Extraction Area (Tertiary - Stage 5)	53	3.7	ha	64	kg/ha/y											77.5	% control	50% control from watering plus 55% control from fencing, bunding or shelterbelts
WE - Extraction Area (Tertiary - proposed)	15	1.1	ha	64	kg/ha/y											77.5	% control	
WE - Extraction Area (Tertiary - Stage 5 part rehabilitated)	105	5.5	ha	64	kg/ha/y											70	% control	vegetative cover
WE - Extraction Area (Friable - 5A & 5B)	71	4.9	ha	64	kg/ha/y											77.5	% control	50% control from watering plus 55% control from fencing, bunding or shelterbelts
WE - Extraction Area (Friable - 4A & 4B plus VENM/ENM)	80	4.2	ha	64	kg/ha/y											70	% control	vegetative cover
WE - Extraction Area (Friable - 3A & 3B partly rehabilitated)	51	2.7	ha	64	kg/ha/y											70	% control	vegetative cover
WE - Processing Area including Stockpile	32	3.4	ha	64	kg/ha/y											85	% control	Chemical wetting agent
TOTAL PM2.5 EMISSIONS	**6,783**																	

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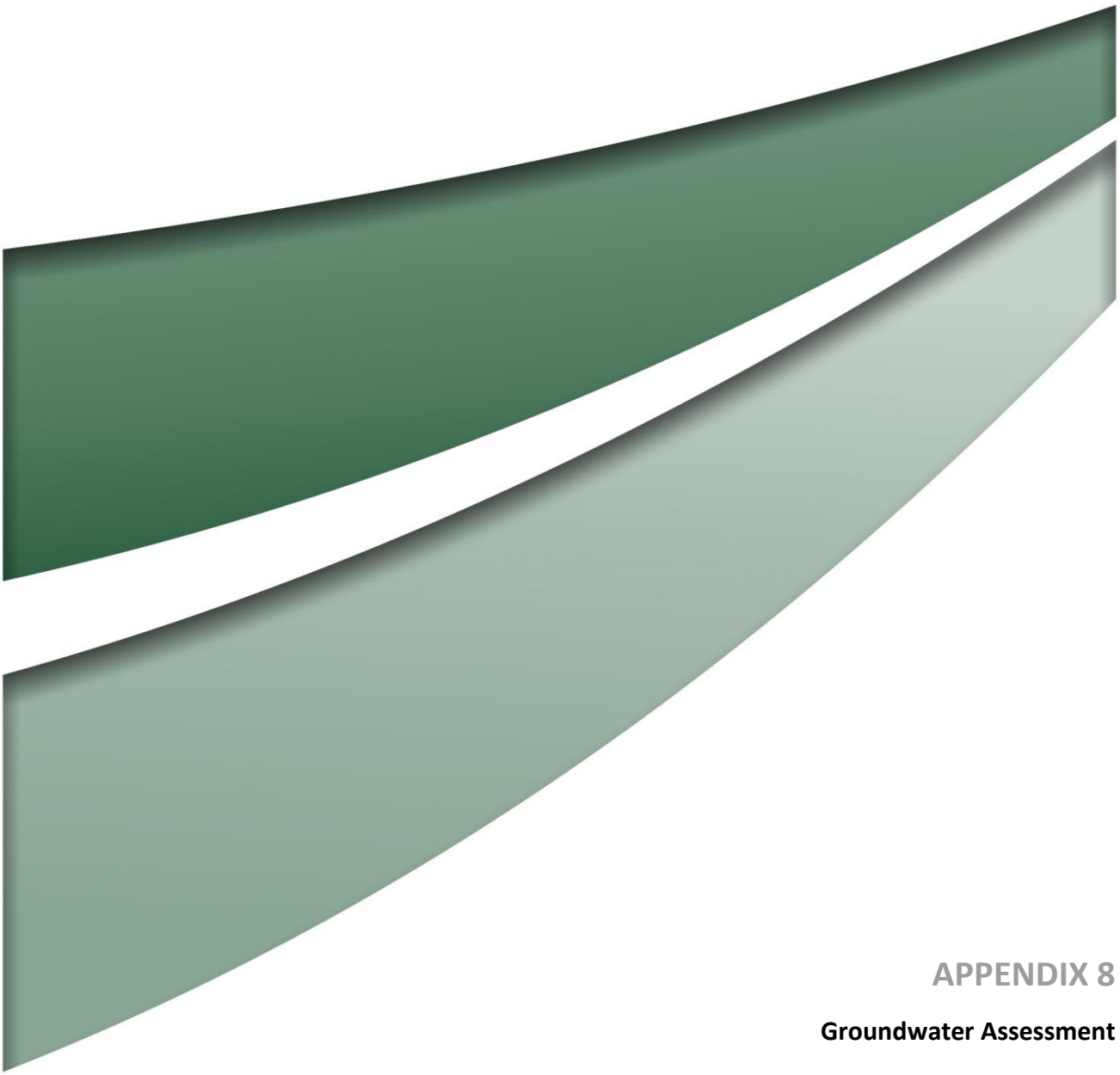

APPENDIX 8

Groundwater Assessment

REPORT

GROUNDWATER ASSESSMENT FOR DA 165-7-2005 MOD3

Dixon Sand (No. 1) Pty Ltd

Submitted to:

Umwelt (Australia) Pty Ltd

Submitted by:

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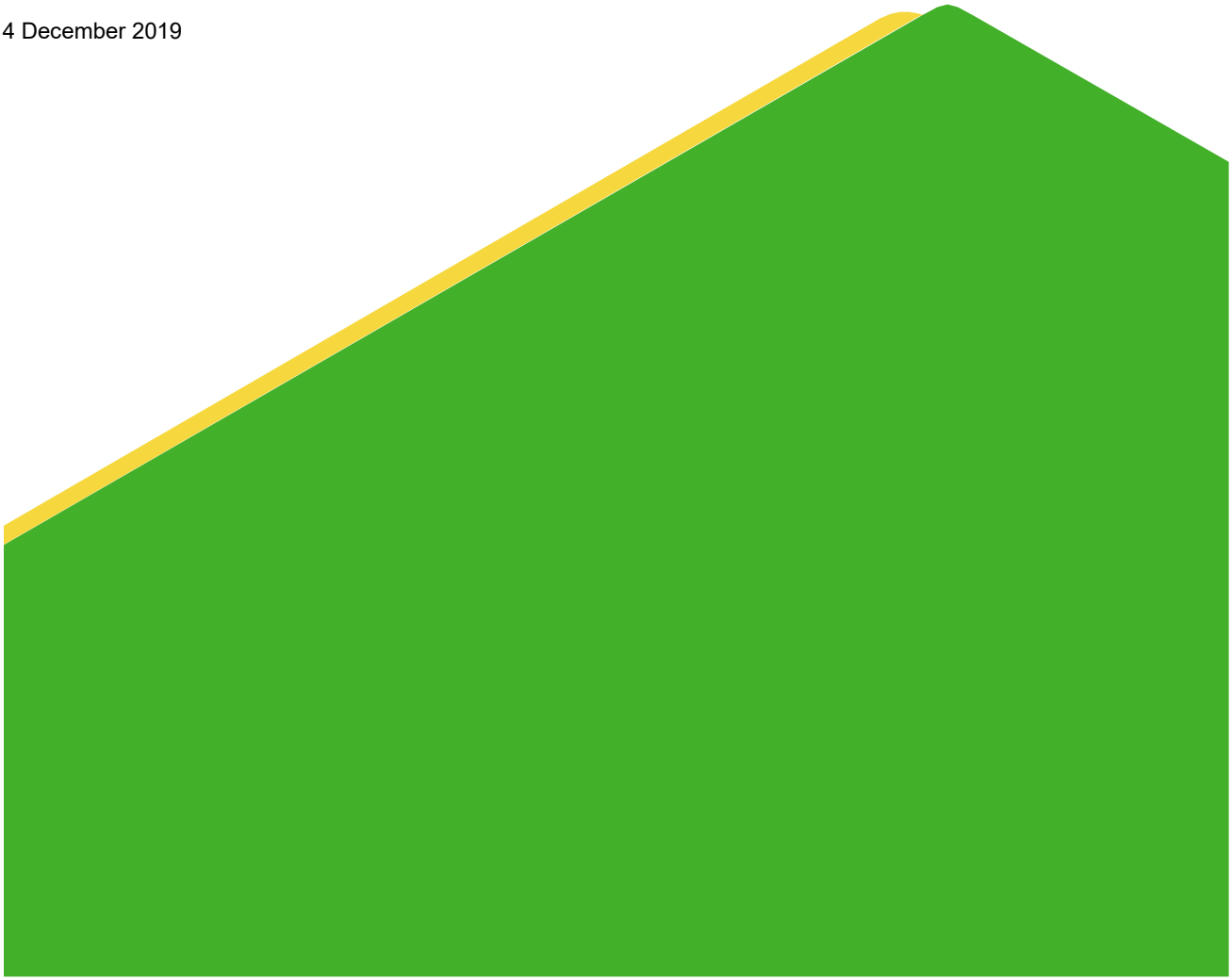
19122949-002-R-Rev2

4 December 2019



Distribution List

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Table of Contents

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

Dixon Sand (No. 1) Pty Ltd (Dixon Sand) operates the Haerses Road Quarry, Maroota. The site covers 128 ha either side of Haerses Rd (Figure 1). The quarry operates in accordance with Development Consent DA 165-7-2005, which has been subsequently modified on two occasions ('MOD1' and 'MOD2').

Dixon Sand is proposing a third modification ('MOD3') to DA 165-7-2005 under Section 4.55 (2) of the EP&A Act to allow for the following key modifications:

- Increased maximum annual extraction (to 495,000 tonnes per annum).
- Increased truck movements (to 180 per day).
- Small increase to the extraction area (into buffer at northern end of site) (see Figure 1).
- Increased volume of Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM) to be imported to the Quarry (primarily for backfill and landform construction) to match the proportional increase in extraction rate.

No increase in extraction depth is proposed for MOD3. The existing consent allows for extraction to a depth of 2 m above the maximum wet weather groundwater level of the following underlying groundwater sources:

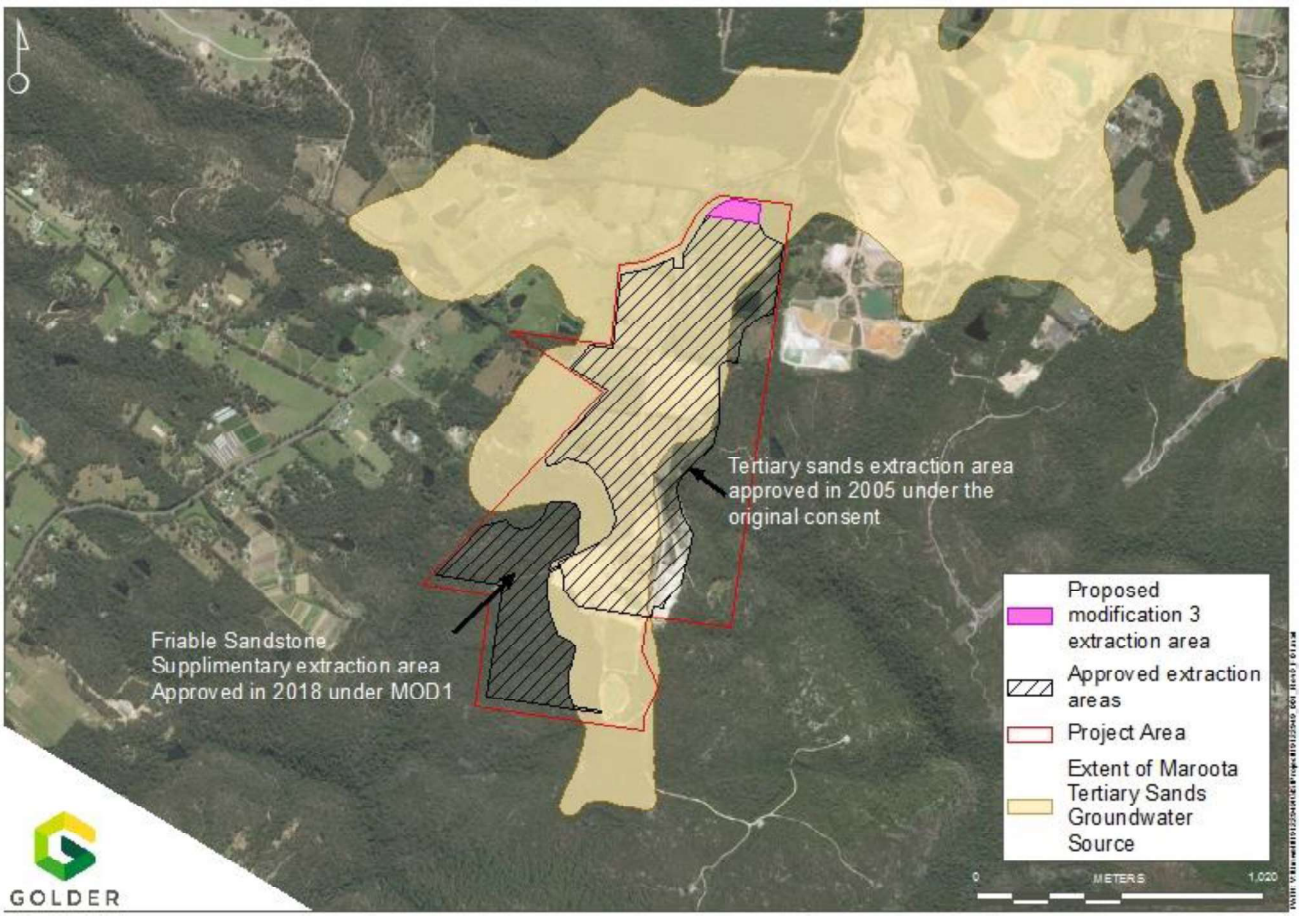
- Maroota Tertiary Sands Groundwater Source (MTSGS), a shallow water table aquifer which comprises the Maroota Tertiary Sands and weathered Hawkesbury Sandstone. The mapped boundary of the MTSGS is shown on Figure 1 and underlies the original approved extraction area of the original consent DA 165-7-2005.
- Sydney Central Basin Groundwater Source (SCBGS), a deep regional hard rock aquifer which comprises the deeper Hawkesbury Sandstone Aquifer and underlies the supplementary extraction stages approved under MOD1 (DA 165-7-2005-MOD1) (Figure 1).

The proposed extension to the extraction area of MOD3 is situated to the north of the original extraction area and is therefore within the boundaries of MTSGS (Figure 1).

Umwelt provided a Preliminary Environmental Assessment (PEA) to the Department of Planning and Environment (DPE) that outlined the proposed modification to the consent conditions together with a brief justification for the proposed changes. In terms of groundwater related impacts, the Department requested that the modification consider the potential impacts on groundwater of the proposed extension area. A key aspect of this was to:

- Determine the wet weather groundwater level of the of the MTSGS and maximum extraction depth within the current approved and proposed MOD3 extraction area; and
- Reassess the proposed modification against Section 3.2.1 of the Aquifer Interference Policy (AIP) (DPI, 2012). Section 3.2.1 of the AIP includes the concept of ensuring "no more than minimal harm" for the granting of project approvals. Aquifer interference approvals are not to be granted unless the Minister is satisfied that adequate arrangements are in force to ensure that no more than minimal harm will be done to any water source.

Figure 1: Site Location Plan



1.1 Scope of Work

The overall objective of this report is to provide an assessment of the effects of MOD3 on groundwater. The scope of work addressed in this report includes:

- A summary of the proposed modification.
- A summary of the groundwater assessments that were undertaken to support previous modifications.
- A summary of the site hydrogeology supported by recent groundwater monitoring data. Of relevance are the wet weather groundwater levels as the current consent conditions (DA 165-7-2005) allows for extraction to a maximum depth of 2 m above the wet weather groundwater level.
- An assessment of MOD3 against the AIP and in particular, an assessment against the Minimal Impact Considerations listed under Table 1 of the AIP.

2.0 SITE DESCRIPTION

Dixon Sand operates the Haerses Road Quarry (the quarry) at Maroota in New South Wales (NSW), within the Hills Shire Council Local Government Area (LGA). The quarry site is approximately 128 hectares (ha) and includes Lot 170 DP 664766, Lot 170 DP 664767, Lots A and B DP 407341, Lots 176, 177 and 216 DP 752039 which adjoin Haerses Road. Haerses Road is a no-through road providing access to the nominated lots of the quarry, as well as Lot 7308 DP1163424 and Lot 1 DP1139713 of Deerubbin Local Aboriginal Land Council (LALC) (formerly Maroota State Forest).

The quarry is located within the small rural community of Maroota which supports several other sand extraction operations, including the Old Northern Road Quarry which is also operated by Dixon Sand. The quarry supplies concrete sand and specialty sands to the Sydney metropolitan market.

3.0 APPROVED AND PROPOSED QUARRY OPERATIONS

3.1 Approved Quarry Operations

The quarry operates in accordance with Development Consent DA 165-7-2005 (State Significant Development under the State Environmental Planning Policy, State and Regional Development 2011) (the development consent).

Since commencing operations in 2006, the DA 165-7-2005 has been modified twice, in 2018 to increase the extraction area and allow for the importation of VENM and ENM for processing and backfill (MOD1), and most recently in 2019 to correct a minor inconsistency in the identification of buffers between the operational areas and quarry site boundary (MOD2). The current approved extraction areas are shown on Figure 1.

The current development consent provides for an extraction rate of 250,000 tonnes per annum (tpa) until February 2046.

Key components of the approved operations are as follows:

- Progressive extraction and rehabilitation of the five original and supplementary extraction stages of MOD1 (shown on Figure 1). The exception being stage 1 which will remain operational for the life of the quarry.
- Progressive extraction and reinstatement of Haerses Road, which runs through the site, so that access is maintained as during the life of the quarry.
- Onsite processing to remove coarse rejects using mobile power screen.
- On-site wet processing to remove fine material from the sand.
- Haulage of up to 190,000 tpa of screened sand to Old Northern Road Quarry (for further processing and washing).
- Haulage of up to 250,000 tpa of screened sand direct to local and regional markets.
- Rehabilitation of the Quarry Site to class 4 agricultural land and native vegetation.

The approved depth of the current quarrying operations is restricted to 2 metres above the maximum wet weather groundwater level of both the MTSGS and SCBCS. For example, extraction within the Tertiary Sand extraction area (for the original consent DA 165-7-2005) is restricted to 2 m above the maximum wet weather groundwater level of the MTSGS, however extraction from the Hawkesbury Sandstone (MOD1 DA 165-7-2005-MOD1), is restricted to 2 m above the maximum wet weather groundwater level of the SCBCS and the MTSGS, where extraction occurs within 100 m of the MTSGS

3.2 Proposed Quarry Modifications (MOD3)

Dixon Sand is proposing a third modification to the development to allow for the following.

- A small extension in extraction area of approximately 1 ha and modification to the buffer at the northern end of the quarry. The proposed extension is situated within the boundaries of the MTSGS (see Figure 1).
- Increase in the rate of extraction from the Quarry from 250,000 tpa to 495,000 tpa. The proposed extraction rate increase would better reflect the approved resource available for extraction which includes the additional 15 million tonnes approved by MOD1.
- An associated increase in the number of daily truck movements permitted to access or depart form the Quarry from 56 trucks per day to 180 trucks per day is proposed.
- As a consequence of the increased extraction and production rate, additional water could be required for dust suppression. This water depend would be supplied by a combination of surface runoff captured on the Quarry Site and from water allocations already held by Dixon Sand.

The depth of the proposed quarrying operations will be restricted to 2 metres above the maximum wet weather groundwater level of the MTSGS. This depth is determined by the existing network of groundwater monitoring bores and is assessed under section 6 below.

Furthermore, no changes to the extraction depths are proposed for the approved extraction areas.

4.0 PREVIOUS STUDIES

4.1 Overview

In the Maroota area there have been numerous groundwater assessments completed. The most relevant for the quarry site include:

- Haerses Road Quarry EIS (ERM, 2005) and the Haerses Road Sand Quarry Environmental Monitoring Plan (EMP) (ERM, 2006), which were undertaken in support of the original DA 165-7-2005. A key element of this assessment was to determine the wet weather groundwater levels of the MTSGS and the maximum extraction depth above the MTSGS.
- An Independent Audit was subsequently undertaken for the above extraction area in 2017 (by Dundon Consulting) to review the wet weather groundwater level of the MTSGS and update the Maximum Extraction Depth Map, based on longer term groundwater monitoring data.
- Haerses Road Quarry Groundwater Assessment (AGT, 2016), undertaken to support DA 165-7-2005 MOD1 for extraction within the Hawkesbury sandstone to the west of the MTSGS (see Figure 1). The focus of this assessment was to determine the groundwater levels within the adjacent Hawkesbury Sandstone, which in turn was used to establish maximum extraction depth.
- Maroota Extractive Industry Groundwater Study (EMM, 2018), which focused on groundwater levels in the shallow aquifer across the area, and an improved assessment of recharge, discharge and flow-through areas and processes. EMM used groundwater level data obtained from Dixon Sand and other quarries to develop a groundwater level map to benchmark the upper (high) wet weather groundwater level of the shallow sand aquifer.

4.2 Original EIS Assessment

In 2005, Environmental Resources Management (ERM) conducted an environmental impact assessment for development application DA 165-7-2005 to support quarry extraction to 2 m above the 'wet weather' groundwater level of the MTSGS. Based on the groundwater level monitoring data at the time, the study concluded that the 'wet weather' groundwater level ranged between 171.5 m AHD to 185.7 m AHD, allowing quarrying to a maximum depth of between 173.5 m AHD and 187.7 m AHD (ERM 2005).

The assessment also considered potential impacts including:

- Reduced groundwater availability to users from water table lowering.
- Groundwater contamination.
- A reduction in groundwater quality to streams.

The following outlines the findings of the 2005 EIS.

4.2.1 Reduced Groundwater Availability to Users / Water Table Lowering

The original assessment concluded that because quarrying is restricted to two metres above the wet weather groundwater level, the groundwater surface will not be exposed at any time during quarrying. As such, a lowering of the groundwater levels as a result of evaporation losses is unlikely to occur.

In addition, rapid groundwater infiltration to the shallow aquifer occurs through the site's highly permeable soils, such that the quarrying of sand will not significantly increase the rate of recharge nor accelerate groundwater mounding through vertical infiltration.

4.2.2 Aquifer Contamination

The original EIS identified the potential for aquifer contamination from fuel spillages principally from the operation of heavy machinery during quarry excavation. ERM (2005) assessed the risks from this activity as low provided adequate management strategies were in place i.e. appropriate fuel storages and implementation of a site management plan.

4.2.3 A Reduction in Groundwater Quality to Streams

Stripping of vegetation and topsoil for quarrying would typically cause recharge waters to be less acidic because of removal of humic material. The quarry area has been previously used for agriculture and the organic level of the soil has been altered. Therefore, the proposed quarry is unlikely to change the pH of the downstream environment (ERM, 2005).

4.3 Independent Audit Review of Extraction Depth

An Independent Environmental Audit was undertaken by Dundon Consulting in 2018 to review and update the Maximum Extraction Depth Map above the MTSGS to the satisfaction of the Director-General.

The existing Development Consent required that prior to carrying out any development the Applicant *"…establish the wet weather groundwater level for the site based on at least 12 months of site specific groundwater monitoring data".* It further requires the maximum extraction depth was determined from the wet weather groundwater level to comply with Condition 19 of Schedule 2 of the development consent, which states that extraction cannot take place within 2 m of the wet weather groundwater level. Finally, the Consent requires that after each 3-yearly Independent Environmental Audit "…the Applicant shall review and update the maximum extraction depth map for the Development to the satisfaction of the Director-General."

Dundon Consulting in 2018 noted there is no definition of Wet Weather Groundwater Level in the modified Consent, so followed the same methodology as previously, which is to determine all occasions when a rainfall of at least 50 mm was recorded in a 24 hour period and noted the water level immediately following this event. The maximum water level for each bore was determined in this way.

Contours of extraction depth based on wet weather high groundwater levels of the current approved extraction area ranged from 173 m AHD to 189 m AHD.

4.4 Groundwater Assessment for DA 165-7-2005 MOD1

The groundwater assessment undertaken for MOD1 (AGT, 2016) focused on the western extraction area within the Hawkesbury Sandstone to the west of the MTSGS (Figure 1). This groundwater assessment and the subsequent drilling of an additional 13 monitoring bores focused on characterising the wet weather groundwater level of the deeper regional SCBCS and overlying perched groundwater systems along the western margin of the MTSGS.

5.0 HYDROGEOLOGICAL SETTING

5.1 Overview

Information collected during previous drilling campaigns, together with long term groundwater monitoring has provided a large amount of hydrogeological information. From this, a good understanding of the groundwater resources has been possible.

The aquifers identified across the Maroota area include the:

- The Maroota Sands that together with the upper part of the Hawkesbury Sandstone (eluvial sands) constitute the water table aquifer. This unit forms the MTSGS and the boundary is presented on Figure 1.
- The Hawkesbury Sandstone, a regional fractured rock aquifer. The Hawkesbury Sandstone forms part of the SCBCS. The unit is competent (lithified) with secondary fracturing the predominant mechanism for groundwater flow.

5.2 Maroota Tertiary Sands Groundwater Source

The extent of the MTSGS is shown on Figure 1 and was delineated by Etheridge (1980). This report has been used by authorities to determine the extent of the Maroota Tertiary Sands, including the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011 – Maroota Tertiary Sands Ground Water Source (NOW 2011).

The MTSGS is recharged by direct rainfall infiltration and is subject to seasonal rainfall variations and long term climatic cycles. At the quarry site, water bore drilling has identified the MTSGS comprises of thin layers of gravel, thick sequences of clay, and interbedded clays and sands. These profiles are typical of palaeochannel sequences and represent the meandering nature of old river systems (Woodward and Clyde 1999).

In the Weathered Profile of the underlying Hawkesbury Sandstone, small aquifer zones have developed in the eluvial sand, which comprises the leached and weathered profile of the Hawkesbury Sandstone. These zones often form perched aquifer systems which also constitute the MTSGS but are above the deeper regional water level of the Hawkesbury Sandstone. In the majority of cases, these perched aquifer systems have limited resource value because, like the Maroota Tertiary Sands, they have small aerial extent and storage. They act as temporary storage of groundwater prior to leakage to underlying aquifers.

The water level of the MTSGS has been monitored and recorded at the Haerses Road Quarry since 2005. Thirteen monitoring bores (H series) have been used to monitor the water levels, however ongoing quarry operations have resulted in a number of the original bores being removed and new bores installed. Recorded hydrographs for these bores are presented in Figure 2. The cumulative deviation from mean monthly rainfall (Figure 2) demonstrates a strong relationship between rainfall and groundwater level within the MTSGS.

Contours of the water table elevation (m AHD) for the MTSGS are shown on Figure 3. The direction of groundwater flow is typically in the westerly direction. The higher groundwater levels measured in H2 appear to be influenced by a nearby dam.

The average groundwater salinity of the MTSGS based on Dixon Sand monitoring data is 176 µS/cm EC or 97 mg/L TDS. As the groundwater salinity is <1,500 mg/L, the groundwater source is classified as a highly productive groundwater source under the criteria of the AIP.

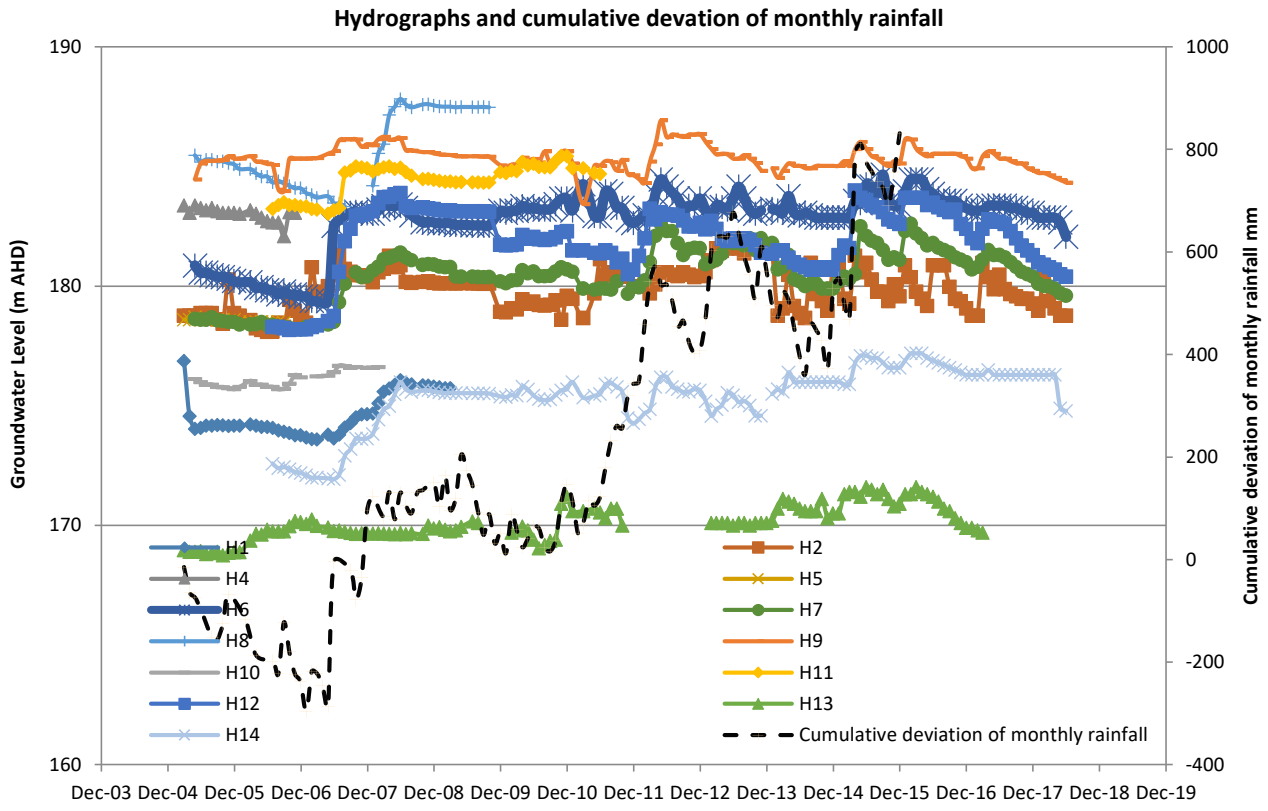
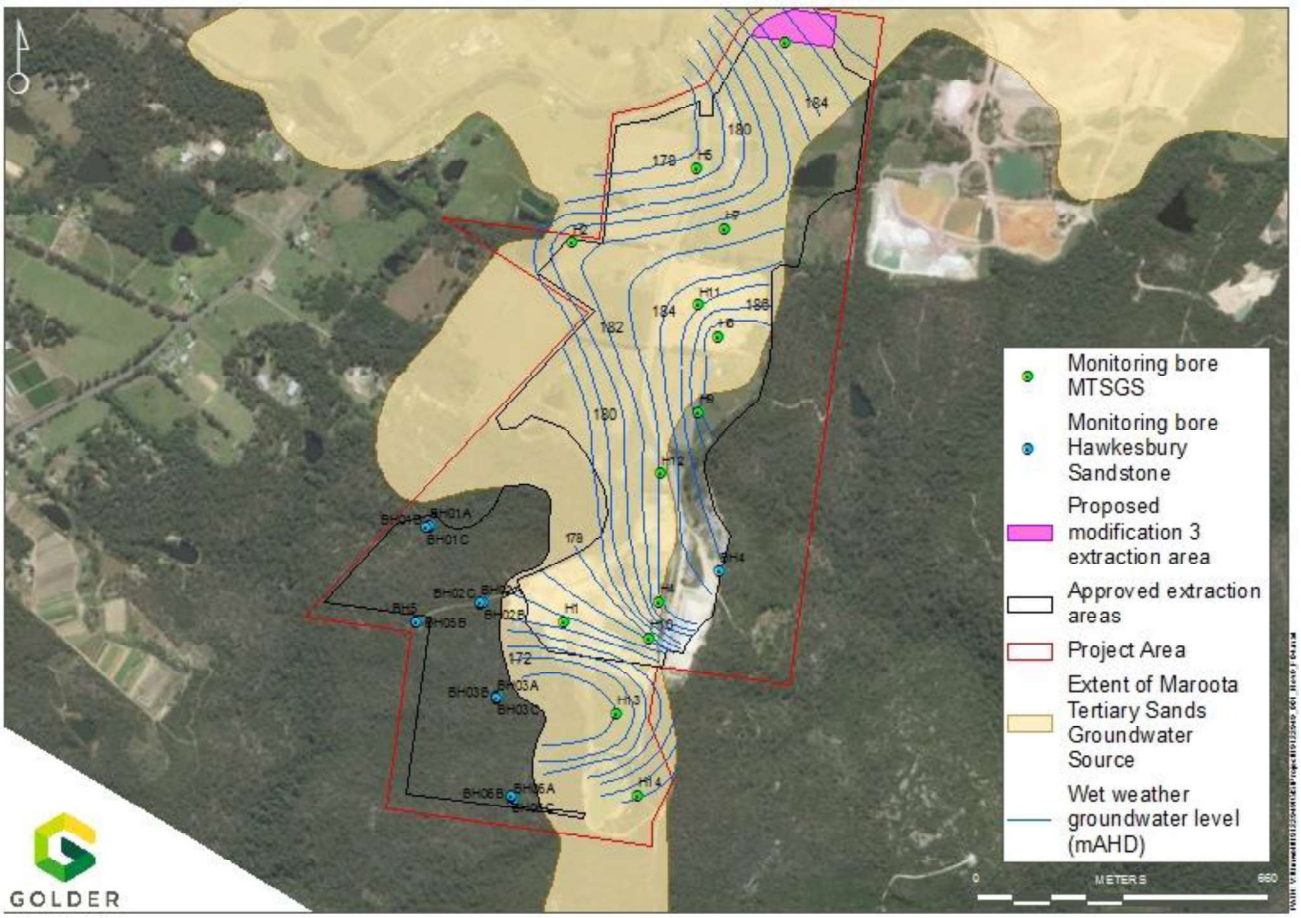


Figure 2: Hydrographs for Monitoring Bores Targeting the Maroota Tertiary Sands Groundwater Source

Figure 3: Water Table Contours (m AHD) of the MTSGS



5.3 Sydney Basin Central Groundwater Source

The Hawkesbury Sandstone is generally an impermeable rock, due to the fine grained clayey matrix (largely kaolinite and illite) and large degree of grain cementation resulting from the development of secondary minerals in the interstitial spaces, such as secondary silica and siderite (iron carbonate). Although the rock has very little primary permeability, fracturing and jointing, where open and interconnected, provides secondary permeability and storativity.

Throughout the region different perched water tables are intersected during drilling in the Hawkesbury Sandstone, due to the different degree of fracturing and the presence of confining layers (such as the shale lenses) within the rock mass (DWLC, 2001). This was also apparent from the drilling undertaken on-site in support of MOD1 extraction area to the west.

Twelve monitoring bores (BH series) constructed at differing depths within the Hawkesbury Sandstone at four sites (three cluster monitoring bores per site) revealed localised perched groundwater in the range of 146 m AHD to 150 m AHD in shallow constructed bores (15 m). By contrast, site monitoring bores completed at depths of 80 m, in the regional Hawkesbury Sandstone, revealed deeper groundwater levels in the range of 102 m AHD to 137 m AHD. The large difference in groundwater elevation between the shallow perched water and deeper regional groundwater level of the Hawkesbury Sandstone suggests poor hydraulic connection between each of the water bearing horizons in the Hawkesbury Sandstone. Nonetheless, perched groundwater can drain to deeper regional groundwater system.

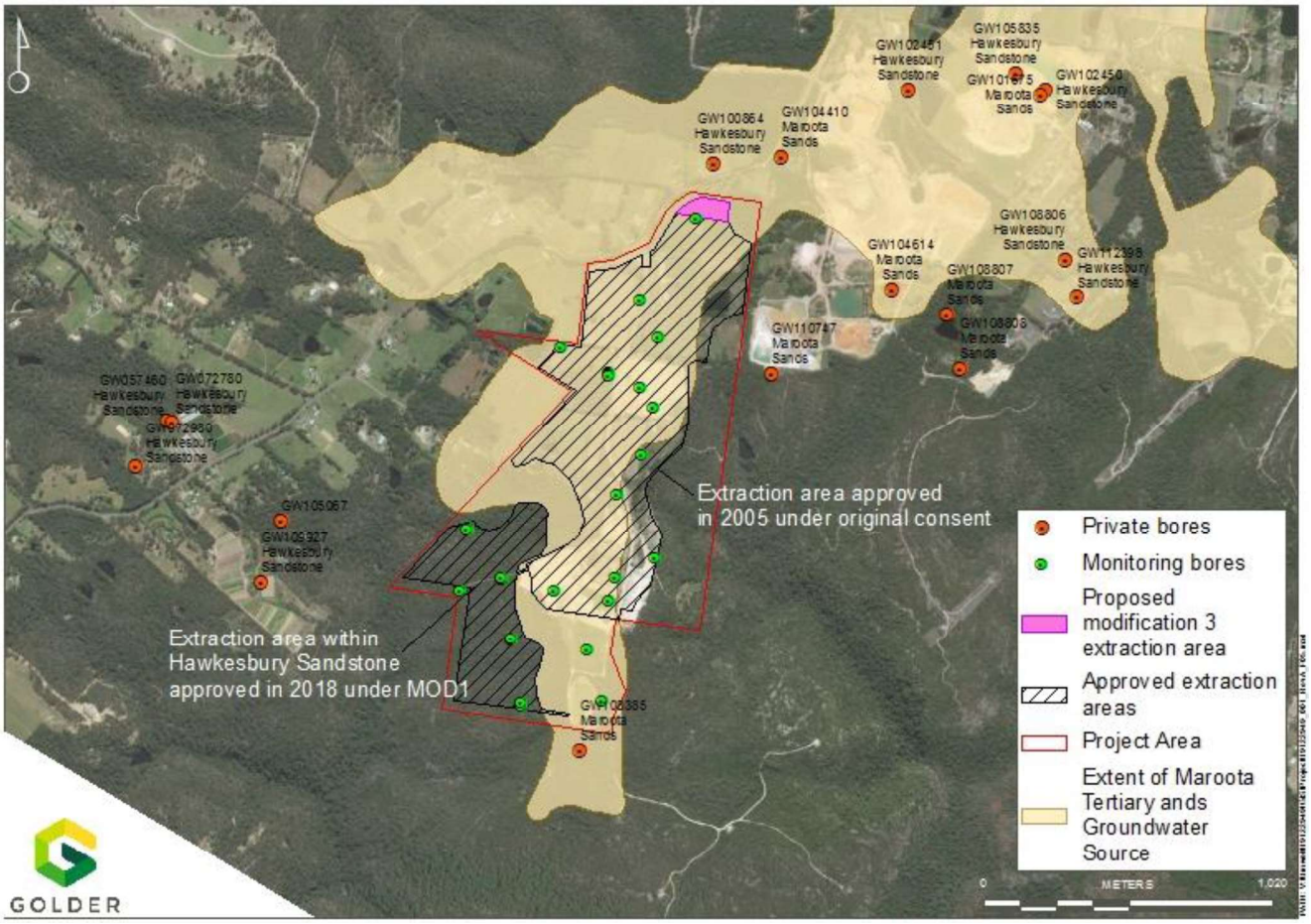
Hydraulic conductivities of the Hawkesbury Sandstone derived from slug tests performed of BH series bores ranged from 0.0002 m/d to 0.007 m/d (2.3 x 10^{-9} m/s to 8 x 10^{-8} m/s).

5.4 Existing Groundwater Users

There is a total of 18 existing bores within 1 km of the quarry, 11 of which target the deep SCBGS with the remaining 7 targeting the shallow MTSGS (Figure 4).

At the closest point to MOD 3 extraction area there is one bore that targets the SCBCS (GW100864– status unknown) located ~200 m north of the proposed extension area. It was drilled to a depth of 137 m. No recorded groundwater level data is available for this bore. The nearest MTSGS bore (GW104410 – status unknown) is located ~250 m to the northeast of the proposed extension area and was drilled to a depth of 11.83 m and a reported groundwater level of 10.57 m bgl.

Figure 4: Third Party Groundwater Users



5.5 Groundwater Dependent Ecosystems

In the immediate area of the Maroota Sand and eluvial sands on Hawkesbury Sandstone, Freimanis et al (2000) identified ten discrete locations that were considered partially groundwater dependent based on their distinct plant communities. These are mostly around the edges of the sand mass in shallow aquifer discharge areas where springs are likely to occur at the base of the alluvial sand or eluvial sand deposit. The closest GDE identified in the Freimanis 2000 report is located near the edge of the sand mass about 500 m to the north of the MOD3 extension area

6.0 ASSESSMENT OF EXTRACTION DEPTH

The extraction area approved under the development consent and the proposed MOD3 northern extension area are situated within the boundary of the MTSGS (Figure 5). Condition 10 of schedule 2 of the development consent states that extraction cannot take place within 2 m of the wet weather groundwater level.

To be consistent with the Independent Audit undertaken by Dundon Consulting in 2018 (outlined under section 4.3 of this report), the wet weather groundwater level of the MTSGS was calculated based on the maximum water level reached following a 50 mm rainfall event in a 24 hour period.

The historical daily rainfall records for the nearest BoM rainfall recording station have been analysed to determine the relevant groundwater level at each of the sites that have been monitored over the quarry life. Since 2005, the recorded rainfall at the nearest BoM station 67014 (Maroota Old telegraph Road) have included approximately 31 days when the total daily rainfall exceeded 50 mm, as listed in Appendix A.

Table 1 shows the peak water level measured at each of the bores completed in the Maroota Sands after each daily rainfall of 50 mm or more. Both current and past monitoring bores are included in the table. Contours of maximum extraction depth have been created by adding 2 m to each wet weather groundwater level and these are presented on Figure 5.

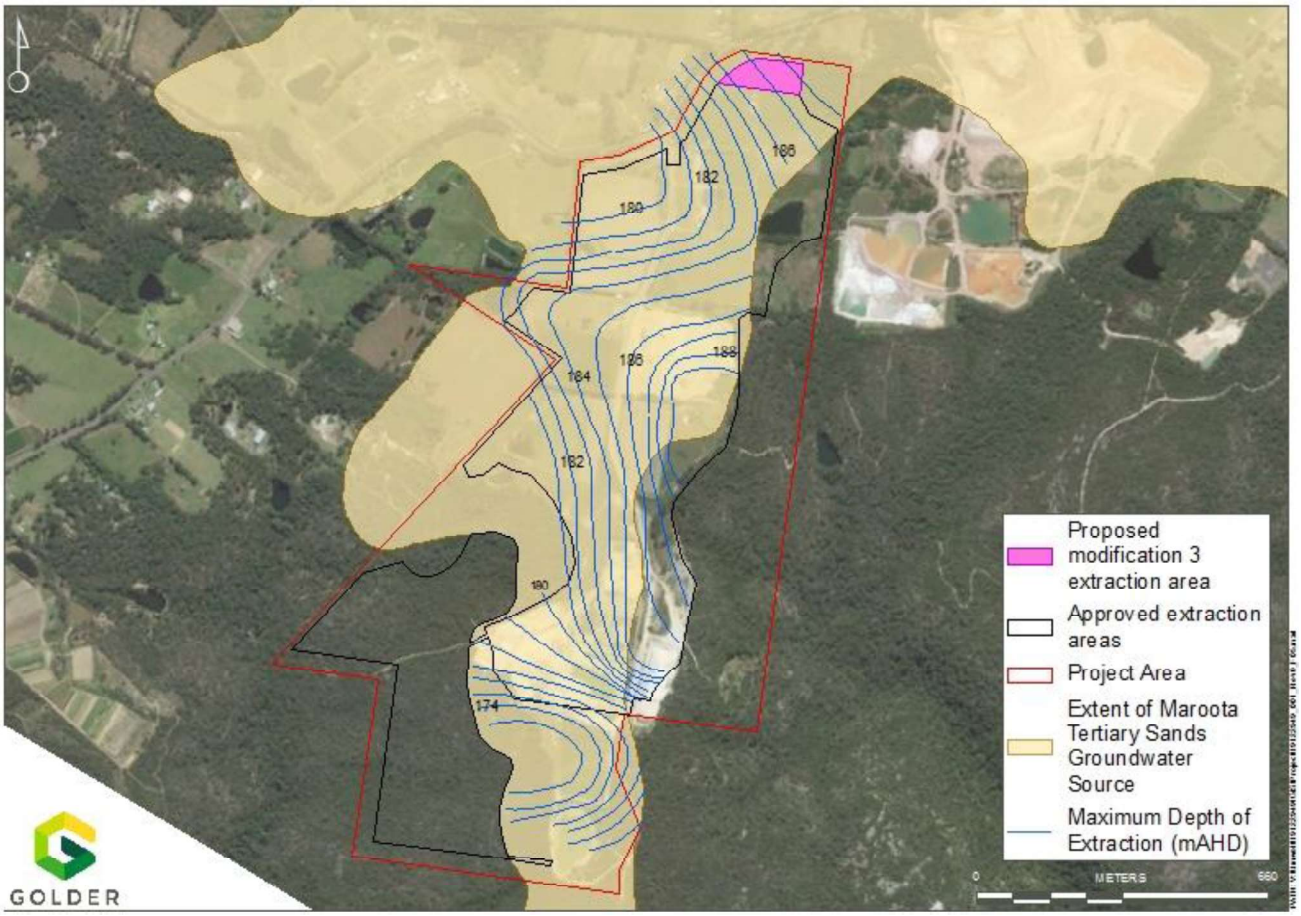
Based on the wet weather groundwater level calculated at H6, the hydraulic gradient beneath the new extraction area and the requirement of 2 m separation between the quarry depth and wet weather groundwater level, the maximum extraction depth for the extension area ranges from 186 m AHD in the west to 188 m AHD in the east (Figure 5). Overall, the wet weather groundwater level for the remaining monitoring bores and therefore extraction depth has not changed since the independent review in 2017, and therefore the maximum extraction depth for the current approved extraction areas has not changed.

Table 1: Peak Water Level After >50 mm/day Rainfall Event

Monitoring Bore ID	Peak water table elevation (m AHD)
*H1	176.87
H2	182.05
*H4	183.37
*H5	178.6
H6	**184.46**
H7	182.6
*H8	187.59
H9	186.93
*H10	176.68
*H11	184.8
H12	183.69
H13	171.3
H14	177.19

*Historic monitoring bore

Figure 5: Maximum Depth of Extraction (m AHD)



7.0 GROUNDWATER MONITORING AND MANAGEMENT

7.1 Groundwater Management

The strategy for groundwater management for MOD3 is to prevent groundwater inflows from the MTSGS and preservation of pre-quarrying groundwater quality. It involves maintaining the depth of quarrying to an elevation which is at least 2 m above the wet weather groundwater level.

Ongoing groundwater monitoring serves to notify changes to the groundwater level, quality or unforeseen discharges into the pit (interference with groundwater flow). Monitoring is necessary to indicate whether an abnormal condition relating to quarrying has developed as well as compliance with the rules of the AIP detailed under section 8 of this report.

Finally, in accordance with the current Consent a 3-yearly Independent Environmental Audit will be undertaken to review and update the maximum extraction depth map for the Development to the satisfaction of the Director-General.

7.2 Existing Groundwater Monitoring Network

The locations of the groundwater monitoring bores at the quarry are presented in Figure 3 and are summarised in Table 2 and Table 3.

The H series monitoring bores (Table 2) target the MTSGS and were drilled to establish to wet weather groundwater level for the original Tertiary Sand extraction area which includes the MOD3 extension area. The BH series monitoring bores (Table 3) target deeper regional groundwater system of the Hawkesbury Sandstone (SCBCS) or shallow perched groundwater systems within the upper Hawkesbury Sandstone.

The BH series monitoring bores were drilled in 2011 and 2018 to support the supplementary extraction in the Hawkesbury Sandstone and are therefore located at least 1.2 km from the proposed MOD3 extension area.

Table 2: Groundwater Monitoring Bores - MTSGS

Bore ID	Groundwater source	Status	Easting	Northing	RL Top of PVC (AHD)	RL Ground Level (AHD)	Pressure transducer installed
H1	MTSGS	Decommissioned	312492.2	6293753.1	183.37	182.6	
H2		Active	312512.3	6294610.5	182.57	181.88	Y
H3		Decommissioned			198.85		
H4		Decommissioned	312704.9	6293799.2	187.87	187.27	
H5		Decommissioned	312791.8	6294778.1	197.4	196.65	
H6		Active	312991.8	6295062.7	195.16	194.34	Y
H7		Active	312856.0	6294641.5	193.8	193	Y
H8		Decommissioned	312839.4	6294397.1	199.89	199.11	
H9		Active	312797.2	6294228.9	193.83	193.04	Y
H10		Decommissioned	312682.6	6293716.6	189.99	189.17	
H11		Decommissioned	312794.2	6294469.8	199.43	198.61	
H12		Active	312710.9	6294089.1	192.49	191.64	Y
H13		Active	312608.9	6293545.7	186.2	185.31	
H14		Active	312657.1	6293362.7	184.69	183.87	Y

Table 3: Groundwater Monitoring Bores – Hawkesbury Sandstone

Bore ID	Targeted Aquifer	Status	Easting	Northing	RL Ground Level	BH Depth (m)	Pressure Transducer Installed
BH01A	SCBCS	Active	312187.15	6293967.4	145.48	70	Y
BH01B	Perched HS (intermediate)	Active	312188.05	6293973.04	145.59	40	Y
BH01C	Perched HS (shallow)	Active	312182.34	6293968.11	145.16	10	Y
BH02A	SCBCS	Active	312303.65	6293793.6	164.5	80	Y
BH02B	Perched HS (intermediate)	Active	312312.09	6293796.52	165.06	42	Y
BH02C	Perched HS (shallow)	Active	312304.05	6293798.97	164.44	15	Y
BH03A	SCBCS	Active	312340.83	6293578.67	158.86	80	Y
BH03B	Perched HS (intermediate)	Active	312340.59	6293585.47	159.07	23	Y
BH03C	Perched HS (shallow)	Active	312340.39	6293582.32	159.14	15	Y
BH06A	SCBCS	Active	312375.63	6293346.93	165.06	70	Y
BH06B	Perched HS intermediate)	Active	312373.05	6293356.42	164.92	38	Y
BH06C	Perched HS (shallow)	Active	312372.57	6293360.57	165	15	Y
BH05	SCBCS	Active	312843.05	6293869.05		65	Y
BH05B	Perched HS (intermediate)	Active	312160.25	6293752.37	152.58	35	Y
BH04	SCBCS	Active	312159.4	6293753.96		65	Y

The proposed monitoring program for an approved operation is summarised in Table 4 and has been designed to detect changes in groundwater levels, groundwater quality, or to indicate an abnormal condition in response to quarrying. Key aspects include:

- Water quality sampling from groundwater across the project area on a biannual basis.
- Monitoring and assessment of groundwater inflows and quality to the quarry operations, in the unlikely event that groundwater inflows occur.
- Monitoring groundwater levels in the MTSGS and SCBCS using pressure transducers and manual dip measurements.

Table 4: Proposed Groundwater Monitoring

Site	Purpose	Monitoring Parameter and Frequencies		
		Weekly	Monthly	Bi-annual
Pre-quarrying				
MTSGS – H2,6,7,9,12,14 SCBGS – BH1 to 6	To obtain baseline, pre-quarrying conditions for the two aquifers	-	Water level	-
	Provide the foundation for establishing trigger values for investigation	-	-	Field Parameters EC, TSS, pH, Turbidity
	Obtain natural variation of regional groundwater level, such that depth of quarrying can be determined	-	Water level	-
During Quarrying				
MTSGS – H2,6,7,9,12,14 SCBGS – BH1 to 6	Ensure quarrying is maintained 2 m above the groundwater levels of the MTSGS and SCBCS	No pit seepages are expected, but undertake volumetric measurements in the unlikely event that measurable seepages occur	Water level	-
	Monitor any unforeseen water quality impacts, ensuring that there is no change in overall beneficial use category >40 m from site	No pit seepages are expected, but sample for water quality in the unlikely event that measurable seepages occur	-	Field Parameters EC, TSS, pH, Turbidity
	Monitor unforeseen regional impacts, ensure there are no WL/WQ impacts to neighbouring private bores	-	Water level	Field Parameters EC, TSS, pH, Turbidity
	Ongoing compliance with the AIP			
Post Quarrying				
MTSGS – H2,6,7,9,12,14 SCBGS – BH1 to 8	Monitoring of post-quarrying water level and quality impacts and ensuring ongoing compliance with the AIP	-	-	Water level & Field Parameters EC, TSS, pH, Turbidity

8.0 ASSESSMENT OF MOD3 AGAINST THE AQUIFER INTERFERENCE POLICY

As detailed in this report, the depth of extraction will be maintained at least 2 m above the wet weather groundwater level determined for the MTSGS within the approved and proposed extraction areas. For this reason, aquifer interference will not occur, and the project is compliant with the rules of the AIP. For clarity however, all of the rules and requirements stipulated in the AIP have been summarised in Table 5, with reasons why the rules are satisfied. Table 6 provides additional data to support the assessment of “minimal impact” as stipulated in the AIP (see page 26 of AIP, 2012).

Table 5: Assessment of MOD3 Against the AIP

Highly Productive Groundwater Sources - Alluvial Water Sources			
AIP requirement - Water Table	**Summary of Impact and Monitoring**	**AIP Requirement-Water Quality**	**Summary of Impact and Monitoring**
Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any: (a) high priority groundwater dependent ecosystem; or (b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan. A maximum of a 2 m decline cumulatively at any water supply work. 2. If more than 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any: (a) high priority groundwater dependent ecosystem; or (b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan then appropriate studies (c) will need to demonstrate to the Minister's satisfaction that the variation will not prevent the long-term viability of the dependent ecosystem or significant site. If more than 2 m decline cumulatively at any water supply work, then make good provisions should apply.	**Summary of Impact:** No groundwater impacts to the MTSGS are expected from the proposed modification as the extraction depth will continue to be maintained at least 2m above the wet weather level Also, no groundwater dependent ecosystems have been identified in the area. **Mitigation Measure:** Extraction is currently limited to 2 m above the wet weather elevations as determined by the network of H series monitoring bores **Monitoring**: Groundwater level monitoring is being conducted within the approved and proposed extraction areas. The wet weather groundwater level will be reviewed every three years to determine wet weather elevation and extraction depth map. The monitoring program also includes visual inspections of the pit walls. In the event seepage is detected in the pit the groundwater monitoring	1. Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity. 2. If condition 1 is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works.	**Summary of impact:** No groundwater quality related impacts have occurred from existing quarry operations and none are expected to occur as a result of the proposed modification There are no GDE or water supply works identified in the greater area that could be impacted. **Mitigation Measure:** Quarrying will be maintained 2 m above the wet weather level. There are no water quality impacts as a result of the project. **Monitoring**: Existing monitoring bores will be maintained to detect any unforeseen groundwater quality impacts for the duration of quarry life.

Highly Productive Groundwater Sources - Alluvial Water Sources			
	data will be reviewed to determine the source of the water.		

Table 6: Minimal Impact Considerations

Requirement	Summary of Compliance
Establishment of baseline groundwater conditions including groundwater depth, quality and flow based on sampling of all existing bores in the area potentially affected by the activity, any existing monitoring bores and any new monitoring bores that may be required under an authorisation issued under the Mining Act 1992 or the Petroleum (Onshore) Act 1991	Groundwater monitoring network has been continuously upgraded since 2005 and currently includes 22 active monitoring bores Baseline groundwater and quality data has been captured since 2005 for MTSGS and 2011 for SCBCS, over a range of climatic variations. From this data the wet weather groundwater level and maximum extraction depth has been determined.
A strategy for complying with any water access rules applying to relevant categories of water access licences, as specified in relevant water sharing plans. For example, returning water of an acceptable quality to the affected water source during periods when flows are at levels below which water users are not permitted to pump	Dixon Sands hold existing water allocations for dust suppression and the onsite wet processing. The proposed MOD3 extraction will not result in any take of groundwater from the MTSGS or regional SCBCS as extraction will be maintained 2 m above the wet weather groundwater level.
Details of potential water level, quality or pressure drawdown impacts on nearby water users who are exercising their right to take water under a basic landholder right. Consideration will need to be given to any relevant distance restriction requirements that may be specified in any relevant water sharing plan or any remediation measures to address these impacts	No impact to existing users as extraction will be maintained at least 2 m above the wet weather groundwater level and groundwater will therefore not be intercepted by extraction.
Details of potential water level, quality or pressure drawdown impacts on nearby licensed water users in connected groundwater and surface water sources	Third party bores have been identified. No impact to existing users as extraction will be maintained at least 2 m above the wet weather groundwater level and groundwater will therefore not be intercepted by extraction
Details of potential water level, quality or pressure drawdown impacts on groundwater dependent ecosystems.	The closest GDE was identified in the Freimanis 2000 report, which is located near the edge of the sand mass about 500 m to the north of the MOD3 extension area. There will be no drawdown impact this GDE as the water table will not be intercepted by quarrying

Requirement	Summary of Compliance
Details of potential for increased saline or contaminated water inflows to aquifers and highly connected river systems	Mitigation measures for contamination are in place.
Details of the potential to cause or enhance hydraulic connection between aquifers	There will be no enhanced hydraulic connection between the MTSGS and underlying SCBCS as extraction will be maintained at least 2 m above the wet weather groundwater level.
Details of the potential for river bank instability, or high wall instability or failure to occur	Quarrying will not be carried out near any creek or river.
Details of the method for disposing of extracted water (in the case of coal seam gas activities)	N/A

9.0 CONCLUSIONS

Key conclusions from this assessment are summarised below.

- The quarry operates in accordance with Development Consent DA 165-7-2005, which has been subsequently modified on two occasions ('MOD1' and 'MOD2').
- Dixon Sand is proposing a third modification ('MOD3') to DA 165-7-2005 under Section 4.55 (2) of the EP&A Act to allow for Small increase to the extraction area (into buffer at northern end of site).
- The proposed extraction area of MOD3 is situated to the north of the original extraction area (approved under the original consent) and is therefore within the boundaries of MTSGS.
- To prevent groundwater related impacts the existing consent allows for extraction to a depth of 2 m above the wet weather groundwater level of the MTSGS.
- The maximum extraction depth has been calculated based on extensive groundwater level monitoring, with the length of monitoring records spanning up to 14 years. The maximum extraction depth for the extension area ranges from 186 m AHD in the west to 188 m AHD in the east of the MOD3 extension area.
- The MOD3 will not result in any take of groundwater through extraction. Dixon Sand currently hold groundwater licences (10CA105044 and 10CA104191) and will utilise surface water runoff for the purpose of dust suppression and the onsite wet processing.

  The potential impacts of MOD3 on groundwater have been assessed against Section 3.2.1 of the AIP, which includes the concept of ensuring "no more than minimal harm" for the granting of approvals. The proposed modification will satisfy this requirement of the AIP as the situation in terms of groundwater risks will not alter by maintaining extraction at least 2 m above the wet weather elevation.

10.0 IMPORTANT INFORMATION

Your attention is drawn to the document – "Important Information", which is included in Appendix B of this report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be. The document is not intended to reduce the level of responsibility accepted by Golder Associates, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

11.0 REFERENCES

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Signature Page

Golder Associates Pty Ltd

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JVDA/EVN/jd

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https://golderassociates.sharepoint.com/sites/108914/project files/6 deliverables/19122949_r_rev1_dixon sands haerses rd-techrevevn.docx

APPENDIX A

Wet Weather Groundwater Level Calculations

Maroota Daily Rainfalls Exceeding 50mm – 2005 to 2018															
Year	Date	Rainfall	Comment	Peak water level after >50mm/day rainfall											
				H1	H2	H4	H5	H6	H7	H8	H9	H10	H11	H12	H13	H14
2005	2-3 February	50.0	2 day total	176.87	178.77	183.37	178.60	180.86	178.63	185.47	184.46	176.12			168.97	
	21 February	60.0		176.87	178.77	183.37	178.60	180.86	178.63	185.47	184.46	176.12			168.97	
	23-27 November	55.0	5 day total	174.17	178.87	183.07	178.60	180.21	178.5	185.09	185.33	175.69			168.89	
2006	7 September	65.0		173.86	179.42	183.09	178.50	179.64	178.26	185.32	185.32	175.93	183.39	178.17	169.97	172.35
2007	13 February	52.2		173.79	179.77			179.38	178.35	183.70	185.35	176.23	183.20	178.36	169.98	172.00
	9 June	172.0		173.79	181.30			182.75	179.32	183.45	186.10	176.68	183.26	180.59	169.79	172.11
	20 July	136.5		174.09	181.88			182.96	180.10	183.33	186.14	176.66	184.75	181.88	169.74	172.91
	6 December	50.6		174.68	180.16			183.03	180.64	184.19	185.89	176.59	184.79	183.13	169.66	173.82
2008	5 June	51.0		175.96	180.17			183.26	181.20	187.59	185.68		184.76	183.34	169.63	175.69
2009	2 April	51.0			180.12			182.56	180.39	187.49	185.42		184.35	183.13	169.94	175.53
	22 May	78.0			180.11			182.54	180.39	187.48	185.43		184.34	183.12	170.17	175.52
2010	7 February	75.0			179.02			183.14	180.25		185.11		184.80	181.74	169.80	175.42
2011	20 August	74.5			180.47			183.28	180.20		184.83			180.99	170.70	175.79

Maroota Daily Rainfalls Exceeding 50mm – 2005 to 2018														
Year	Date	Rainfall	Comment	Peak water level after >50mm/day rainfall										
				H1	H2	H4	H5	H6	H7	H8	H9	H10	H11	H12	H13	H14
2012	18 April	52.0			180.57			184.46	182.60		186.93			183.09		176.19
2013	29 January	118.0			181.08			182.69	180.24		185.73			182.72	170.10	174.57
	23 February	72.0	154.4 mm over 2 days (23-24 February 2013)		181.57			183.36	181.00		185.51			182.39	170.10	174.85
	24 February	82.4			181.57			183.36	181.00		185.51			182.39	170.10	174.85
2014	19 August	52.6			179.67			182.86	180.10		185.03			180.79	170.60	175.99
	7 December	55.0			180.77			182.86	180.20		185.03			181.29	170.50	175.99
2015	21 April	161.0	279 mm over 2 days (21 to 22 April 2015)		180.57			183.46	182.50		186.03			183.69	171.20	177.09
	22 April	118.0			180.57			183.46	182.50		186.03			183.69	171.20	177.09
	22 December	63.6			180.87			183.96	182.30		186.13			183.69		176.89
2016	5 January	108.0	221.2 mm over 4 days (4 to 7 January 2016)		180.37			184.46	182.60		186.13			183.69		177.19
	6 January	68.0			180.37			184.46	182.60		186.13			183.69		177.19
	5 June	69.0	147.4 mm over 3 days (4 to 6 June 2016)		180.87			183.66	181.60		185.53			183.29		176.79
	6 June	68.0			180.87			183.66	181.60		185.53			183.29		176.79

Maroota Daily Rainfalls Exceeding 50mm – 2005 to 2018														
Year	Date	Rainfall	Comment	Peak water level after >50mm/day rainfall												
				H1	H2	H4	H5	H6	H7	H8	H9	H10	H11	H12	H13	H14
2017	18-Mar	54.8			180.97			183.36	181.50	-	185.63			182.79	171.3	176.49
	31-Mar	55.0			180.97			183.36	181.50	-	185.63			182.79	171.3	176.49
2018	26-Feb	66.0			180.57			182.86	180.00		184.73			180.99	170.3	176.29
	5-Oct	55.0			182.05			182.01	180.28		184.92			181.24		175.06
2019	16-Mar	86.0	86 mm from 16 to 18 March 2019		181.90			181.43	180.32		184.95			181.12		174.91
Peak water level after >50mm/day rainfall event				**176.87**	**182.05**	**183.37**	**178.6**	**184.46**	**182.6**	**187.59**	**186.93**	**176.68**	**184.8**	**183.69**	**171.3**	**177.19**

APPENDIX B

Important Information

The document ("Report") to which this page is attached and which this page forms a part of, has been issued by Golder Associates Pty Ltd ("Golder") subject to the important limitations and other qualifications set out below.

This Report constitutes or is part of services ("Services") provided by Golder to its client ("Client") under and subject to a contract between Golder and its Client ("Contract"). The contents of this page are not intended to and do not alter Golder's obligations (including any limits on those obligations) to its Client under the Contract.

This Report is provided for use solely by Golder's Client and persons acting on the Client's behalf, such as its professional advisers. Golder is responsible only to its Client for this Report. Golder has no responsibility to any other person who relies or makes decisions based upon this Report or who makes any other use of this Report. Golder accepts no responsibility for any loss or damage suffered by any person other than its Client as a result of any reliance upon any part of this Report, decisions made based upon this Report or any other use of it.

This Report has been prepared in the context of the circumstances and purposes referred to in, or derived from, the Contract and Golder accepts no responsibility for use of the Report, in whole or in part, in any other context or circumstance or for any other purpose.

The scope of Golder's Services and the period of time they relate to are determined by the Contract and are subject to restrictions and limitations set out in the Contract. If a service or other work is not expressly referred to in this Report, do not assume that it has been provided or performed. If a matter is not addressed in this Report, do not assume that any determination has been made by Golder in regards to it.

At any location relevant to the Services conditions may exist which were not detected by Golder, in particular due to the specific scope of the investigation Golder has been engaged to undertake. Conditions can only be verified at the exact location of any tests undertaken. Variations in conditions may occur between tested locations and there may be conditions which have not been revealed by the investigation and which have not therefore been taken into account in this Report.

Golder accepts no responsibility for and makes no representation as to the accuracy or completeness of the information provided to it by or on behalf of the Client or sourced from any third party. Golder has assumed that such information is correct unless otherwise stated and no responsibility is accepted by Golder for incomplete or inaccurate data supplied by its Client or any other person for whom Golder is not responsible. Golder has not taken account of matters that may have existed when the Report was prepared but which were only later disclosed to Golder.

Having regard to the matters referred to in the previous paragraphs on this page in particular, carrying out the Services has allowed Golder to form no more than an opinion as to the actual conditions at any relevant location. That opinion is necessarily constrained by the extent of the information collected by Golder or otherwise made available to Golder. Further, the passage of time may affect the accuracy, applicability or usefulness of the opinions, assessments or other information in this Report. This Report is based upon the information and other circumstances that existed and were known to Golder when the Services were performed and this Report was prepared. Golder has not considered the effect of any possible future developments including physical changes to any relevant location or changes to any laws or regulations relevant to such location.

Where permitted by the Contract, Golder may have retained subconsultants affiliated with Golder to provide some or all of the Services. However, it is Golder which remains solely responsible for the Services and there is no legal recourse against any of Golder's affiliated companies or the employees, officers or directors of any of them.

By date, or revision, the Report supersedes any prior report or other document issued by Golder dealing with any matter that is addressed in the Report.

Any uncertainty as to the extent to which this Report can be used or relied upon in any respect should be referred to Golder for clarification

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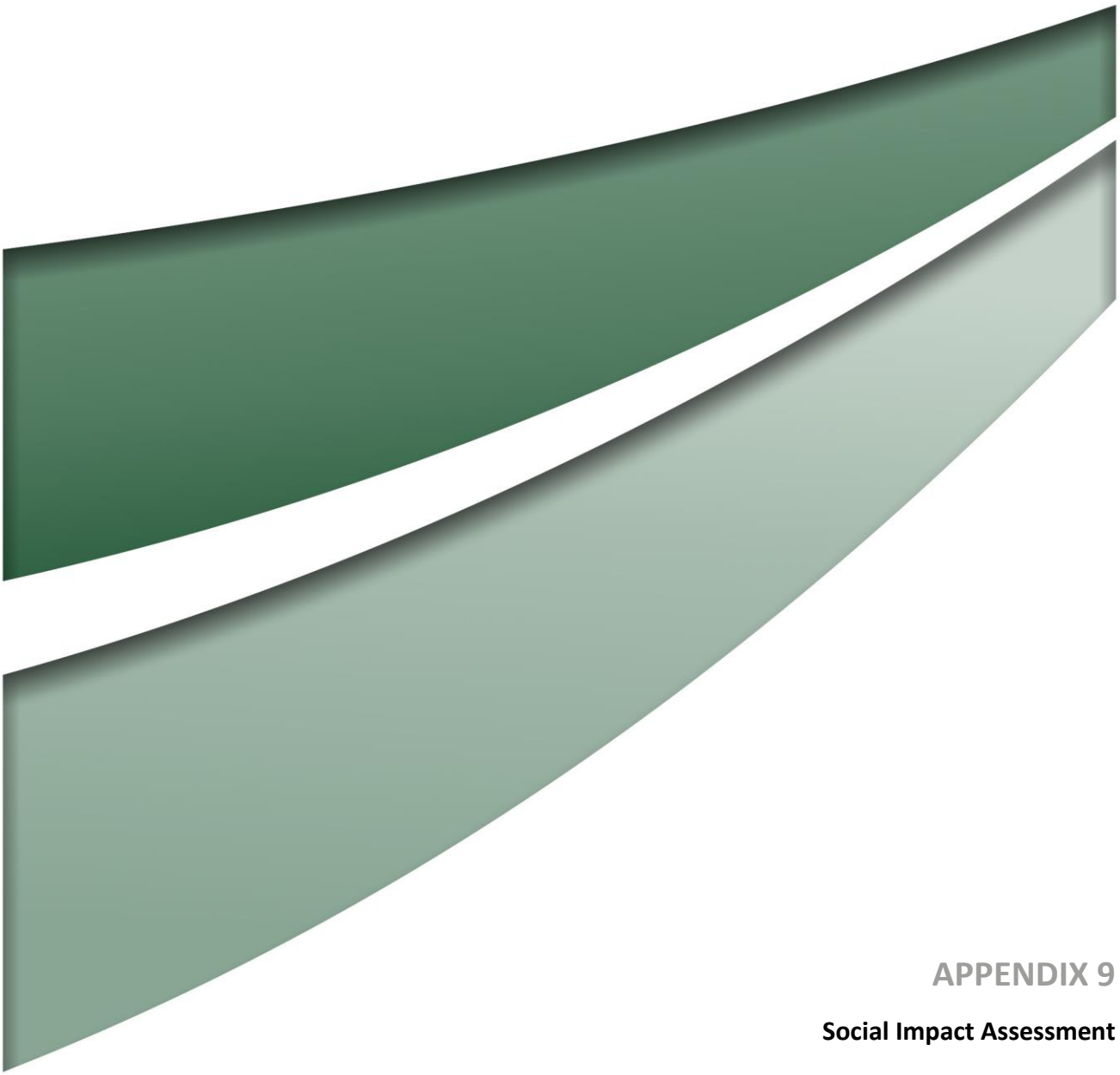
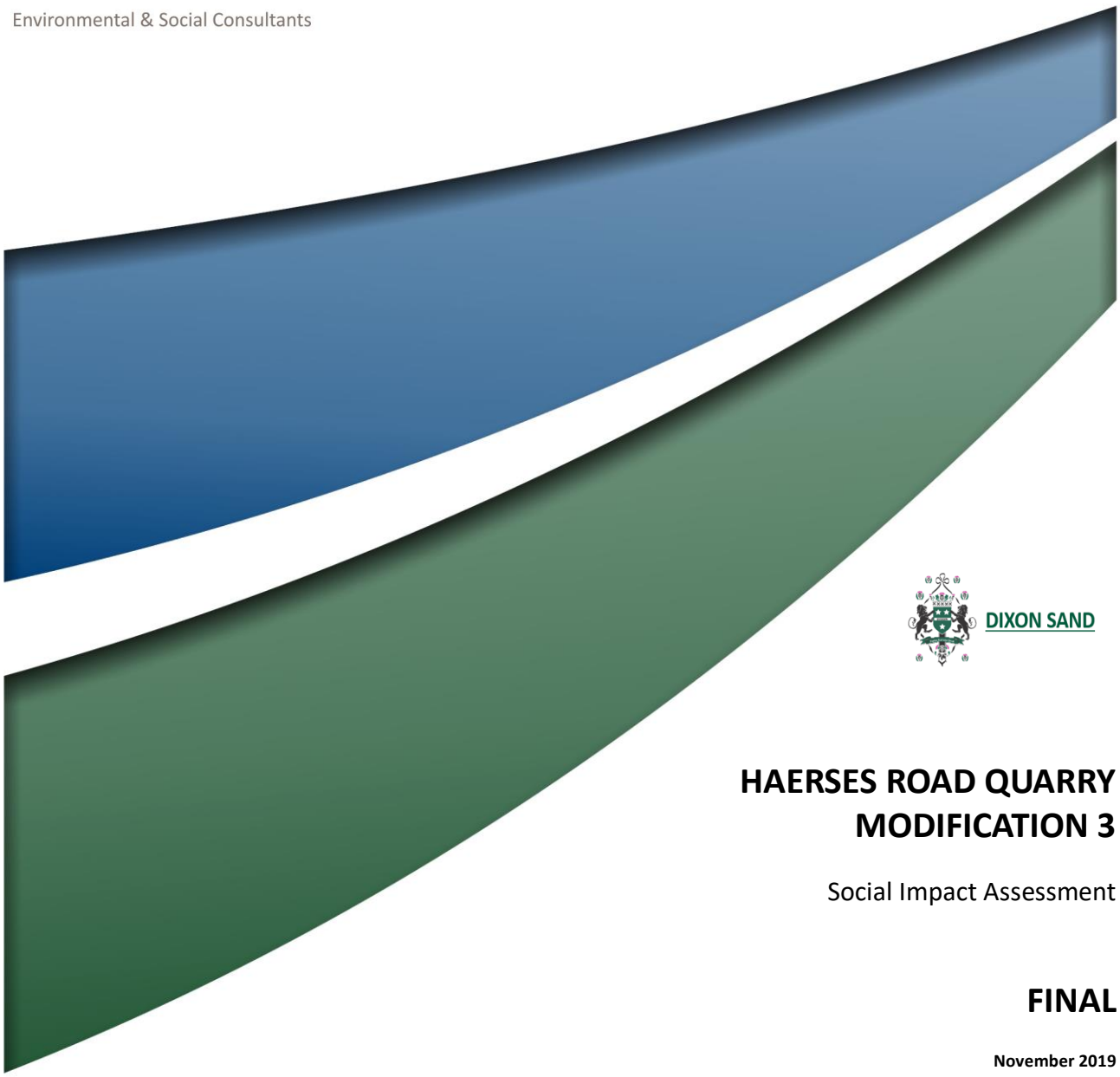


APPENDIX 9

Social Impact Assessment

umwelt
Environmental & Social Consultants



DIXON SAND

HAERSES ROAD QUARRY MODIFICATION 3

Social Impact Assessment

FINAL

November 2019

DIXON SAND

HAERSES ROAD QUARRY MODIFICATION 3

Social Impact Assessment

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Dixon Sand Pty Limited

Project Director:	Karen Lamb
Project Manager:	Sarah Bell
Report No.	4607/R05
Date:	November 2019

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This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	**Date**	**Name**	**Date**
Final	Sarah Bell	7/11/2019	Karen Lamb	7/11/2019

Table of Contents

Figures

Tables

Appendices

Abbreviations

Term	Definition
ABS	Australian Bureau of Statistics
ASR	Age Standardised Rate
CALD	Culturally and Language Diverse
CBD	Central Business District
CCC	Community Consultative Committee
Council	The Hills Shire Council
DA	Development Application
DP&I	Department of Planning and Infrastructure
DPE	NSW Department of Planning and Environment (now DPIE)
DPIE	NSW Department of Planning, Infrastructure and Environment (previously DPE)
DRG	Division of Resources and Geosciences
ENM	Excavated Natural Material
EP&A Act	Environmental Planning and Assessment Act 1979
EPA	Environmental Protection Authority
FTE	Full time equivalent
ha	Hectare
IAIA	International Association for Impact Assessment
km	Kilometres
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
LHD	Local Health District
MP	Member of Parliament
Mt	Million tonnes
NSW	New South Wales
PNTLs	Project Noise Trigger Levels
Quarry	Haerses Road Quarry
RMS	Roads and Maritime Services
SEIFA	Socio-Economic Indexes for Areas
SES	Socio-Economic Status
SIA	Social Impact Assessment
SIA Guidelines	Social Impact Assessment: NSW Guidelines for State significant mining, petroleum production and extractive industry development
SSC	State Suburb Code
SSD	State Significant Development
State	New South Wales (unless otherwise stated)
tpa	Tonnes per annum
Umwelt	Umwelt (Australia) Pty Limited
VENM	Virgin Excavated Natural Material

Executive Summary

Dixon Sand (No.1) Pty Limited (Dixon Sand) operates the Haerses Road Quarry (the Quarry) on land adjoining Haerses Road at Maroota in New South Wales (NSW), within The Hills Shire Council Local Government Area (LGA). This Social Impact Assessment (SIA) has been prepared by Umwelt (Australia) Pty Limited (Umwelt) as part of the Statement of Environmental Effects (SEE), to assess the social impacts associated with Dixon Sand's Proposed Modification. Dixon Sand are proposing to modify existing the development to allow for:

- a small extension in extraction area of approximately 1 hectare (ha) and modification to the buffer at the northern end of the Quarry
- an increase in extraction rate from 250,000 tonnes per annum (tpa) to 495,000 tpa
- an increase in the amount of VENM and ENM to be imported to the Quarry from 100,000 tpa to 250,000 tpa
- an increase in the number of trucks permitted to travel to and from the Quarry from 56 per day to 180 per day.

A range of mechanisms have been utilised to obtain the input of the various stakeholder groups including landholders proximal to the operation, and along the haul route and other key stakeholders. Key community concerns in relation to the Proposed Modification include:

- impacts on safety and social amenity from increased heavy vehicle road use
- impacts on social amenity through operational noise, dust and air quality, and visual changes to those North of the Quarry
- impacts on property values
- the desire for increased community engagement and information provision.

The SIA identified the most significant (moderate) social risks based on stakeholder perceptions and technical risk analysis. The Proposed Modification was assessed as having a positive economic impact through generating employment for eight people. The moderate impacts related to social amenity associated with:

- traffic – impact of the increase of heavy vehicle movements on public safety
- noise – concerns relating to increased noise impacts relating to increase of heavy vehicle movements.

Mitigation and enhancement strategies proposed to address social impacts of the Proposed Modification include:

- regular monitoring traffic and operational noise impacts on social amenity
- proactive programs to promote safe driving behaviours in drivers and contractors
- regular engagement with the local community and landholders along the haul route
- community investment programs.

1.0 Introduction

Dixon Sand (No. 1) Pty Limited (Dixon Sand) operates the Haerses Road Quarry (the Quarry) on land adjoining Haerses Road at Maroota in New South Wales (NSW), within The Hills Shire Council Local Government Area (LGA) (refer to **Figure 1.1**). The Quarry Site is approximately 128 hectares (ha) and includes Lot 170 DP 664766, Lot 170 DP 664767, Lots A and B DP 407341, Lots 176, 177 and 216 DP 752039 which adjoin Haerses Road (refer to **Figure 1.2**). Haerses Road is a no-through road providing access to the nominated lots of the Quarry, as well as Lot 7308 DP1163424 (Crown Land) and Lot 1 DP1139713 of Deerubbin Local Aboriginal Land Council (LALC) (formerly Maroota State Forest).

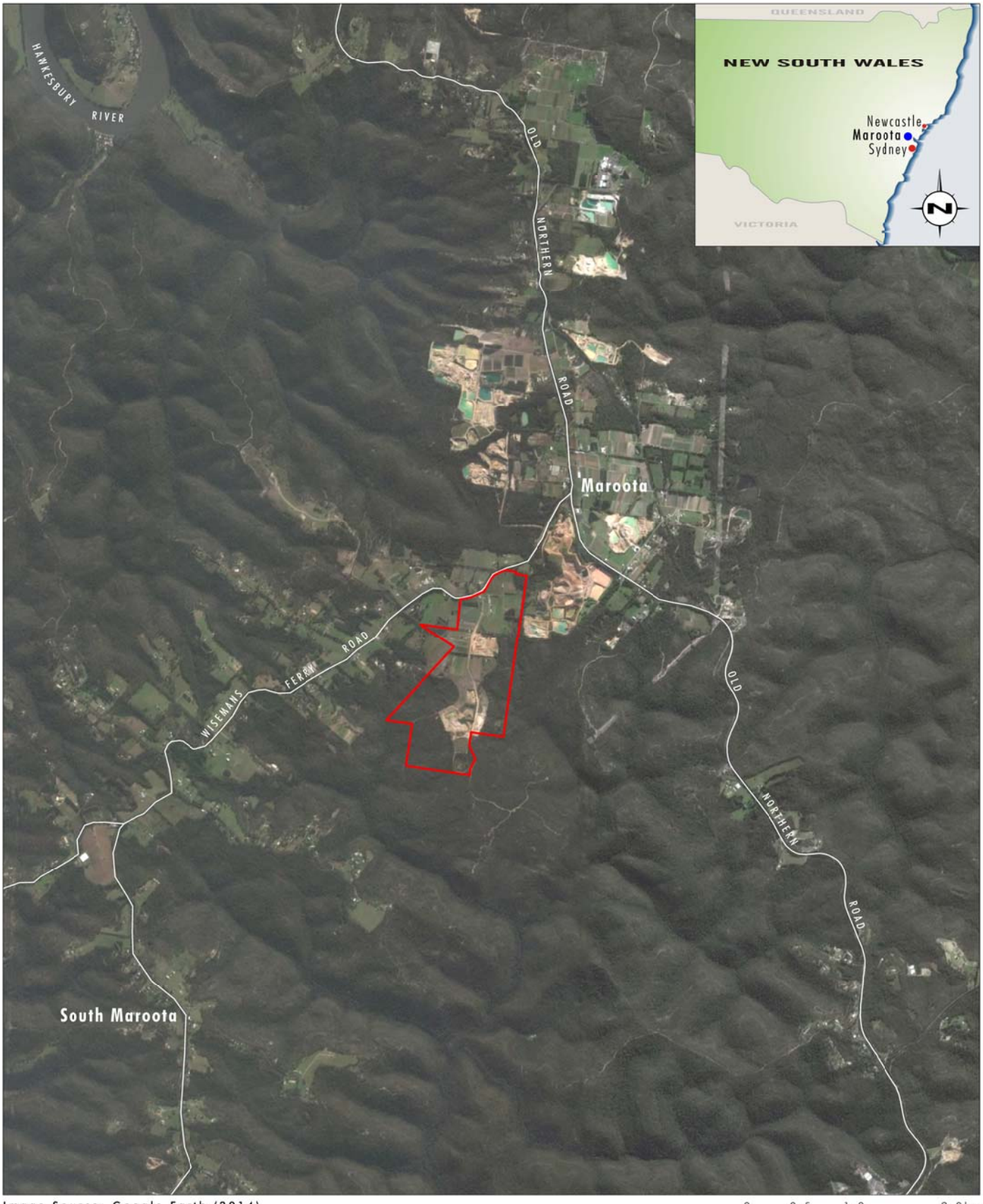

Image Source: Google Earth (2014)

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Legend

Haerses Road Quarry Site

FIGURE 1.1

Locality Map

The Quarry is located within the small rural community of Maroota which supports several other sand extraction operations, including the Old Northern Road Quarry, also operated by Dixon Sand. The Quarry, which supplies concrete sand and specialty sands to the Sydney metropolitan market, operates in accordance with Development Consent DA 165-7-2005 (State Significant Development under the *State Environmental Planning Policy (State and Regional Development) 2011*) (the Development Consent). Since commencing operations in 2006, the DA 165-7-2005 has been modified twice:

- in 2018 to increase the extraction area and allow for the importation of Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM) for processing and backfill (MOD 1)

- in 2019 to correct a minor inconsistency in the identification of buffers between the operational areas and quarry site boundary (MOD 2).

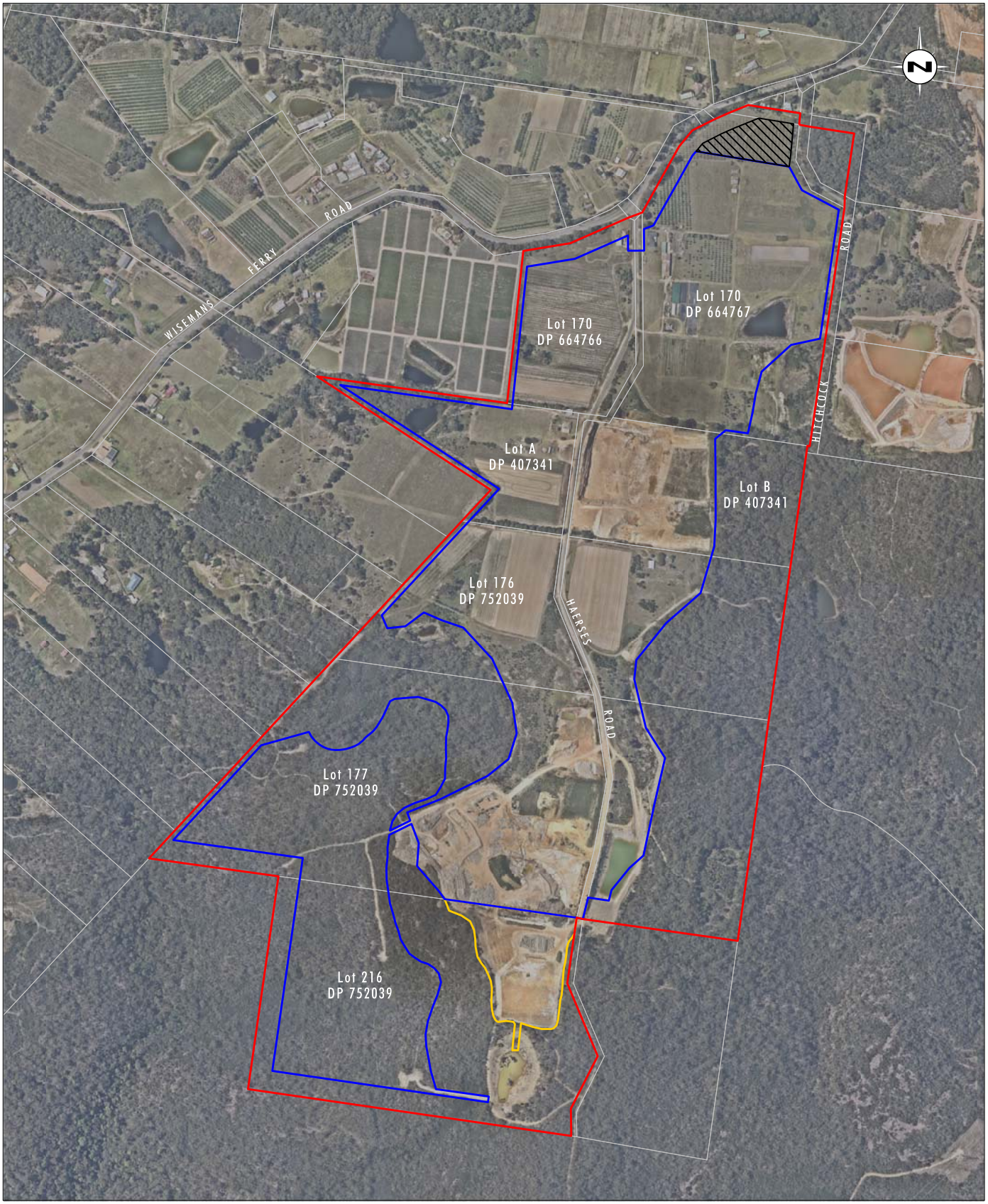

Image Source: Nearmap (Dec 2018)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2019)

0 100 250 500m
1:10 000

Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Processing and Stockpiling Area
- Proposed Extraction Area Extension

FIGURE 1.2

Site Plan

Dixon Sand is proposing a third modification to the development to allow for:

- a small extension in extraction area of approximately 1 ha and modification to the buffer at the northern end of the Quarry (refer to **Figure 1.2**)
- an increase in extraction rate from 250,000 tonnes per annum (tpa) to 495,000 tpa
- an increase in the amount of VENM and ENM to be imported to the Quarry from 100,000 to 250,000 tpa
- an increase in the number of trucks permitted to travel to and from the Quarry from 56 per day to 180 per day.

Associated with these changes will be some minor modifications to the on-site fleet of mobile equipment. There is to be no change to the Quarry's hours of operation, existing access arrangements and transport routes.

This Social Impact Assessment (SIA) has been prepared by Umwelt (Australia) Pty Limited (Umwelt) as part of the Statement of Environmental Effects (SEE).

1.1 Proposed Modification

Table 1.1 provides a comparative analysis of the Proposed Modification against the Haerses Road Quarry development as originally approved and as recently modified (January 2018).

Table 1.1 Comparison of the Originally Approved Haerses Road Quarry and the Modification

Quarry Component	Originally Approved	As Modified (January 2018) (MOD 1)	Proposed Modification
Quarry life	Quarry operations to cease 14 February 2031	Additional 15 years i.e. quarry operations to cease 2046	No change
Limit on production	250,000 tpa	No change	495,000 tpa
Maximum transport of product	To Old Northern Road Quarry:		
	190,000 tpa	No change	No change
	Direct to market:		
	60,000 tpa	Up to 250,000 tpa	Up to 495,000 tpa
Truck movements	28 truck movements into Haerses Road per day (10 movements allowed between 6am and 7am) 28 truck movements out of Haerses Road per day (0 - 7 left hand turns, 21 - 28 right hand turns)	56 truck movements per day (total in and out) Up to 20 vehicle movements between 6am and 7am Removal of restriction on direction of truck movements	Up to 180 truck movements per day (total in and out)
Total disturbance footprint	Approximately 52 ha	Approximately 74.5 ha	Approximately 75.5 ha

Quarry Component	Originally Approved	As Modified (January 2018) (MOD 1)	Proposed Modification
Overburden	Used for acoustic barriers or stockpiled and used to fill voids	No change	No change
Importation of material	Not included in approved operations	Receival of up to 100,000 tpa of VENM/ENM Reprocessing of clean recycled sand component of VENM/ENM for sale	Increase to 250,000 tpa of VENM/ENM for landform construction or reprocessing and sale
Infrastructure	Haerses Road is key haul road with existing dams used for water supply	House conversion to site office Construction of site workshop, weighbridge and gravel car parking area	No change
Equipment	Front end loader (1), 40 tonne (t) excavator (1), 30 t trucks (2), water cart (1), mobile dry screen, dozer, grader, service vehicle	Additional mobile jaw and rotary crushers and wet processing plant	40 t trucks (2) to replace 30 t trucks (2) Additional excavator Additional front-end loaders (3)
Hours of operation	Monday to Saturday 7am to 6pm Vehicle access and sand loading 6am to 7am Monday to Saturday No work on Sundays and public holidays	No change	No change
Employment	Equivalent to 2 people full time	Up to 8 people full time	Up to 16 people full time

1.2 Social Impact Assessment Framework

In September 2017, the Department of Planning and Environment (DPE), now Department of Planning, Industry and Environment (DPIE), released the *Social Impact Assessment: Guidelines for State Significant Mining Petroleum Production and Extractive Industry Development (*the SIA Guideline). While there is no requirement for this SIA to be prepared in accordance with the SIA Guideline, this report has been prepared cognisant of the requirements contained within.

In particular, this SIA program has been designed to:

- Profile key communities in proximity to and associated with the existing operations and the Proposed Modification.
- Scope and assess the potential social issues/impacts and opportunities associated with the Proposed Modification on these communities.
- Develop strategies to address any significant identified impacts and opportunities and monitor and manage social impacts associated with the Proposed Modification should it be approved.

1.3 Report Structure

Based on the above framework, the SIA has been structured according to a number of key sections as detailed below:

- **Section 1:** Provides an introduction and background to the Proposed Modification, including a summary of key project components.
- **Section 2:** Details the methodology employed as part of the SIA.
- **Section 3:** Provides context for the Quarry operation including geographical location, current workforce and community contributions.
- **Section 4:** Comprises a socio-economic profile and demographic analysis of The Hills Shire LGA and the State Suburb of Maroota (Maroota SSC).
- **Section 5:** Identifies the perceived positive and negative social impacts associated with the Proposed Modification, as identified through engagement activities.
- **Section 6:** Provides an assessment of impacts and opportunities associated with the Proposed Modification.
- **Section 7:** Discusses recommended strategies to manage the predicted and perceived social impacts identified during the assessment process and enhance the potential benefits and opportunities associated with the Proposed Modification.

2.0 Methodology

SIA is an approach to predicting and assessing the likely consequences of a proposed action in social terms and developing options and opportunities to improve social outcomes. Best practice SIA is participatory and involves understanding impacts from the perspectives of those involved in a personal, community, social or cultural sense to provide a complete picture of potential impacts, their context and meaning.

The generally agreed international principles relating to SIA (Vanclay, 2003) and the DPIE SIA guideline (2017) identify social impacts as the matters affecting, directly or indirectly:

- **Way of life** - how they live, work, play and interact with one another on a day to day basis
- **Culture** - their shared beliefs, customs, values and language or dialect
- **Community** - its cohesion, stability, character, services and facilities
- **Political systems** - the extent to which people are able to participate in decisions that affect their lives, the level of democratisation that is taking place, and the resources provided for this purpose
- **Environment** - the quality of the air and water people use, the availability and quality of the food they eat, the level of hazard or risk, dust and noise they are exposed to, the adequacy of sanitation, their physical safety, and their access to and control over resources
- **Health and wellbeing** - a state of complete physical, mental, social and spiritual wellbeing and not merely the absence of disease or infirmity
- **Personal and property rights** - particularly whether people are economically affected or experience personal disadvantage which may include a violation of their civil liberties
- **Fears and aspirations** - their perceptions about their safety, their fears about the future of their community, and their aspirations for their future and the future of their children.

As is the case with any type of change, some individuals or groups within the community may benefit, while others may experience negative impacts. If negative impacts are predicted, it is the role of the SIA to determine how such impacts may be addressed effectively to reduce the degree of social disruption to those affected. If positive impacts are predicted, the aim of the SIA is to maximise these opportunities and identify how they might be further enhanced.

Monitoring and evaluation are also key components of the SIA process to identify any unanticipated impacts that may arise in the future as a result of Proposed Modification.

2.1 Assessment activities

As highlighted above, the SIA for the Proposed Modification has involved a number of key phases.

- Developing a profile of the social and economic context in which the Proposed Modification is located, at a local and regional scale, and summarising the social and community issues of relevance to the communities of interest.

- Identifying the impacts and opportunities that are most important to the local community in relation to the Proposed Modification, through analysis of secondary data sources relevant to the Maroota SSC and engagement of landholders proximal to the Proposed Modification.

- Assessing and predicting the significance of impacts associated with the Proposed Modification through the application of a 'risk-based approach'; integrating both perceived and technical assessment of risk. Where available, relevant data sets have been used to inform the assessment of impacts associated with the Proposed Modification and to explore perceptions raised in consultation with the community. This approach affords greater integration with the broader environmental assessment work so that impacts of relevance to technical specialists and community members are adequately discussed and considered in the impact assessment process.

- Developing strategies that address and manage the predicted social impacts associated with the Proposed Modification and those which may enhance opportunities in a manner that values existing community aspirations and assets.

- Identifying what will require monitoring should the Proposed Modification be approved and how any unanticipated social impacts that may result from the Proposed Modification will be identified.

The methods that have been utilised in the current assessment are summarised for each phase of the Proposed Modification SIA in **Table 2.1**.

Table 2.1 Summary of Social Impact Assessment and Engagement Methods

Phase	Summary
Phase 1 – Program Planning	Preliminary Project scoping and identification of likely issues and/or impacts.
Phase 2 – Community Profiling	Detailed analysis of publicly available secondary data, including: • demography and population trends; • relevant statistics such as key health and economic indicators; • local media and current affairs; • relevant government strategic plans and other publications; and • other secondary sources as appropriate.
Phase 3 – Scoping of Issues and Opportunities	Review and summary of stakeholder engagement undertaken by Dixon Sand with potentially impacted landholders via information provision, email correspondence, face-to-face meetings and phone calls. Follow up phone calls by Umwelt to potentially impacted landholders, followed by ranking of perceived issues and opportunities relative to frequency of response.
Phase 4 – Assessment of Impacts and Opportunities	Consideration of the Project in relation to the social context in which it is situated, and assessment of any issues predicted to occur.
Phase 5 – Prediction of Impact and Strategy Development	Development of assessment conclusions and recommendations of mechanisms to preferentially avoid, minimise, mitigate or manage potential negative social or economic impacts and maximise potential opportunities.

2.2 Project Stakeholders

Social impact assessment involves the cooperation and coordination of a number of 'social partners' or 'stakeholders'. As Burdge (2004) outlines, stakeholders may be affected groups or individuals that:

- live nearby the resource/Project
- have an interest in the proposed action or change
- use or value a resource
- are interested in its use
- are forced to relocate.

As part of the SIA for the Proposed Modification, a number of key stakeholders have been identified and involved in the program including:

- residents in proximity to the Quarry
- residents and landholders along the haul route
- key interest groups, including the Community Consultative Committee (CCC)
- Dixon Sand employees and contractors
- State and Local government agencies
- local businesses.

Dixon Sand distributed an information sheet (Community Information Sheet No. 1) in April 2019 to 75 mailboxes along Wisemans Ferry Road and Old Northern Road (refer to **Figure 2.1**). Letters were delivered to all residences from 1370 Wisemans Ferry Road (The Stone House Café) to the intersection of Wisemans Ferry Road and Old Northern Road (approximately 4.5km), and all residences between the intersection and 4261 Old Northern Road (approximately 2km, towards Sydney). As noted in **Section 2.5**, consultation by Umwelt focused on those residents who responded to this information sheet.

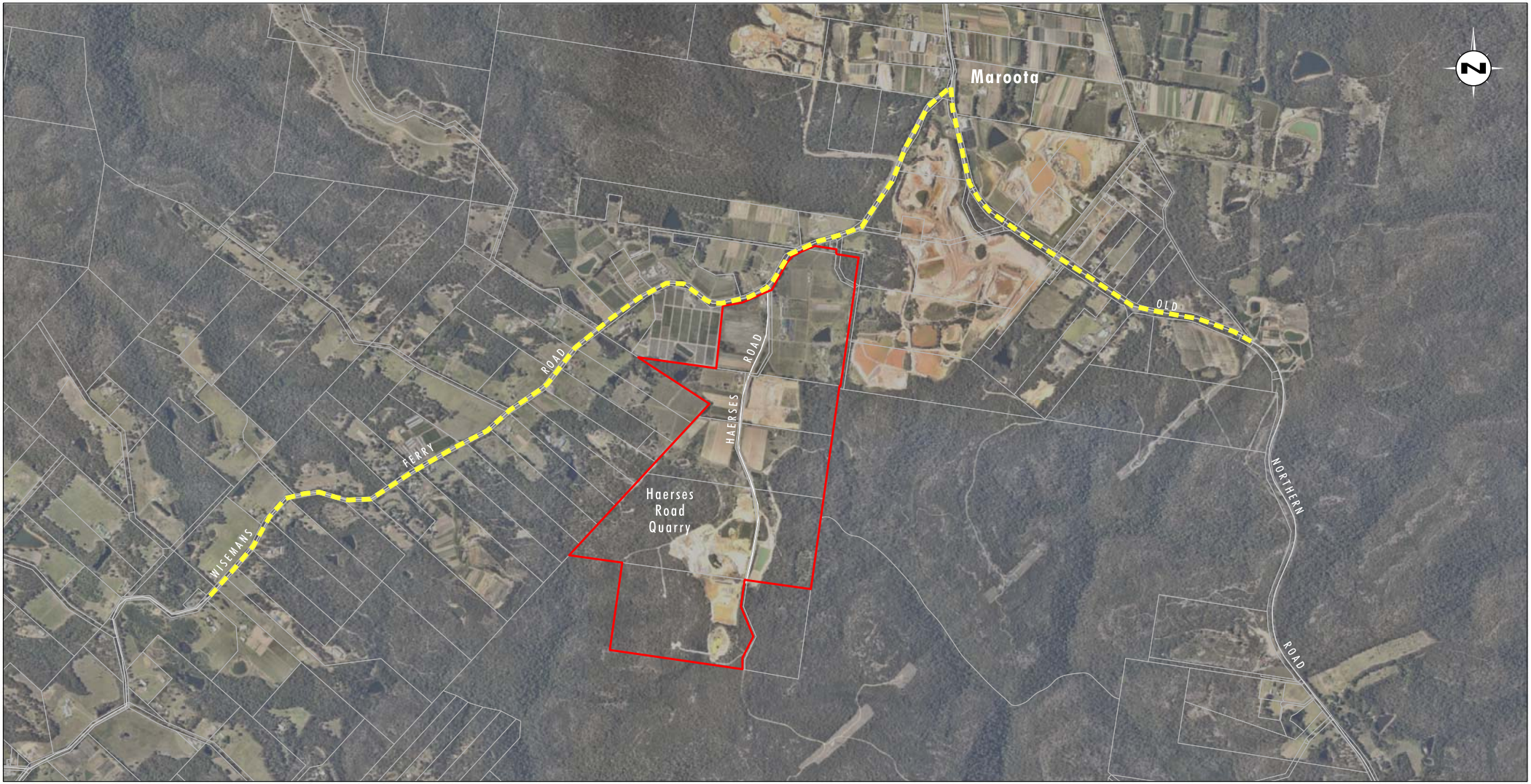

Image Source: Nearmap (Dec 2018)

0 0.25 0.5 1.0km
1:25 000

Legend

- Haerses Road Quarry Site
- Coverage of Letterbox Drop (11th April 2019)

FIGURE 2.1

Coverage of Letterbox Drop (11th April 2019)

2.3 Mechanisms for Engagement

A range of mechanisms have been utilised to obtain the input of the various stakeholder groups outlined above. The mechanisms to engage with local landholders, key stakeholders and the wider community during the preparation of the SIA are outlined in **Table 2.2** below.

Table 2.2 Engagement Mechanisms

Stakeholder Group	SIA/SEE Development
Local Community	Provision of two Community Information Sheets. The first information sheet provided notice of the Proposed Modification and outlined the reasons for it. Stakeholders were also invited to participate in the consultation process. The second information sheet provided a summary of the outcomes of the technical assessment studies. Both sheets included a detailed map of the Project and discussion of the main transport routes and were distributed to 75 households along the transport routes (refer to **Figure 2.1**). **Round 1**: Nine residents responded to the invitation included in Community Information Sheet No. 1 to be involved in the consultation process. Dixon Sand engaged in telephone and email correspondence with affected residents and conducted multiple face-to-face meetings (attended by the Managing Director and Senior Dixon Sand Staff). During this consultation, Dixon Sand recorded the issues of concern raised by these residents, identified perceived impacts and provided further information on the Project. **Round 2:** Umwelt offered phone interviews to these nine residents, seven of whom chose to be involved in further consultation.
CCC	Project briefing. Provision of two Community Information Sheets and a Proposed Modification General Question and Answer Document.
Employees / Contractors	Briefing for employees.
State Government / Local Government	Targeted written correspondence with key agencies undertaken by Dixon Sand as required, including: • DPIE • The Hills Shire Council • Department of Industry – Lands and Water • Department of Primary Industries • Environment Protection Authority (EPA) • DPIE Division of Resources and Geoscience • WaterNSW • Natural Resources Access Regulator • Office of Environment and Heritage (OEH) • OEH Heritage Division NSW • Roads and Maritime Services (RMS) The outcomes of this consultation are described in further detail in the SEE.

2.4 Engagement Materials

The materials described in **Table 2.3** have been used to complement the engagement program. The development of these materials has been informed by the submissions received so far and similar consultations.

Table 2.3 Engagement Materials

Materials	Description
Information Sheets	• **Community Information Sheet No. 1 (April 2019)** – provided a description of the Proposed Modification and invited community members to contact Dixon Sand or Umwelt to provide feedback or receive further information. • **Community Information Sheet No. 2 (September 2019)** – provided a summary of the SEE outcomes and an update on the approval process for the Proposed Modification. • **Proposed Modification General Questions and Answers (June 2019)** – provided a summary of key questions and responses.
Interview Guide/ Telephone Script	Development of an interview guide to facilitate discussions with landholders/residents in relation to the Proposed Modification. Discussion guide questions included, but were not limited, to: • Previous knowledge and experience of Dixon Sand • Perceived impacts relating to the Proposed Modification • Potential mitigation measures for identified impacts
Engagement Database	Database to collate all stakeholder contact information and data obtained through the interview process.

2.5 Assessment Constraints

In considering the analysis, conclusion and recommendations to this report it is important to note that:

- Detail and assumptions in relation to the Proposed Modification are based on information provided by Dixon Sand and are understood to be current at the time of report preparation.

- Engagement undertaken by Umwelt was limited to those residents who made contact with the Project Team in response to the Community Information Sheet No. 1. As such, the community impacts outlined in **Section 5.0** may not represent the full range of impacts experienced and perceived by stakeholders in relation to the Proposed Modification.

3.0 Operational Context

- The Dixon Sand operation is situated within the suburb of Maroota, one of 25 suburbs within The Hills Shire LGA. **Figure 3.2** provides a map of the area covered by The Hills Shire LGA. Suburbs to the south of the LGA are on the fringe of Greater Sydney and are suburban in nature, whilst areas further north are semi-rural/rural. There are a diverse range of residential, commercial and industrial zones throughout the LGA. Maroota is in the north of the LGA and is well known for its sand, with Dixon Sand and several other sand and sandstone quarries located within the SSC (refer to **Figure 3.2**). There are also several small farms, although the majority of the SSC is bushland (refer to **Figure 3.2**) (The Hills Shire Council, 2003).

  Trucks transport material from the Quarry along Wisemans Ferry Road and Old Northern Road to service the Sydney construction market, travelling via the Hawkesbury LGA suburbs of Pitt Town and Windsor, and The Hills Shire LGA suburb of Castle Hill.

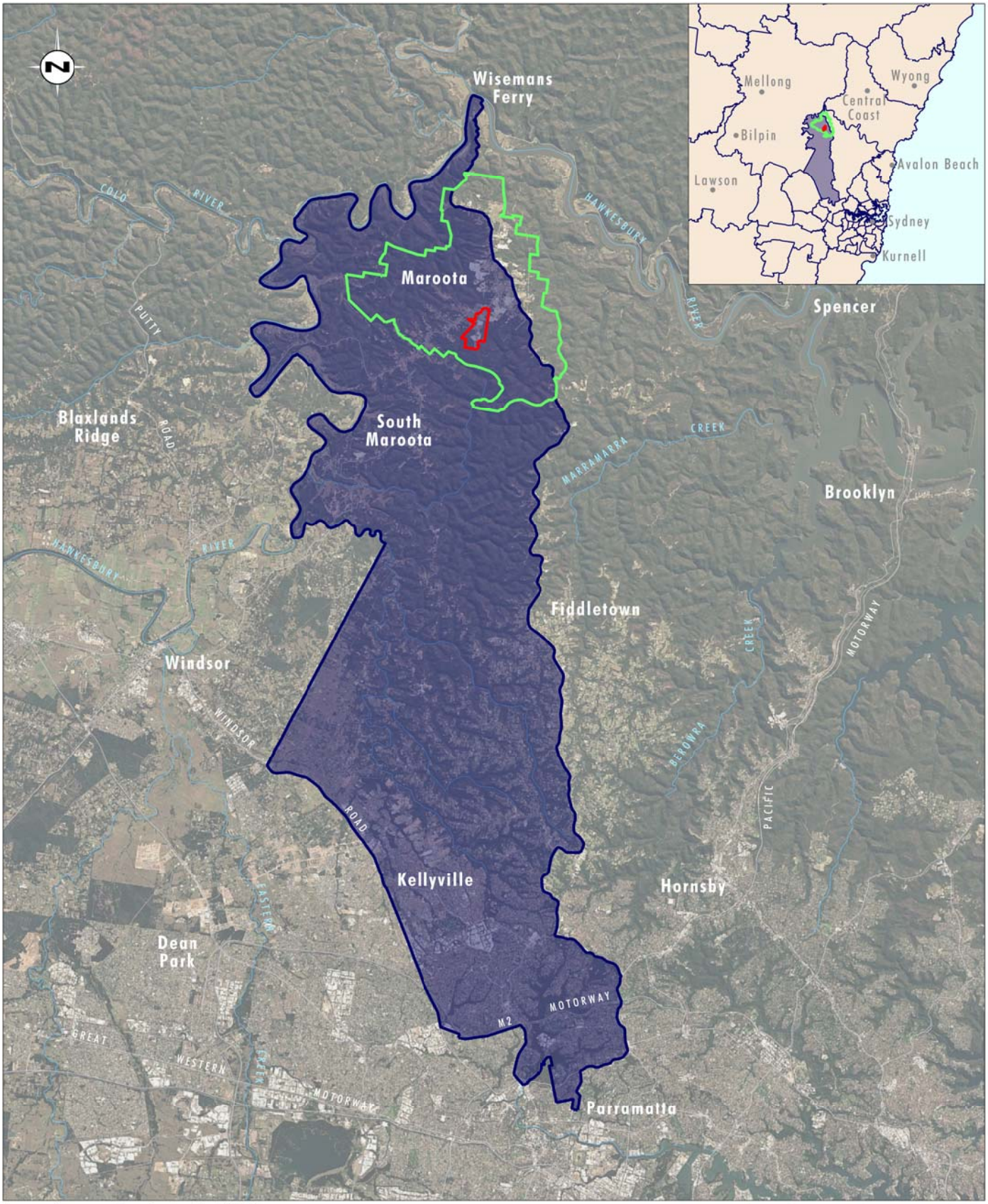

Image Source: Google Earth (2019)
Data Source: LPI (2018)

0 2.5 5.0 10.0km
1:250 000

Legend

- Haerses Road Quarry Site
- Maroota Local Suburb Area
- Local Government Area
- The Hills Shire Local Government Area

FIGURE 3.1

Regional Locality Plan

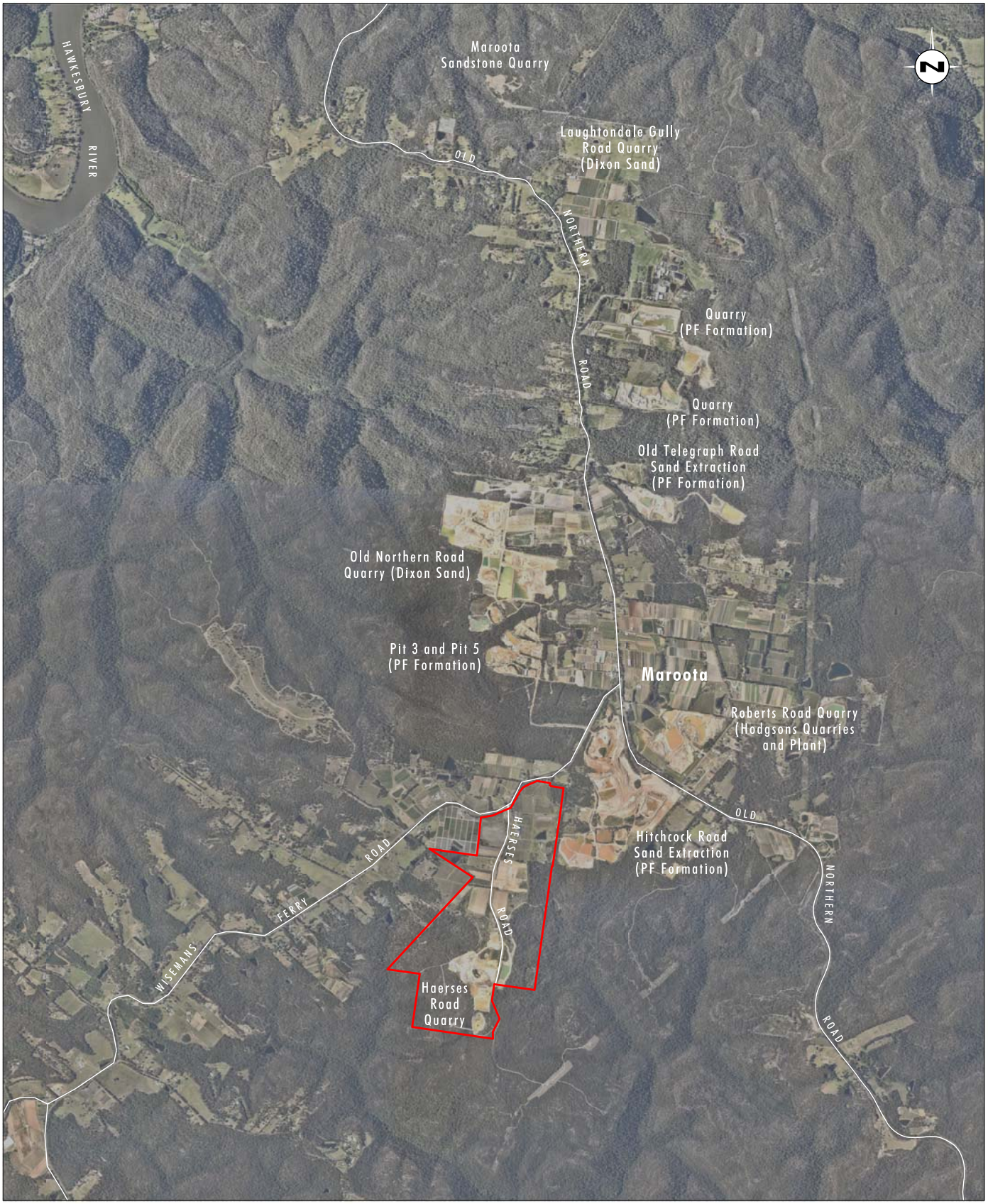

Image Source: Nearmap (Dec 2018)

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1:40 000

Legend

Haerses Road Quarry Site

FIGURE 3.2

Local Quarry Operations

3.1 Employees, Contractors and Suppliers

The current Dixon Sand workforce (across all quarry operations) consists of 21 full time equivalent (FTE) employees, five of whom reside within Maroota (24% of total workforce). The majority of the workforce reside in nearby towns and suburbs, with 52% of the total workforce based in locations along the eastern boundary of the Hawkesbury LGA (refer to **Table 3.1**).

As Dixon Sand utilises contractors for transport of materials, it is likely that the Quarry also contributes to the employment of the 6.3% of Maroota residents employed in the road freight transport industry (see **Section 4.2.7**). Furthermore, the Proposed Modification is expected to create an additional eight full time positions, in addition to the six roles arising from the modification of the Quarry in 2018 (see **Table 1.1**).

Table 3.1 Dixon Sand Employee Location of Residence

Location	Number of Employees	Proportion of Employees (%)
The Hills LGA	6	29
Maroota	*5*	*24*
Glenorie	*1*	*5*
Hawkesbury LGA	11	52
Blacktown LGA	1	5
Lithgow LGA	1	5
Northern Beaches LGA	1	5
Penrith LGA	1	5
Total	**21**	**100**

Umwelt, 2019; data sourced from Dixon Sand, 29/10/2019, NB: figures affected by rounding

Table 3.2 shows the locations of Dixon Sand's 19 primary suppliers. Similar to employees, a large proportion of suppliers are located nearby to the Project, with 16% operating within The Hills Shire LGA, and 37% within the Eastern suburbs of the Hawkesbury LGA.

Table 3.2 Dixon Sand Supplier Locations

Location	Count of LGA	Proportion (%)
The Hills LGA	3	16
Maroota	*2*	*11*
Glenorie	*1*	*5*
Hawkesbury LGA	7	37
Hornsby LGA	2	11
Camden LGA	1	5

Location	Count of LGA	Proportion (%)
Cumberland LGA	1	5
Fairfield LGA	1	5
Maitland LGA	1	5
Penrith LGA	1	5
Queensland	1	5
Sydney LGA	1	5
Total	19	100

Umwelt, 2019; data sourced from Dixon Sand, 2019 NB: Figures affected by rounding

3.2 Community Contributions

Table 3.3 provides a summary of the community contributions made by Dixon Sand to several local charity and educational organisations between July 2017 and June 2019. Dixon Sand contributed a total of $12,200 towards community projects in the area over that two-year period, with $8,200 of this contributed in the last financial year (2018-19). Of the total amount invested, approximately one third ($4,000) was directed towards schools and education.

Table 3.3 Dixon Sand Social Investments

Recipient	Amount	Financial Year
Rural Aid Ltd	$5,700.00	2018-19
Cattai Public School P & C	$1,000.00	2018-19
Royal Flying Doctor Service	$1,000.00	2018-19
The Wisemans Ferry Sunshine Group Inc	$500.00	2018-19
Total 2018-19	**$8,200.00**	**2018-19**
Cattai Public School P & C (2017)	$1,000.00	2017-18
Cattai Public School P & C (2018)	$1,000.00	2017-18
Royal Flying Doctor Service	$1,000.00	2017-18
Maroota P & C	$1,000.00	2017-18
Total 2017-18	**$4,000.00**	**2017-18**
Total 2017 to 2019	**$12,200.00**	**2017-2019**

Data sourced from Dixon Sand, 2019

4.0 Social Profile

A baseline social profile gathers knowledge of primary and secondary sources to increase understanding of the existing social environment in which a project is proposed and to provide a foundation from which impacts associated with a project may be predicted.

Data sources used in the preparation of this baseline profile include:

- ABS Census data (ABS, 2016)
- Social Health Atlas (PHIDU, 2018) and other social indicators
- Local and State Government Reports
- Review of relevant media (where applicable).

4.1 Governance

An overview of Local, State and Federal Government policies in relation to The Hills Shire LGA has been prepared to afford a greater sense of the interactions between planning and approvals associated with current roads, traffic and infrastructure and industry developments.

4.1.1 Local Governance

The Hills Shire Council consists of 13 councillors, including the Mayor. **Table 4.1** presents the current councillors of The Hills Shire Council, as elected in the most recent election in 2017. This election resulted in the appointment of Dr Michelle Byrne as Mayor, the first Mayoral election by popular vote for the LGA. Dr Byrne has previously served as mayor from 2012 to 2014, and 2015 to 2017 prior to the latest election. The Hills Shire Council identifies ten values as core to The Hills Shire community: *Community spirit*, *Accessibility*, *Sustainability*, *Leadership*, *Natural Beauty*, *Innovation*, *Balance*, *Proactivity*, *Safety*, and *Families* (see The Hills Shire Council, 2018).

Table 4.1 The Hills Shire Council Representatives 2019

Role	Councillors	
Mayor	Michelle Byrne	
Deputy Mayor	Alan Haselden	
Councillors	Robyn Preston Peter Gangemi Brooke Collins Elizabeth Russo Frank De Masi Tony Hay	Samuel Uno Ryan Tracy Mike Thomas Reena Jethi Jacob Jackson

Source: The Hills Shire Council (2019)

In 2017, The Hills Shire Council released the 'Hills Future 2017-2021 – Community Strategic Plan' (The Hills Shire Council, 2017). The key pillars of the Council's vision for the community are summarised in **Table 4.2** below.

Table 4.2 Key Pillars of The Hills Shire Council Strategic Plan

Focus Areas	Key Strategies
Building a Vibrant Community and Prosperous Economy	• To promote and support new business and local employment opportunities • Support a visitor economy for planned growth • Support existing businesses and business networks to increase business capacity and capabilities to grow jobs • Encourage connected and inclusive community with access to a range of services and facilities that contribute to health and wellbeing • Support education opportunities • Recognise and value our community's local heritage and culture
Proactive Leadership	• To facilitate relationships with the community and involve them in local planning • Provide prompt, complete, friendly and helpful advice and information to the community • To provide governance that values and engages our customers and is based on transparency and accountability • Council has a clear strategic direction that guides its decision making
Shaping Growth	• To manage the natural and built environment through strategic land use and urban planning • Strategically plan for the North West Sector growth through the development and construction of transport infrastructure, integrated local roads, parks and other civil infrastructure
Delivering and Maintaining Infrastructure	• Provide and maintain sustainable infrastructure and assets that enhance the public domain, improve the amenity and achieve better outcomes for the community • Manage and maintain a diverse range of safe, accessible and sustainable open spaces and provide recreation, sporting and leisure activities and facilities • Provide new and refurbished infrastructure in a timely manner that meets the needs of our growing Shire
Valuing our Surroundings	• Manage the natural surroundings in an environmentally sustainable way • Manage new and existing development with a robust framework of policies, plans and processes that is in accordance with community needs and expectations • Provide services, infrastructure, information and education that facilitate resource recovery and encourage commercial and residential waste minimisation

Source: The Hills Shire Council (2017)

4.1.2 State Government

The Quarry is located within the boundaries of the Hawkesbury State Electorate, which covers the majority of The Hills Shire LGA (boundary is north of Box Hill, Annangrove and Kenthurst) and the Hawkesbury LGA (excluding Berambing). Hon. Robyn Preston, member for the Liberal Party, was elected to the House of Representatives for the Hawkesbury State Electorate 2019 and is serving her first term in this role.

4.1.3 Federal Government

The majority of The Hills Shire LGA, including Maroota where the Proposed Modification is located, falls within the Australian electoral division of Berowra in NSW. The current member for Berowra is Julian Leeser who is the Chair of the Joint Select Committee on Constitutional Recognition relating to Aboriginal and Torres Strait Islander Peoples and a member of the Liberal Party of Australia. He has been serving his first term elected to the House of Representatives for Berowra since 2016.

4.2 Demographic Analysis

Socio-economic characteristics of the relevant communities are largely based on State Suburb Code (SSC) and LGA levels of analysis and informed by data available from the latest 2016 Census, and other social indicators data sources as relevant. The primary communities of interest for the purposes of this assessment include:

- Maroota SSC
- The Hills Shire LGA
- NSW State (for comparative purposes)

In order to better understand the potential impacts specific to the Maroota SSC and the surrounding LGA, a summary of key social demographics can be found in **Table 4.3**, with indicators also provided at the NSW State level for the purpose of comparative analysis. Key differences between these geographic areas are outlined below and broken down into the following broad categories:

- Population characteristics
- Cultural diversity
- Household and family composition
- Income, housing and cost of living
- Health
- Industry, employment and transport
- Infrastructure and services

Table 4.3 Key Social Indicators by Locality

	Key Indicators	Maroota* (SSC)	The Hills Shire (LGA)	NSW
Population	Total Population	617	157,243	7,480,231
	Proportion female (%)	49.7	50.7	50.7
	Median age (Years)	39	38	38
	Indigenous (%)	1.8	0.5	2.9
Cultural Diversity	Country of birth outside Australia (%)	25.1	34.8	34.5
	Households where a non-English language is spoken (%)	12.6	32.0	26.5
Households	Family Households (%)	80.2	87.1	72.0
	Lone person households (%)	14.8	11.3	23.8
	Group households (%)	4.9	1.5	4.2
	Families with children (%)	45.5	60.4	45.7
	Families with no children (%)	38.5	28.8	36.6
	Single parent family (%)	16.0	9.9	16.0
	Median weekly household income ($)	1,761	2,363	1,486
	Less than $650 gross weekly income (%)	10.2	9.4	19.7
	Households with rent payments greater than or equal to 30% of household income (%)	10.0	5.9	12.9
	More than $3,000 gross weekly income (%)	22.8	36.6	18.7
	Households where rent payments are less than 30% of household income (%)	90.0	94.1	87.1
Housing	Median rent ($)	275	562	380
	Rented (%)	24.5	17.1	31.8
	Owned outright (%)	36.7	34.5	32.2
	Owned with a mortgage (%)	32.4	45.7	32.3
	Occupied private dwellings (number)	183	47,845	2,604,320
	Occupancy rate (%)	91.5	94.6	90.1
	Separate House (%)	98.4	82.4	66.4
Employment	Unemployment (%)	2.0	4.6	6.3
	Labour force participation (%)	63.7	68.0	59.2
	Worked full-time (%)	62.2	62.3	59.2
	Worked part time (%)	28.0	29.4	29.7
Transport Arrangements	Travel to work in car as driver or passenger (%)	66.6	69.3	64.6
	Travel to work using public transport (%)	0.0	16.1	16.0
	Worked at home (%)	14.1	6.1	4.8
	Occupied dwellings with one/more registered vehicles (%)	91.6	96.2	87.1
	Occupied dwellings with no registered vehicles (%)	1.7	2.1	9.2

Source: ABS Quickstats, 2016
*data is indicative only, due to random adjustments made on low numbers by the ABS

4.2.1 Key population characteristics

Whilst Maroota is a small rural-residential community, a large part of The Hills Shire Council area is comprised of suburban areas in the north-west of the Sydney metropolitan area. As such, there is a key divide between the largely city-based demographic in the southern regions of The Hills Shire and the more regional community, in the northern areas around Maroota.

Key population trends and characteristics of the communities of Maroota and The Hills Shire LGA (refer to **Table 4.3**) are outlined below.

As at the 2016 Census, the median age was equivalent in Maroota (39), The Hills Shire (38) and NSW (38), however, when comparing the age distribution for each of the communities, some differences are apparent (refer to **Figure 4.1**). Key points of difference include:

- A high proportion of the population in the Maroota SSC fall within the 0-4 year age bracket (8.4% compared to 6.2% in the Hills Shire and 6.2% across the State).
- 22.3% of The Hills Shire population are between 5 and 19 years old (compared to 19.3% in Maroota and 18.3% across NSW).
- A lower proportion of persons aged 20 to 34 reside in Maroota (16.2%) and The Hills Shire (16.6%) compared to NSW (20.7%)
- Marginally higher proportions in the 40 to 49 year age bracket in Maroota (14.8%) and The Hills Shire (15.5%) than across NSW (13.3%).

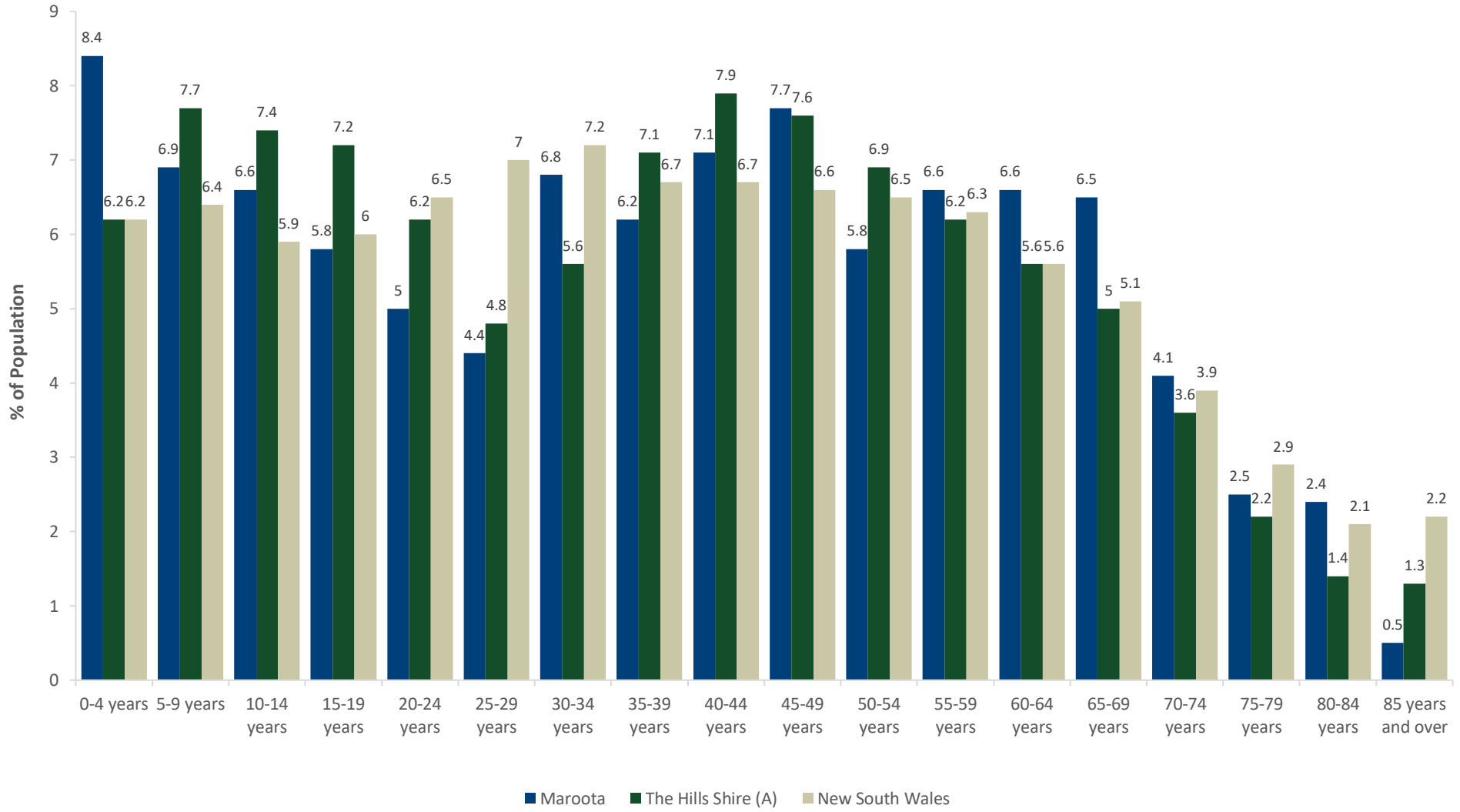

Figure 4.1 Age Distribution

4.2.2 Population projections and growth

The Hills Shire Council LGA is one of the most rapidly growing populations in Australia (REMPLAN, 2019).

According to the population projections for The Hills Shire LGA as provided by the 'NSW State and Local Government Area Population and Household Projections' (2016) the LGA is expected to reach a total population of 290,900 by 2036, or an overall increase of approximately 76% between 2016 and 2036. This equates to an annual population growth rate of between 2.5% and 3.7% between 2016 and 2036 (refer to **Table 4.4** and **Figure 4.2**). For comparative purposes the population projections estimate an annual growth rate between 1.1% and 1.4% for NSW as a whole and an overall population increase of 28% (for the same period) (NSW Government , 2016). However, it should be noted that when compared to the ABS Census results, the population projections (developed in 2011) overestimated the 2016 population of The Hills Shire LGA by approximately 8,400 people.

As can be seen in **Table 4.5**, the relative change in the proportions of the population in each age group suggests an aging population, with an increase in the proportion of the persons aged 75 years and over, and a decrease in the proportion of the population aged between 30 and 44 years.

As discussed further in **Section 4.3**, this population growth is being supported by a number of infrastructure projects including the Metro Northwest rail line and a number of housing development projects, such as the Riverside Oaks Golf Resort redevelopment, which will supply an additional 300 residential homes to the Cattai area (for further detail, refer to **Section 4.3.1**).

Table 4.4 The Hills Shire Population Growth Rate

	2011-16	2016-21	2021-26	2026-31	2031-36
Total Population Change	17,600	22,050	37,550	31,700	34,000
Average Annual Population Growth Rate (%)	2.3	2.5	3.7	2.7	2.5

Source: NSW Government Planning & Environment, 2016 New South Wales State and Local Government Area Population and Household Projections, and Implied Dwelling Requirements

Table 4.5 Population Projections by Age Groups

Age Groups	2016	2036	Proportional Increase[1]	Change in Proportions[2]
0-4	10,750	17,450	62%	0%
5-9	12,100	20,000	65%	0%
10-14	12,000	20,750	73%	0%
15-19	11,650	20,650	77%	0%
20-24	10,500	18,500	76%	0%
25-29	8,850	14,700	66%	0%
30-34	10,000	15,550	56%	-1%
35-39	11,600	18,700	61%	-1%
40-44	12,950	21,250	64%	-1%
45-49	12,550	22,100	76%	0%
50-54	11,500	20,750	80%	0%

[1] Proportional Increase is the population change (2016-2036) as a proportion of the total number of persons in 2016, broken down for each age group

[2] Proportional change is the number of people in each age group relative to the total number of persons at each point in time

Age Groups	2016	2036	Proportional Increase[1]	Change in Proportions[2]
55-59	10,500	17,550	67%	0%
60-64	9,150	15,600	70%	0%
65-69	7,800	12,950	66%	0%
70-74	5,950	10,750	81%	0%
75-79	3,650	8,950	145%	1%
80-84	2,150	6,950	223%	1%
85+	2,000	7,700	285%	1%
Total Population	165,650	290,850	76%	

Source: NSW Government Planning & Environment, 2016 New South Wales State and Local Government Area Population and Household Projections, and Implied Dwelling Requirements

4.2.3 Cultural diversity

Cultural diversity is high in The Hills Shire with 34.8% of residents born outside Australia and 32% of households speaking a language other than English, compared to 34.5% and 26.5% across NSW respectively (refer to **Table 4.3**). However, this diversity is not reflected as strongly in Maroota, where 25.1% of residents are born outside Australia and 12.6% of households speak a language other than English at home. Furthermore, as at the 2016 Census the languages most frequently spoken at home in The Hills Shire (after English) were Cantonese, Mandarin, Korean, Arabic, Hindi and Persian/Dari, whilst in Maroota they were Maltese, Italian, German, Afrikaans and Arabic.

The Indigenous population in The Hills Shire is proportionally less than the State average - 2.9% in NSW compared to 1.8% in Maroota SSC and 0.5% in The Hills Shire LGA (0.5%).

SEIFA Index of Relative Socio-economic Advantage and Disadvantage provides the overall socio-economic status and level of disadvantage or advantage within each community, by ranking areas in each State or Territory according to relative socio-economic advantage or disadvantage. A low score indicates a greater degree of disadvantage, with the lowest 10% of areas receiving a decile of one, and the highest, a ten.

When compared to other suburbs across NSW, Maroota scored within the 6th decile, indicating a higher than average level of socio-economic advantage. The Hills Shire falls within the highest decile of socio-economic advantage (10th decile; ABS, 2016). It should be noted that no direct comparison can be made between LGAs and State Suburbs on ranking, as rankings are only comparative within each geographic classification. However, given the differences in economic and social demographics between Maroota and The Hills Shire more broadly (described above and in the paragraphs below), it can be inferred that Maroota is comparatively less affluent than the more densely populated suburbs within the southern section of the LGA.

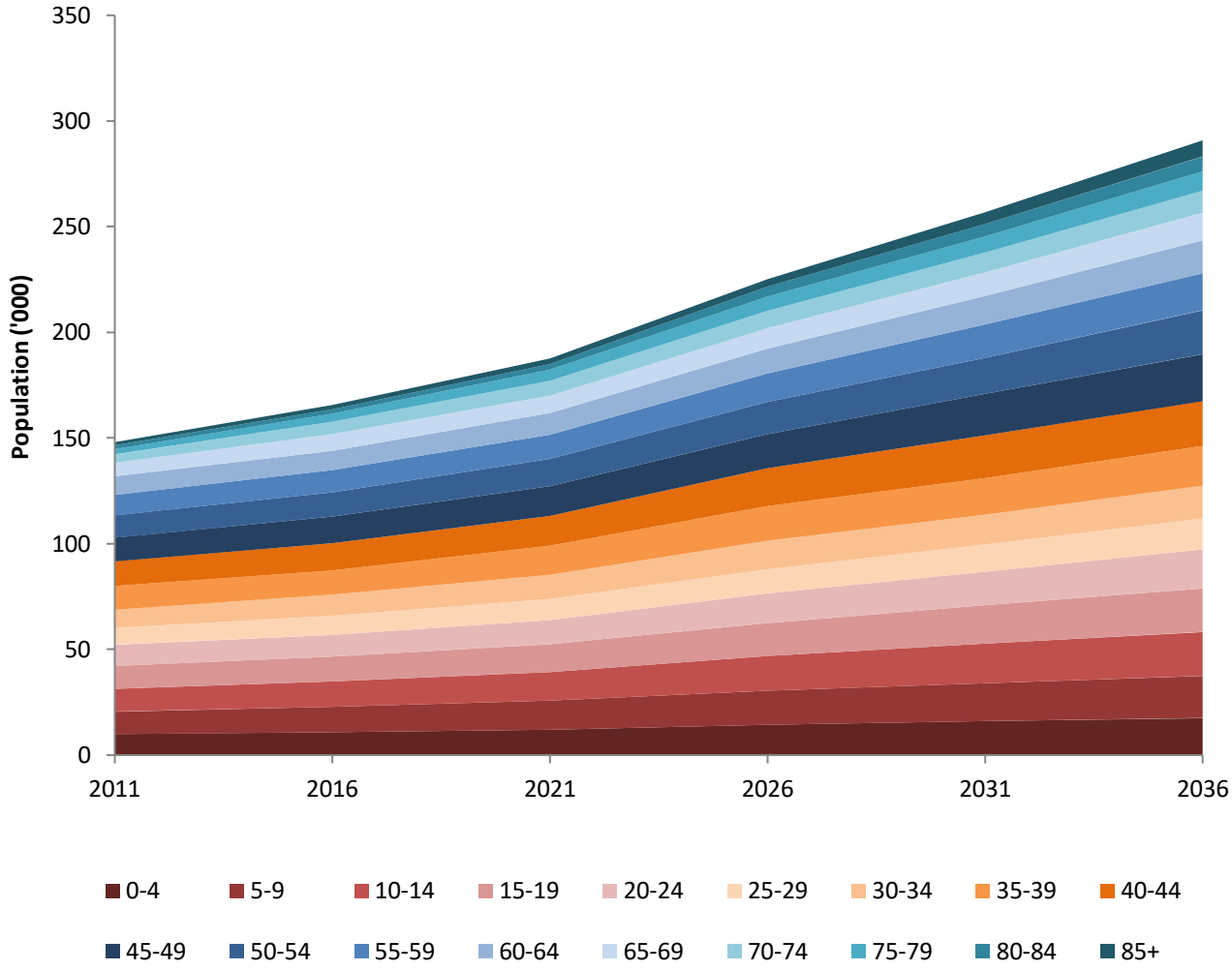

Figure 4.2 Population Projections (thousands)

Source: Created by Umwelt utilising data sourced from NSW Government Planning & Environment, 2016 New South Wales State and Local Government Area Population and Household Projections, and Implied Dwelling Requirements

4.2.4 Household and family composition

Key characteristics of Maroota SSC and the LGA in relation to household and family composition can be identified as follows:

- There are proportionally higher rates of family households in Maroota SSC (80.2%) and the LGA (87.1%), than the NSW average (72%).
- There are fewer lone person households in Maroota (14.8%) and The Hills Shire (11.3%) compared to NSW (23.8%).
- There is a smaller proportion of group households in The Hills Shire (1.5%) compared to both Maroota (4.9%) and NSW (4.2%).
- The proportion of single parent households in Maroota is equal to that in NSW (16%), but higher than in The Hills Shire (9.9%). This is likely to be a reflection of the comparatively higher pressures of the Sydney housing market on single parents, lone persons and young person group households in The Hills Shire, compared to more regional Maroota and NSW more broadly (refer to **Section 4.2.5**).

- The proportion of family households with children is higher in The Hills Shire (60.4%) than in Maroota and across the State (45.5% and 45.7% respectively). Similarly, The Hills Shire has a lower proportion of families without children (28.8%), while Maroota conforms to the State average (38.5% compared to 36.6% across the State) (refer to **Table 4.3**).

This data suggests that the Maroota area is a socially robust community, primarily populated by families and group households with family composition typical of that found across the State.

4.2.5 Income, housing and cost of living

ABS Census (2016) income data suggests that households in The Hills Shire are considerably more affluent than the median household across NSW. Maroota also sits above the NSW median, albeit more modestly.

- Compared with NSW ($1,486), the median weekly household income for The Hills Shire ($2,363) is substantially higher, and also slightly higher in Maroota ($1,761).
- The proportion of low-income households as defined by the ABS where gross weekly income is less than $650 is lower in Maroota (10.2%) and The Hills Shire (9.4%) than in NSW (19.7%).
- Similarly, the proportion of high-income households with gross weekly income greater than $3,000 is greater in both Maroota (22.8%) and The Hills Shire (36.6%), than in NSW (18.7%).

Reflective of the higher affluence of households in The Hills Shire, median rent in the LGA ($562) is higher than the State median ($380). Despite higher household income in Maroota compared to NSW, the median rent is lower, at $275 per week. Data from realestate.com.au indicates lower demand for properties, with a reported average of 438 site visits per property for sale in Maroota over the 2018-19 financial year, compared to 704 across the State.

Comparing median rent to median household income, Maroota has the lowest proportional difference, with rent accounting for 16% of household income, compared to 24% and 26% in The Hills Shire and NSW respectively. However, the contrast between median rent and median household income also suggests reduced cost-of-living in comparison to both the LGA and NSW.

This is partially supported by rental data from the Census, which indicates that in Maroota there is a marginally higher proportion of households where rent is below 30% of household income (90% compared to 87% in NSW) and an equally slight proportion of households where rent is equal to or greater than 30% of income (10% compared to 13% NSW).

Interestingly, data from The Hills Shire does not match the differences seen in medians. Rather, it shows a greater level of economic advantage than Maroota, with 94% of households having rent less than 30% of income and just 5.9% where rent is equal to or greater than 30% of income.

Compared to NSW State, there are high rates of home ownership in Maroota and the LGA which is reflected by the following:

- The percentage of rented properties in Maroota SSC (24.5%) and The Hills Shire LGA (17.1%), is less than the State average of 31.8%
- The proportion of houses owned outright is higher in Maroota (36.7%), and The Hills Shire LGA (34.5%), than in NSW (32.2%)
- The percentage of houses owned with a mortgage is higher in The Hills Shire LGA (45.7%) than the State average (32.3%), with Maroota being more comparable to the State (32.4%).

The NSW Valuer General releases a number of metrics on the housing market, including current and historical sale prices, land values and lot size. **Figure 4.3** shows the overall number of property sales in Maroota each year from 2010 to present, while **Figure 4.4** show the change in median sale price of properties in Maroota mapped against the median lot size of sold properties.

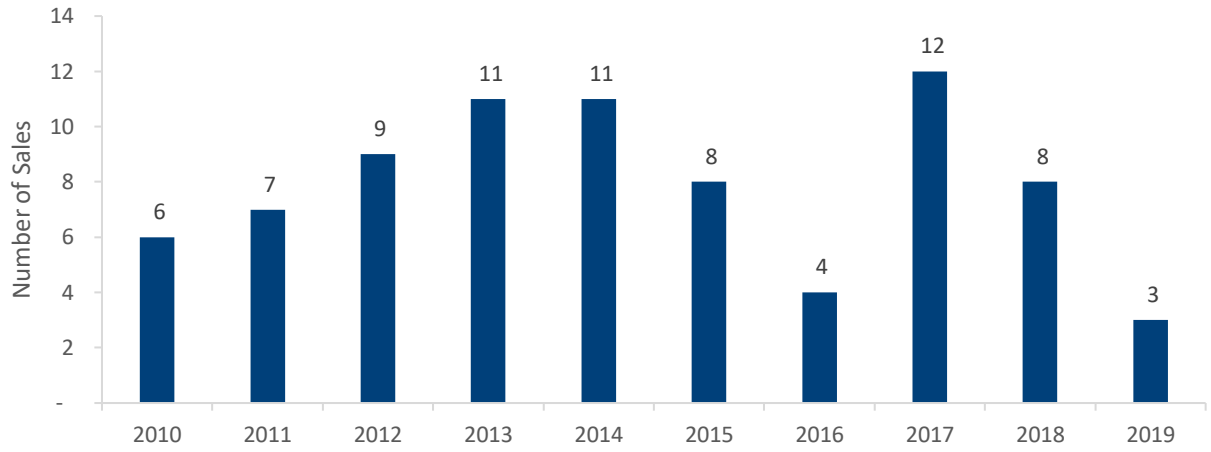

Figure 4.3 Number of Property Sales in Maroota

NSW Valuer General's Office, 5 September 2019

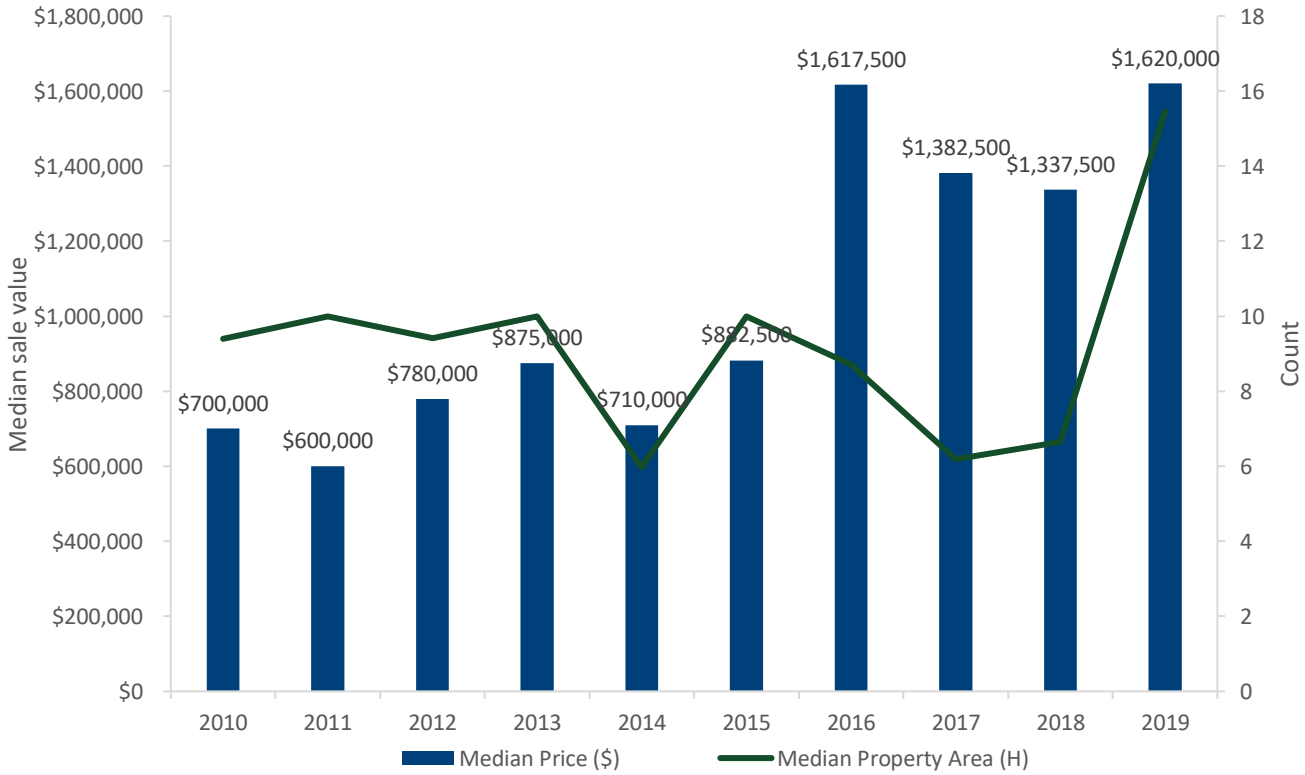

Figure 4.4 Median Property Sale Price in Maroota

Source: NSW Valuer General's Office, 5 September 2019

Overall, the data suggests that the price of houses in Maroota has experienced considerable growth from 2010 to 2019, rising from a median of $700,000 to $1,620,000 for the 2019 year to date. Property sales are generally quite low, with a high of 12 sales in 2017 dropping back to eight in 2018, and just three for the 2019 year to date (as at 5 September 2019). The median area of sold properties has remained relatively stable in Maroota, with a large increase in the median in 2019 likely to at least partially explain the high median sale price.

Further analysis of property sales in Maroota for the 10 year period from 2010 to 2019 indicates that both year of sale and property area are significant predictors of property price, explaining 29% of the variance in median sales prices ($F(2,77)=17.151$, $p<0.001$).

A more stable measure of property value is the land valuation, which provides a baseline of value (excluding buildings) upon which council can calculate rates. As can be seen in **Figure 4.5**, between 2014 and 2018, the median land value in Maroota has risen steadily, whilst values across the LGA appear to have decreased. Whilst this appears counterintuitive given the population growth and high affluence of some suburbs within the LGA (see also, **Section 4.2.2**), the reduction in median land value is likely to be the result of increased subdivision of large blocks of land to accommodate the influx of new residents (further described in **Section 4.3.1**). Furthermore, review of the median house valuations for the Hills Shire LGA (Economy id, 2019) reveals that despite the decrease in land values, property values across the LGA are well above average (see **Figure 4.6**).

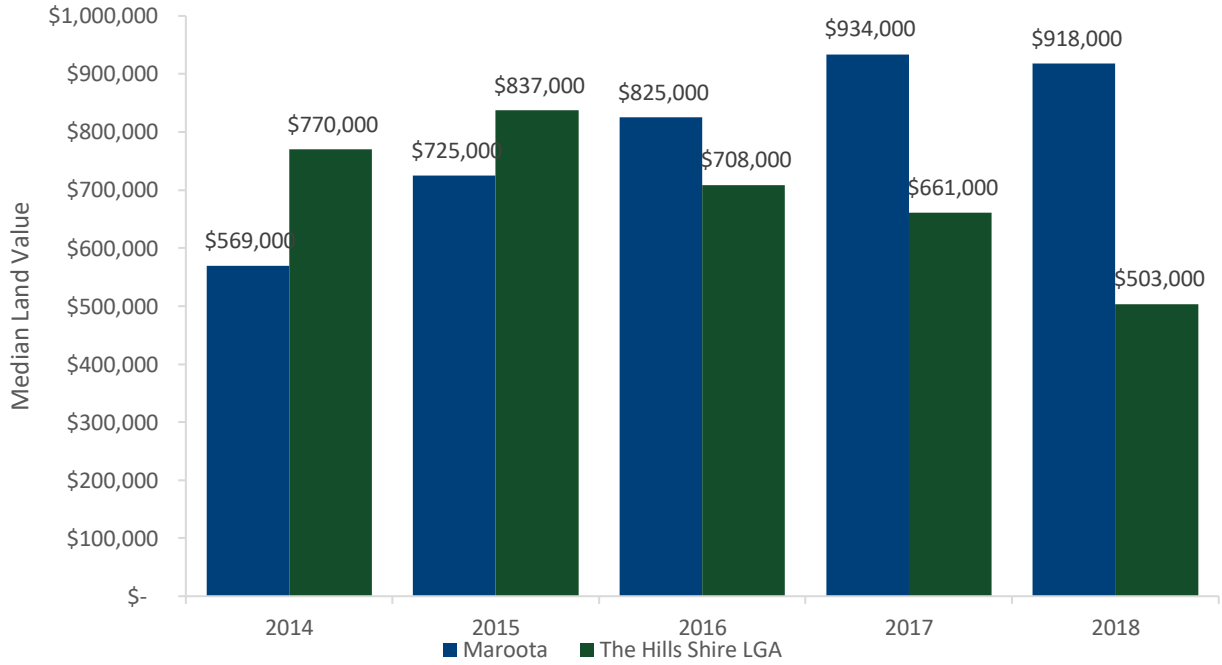

Figure 4.5 Land Values of properties in Maroota (N = 233) and the Hills Shire LGA (N = 55,669)

Source: NSW Valuer General's Office, 5 September 2019
Note: N represents the maximum number of properties assessed – not all properties were counted each year

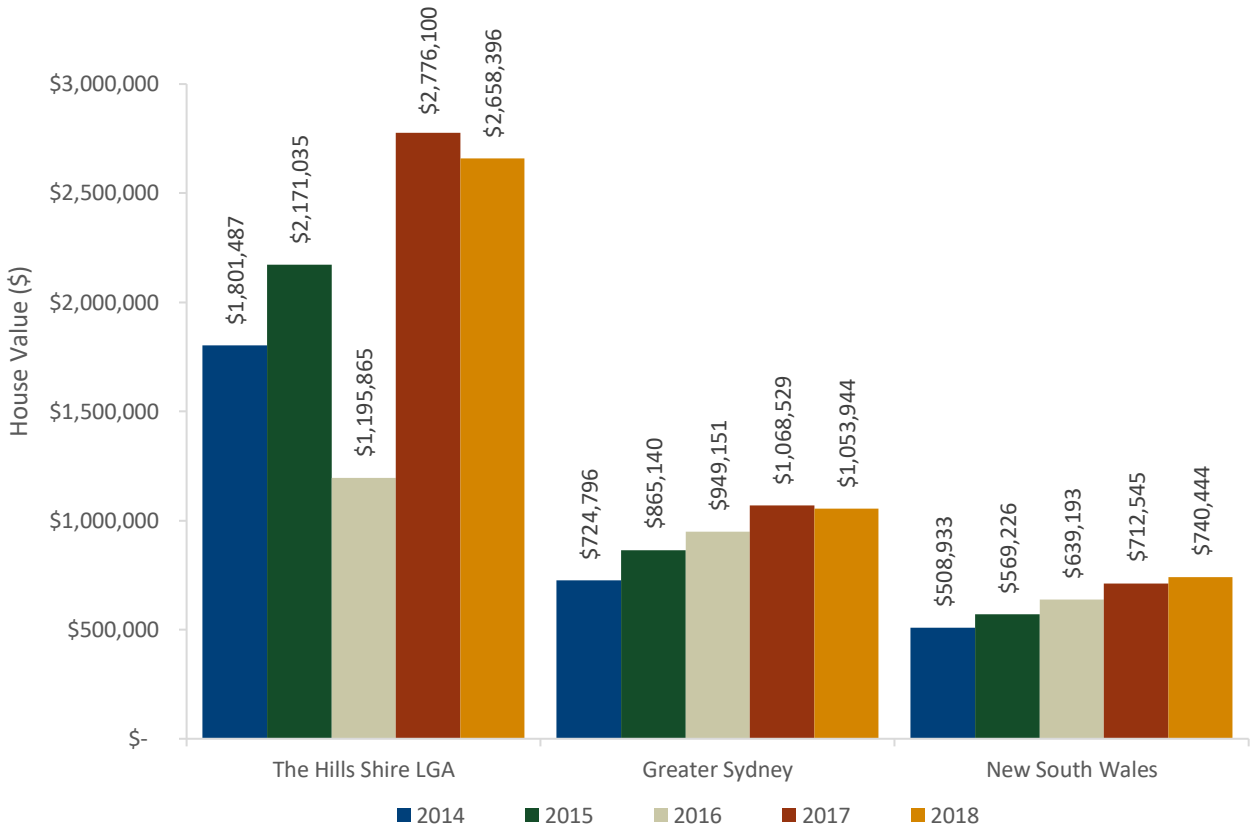

Figure 4.6 Median House Values

Source: Hometrack Housing Valuation System, as referenced by Economy ID, 2019

4.2.6 Health

Health data for the suburb of Maroota is difficult to isolate, due to its proximity to Sydney and the comparatively regional zoning of the suburb in comparison to nearby areas. The ABS Census provides data on persons requiring assistance with core household activities, and the number of persons who provide unpaid assistance to a person with a disability. From the available data, it appears that there is a higher proportion of persons requiring assistance due to disability or other factors, with 6.5% of persons in Maroota requiring assistance, and 13.3% providing unpaid assistance, compared to 5.4% and 11.6% respectively across NSW. In The Hills Shire, 3.2% of persons require assistance, whilst 11.7% provide it.

Maroota falls within the Western Sydney Local Health District (LHD), which contains several Culturally and Language Diverse (CALD) suburbs such as Parramatta and Blacktown, and some of the most disadvantaged suburbs in the State, including Mount Druitt and Whalan. As such, the relatively high levels of disease deaths, hospitalisations and risk factors in the LHD comparative to other areas in Sydney and across NSW are not necessarily reflective of the Maroota area (NSW HealthStats , 2019).

These disadvantages are not reflected in The Hills Shire LGA, where hospitalisations and deaths are generally lower for all disease types when compared to the State average. For example, the number of hospitalisations per 100,000 population in The Hills Shire LGA for Asthma (87.8) and Obstructive Pulmonary Disease (82.9) are approximately half those found across NSW (146.1 and 233.9 respectively) (NSW HealthStats , 2019).

The suburb of Maroota is also captured within the ABS's Dural – Wiseman's Ferry Statistical Area Level 3 (SA3) (which encompasses a large, mainly rural area between Hornsby and the Hawkesbury area, but excludes the more suburban locations of The Hills Shire LGA). In this area levels of health issues are also reportedly lower than levels found in the Western Sydney LHD and across the State, with lower numbers of deaths per 100,000 of the population due to Cancer, Cardiovascular Disease and Suicide in comparison to other areas (PHIDU, 2016, as quoted in The Sydney Morning Herald, 2017).

An exception to this is mental health, with the Dural – Wisemans Ferry SA3 having high rates of hospitalisations for mental health disorders in 2014-15, particularly depressive disorders (184 per 100,000 compared to 118 across Australia) and Bipolar and Mood Disorders (112 compared to 101 across the country) (Australian Government Department of Health, 2017). Compared to other Sydney SA3s, Dural – Wisemans Ferry had the second highest rate of prescriptions for anti-depressant medicines per 100,000 persons (17 years and over) at 7,332 for all Western Sydney Suburbs (Age Standardised Rate decile, 6). It should be noted that this SA3 is in the highest Socio-Economic Status (SES) quintile, indicating greater socio-economic advantage compared to other SA3s across the State, and that the rate of prescriptions appears to be inversely related to SES, with fewer prescriptions in lower SES areas such as Mount Druitt.

4.2.7 Industry, employment and transport

The specific top industries of employment for the study communities include the following:

- **Maroota SSC:** Vegetable growing (outdoors) (9.0%), road freight transport (6.3%), mineral sand mining (5.0%) and nursery production (3.6%).

- **The Hills Shire LGA:** Hospitals (3.3%), computer system design and related services (3.3%), banking (2.6%), and supermarket and grocery stores (2.3%). (ABS 2016 Census – QuickStats).

The presence of these industries indicates the coexistence of industrial and agricultural enterprises in Maroota, and the prevalence of residents employed within the Sydney economy within the larger area of The Hills Shire. This is reflected more broadly in the high-level industry categories shown in **Table 4.6**, with the biggest single employers in Maroota being the agriculture, forestry and fishing industry and the construction industry, whilst health care and social assistance; professional, scientific and technical services; and retail trade are most common in The Hills Shire.

Table 4.6 Industry of Employment

	Maroota (SSC)	The Hills Shire (LGA)	NSW
Agriculture, Forestry and Fishing (%)	15	1	2
Mining (%)	3	0	1
Manufacturing (%)	4	6	6
Electricity, Gas, Water and Waste Services (%)	0	1	1
Construction (%)	14	9	8
Wholesale Trade (%)	2	5	3
Retail Trade (%)	8	10	10
Accommodation and Food Services (%)	5	5	7
Transport, Postal and Warehousing (%)	4	3	5
Information Media and Telecommunications (%)	1	3	2

	Maroota (SSC)	The Hills Shire (LGA)	NSW
Financial and Insurance Services (%)	1	7	5
Rental, Hiring and Real Estate Services (%)	2	2	2
Professional, Scientific and Technical Services (%)	4	10	8
Administrative and Support Services (%)	4	3	3
Public Administration and Safety (%)	3	5	6
Education and Training (%)	5	9	8
Health Care and Social Assistance (%)	7	12	12
Arts and Recreation Services (%)	3	1	2
Other Services (%)	5	4	4
Inadequately described/Not stated (%)	8	4	5

ABS Census 2016 – Community Profiles

Labour force participation is higher than the State average (59.2%) in both Maroota and The Hills Shire LGA, with 63.7% and 68% of the population respectively reporting participation at the 2016 Census. Unemployment was also reportedly lower, with 2% unemployment in Maroota and 4.6% in The Hills Shire LGA, compared to 6.3% across NSW. Of those persons who were employed, full time employment was more common than part time in the study communities.

Travel arrangements for the localities appear to be primarily by private vehicle, with 96.2% of The Hills Shire residents and 91.6% of Maroota residents owning at least one vehicle and 69.3% of LGA residents commuting to work as a passenger or driver of a car (see **Table 4.7**).

Notably, no Maroota residents were reported as having utilised public transport to get to work, while 16.1% of The Hills Shire residents were reported to have done so, in line with NSW proportions. Over 6% of workers reported travelling to work in a truck in Maroota, compared to 1% across the Shire and NSW. This aligns with the high proportion of employees who work in the road freight transport industry in the Maroota area (ABS, 2016).

Table 4.7 Method of travel to work

Employed people aged 15 years and over	Maroota (SSC)	The Hills Shire (LGA)	NSW
Car, as driver (%)	64.3	62.1	57.8
Worked at home (%)	14.1	6.1	4.8
Bus (%)	-	10.6	4
Car, as passenger (%)	3	3.6	4.3
Walked only (%)	5.1	1.2	3.9
Truck (%)	6.1	1	1
People who travelled to work by public transport (%)	-	16.1	16
People who travelled to work by car as driver or passenger (%)	66.6	69.3	64.6

Source: ABS Quickstats, 2016

4.3 Infrastructure and Services

4.3.1 Housing

There are 183 occupied private dwellings in Maroota SSC, with a high occupancy rate of 91.5% equivalent to the NSW rate of 90.1%, and slightly lower than the occupancy rate across The Hills Shire (94.6%). There is little diversity in the housing stock, with the vast majority of dwellings being separate houses, accounting for 98.4% of total housing stock in Maroota compared to 82.4% in The Hills Shire and 66.4% across NSW.

As can be seen in **Figure 4.7**, the total number of buildings being approved for development has risen considerably from a total of 532 buildings in the 2008-09 financial year, to 2,510 in 2018-19. Developments peaked at 3,663 residential buildings in 2016-17. Notably, it appears that the proportion of new developments being approved that are houses has decreased, whilst the proportion of 'other' residential building approvals has gone up[3].

Reflecting the current and projected population growth across the region, several large-scale housing estates are being developed to accommodate the influx of people and businesses (realestate.com, 2018), particularly within the southern suburbs of the LGA. Housing developments are currently underway in the southern suburbs including Box Hill, Rouse Hill, Bella Vista/Kellyville, Baulkham Hills and Castle Hill (Domain, 2018). It should be noted that public transport is largely isolated to these southern suburbs of the LGA (see also, The Hills Shire Council, 2019).

However, there is additional proposed development in the more northern suburb of Cattai. The redevelopment of the Riverside Oaks Golf Resort will involve the development of 300 residential homes and a 150-room hotel, with internal road networks (Golf Industry Central, 2019; The Hills Shire Council, 2016). The Riverside Oaks Golf Resort project was amended in 2013 to include up to 300 homes and approved by the DPIE in May 2019. The development includes four residential areas with room to support future development.

[3] 'Other' residential buildings contain more than one dwelling unit within the same structure – for example - semi-detached, row or terrace houses; flats, units or apartments in blocks, or flats attached to houses or shops.

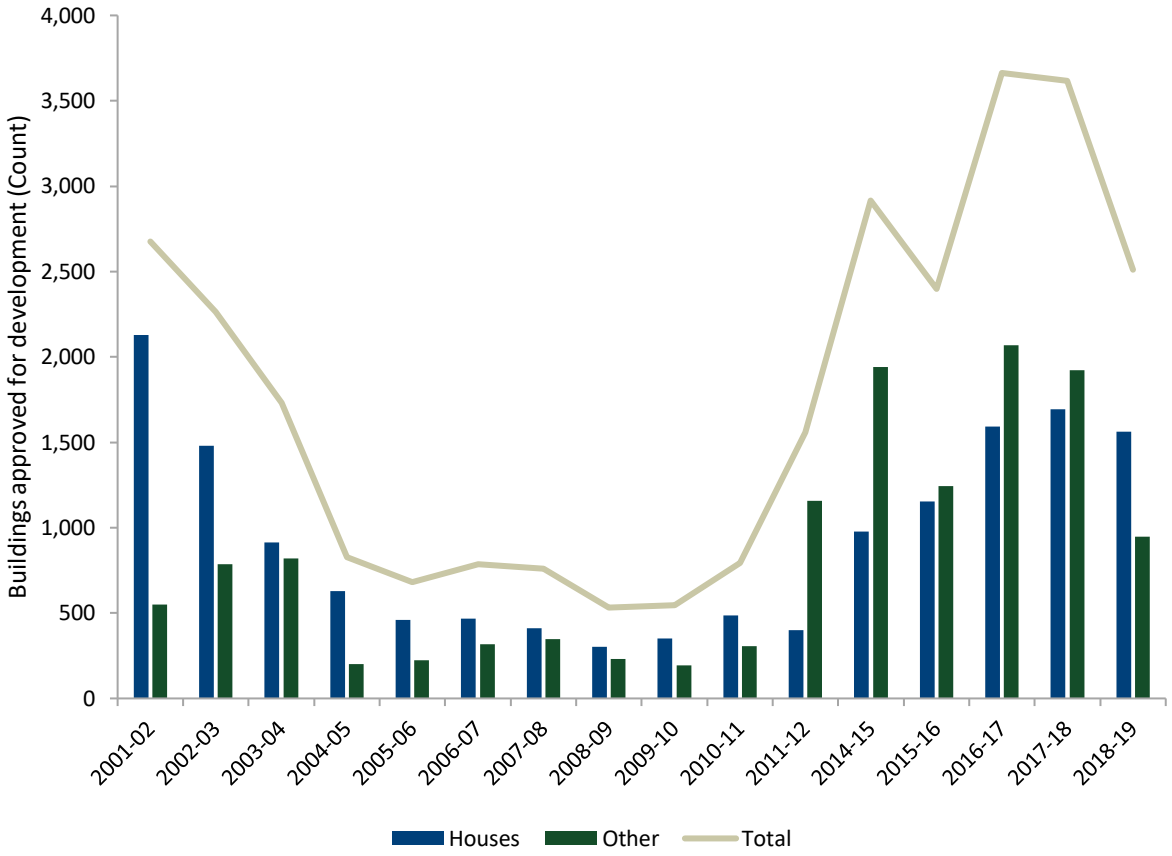

Figure 4.7 The Hills Shire Residential Building Approvals 2001 to 2019 (Financial Year)

In terms of infrastructure The Hills Shire Council's Strategic Plan outlines a need to ensure that the LGA is well equipped to accommodate expected growth (The Hills Shire Council, 2017). In June 2019, the Council released a draft housing strategy outlining Council's plans to house the large increase in population that is projected, from 162,500 in 2016 to 290,900 in 2036 (The Hills Shire Council, 2019). As such, the plan identifies the need to carefully manage the delivery and maintenance of housing and supporting infrastructure to facilitate this growth.

4.3.2 Transport and roads

Population growth in The Hills Shire, and Northwest Sydney more generally, is also being supported by transport infrastructure projects such as the Sydney Metro Northwest rail line and road upgrades.

On 26 May 2019, the $8.3 billion Sydney Metro – Northwest train line was officially opened, providing a turn up and go train service from Rouse Hill to Chatswood, with driverless trains running every four minutes (ANZIP, 2019; TransportNSW, 2019). The Metro line serves to open up the LGA to the Greater Sydney region and stops in The Hills Shire suburbs of Rouse Hill, Kellyville, Bella Vista, Baulkham Hills and Castle Hill, and the nearby suburb of Cherrybrook. As noted in **Section 4.2** above, these communities are currently experiencing record population growth, which in turn has led to the further development of public infrastructure to accommodate growing residential numbers. Further construction of the Metro line is currently underway, with eventual plans to terminate in the CBD (SMH, 2019). However, whilst there have been a number of State Government developments within the more densely populated southern suburbs of the LGA, including the completion of the M2 Upgrade in 2013 (RMS, 2018), the more regional northern suburbs are less well connected to the Greater Sydney area.

There are two major roads that run through the Maroota SSC. They are:

- Wisemans Ferry Road that runs south-west from the centre
- Old Northern Road that runs north-west to south-east.

Wisemans Ferry Rd connects Maroota to other towns and suburbs in The Hills Shire to the south-west whilst Old Northern Road is the only road connecting Maroota to towns and suburbs to the south, to the Hornsby LGA and Greater Sydney. Old Northern Road is used as a haul route by the various quarries in Maroota and other industries (such as agriculture). For the most part, this road is two-lanes (one in either direction) with occasional overtaking and/or turning lanes.

There have been no reports in local media over the past two years indicating negative sentiment regarding developments in Maroota. A single article published in the Hawkesbury Gazette in June 2017 indicated that residents of Pitt Town had previously held concerns over truck movements through the town centre, however these concerns appear to have been mollified by the construction of a bypass to redirect quarry transport outside the centre of the town (Hawkesbury Gazette, 2017, see **Appendix 1**). However, there has been no reported media with regards to community concerns relating to any of the Dixon Sand operations and their truck movements over the past two years.

4.3.3 Community services and facilities

There are limited community services and infrastructure within Maroota SSC, with one primary school and a service station located within the suburb boundaries. There are no General Practices, hospitals, high schools or other health and social services located in the SSC with these services located nearby throughout The Hills Shire LGA and the Hornsby Shire LGA.

4.4 Social profile summary

In summary, key characteristics of the Maroota SSC and The Hills Shire LGA are outlined below.

- The LGA comprises a diverse range of land uses, including suburban, rural residential, industrial/commercial and bushland. The area around Maroota is predominantly bushland and rural residential, while the more southern areas of the LGA are more suburban in nature.
- These land uses are also reflected in the key industries of employment in Maroota, namely vegetable growing, road freight transport, mineral sand mining and nursery production.
- Population projections suggest that the population will grow rapidly over the next two decades and also age, with the proportion of persons aged over 75 years expected to also increase over this timeframe. There are a number of housing developments and infrastructure upgrades in the LGA that will help support this growth.
- Compared with NSW, there are lower levels of cultural diversity within Maroota with lower proportions of the population born outside Australia and households who speak a language other than English at home.
- Compared with NSW, Maroota has a lower proportion of lone households and a higher proportion of family households (the majority of which are families with children).
- Maroota is seen to have a higher than average level of socio-economic advantage.

- Maroota has lower costs of living (rental prices) compared with NSW, however this is not consistent throughout the LGA, where the average rental costs are higher than NSW.
- Maroota and the LGA more broadly are considered more affluent with weekly household incomes above the State average.
- Maroota and the LGA have low housing diversity with the majority of housing stock comprising separate houses.
- For Maroota and the LGA, unemployment rates are below the State, while workforce participation rates are above the State average.
- Maroota has a high proportion of the population who work from home.
- Maroota has higher rates of persons requiring assistance with core household activities, and of persons who provide unpaid assistance to a person with a disability.
- Only a small percentage of households do not have a vehicle in Maroota and the LGA.

Table 4.8 summarises the findings of the social profile indicating the strengths and vulnerabilities of Maroota and The Hills Shire LGA.

Table 4.8 Summary of social profile

	Strengths	Vulnerabilities
Environment	Abundant and diverse natural resources, including mineral sand resources, agricultural lands and bushland	Potential land use conflicts Housing developments and industry impacting on environment
Community	Significant population growth Lower proportions of lone person households	Low levels of cultural diversity Limited community services and facilities in Maroota
Infrastructure	Metro-Northwest train line increasing connection of the LGA to the Sydney metropolitan area Road upgrades	Disparity in infrastructure between northern and southern suburbs Limited public transport in Maroota Housing developments concentrated in the southern suburbs
Economic	Lower costs of living Above State average household income	
Industry	Diverse economy Low unemployment	Industry dependent on natural resources (e.g. sand quarries, agriculture)

5.0 Perceived Issues and Opportunities of the Proposed Modification

This section considers the outcomes of engagement with proximal landholders and other key stakeholders relevant to the Proposed Modification with the intent of presenting a more complete description of community perceptions of the Proposed Modification from the perspectives of those involved, in a personal, community, social and cultural sense.

This phase of the SIA program therefore has two main objectives. To identify:

- Perceived issues/impacts and opportunities associated with the Proposed Modification; and
- Strategies for management of identified perceived impacts and enhancement of potential opportunities.

These objectives were achieved through engagement with key stakeholders, as outlined in **Section 2.0**.

Section 5.1 provides a summary of the outcomes of engagement undertaken with key agencies through the approvals process. **Section 5.2** provides a summary of the impacts and mitigation strategies raised by community members, through review of local media, Dixon Sand correspondences and analysis of consultation undertaken by Umwelt.

A key component of the SIA is the process of understanding, from a community perspective, community values and uses within the assessment area, and specifically the social impacts and opportunities associated with the Proposed Modification. These impacts are then further assessed to predict impacts in relation to the Proposed Modification that are considered significant and which may require mitigation or enhancement (refer to **Sections 6.0** and **7.0**).

5.1 Agency Consultation

As highlighted at **Table 2.2**, a range of government agencies have been contacted in regards to the application for Proposed Modification including:

- DPIE
- The Hills Shire Council
- Department of Industry – Lands and Water
- Department of Primary Industries
- Environment Protection Authority (EPA)
- DPIE Division of Resources and Geoscience
- WaterNSW
- Natural Resources Access Regulator
- Office of Environment and Heritage (OEH)

- OEH Heritage Division NSW
- Roads and Maritime Services (RMS)

During discussions in the early phases of the Proposed Modification, The Hills Shire Council identified concerns with regards to the potential increase in truck movements and felt that the increase warranted the Project being treated as more than a modification. Council also flagged concerns about the potential increase in VENM/ENM resulting in a change in site classification to a waste management facility. Legal advice was sought in relation to this latter point and it was deemed that current DA was appropriate for the Proposed Modification.

As per one of the key pillars of its Strategic Plan, *Valuing our Surroundings*, the Council also indicated that it seeks to manage the natural surroundings in an environmentally sustainable way suggesting that if there are any negative environmental impacts as a result of the Proposed Modification, the Council may seek assurances that these are effectively mitigated. The Council's Strategic Plan also calls for the management of all new developments to be in line with community needs. This aspect of their plan also draws attention to the effective management of waste.

State Government agencies that were engaged during the preliminary phase of the approval process for the Proposed Modification identified the need for the following aspects to be considered as part of the SEE.

- Biosecurity assessments and a response plan, due to the increased import of foreign soils (VENM/ENM) for remediation and reprocessing. Addressed in Sections 3.2.4, 4.2.3 and 7.10.4 of the SEE.
- Assessment of air quality, noise and water impacts as a result of the increase in production and changes to onsite processing, change to site boundaries and buffer zones, and increased traffic movement. Addressed in Sections 7.3 to 7.8 of the SEE.
- Resource assessment documenting the quality and size of the sand resource in the extended area and methods used to assess these resource qualities. Addressed in **Sections 3.2.2** and **4.3** of the SEE.

5.2 Residents and Landholders

Following the distribution of Community Information Sheet No. 1, Dixon Sand received responses from nine local residents regarding the Proposed Modification (Round 1). As noted in **Table 2.2**, Senior Dixon Sand staff and the Managing Director responded to community concerns directly via email and phone correspondence and conducted multiple face-to-face meetings on site. Additionally, seven of these residents participated in follow up interviews with a member of the Umwelt social team (Round 2). In order to maintain the anonymity of these seven respondents, data from Round 1 and Round 2 have been combined. Demographic information obtained during interviews generally indicates that respondents:

- owned their homes
- had lived in the area for a substantial amount of time (minimum 7 years, predominantly 30 years or longer)
- had significant family history in the area
- typically lived in four-person family households
- were of working age

- were not formally or actively associated with local community groups, but kept up to date on community news through resident group Facebook pages

- had varying levels of prior experience with Dixon Sand, with sentiment towards prior engagement ranging from neutral to positive.

Several of the responses received were in support of the Proposed Modification, while others raised concerns around impacts relating to traffic, noise, air quality and visual amenity. Typically, residents holding concerns around truck traffic and traffic noise were located on the haul route and opposed to neighbouring quarries and the Proposed Modification itself. Those residents living nearby to the Quarry who raised concerns around dust, noise, and visual impacts, tended to be more favourable towards the Project so long as they felt the impacts were properly managed and mitigated against.

Figure 5.1 presents the proportion of residents who mentioned each broad impact theme raised by during consultation. Impacts have been categorised broadly into comments and concerns related to transport and trucks, operations, community engagement, economic impacts, personal and property rights and environmental impacts. These areas of impact are broken down into specific impacts or sub issues in **Table 5.1** and are explored further in the sections below. Overall, comments highlighted the changing development context of The Hills Shire suburbs with residents expressing concerns around cumulative impacts of quarry operations with other industrial projects and residential developments.

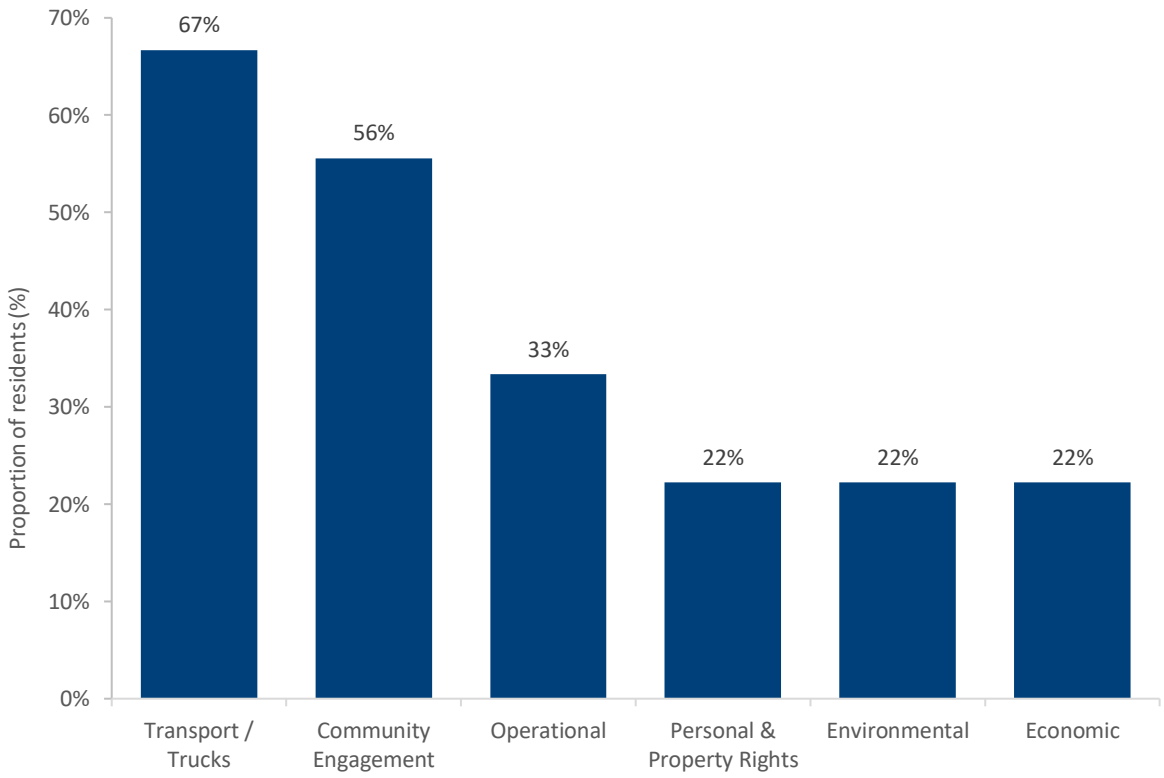

Figure 5.1 Perceived Community Impact Themes (n = 9 residents)

N = 53 mentions
Note: Multiple responses allowed; proportions based on total number of mentions of all categories within each theme

Table 5.1 Perceived Community Impacts

Theme	Impact / Concern	Proportion of issues (%)
Transport/Trucks	Health & Wellbeing - Truck start times	10%
	Safety	9%
	Road Suitability (Surface, corners, etc.)	9%
	Noise	7%
	Cumulative Impact - Truck noise	7%
	Cumulative Impact - traffic & Congestion	5%
	Regulation - Transport	5%
	Driver behaviour	5%
	Regulation - Pay-per-load	3%
Operational	Visual Amenity - stockpiling	5%
	Social Amenity - dust	5%
	Social Amenity - noise	5%
	Health & Wellbeing - dust	3%
	Visual Amenity - extension into buffer zone	2%
Community Engagement	Positive - community engagement	5%
	Negative - community engagement	3%
Personal & Property Rights	Property Value/Property Impacts	4%
Environmental	Fauna - roadkill	2%
	Weed control – positive	2%
Economic	Negative - livelihood	2%
	Positive - employment	2%

5.2.1 Transport/Trucks

As can be seen in **Figure 5.1**, traffic impacts from quarry transport were the most frequently raised concerns (n=6 residents). Residents living along the haul route raised concerns around increased truck movements resulting in increased noise from trucks impacting on social amenity and health and well-being (sleep quality). In addition, concerns were raised that increased truck movements could lead to increases in traffic congestion and a subsequent increase in the risk of traffic-related road incidents.

5.2.1.1 Safety

Resident concerns around safety (n=6 residents) referred to the road surface, geometry and speed limit, as well as to both general road user and truck operator driving practices with the prevailing sentiment being that while the majority of drivers operated responsibly, noise and safety issues may be exacerbated as a result of an increase in trucks on the road due to the Proposed Modification.

> *There are no overtaking lanes on Wisemans Ferry Road and only a one-way overtaking lane from Maroota to Dural. There are very few safe spots to overtake. The increase in the number of trucks on these roads is going to be a safety issue with vehicles overtaking dangerously.*

Wisemans Ferry Road and Old Northern Road are rural roads, and there are sections with no verge, and sections where the pavement conditions are unsatisfactory.

Many vehicles [trucks] *drive recklessly on a daily basis, including, but not limited to, speeding, crossing centre lines, driving outside of marked lanes and using vast amounts of road shoulder (mostly as a by-product of unsafe speed around bends), and tailgating.*

As noted above, the cumulative impact of other developments was also raised, not only for other industrial developments but also large-scale housing developments further south along the transport route.

Riverside Oaks Housing is a current development, so you have cars going out of there too – there is a lot of sub division going out here, which means more cars. There are a lot of families moving to the area, it's not the quiet rural road it used to be.

The inadequacy of current speed limits, and a perception that truck drivers were exceeding them was a dominant theme.

We are on a corner. Horse floats are regularly exiting our driveway, my daughters are now driving age… sometimes the trucks coming around have to slam on the brakes to slow down. Even when they are going 80km/h a loaded truck is going to take a long time to slow down. Even 80km/h is too fast.

5.2.1.2 Social Amenity (Noise)

For most of the residents who raised concerns related to social amenity, the impact of truck noise on their amenity was a primary source of concern (n=3). While Dixon Sand's considerable existing efforts to minimise the impact of transport on the community were recognised, some residents felt that the cumulative impact would nonetheless have a significant impact on community wellbeing and social amenity. The time at which trucks begin travelling to the Quarry in the morning was a central issue for many residents.

I am not against development or change but the increased noise from the trucks is really starting to take its toll on not only me but many others I have spoken to in the area. Unfortunately for your company, we the public, don't know whose trucks they are at 4.30am in the morning so when I see a proposal to have even more trucks added into this you can surely understand my apprehension.

These residents felt that truck drivers were not adhering to noise standards and were operating engine braking in suburban and rural residential areas in the early hours of the morning and throughout the day.

It is a regular occurrence for trucks using your (and others) quarries to attend site as early as 4:30am. These trucks may not be gaining admittance to the Quarry but they are traversing the roads at unnecessary times with the view toward being ready in line for loading.

Residents complained of impacts to health and well-being through sleep disturbance and loss of social amenity as a result of the cumulative impact of trucks in the area.

Combined with the completely unnecessary action by some drivers using their Jake brakes… at this early hour [as early as 4am]*, the sleep of residents in the vicinity of Wisemans Ferry Road is severely impacted on an almost daily (nightly when considering the early hour) basis and MUST be brought to a stop.*

Furthermore, one resident felt that changes to approved truck movements at the Dixon Sand Haerses Road Quarry may trigger similar increases at the surrounding quarries, further exacerbating cumulative impacts.

I think as residents of the area we already accept our fair share of noise from trucks and I don't think it's right that we should be expected to put up with even more. If Dixon Sand is allowed these changes then who's to say that the other nine major operators in the area won't also request more truck movements.

Whilst the concern around traffic noise was raised in both the initial consultation and the follow up interviews conducted by Umwelt, the consensus amongst community members was that the efforts of Dixon Sand had led to a noticeable improvement in noise from the trucks (see **Section 5.2.3**).

5.2.1.3 Community identified mitigation strategies – transport and trucks

Residents raised a number of possible mitigation strategies to address perceived traffic impacts. Suggested strategies relating to transport, trucks, safety and social amenity (noise) in particular include:

- Reducing the speed limit along Wisemans Ferry Road
- Random monitoring of trucks along haul route (personnel stationed on roadside)
- Further restrictions on start times
- Construction of acoustic bunds at strategic locations along the route
- Cameras/monitoring of trucks arriving early at the Quarry

In its correspondence with residents, Dixon Sand has highlighted the existing arrangements to encourage good driver behaviour and discourage use of compression braking, including:

- A 'three strikes out' policy on bad behaviour, enforced through a community complaint driven Traffic Management Policy, of which two other quarries in the Maroota area are also signatories
- Reminders of driver responsibilities under the code of conduct in cases of community complaints that identify a specific truck (first two strikes)
- Training inductions for drivers on the Traffic Management Policy
- Current efforts to lobby the RMS for a decrease in the speed limit along Wisemans Ferry Road.

5.2.2 Operational

A few of the residents neighbouring the Quarry raised concerns around the impacts of the Proposed Modification in terms of operational noise, dust and visual amenity (n=3 residents). This is distinct from those changes to social amenity related specifically to trucks and traffic.

5.2.2.1 Social Amenity (Noise)

Some nearby residents (n= 3) raised concerns with operational noise and changes to the bund walls and buffer zones, with one household querying how Dixon Sand would monitor compliance with relevant noise standards.

You have noted that all processing of sand will take place at the back of the Hearses Road site. Will your application outline how noise levels will be monitored in relation to our property? We currently have peaceful ambience so we would like to work as best as we can with you to maintain this for our family.

A Few noted that whilst current noise impacts from the Quarry were low, they were apprehensive of how noise levels could change if the Quarry operations were to move closer to their properties.

> *If it comes closer to the property, the noise will increase. I can already hear it from the bottom of the driveway.*

5.2.2.2 Social Amenity (Dust and air quality)

Residents also raised concerns about dust and air quality impacts from the Quarry operations (n= 3). One resident living near the Quarry raised the issue of dust with Dixon Sand, querying how they planned to manage and mitigate the impacts of dust from site operations.

> *We would like to know what measures you plan to take to control dust during operation and when operation has ceased after hours or on the weekend. We have a young family and we spend much of our weekends and afternoons outside so this factor is also very important to us.*

When informed of current mitigation practices, the resident further queried these management strategies with reference to other local quarry operations and requested that rehabilitation of the site be made a priority.

Minimising land that is open – I know they said that they are required to fill the areas they are no longer using, but when you look at the other mines in the area they have huge patches of ground that are open, and they aren't even working in them – so we would like to see them make that [progressive rehabilitation] a focus.

5.2.2.3 Social Amenity (Visual)

Similarly, concerns were raised about the visual impacts of the Proposed Modification with nearby residents raising concerns around the visual impacts of stockpiling (n=3) and changes to bund walls and buffer zones (n= 1) as part of the Proposed Modification.

> *We are concerned that shortening buffer zones and moving bund walls and extraction areas closer to our house could result in no views from our home and/or a view that doesn't fit with the current natural surroundings.*

> *Other mines in the area – stockpiles are quite high; we don't want to see it. I don't know what the regulations are, but we want our view to be as natural as possible*.

One respondent was particularly concerned about the distance of the Proposed Modification to their residence.

5.2.2.4 Community identified mitigation strategies – Operational

During discussions, residents have identified a range of mitigation and management measures to minimise the impact of the operations on their amenity.

In terms of operational noise, residents indicated they would like to be kept informed with regards to final acoustic bund designs, monitoring and modelling of noise impacts.

In response to the identified concern regarding dust and air quality mitigation, Dixon Sand highlighted their existing dust management strategies which include:

- progressive site rehabilitation to minimise dust from exposed open areas

- 24-hour monitoring of dust levels

- the use of contingency plans such as water carts and sprinklers in the event that the monitors identify a risk of dust level exceedance.

With regards to possible impacts on visual amenity, one resident expressed a need to maintain a natural view and minimise the length of time bunds would be in place to the greatest extent possible.

They also expressed a need for bunds to adhere to appropriate legislated setback requirements.

During subsequent discussions with relevant residents, Dixon Sand has confirmed that bunds will adhere to Council requirements and relevant planning legislation and that noise modelling of potential noise impacts would be conducted as part of the broader Environmental Assessment (addressed further at **Section 6.1.3** below and **Section 7.4** of the SEE). It was also confirmed that processing activities at the Quarry would be restricted to the southern Processing and Stockpiling Area.

5.2.3 Community Engagement

In general, community sentiment towards Dixon Sand's community engagement and integration was largely positive (n=3 mentions). One resident, who was particularly supportive, felt that Dixon Sand had earned their social license to operate through the integration of Dixon Sand personnel within the community at a social level.

> *I support those who support the community… David is very vocal in the community in a positive manner. That isn't common, so I want to show my support and give back to them in whatever way I can. If I can help the project go ahead, I will.*

Overall, residents acknowledged the efforts made by Dixon Sand to respond to community concerns. This was partially raised in regard to attempts made by Dixon Sand to encourage good behaviour from drivers visiting the Quarry.

> *Further to my email below, I note a marked improvement overall in driver behaviour over the past few days. I can only presume there was a toolbox talk held as per your comments of same so please pass on our thanks to the Quarry managers.*

> *No issues, as I always contact Dave if we have problems – he is good, he understands that we get the brunt of it. There was an issue with noisy trucks but not anymore – that has been fixed.*

However, some consulted residents also felt that the measures currently in place were insufficient to curb driver behaviour once trucks left the immediate surroundings of the Quarry (n=2).

> [I contacted Dixon Sand] *2 years ago about the trucks and their driving style. It was not really resolved, they said there wasn't much they could do about it at the time*.

Some residents living outside of Maroota also noted that those community members living along the haul route were not engaged with adequately.

5.2.3.1 Community identified mitigation strategies – Community Engagement

Suggestions and recommendations for Dixon Sand to improve upon their existing engagement activities provided during discussions included a broadening the definition of potentially impacted stakeholders, for example:

Expand their view of who is impacted – I think they should be including everyone between the Quarry and Windsor Road.

Other suggestions requested that in the future Dixon Sand hold community forums to work through community concerns and communicate outcomes of complaint management and environmental monitoring outcomes. It was also suggested that CCC meetings should be held quarterly (as opposed to only twice a year) and provide a summary of goals set and outcomes at each meeting, to be distributed to the community.

In response to the above suggestions, Dixon Sand has further communicated current measures taken to keep the community informed. These include:

- Six-monthly independently chaired CCC meetings including representatives from The Hills Shire Council, Maroota Public School, stakeholder groups and the community
- Provision of CCC minutes and Annual Environmental Management Reports (environmental monitoring reporting) on the Dixon Sand website
- A dedicated environment officer and contact details available on the website for community queries and complaints.

5.2.4 Economic

5.2.4.1 Employment

One resident identified employment as a positive impact resulting from Proposed Modification, noting that they had family members already employed by Dixon Sand.

5.2.4.2 Personal and Property Rights

Two residents raised concerns relating to the negative impact of the Proposed Modification on their personal and property rights, with one resident specifically noting a concern that the Proposed Modification would have a potential negative economic impact due to noise levels affecting their horse breeding business located near to the transport route.

Two residents also felt that increased impacts could lead to a decrease in property values.

No one wants to live somewhere with that much noise.

Given that these impacts related almost exclusively to noise, mitigation strategy suggestions were aligned with those described in **Section 5.2.1.2** and **Section 5.2.2.1.**

5.2.5 Environment

One resident felt there was a wildlife 'kill zone' along Cattai Road. It was felt that the impact was not only environmental due to the loss of native fauna, but also related to safety concerns and social amenity due to the increase in roadkill leading to increased potential for traffic accidents and also being visually unappealing.

Cattai Creek Road there are kangaroos getting hit… Going through there on the way to school, sometimes the carnage you see - there are animal parts lying everywhere. They [kangaroos] aren't small either, so it's a safety concern.

Another resident identified a positive environmental impact, indicating that as part of the local environmental group they had an ongoing collaborative relationship with Dixon Sand in the management of weeds. The resident felt that Dixon Sand were responsive and diligent in managing the potential impact of Crofton Weed entering the waterways as a result of the ground disturbance associated with the Quarry.

5.2.5.1 Community identified mitigation strategies – Environment

In response to the above identified concern regarding Project impacts on native fauna, it was suggested by the concerned resident that a solution for wildlife deaths may be the installation of a fence at strategic locations along the route. In regard to weed control, the need to continue diligent monitoring of Crofton Weed around waterways was highlighted.

6.0 Assessment and Prediction of Social Impacts

This section provides an assessment of the perceived and predicted social impacts that may occur as a result of the Proposed Modification. The Proposed Modification impacts are assessed with reference to the analysis and assessment of similar projects of this size and magnitude; and contextualised through an overview of the potential issues affecting social amenity that are expected as a result of the Proposed Modification from a technical and perceived perspective.

The SIA has utilised data from a range of sources, in order to develop a layered picture of the potential social impacts arising from the Proposed Modification. These include the analysis of secondary data sources, assessment of projects of similar scale and magnitude, and stakeholder engagement (summarised in **Table 6.13**).

As mentioned in **Section 2.3**, of the stakeholders issued the Community Information Sheet, nine stakeholders actively engaged with Dixon Sand and Umwelt to offer objection or put forward their perceived positive or negative impacts as a result of the Proposed Modification.

Relevant social impact characteristics that have been considered include:

- **Extent** – geographical area affected by the impact (or the proportion of people or population groups affected)
- **Duration** – the timeframe over which the impact occurs
- **Severity** – scale or degree of change from the existing condition as a result of an impact
- **Stakeholder perceived risk ranking** - the importance placed or level of concern that those potentially affected feel about the social matter
- **Sensitivity** – Susceptibility or vulnerability of people, receivers or receiving environments to adverse changes caused by the impact, including value or importance to the community.

The assessment is undertaken using a risk based consequence and likelihood framework i.e. assessing the consequence of a given social impact factor (e.g. catastrophic, major, negligible) against the likelihood that it will occur (e.g. almost certain, likely, possible), in order to determine the overall risk assessment of the social impact as 'low', 'moderate' or 'high' (refer to **Table 6.1** and **Table 6.2**). Both positive and negative impacts are considered in this regard, with slight adjustments made to the approach to reflect positive impacts e.g. level of concern becomes level of interest, severity become scale of improvement or benefit, sensitivity becomes importance of the improvement or benefit and the equity of its distribution etc.

Section 6.1 outlines the assessment of social impacts of the Proposed Modification relating to key social impact themes, with these impacts and their relevant social risk rating summarised at **Table 6.13**.

Table 6.1 Social Risk Matrix

		Consequence Level				
		1	2	3	4	5
		Minimal	Minor	Moderate	Major	Catastrophic
Likelihood category	A. Almost certain	HIGH	HIGH	EXTREME	EXTREME	EXTREME
	B. Likely	MODERATE	HIGH	HIGH	EXTREME	EXTREME
	C. Possible	LOW	MODERATE	HIGH	EXTREME	EXTREME
	D. Unlikely	LOW	LOW	MODERATE	HIGH	HIGH
	E. Rare	LOW	LOW	MODERATE	HIGH	HIGH

Source: SIA Guidelines (DPE, 2017)

Table 6.2 Social Likelihood Definitions

Likelihood Category	Definition
Almost certain	Common repeating occurrence, ongoing Will occur in most circumstances
Likely	Will probably occur in most circumstances There is at least a 50% chance that it may happen
Possible	Might occur at some time Could occur but not often 5% chance it could happen
Unlikely	Unusual occurrence Unexpected
Rare	May occur only in exceptional circumstances Unheard of in the industry

6.1 Impacts on social amenity

Social amenity impacts are those that relate primarily to the change in land use within the immediate locality, increase of trucks and subsequent impacts of dust, noise, traffic and land management. The Proposed Modification proposes to increase the number of truck movements per day and increase production levels which may have a number of flow-on impacts to the existing social amenity. These are addressed in the sections below.

6.1.1 Traffic

A number of perceived issues were identified by stakeholders that related to traffic and road safety, with the most common concern relating to the Proposed Modification increase in truck movements. The speed of trucks, along the transport route, and subsequent impacts on public safety were also raised.

Discussions with landholders on the haul route indicated that some residents held concerns around traffic safety related impacts on amenity as a result of increased truck movements. Concerns related to road surface and suitability, start time, driving practices of truck drivers, speeding and speed limits and cumulative impacts of this and other developments on congestion and other traffic impacts. The social impacts can be summarised into concerns around safety in relation to road wear, driving practices, speeding and roadkill; and social amenity in regard to start time and the cumulative impacts of other heavy vehicle road use.

Given that impacts of traffic on social amenity was one of the key concerns raised during engagement, the perceived impact has been rated as *high*.

As part of the SEE, a technical assessment of the impact of the Proposed Modification on traffic on the road network was undertaken. The assessment indicated that on those days on which the maximum number of truck movements (180) are generated, the Proposed Modification could see typical daily flows on Wisemans Ferry Road and Old Northern Road (south of Wisemans Ferry Road) increase by 62 movements (an increase of 2.7% over the existing average daily traffic flows). As such, the predicted traffic levels would remain well within the capacity of both roads.

Regarding both congestion and traffic safety, the traffic assessment found that the performance of the intersections used by quarry traffic are not predicted to change. Notably, Dixon Sand will be upgrading the intersection of Wisemans Ferry Road and Haerses Road to provide an extended channelised right turn lane. RMS have confirmed this upgrade as providing improved safety and reduced potential for rear-end and overtaking crashes.

In addition, there are a range of measures currently in place that will ensure maintenance of road condition. The Hills Shire Council's strategic plan's key focus area is ensuring infrastructure strategies are in place to accommodate the increases in population and increasing impact on road infrastructure (refer to **Section 4.3**). Accordingly, Dixon Sand may need to advise the Council of any impacts on surrounding road infrastructure so effective planning and maintenance may be undertaken to manage any road condition impacts relating to the increase in heavy vehicle movements as part of the Proposed Modification.

Infrastructure improvements will also be facilitated by Dixon Sand's contributions to social infrastructure maintenance under 'Section 94 Contribution' of Council's development control plan, which requires that quarries pay $1 for every tonne of material sold. Currently, Dixon Sand has contributed $2.2 million under Section 94 contribution over a four year period from FY2014 to FY2018, and given that an increase in production would lead to a greater contribution towards Council infrastructure maintenance, the Proposed Modification would provide Council with increased capital to maintain public roads in the LGA.

Further to the above, Dixon Sand is one of three quarries operating in the Maroota Sand Resource area who have signed the Maroota Local Traffic Management Policy, which regulates transport operations on local roads to minimise noise, dust and safety-related impacts. The Policy states that all trucks entering and leaving the signatory quarries' sites must comply with speed limits, cover all loads and not use engine/exhaust brakes near the Quarry sites.

The Quarry operators encourage local residents to notify them of any violations and where a specific truck/driver can be identified, the driver is cautioned. The employing transport company is also reminded of their obligations under the agreement. The Policy operates on a three strikes policy, after which the offending truck/driver is barred from picking up at the Quarry. Continuous violations of the agreement have led to the banning of all trucks from some transport operators. Dixon Sand is currently reviewing this Policy to improve effectiveness and will continue to promote and actively implement measures to encourage safe and respectful driving practices.

Based on the above factors and the mitigation strategies that have already been put in place, impacts on safety associated with the increase to truck movements as part of the Proposed Modification are categorised as *unlikely* to occur but of *moderate* consequence, resulting in a *moderate* negative impact (refer to **Table 6.3**).

In addition, due to high community concerns relating to traffic and safety, it is recommended that Dixon Sand implement strategies to encourage their drivers and contractors to adhere to safe driving practices (refer to **Section 7.0**).

Table 6.3 Summary - Traffic impacts

Impact theme	Project aspect	Social impact	Affected Parties	Duration	Perceived Stakeholder Ranking	Social Impact Ranking - mitigated
Social amenity – traffic	Increased truck movements	Surroundings – impact on public safety	Road users Pedestrians Local residents Haul route residents	Long term	High	Moderate

6.1.2 Noise – traffic

Under the Proposed Modification, the maximum number of heavy vehicle movements between 6.00am and 7.00am (M-S) would remain at 20 (as currently approved). In addition, there are no changes to the times trucks will be accessing the Quarry in the morning.

Given that the issues raised around the impacts of truck noise on amenity was largely related to trucks arriving in the early hours of the morning (typically around 4.00-4:30am), the Proposed Modification is unlikely to exacerbate existing noise impacts on sleep quality. However, community participants identified that this was a cumulative impact that they were already experiencing due to the number of quarry operations in the area.

Consequently, the perceived stakeholder risk relating to impacts of truck noise on social amenity has been rated as *high*.

In terms of overall noise associated with the proposed increase to truck movements, an assessment of road traffic noise predicts an increase of 1 dB(A) at the closest residential receivers with the noise level remaining below the road traffic noise criteria.

Noise modelling has been undertaken to compare the likely noise levels received at residences surrounding the Quarry as a result of the Proposed Modification, principally associated with the extension of the extraction area to the north, use of additional equipment to support the increased production rate and increased truck movements.

As noted above, Dixon Sand is committed to curbing excess traffic noise through the Maroota Local Traffic Management Policy.

Consequently, impacts from trucks on residences from a technical perspective while *likely* to occur is expected to be of *minimal* consequence and is therefore ranked as a *moderate* impact (refer to **Table 6.4**).

However, due to high community concerns relating to traffic noise, it is recommended that Dixon Sand undertake targeted ongoing engagement with those residents and landholders proximal to the Quarry and haul route to monitor noise and traffic impacts and how these are being experienced (refer to **Section 7.0**).

Table 6.4 Summary – Truck noise impacts

Impact theme	Project aspect	Social impact	Affected Parties	Duration	Perceived Stakeholder Ranking	Social Impact Ranking - mitigated
Social amenity – noise	Truck noise	Health and well-being Way of life – how people live and interact with one another on a daily basis	Local residents Haul route residents	Long term	High	Moderate

6.1.3 Noise – operational

Concerns relating to operational noise focused on the placement and distance of the noise bunds, as well as how these impacts would be measured and monitored into the future. Perceived community concern relating to the impact of operational noise on social amenity and health and wellbeing is ranked as *moderate*.

As mentioned above, the technical assessment involved noise monitoring to establish background noise levels for receivers surrounding the Quarry, and subsequent noise modelling to compare the likely noise levels received at residences surrounding the Quarry as a result of the Proposed Modification and for the life of the Quarry (i.e. for all operations, not just the modification).

According to the technical noise report, the modelling identified that with the implementation of the existing noise management and mitigation measures (including establishment of noise bunds at select locations around the perimeter of the extraction area) and operation of extraction activities behind a 6 to 7 m advancing face the Project Noise Trigger Levels (PNTLs) could be exceeded at some receivers as operations proceeded further to the north (into Stages 4 and 5 of the tertiary sand extraction area).

Dixon Sand subsequently have provided for additional mitigation of the primary noise source generating these predicted exceedances, i.e. a reduction in the sound power level of the 40t dump trucks by six decibels through application of noise reduction technology.

Subsequent noise modelling demonstrated that with the implementation of the additional noise mitigation measures, predicted noise levels would be reduced to compliant levels at all but one receiver. Dixon Sand has negotiated a noise agreement with the landowner of this receiver, whose residence is located opposite the Quarry Entrance and is therefore subject to noise generated by the movement of road registered trucks onto and off the Quarry Site.

In addition to general operational impacts, noise levels during the 6am to 7am period have also been modelled and compared against PNTLs derived from the noise monitoring for this shoulder period. Noting that the Proposed Modification does not propose any change to currently approved operations during this period, the modelling demonstrates compliance with these derived PNTLs can be achieved at all receivers accept R02.

Notwithstanding the predicted compliance with PNTLs, Dixon Sand will continue to implement proactive noise management measures to ensure compliance with PTNLs at surrounding receivers.

On the basis that a noise agreement has been reached with the owner of R02 and given their low level of concern in relation to noise and the Project in general, the effect of the Proposed Modification on local noise levels are expected to be *possible* but of *minimal* consequence, resulting in a *low* impact (refer to **Table 6.5**). For the receiver where these *minor* and mitigated exceedances are anticipated the mitigated social impact is assessed as *possible* but with *minimal* consequences, resulting in a *low* impact.

Table 6.5 Summary – Operational noise impacts

Impact theme	Project aspect	Social impact	Affected Parties	Duration	Perceived Stakeholder Ranking	Social Impact Ranking - mitigated
Social amenity – noise	Operational noise	Health and well-being Way of life – how people live and interact with one another on a daily basis	Local residents Haul route residents	Long term	Moderate	Low

6.1.4 Visual

Residents in proximity to the operation raised concerns relating to the impact on visual amenity and were particularly concerned that the Proposed Modification may lead to visual impacts due to stockpiling activities and extension of the existing operation into the buffer zone, hence changing the existing natural views from their property. In light of identified concerns, the impact of the Proposed Modification is considered a *high* perceived risk from a stakeholder perspective.

With the proposed extension of the extraction area, quarry activities will be undertaken in closer proximity to properties and residences to the North (on both sides of Wisemans Ferry Road). In accordance with current management practices, the proponent intends to establish an earth bund, which would be vegetated with grass and shrub species to screen views of the extraction area and attenuate noise. This strategy aligns with resident requests around minimising visual impacts and is considered sufficient to minimise the potential impacts (see **Section 5.2.2.1**).

Consequently, considering the mitigation strategies outlined above, it is *possible* the Proposed Modification will cause visual impacts for proximal landholders, but would be a *minimal* consequence resulting in a *low* impact on the community (refer to **Table 6.6**).

Table 6.6 Summary – Visual impacts

Impact theme	Project aspect	Social impact	Affected Parties	Duration	Perceived Stakeholder Ranking	Social Impact Ranking - mitigated
Social amenity – visual	Change to visual amenity/ landscape	Surroundings – the environment's aesthetic value	Local residents	Long term	High	Low

6.1.5 Dust

Residents close to the Quarry identified air quality impacts on amenity due to dust in relation to the Proposed Modification. Given the number of concerns raised, the impact of dust on amenity is considered as a *moderate* perceived risk by consulted residents.

Air quality monitoring undertaken at locations surrounding the Quarry has demonstrated compliance with the relevant airborne particulate matter and deposited dust criteria. Dispersion modelling of the Proposed Modified operations has been undertaken and predicts ongoing compliance with both airborne particulate matter and deposited dust criteria.

It is noted that the concentration of particulate matter in the air will vary daily due to operational, meteorological and background environmental factors. Dixon Sand will continue to monitor operations daily and implement additional dust suppression or modified operations to reduce dust emissions as far as practically possible.

When considering existing and proposed mitigation measures, this mitigated social risk rating has been classified as *possible* but of *minimal* consequence and is therefore classified as *low* (refer to **Table 6.7**).

Table 6.7 Summary – Dust impacts

Impact theme	Project aspect	Social impact	Affected Parties	Duration	Perceived Stakeholder Ranking	Social Impact Ranking - mitigated
Social amenity – air quality / dust	Impact of operations on air quality – in particular dust emissions	Surroundings – access to and use of the natural and built environment, and its amenity Health and wellbeing – including physical and mental health	Local residents	Long term	Moderate	Low

6.1.6 Biodiversity

One resident raised concerns relating to impacts on wildlife, namely concerns that the increased number of trucks may lead to a greater number of wildlife killed on the road. Another indicated the presence of Crofton Weed on the site as a subject of ongoing management but was satisfied with current strategies. Therefore, perceived stakeholder impact has been ranked as *low*.

The proposed extension to the extraction area occurs over an established olive plantation with exotic pasture dominating the ground layer. It has been determined by the biodiversity assessment that the Proposed Modification is unlikely to have a significant impact on any threatened species, threatened populations or endangered ecological communities. The light spill and noise from the Proposed Modification does have the ability to disturb the roosting and foraging behaviour of fauna species, however the biodiversity study concludes that the mitigation measures put in place (including noise bunds, rehabilitation, etc.) will minimise the impact on biodiversity in the area.

Therefore, the impacts to biodiversity as a result of the Proposed Modification are considered *possible* but of a *minimal* consequence resulting in a *low* impact on potentially affected stakeholders (refer to **Table 6.8**).

Table 6.8 Summary – Biodiversity impacts

Impact theme	Project aspect	Social impact	Affected Parties	Duration	Perceived Stakeholder Ranking	Social Impact Ranking - mitigated
Natural environment – biodiversity	Increased truck movements impacting on wildlife, ground disturbance leading to proliferation of weeds	Surroundings – impact on public safety, access to and use of the natural and built environment, and its amenity	Road users Pedestrians Local residents Haul route residents	Long term	Low	Low

6.1.7 Water

A range of other environmental aspects are considered within the broader SEE. These include potential impacts to surface and groundwater.

Impacts to surface and groundwater were not raised by stakeholders during consultation and are consequently ranked as *low* perceived impact from a stakeholder perspective.

The surface water technical assessment assessed the Proposed Modification as having a negligible impact on the Quarry Water Management System (WMS) with the proposed extension to the extraction area contained within the existing WMS catchment. The maximum sand washing rate will not be increased and therefore, the maximum future water demands are expected to be comparable to the existing approved operation.

Water balance modelling indicates that the potential for discharges from the Quarry WMS is expected to be consistent with the existing approved operation and therefore downstream water quality impacts will be consistent with the existing approved operation.

The proposed extension to the extraction area, which occurs within the catchment of the Maroota Tertiary Sands Groundwater Source, will remain two metres above the wet weather groundwater level of this aquifer. As such, no dewatering or other impacts on local groundwater are expected as a result of the Proposed Modification.

Therefore, the mitigated impacts of the Proposed Modification on surface and groundwater is assessed as *unlikely* and of *minor* consequence, and is therefore ranked as *low* social impact (refer to **Table 6.9**).

Table 6.9 Summary – Water impacts

Impact theme	Project aspect	Social impact	Affected Parties	Duration	Perceived Stakeholder Ranking	Social Impact Ranking - mitigated
Natural environment – water	Impact on surface and groundwater due to proposed expansion of the extraction area	Surroundings – impact on public safety, access to and use of the natural and built environment, and its amenity	Local residents Regional residents	Long term	Low	Low

6.2 Decision making and engagement

Some residents raised concerns relating to Dixon Sand's existing community engagement, with some respondents suggesting that information about the Proposed Modification needed to be circulated more widely. Therefore, perceived stakeholder impact with regards to decision making and engagement is ranked as *moderate*.

As mentioned in **Sections 2.2** and **2.5** the two Community Information Sheets were distributed to 75 households in proximity to the Quarry and along the haul routes and side roads, and contained an invitation to be involved in consultation. The first Community Information Sheet was tabled and discussed at a CCC meeting in May 2019 and was followed up with a general Q&A flyer which was distributed to CCC representatives and published on the Dixon Sand website. CCC representatives were also encourages to distribute the information in the Community Information Sheet and Q&A to the wider community. Dixon Sand senior staff actively engaged the community, CCC representatives, community groups and neighbours through providing information about the proposal and through responding to community concerns which involved email and phone discussions and face to face meetings with community members including residents in close proximity to the site. The second flyer was distributed to the CCC in September and will be discussed further at the next CCC meeting scheduled for November 2019 along with progress of Mod 3.

To further mitigate against community concern it is recommended that Dixon Sand continue to engage more widely with the Maroota community and the communities along the haul route to provide regular updates on the Quarry operations (refer to **Section 7.0**).

Considering the above, impacts on decision making and engagement are considered to be *unlikely*, but of *minor* consequence and are therefore ranked as *low* (refer to **Table 6.10**).

Table 6.10 Summary – Decision making and engagement impacts

Impact theme	Project aspect	Social impact	Affected Parties	Duration	Perceived Stakeholder Ranking	Social Impact Ranking - mitigated
People – decision making and engagement	Information provision and community engagement	Decision-making systems	Local residents Haul route residents	Long term	Moderate	Low

6.3 Economic

Economic impacts relating to the Proposed Modification were raised by a number of stakeholders but largely related to the opportunities that may be created by local contribution and investment by Dixon Sand. Perceived stakeholder impact has been ranked as *low.*

The Proposed Modification is likely to result in a number of positive economic impacts to the locality and the region through its small increase in workforce and the continued contribution of the operation to the local and regional economies through employment, capital expenditure and social investment (i.e. funding for community groups, programs and/or infrastructure).

As outlined in **Section 4.2.7**, Maroota currently has a low rate of unemployment compared to the NSW average, a higher median weekly income and a lower median weekly rent/ mortgage repayment, suggesting that the suburb is relatively resilient to negative economic impacts with any such impact having minimal consequence.

The Hills Shire Council's strategic plan indicates a desire to promote and support new business and local employment opportunities. Under the umbrella of Shaping Growth, the Council also indicates it wishes to manage the natural and built environment through strategic land use and urban planning.

The Proposed Modification is expected to generate up to eight additional full-time positions, on top of the additional peak of eight persons under current approved operations (up to 14 additional full-time positions over the two Modifications) and is therefore in line with the above stated Council principles.

As the Proposed Modification would potentially result in an additional eight full time employment opportunities, it is considered that the Proposed Modification will have the *likely* impact of job creation with a *minimal* positive consequence for the local area resulting in a *moderate* positive impact (refer to **Table 6.11**).

A small number of stakeholders also expressed concerns with regards to the possible negative impacts of the Proposed Modification on house and property values and current uses of neighbouring land for business purposes.

Residents were concerned about the impact of noise on these and current land uses. As discussed in **Section 4.2.5**, house prices in The Hills Shire have increased in the past decade and land values are well above the NSW average. In addition, as discussed in **Sections 6.2.2** and **6.2.3** the Project is unlikely to result in a significant noise increase.

Considering the above, and the historical presence of the operation in the community, the Proposed Modification is considered unlikely to result in a decrease in property prices. Consequently, negative impacts to property prices are seen as *unlikely* with a *minor* consequence. The social impact is therefore ranked as *low* (refer to **Table 6.11**).

Table 6.11 Summary – Economic impacts

Impact theme	Project aspect	Social impact	Affected Parties	Duration	Perceived Stakeholder Ranking	Social Impact Ranking - mitigated
Economic – employment and economy	Economic impacts on employment, and local and regional economy	Way of life – how people work, live, play and interact	Local residents Regional residents	Long term	Low	*Moderate (positive)*
Economic – property values & local business	Negative impacts on property prices and local businesses	Way of life – how people work, live, play and interact Personal and property rights including economic livelihoods	Local residents Haul route residents	Long term	Low	Low

6.4 Community sustainability, values and place impacts

Community sustainability, values and place include impacts such as those due to population movements or changes to the economy, as well as less tangible psychosocial aspects of change, such as the impacts of stress, how people value their homes and surroundings, and the sustainability of the community as a whole. The following section addresses these potential social impact issues.

During consultation, stakeholders did not raise concerns relating to community sustainability. Perceived impacts from a stakeholder perspective are therefore ranked as *low*.

Changes to population are a fundamental impact within SIA, given that a population and characteristics underpin the size, diversity and activities of a community. Population change is usually described as a first order social impact, which has the potential to create a number of second order social impacts such as impacts on community infrastructure and services, change in sense of community and social cohesion.

It is generally regarded in the SIA literature, that a project can influence population change by impacts emerging from two main factors:

- an influx of workers (construction related or operational); and
- acquisition of residential land in proximity to the operations.

Dixon Sand currently employs 21 FTE employees (across all quarry operations), the majority of which already live in The Hills Shire or neighbouring Hawkesbury LGA. Similarly, the main suppliers to Dixon Sand are located locally (refer to **Section 3.1**).

The proposed Project will result in an increase of eight full time workers in the operational phase, at full capacity, resulting in a total of 16 full time workers at the Haerses Road Quarry. This is not considered a significant increase in the workforce and it is possible that these roles may be able to be filled by those already residing in the local area. Consequently, population change associated impacts as a result of the Proposed Modification is assessed as *possible* to occur but of *minimal* consequence and is therefore ranked as *low* (refer to **Table 6.12**).

Impacts associated with changes in population also include impacts to housing availability and infrastructure capacity, economic growth and, where significant, changes to sense of community and community sustainability. Given the Council's strategic focus area to support the forecast growth in population of the LGA and the range of housing estates currently being developed, the Proposed Modification is not expected to significantly impact on infrastructure and services in the LGA.

Considering the above, impacts on housing and services are assessed as *possible* to occur but of *minimal* consequence and are therefore ranked a *low* social impact (refer to **Table 6.12**).

Table 6.12 Summary – Community sustainability, values and place impacts

Impact theme	Project aspect	Social impact	Affected Parties	Duration	Perceived Stakeholder Ranking	Social Impact Ranking - mitigated
People - Community	Population change as a result of workforce influx	Community composition	Local residents Regional residents	Long term	Low	Low
	Impacts on housing availability and community infrastructure as a result of workforce influx	Community composition	Local residents Regional residents	Long term	Low	Low
	Changes to sense of community resulting from the Proposed Modification	Community and sense of place	Local residents Regional residents	Long term	Low	Low

6.5 Summary of Positive and Negative Social Impacts

The following table provides a summary of the predicted social impacts in relation to the Proposed Modification.

Table 6.13 Potential Positive and Negative Social Impacts of the Proposed Modification

Impact theme	Project aspect	Social impact	Affected Parties	Duration	Perceived Stakeholder Ranking	Social Impact Ranking - mitigated
Social amenity – traffic	Increased truck movements	Surroundings – impact on public safety	Road users Pedestrians Local residents Haul route residents	Long term	High	Moderate
Social amenity – noise	Truck noise	Health and well-being Way of life – how people live and interact with one another on a daily basis	Local residents Haul route residents	Long term	High	Moderate
	Operational noise	Health and well-being Way of life – how people live and interact with one another on a daily basis	Local residents Haul route residents	Long term	Moderate	Low
Social amenity – visual	Change to visual amenity / landscape	Surroundings – the environment's aesthetic value	Local residents	Long term	High	Low
Social amenity – air quality /dust	Impact of operations on air quality – in particular dust emissions	Surroundings – access to and use of the natural and built environment, and its amenity Health and wellbeing – including physical and mental health	Local residents	Long term	Moderate	Low
Natural environment – biodiversity	Increased truck movements impacting on wildlife	Surroundings – impact on public safety, access to and use of the natural and built environment, and its amenity	Road users Pedestrians Local residents Haul route residents	Long term	Low	Low

Impact theme	Project aspect	Social impact	Affected Parties	Duration	Perceived Stakeholder Ranking	Social Impact Ranking - mitigated
	Impact on surface and groundwater due to proposed expansion of the extraction area	Surroundings – impact on public safety, access to and use of the natural and built environment, and its amenity	Local residents Regional residents	Long term	Low	Low
People – decision making and engagement	Information provision and community engagement	Decision-making systems	Local residents Haul route residents	Long term	Moderate	Low
Economic – employment and economy	Positive economic impacts on employment, and local and regional economy	Way of life – how people work, live, play and interact	Local residents Regional residents	Long term	Low	*Moderate (positive)*
Economic – property values & local business	Negative impacts on property prices and local businesses	Way of life – how people work, live, play and interact Personal and property rights including economic livelihoods	Local residents Haul route residents	Long term	Low	Low
People - Community	Population change as a result of workforce influx	Community composition	Local residents Regional residents	Long term	Low	Low
	Impacts on housing availability and community infrastructure as a result of workforce influx	Community composition	Local residents Regional residents	Long term	Low	Low
	Changes to sense of community resulting from the Proposed Modification	Community and sense of place	Local residents Regional residents	Long term	Low	Low

7.0 Mitigation and Enhancement Strategies

This section provides a summary of the potential strategies that may be implemented in response to the predicted social impacts associated with the Proposed Modification, as outlined in **Section 6.0**.

In addition to mitigation measures Dixon Sand currently implements at the Quarry, and any mitigation measures adopted through the Proposed Modification, neighbouring residents and property owners identified several strategies to address potential social impacts associated with the Proposed Modification. Many of these strategies have already been identified at **Section 5.0** and are summarised in **Table 7.1** for Dixon Sand's consideration.

Table 7.1 Strategies and recommendations

Impact theme	Project aspect	Community and SIA suggested mitigations	Dixon Sand existing and proposed mitigation strategies

Social amenity – traffic	Increased truck movements	Traffic is a key issue that could potentially impact the communities along the haul route. It is recommended that where possible, Dixon Sand implement proactive tools which encourage their drivers and contractors to adhere to safe driving practices.
		
		Mechanisms may include:
		• a toolbox talk with drivers to reinforce positive driver behaviours and messaging
		• installation of strategic signage at key locations on the site to remind drivers to 'be safe'.
		
		In addition, it is recommended Dixon Sand:
		• ensure continued monitoring and maintenance of physical road conditions
		• consider lobbying RMS to reduce the speed limit along Wisemans Ferry Road
		• conduct random monitoring of trucks along haul route (personnel stationed on roadside)
		• provide the community with information regarding:
		  ○ the review of the Maroota Local Traffic Management Policy
		  ○ traffic monitoring results
		  ○ upgrade of the intersection at Wisemans Ferry Road and Haerses Road and the Roads and Maritime Services (RMS) endorsement of this upgrade.
			Dixon Sand has a number of existing arrangements to encourage good driver behaviour and discourage use of compression braking, including:
			• a 'three strikes out' policy on bad behaviour, enforced through a community complaint driven Traffic Management Policy, of which two other quarries in the Maroota area are also signatories
			• reminders of driver responsibilities under the code of conduct in cases of community complaints that identify a specific truck (first two strikes)
			• training inductions for drivers on the Traffic Management Policy
			• current efforts to lobby the RMS for a decrease in the speed limit along Wisemans Ferry Road.
			
			In addition Dixon Sand currently:
			• contributes to social infrastructure maintenance under 'Section 94 Contribution' of Council's development control plan
			• enforces the Maroota Local Traffic Management Policy

Impact theme	Project aspect	Community and SIA suggested mitigations	Dixon Sand existing and proposed mitigation strategies
Social amenity – noise	Truck noise Operational noise	• Provision of information to stakeholders regarding the company's noise management strategies, modelling and monitoring results • Construction of acoustic bunds at strategic locations along the route • Cameras/monitoring of trucks arriving early at the Quarry • Keep the community informed of final acoustic bund designs, monitoring and modelling of noise impacts	• Construction of strategically located noise bunds • Continue to enforce the Maroota Local Traffic Management Policy • Application of noise reducing modifications to haul trucks (of up to 6 dB(A)) as required as extraction progresses to Stage 4 and 5 • Extraction to be undertaken behind 6 to 7 m high face Or other noise mitigation measures providing an equivalent level of noise reduction at receivers
Social amenity – air quality /dust	Impact of operations on air quality – in particular dust emissions	• Provision of information to stakeholders regarding the company's air quality management strategies, modelling and monitoring results. • Progressive rehabilitation of the site	Dixon Sand's current dust management strategies include: • progressive site rehabilitation to minimise dust from exposed open areas; • 24-hour monitoring of dust levels; and • the use of contingency plans such as water carts and sprinklers in the event that the monitors identify a risk of dust level exceedance • use of a water cart to control emissions from haul roads (unsealed) • enforcement of speed limits onsite • minimising drop height of material during truck loading and unloading where possible
Social amenity – visual	Change to visual amenity/landscape	• Maintain natural views were possible • Minimise time visual bunds will be in place	• No stockpiling • Visual bunds will be constructed and vegetated

Impact theme	Project aspect	Community and SIA suggested mitigations	Dixon Sand existing and proposed mitigation strategies
Natural environment – biodiversity	Increased truck movements impacting on wildlife	Installation of a wildlife fence	
	Impact on surface and groundwater due to proposed expansion of the extraction area	Provision of environmental monitoring data publicly	• Proposed extension to the extraction area contained within the existing WMS catchment. • No change to the maximum sand washing rate (thus no expected increase in water use) • Proposed extension to the extraction area will remain two (2) metres above the wet weather groundwater level of this aquifer
People - Community	Population change as a result of workforce influx	It is recommended that Dixon Sand management actively seek and further develop meaningful relationships with the community for mutual benefit. It is recommended that Dixon Sand continue to maximise local and regional spend through support for local groups and organisations.	Dixon Sand currently contribute to a range of community and educational organisations (refer to **Section 3.2**)
	Impacts on housing availability and community infrastructure as a result of workforce influx		
	Changes to sense of community resulting from the Proposed Modification		

Impact theme	Project aspect	Community and SIA suggested mitigations	Dixon Sand existing and proposed mitigation strategies
People – decision making and engagement	Information provision and community engagement	It is recommended that Dixon Sand periodically engage with the CCC, the Maroota community and the communities along the haul route to provide an update on the operation. In addition, community members suggested Dixon Sand could: • hold community forums to work through concerns, communicate outcomes of complaint management and improve reporting practices • hold quarterly CCC meetings and provision of CCC minutes and outcomes to the community It is recommended that Dixon Sand develop an engagement strategy, which aligns with community concern around community engagement, to outline the frequency and mechanisms of information release. Increased communication with the wider community is likely to increase trust in the company.	Current measures taken by Dixon Sand to keep the community informed include: • bi-annual meeting of the CCC with representatives from the community, council, school, and stakeholder groups • provision of environmental monitoring reporting and CCC minutes on the Dixon Sand website • a dedicated environment officer and contact details available on the website for community queries and complaints
Economic – employment and economy	Economic impacts on employment, and local and regional economy	Local employment	
Economic – property values & local business	Negative impacts on property prices and local businesses	• Provision of noise monitoring results • Monitor house prices	

8.0 Conclusions and Recommendations

This SIA has identified a number of potential social and economic impacts associated with the Proposed Modification.

Key community concerns in relation to the Proposed Modification include:

- impacts on safety and social amenity from increased heavy vehicle road use
- impacts on social amenity through operational noise, dust and air quality, and visual changes to those north of the Quarry
- impacts on property values
- the desire for increased community engagement and information provision.

These potential impacts are all manageable with the implementation of the proposed measures. Dixon Sand have a number of existing strategies in place to mitigate these community concerns. A range of measures have also been suggested via engagement discussions to assist with the ongoing management of social impacts in relation to the Project and to minimise the extent to which potential impacts are realised (refer to **Table 7.1**).

The company also undertakes the following to keep the community informed:

- bi-annual meeting of the CCC with representatives from the community, council, school, and stakeholder groups
- provision of environmental monitoring reporting and CCC minutes on the Dixon Sand website
- a dedicated environment officer and contact details available on the website for community queries and complaints.

In line with the above and to enhance existing the company's monitoring and information sharing activities should the Project be approved it is recommended that that Dixon Sand:

- develop an engagement strategy for the Quarry, which aligns with community concern around community engagement, to outline the frequency and proposed mechanisms of information release
- communicate the existing and ongoing mitigation and enhancement measures in place to the community, along with regular updates with regards to Proposed Modification activities
- actively seek and further develop meaningful relationships with the community for mutual benefit.

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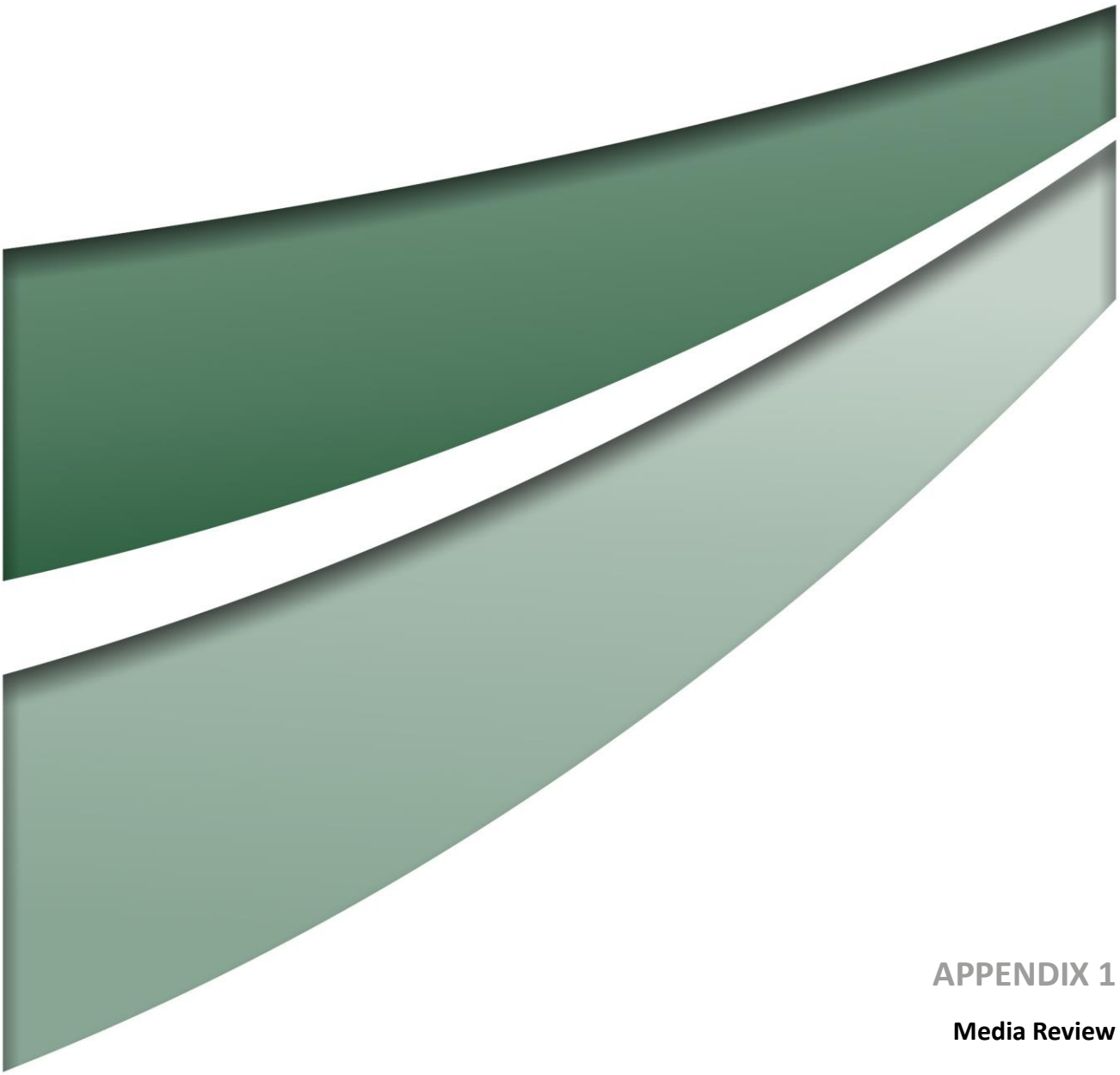

APPENDIX 1

Media Review

Media review of local articles

Title	Date	Source	Summary	Identified Community Groups
Sand Quarry Industry				
Budget funding a step forward for Pitt Town Bypass	20 June 2017	Hawkesbury Gazette	Pitt Town locals celebrate announcement of the Pitt Town Bypass project. The project will see traffic, including trucks from Maroota Sand Quarry diverted from passing through the Pitt Town village centre. A representative of the Pitt Town Progress Association said that up to 30% of Sydney's construction sand was transported through the town from the Maroota Quarry prior to the Bypass.	The Pitt Town Progress Association
RMS announces speed limit changes on local roads	7 November 2018	Hawkesbury Gazette	RMS announce a reduction in speed limit from 80km/h to 70km/h on several local roads in the Hawkesbury Shire, following a review of community and council requests, crash history, road geometry, environment and traffic volumes.	
The population boom coming to The Hills Shire	18 May 2018	Domain	The Hills Shire is one of the fastest-growing regions in NSW. In fact, more than 250,000 people will call the shire home by 2031. The need to accommodate this influx has led to the development of several large greenfield residential development areas. Provision of public infrastructure and high standards of education, living, open space and low crime rates contribute to this growth.	

(about Source: https://www.theherald.com.au/, https://www.portstephensexaminer.com.au/, https://www.abc.net.au/news

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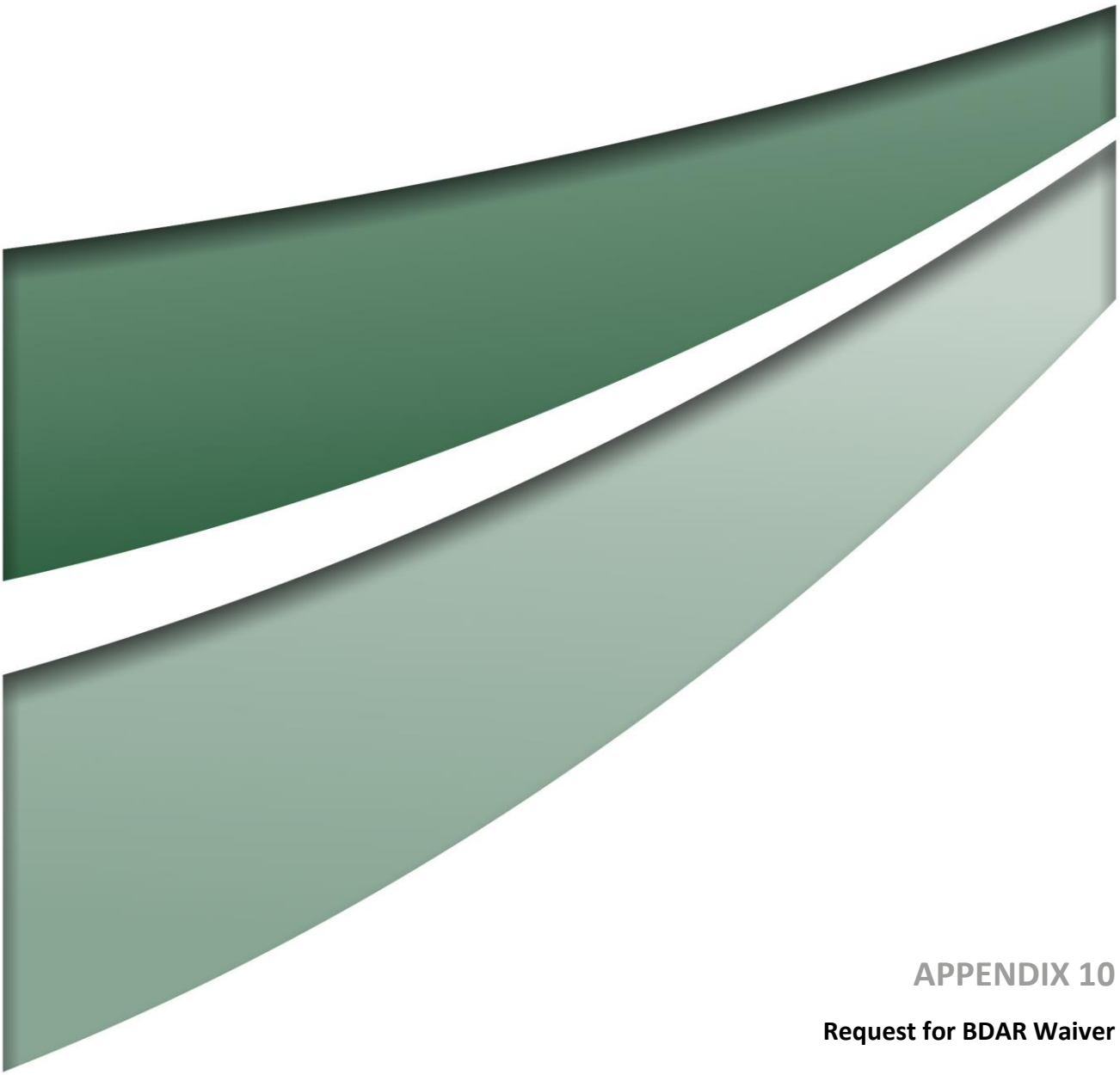

APPENDIX 10

Request for BDAR Waiver

umwelt
Environmental & Social Consultants

Our Ref: 4607/RP/JG/18062019

18 June 2019

Secretary
NSW Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2000

Dear Sir / Madam

Re: Biodiversity Development Assessment Report Waiver Request for the Proposed Haerses Road Quarry Extraction Area Extension Modification (DA 165-7-2005) – request for determination under Section 7.9(2) of the *Biodiversity Conservation Act 2016*

1.0 Introduction

Umwelt (Australia) Pty Ltd (Umwelt) was engaged by Dixon Sand (Penrith) Pty Limited (Dixon Sand) to undertake a biodiversity assessment to support a Statement of Environmental Effects (SEE) for the proposed modification to Haerses Road Quarry (MOD 3) (DA 165-7-2005) at Maroota (hereafter referred to as the 'proposed modification').

Under Section 7.9(2) of the *Biodiversity Conservation Act 2016* (BC Act): *"Any such application [SSD] is to be accompanied by a biodiversity development assessment report unless the Planning Agency Head and the Environment Agency Head determine that the proposed development is not likely to have any significant impact on biodiversity values."*

This document addresses the impacts on biodiversity values to which the biodiversity offsets scheme applies under Section 6.3 of the BC Act in relation to the Proposed MOD 3 Assessment Area. The remainder of the site is approved for extraction in accordance with Development Consent DA 165-7-2005. This BDAR waiver request explains whether or not each biodiversity value (as listed under the BC Act and *Biodiversity Conservation Regulation 2017* (BC Regulation)) is relevant to the Proposed MOD 3 Assessment Area.

This BDAR waiver request specifically relates to the defined area shown in **Figure 1** and **2** and has been prepared in accordance with requirements sent through by email from OEH on 10 May 2019.

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ABN: 18 059 519 041

2.0 Background

2.1 The Proponent

The operator of the Quarry and Proponent for the proposed modification is Dixon Sand (No. 1) Pty Ltd (Dixon Sand). Dixon Sand is a family owned and operated business that has been in operation since 1955 and supplies specialty concrete and mortar sand to the Sydney metropolitan region. Dixon Sand currently operates two quarries at Maroota (Haerses Road and Old Northern Road Quarry) and one at Agnes Banks.

Contact: Mark Dixon
Phone: 02 4566 8348 or 0477 112 220
Email: mark@dixonsand.com.au

2.2 Project Identification

The Quarry operates in accordance with Development Consent DA 165-7-2005 as State Significant Development under the State Environmental Planning Policy (State and Regional Development) 2011, originally issued by the Minister for Planning on 14 February 2006 (the development consent). The development consent provides for the operation of a sand quarry at an extraction rate of 250,000 tonnes per annum (tpa) until February 2046. The development consent also approves the importation of up to 100,000 tpa of Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM). Since commencing operations in 2006, the DA 165-7-2005 has been modified twice.

- The first modification (MOD 1) was issued under (the now repealed) Section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act) on 22 January 2018 and approved an extension to the extraction area as well as the importation of VENM and ENM.

- The second modification (MOD 2) was issued under Section 4.55(A) of the EP&A Act to correct an inconsistency between the approved area of disturbance and identified buffers to this disturbance.

Dixon Sand is proposing a third modification to DA 165-7-2005 under Section 4.55(2) of the EP&A Act to allow for a small extension in extraction area (Proposed MOD 3 Assessment Area - the subject of this BDAR waiver request), an increase in extraction rate, an increase in the volume of imported material and an increase in the number of trucks permitted to travel to and from the quarry.

The site plan for the currently approved and proposed quarry operations is shown in **Figure 1**.

A Preliminary Environmental Assessment (PEA) has been prepared and submitted to the DPE in order to seek the Environmental Assessment Requirements (EARs) for the Proposed Modification. In correspondence dated 5 March 2019, the DPE confirmed their general satisfaction with the proposed approach to the preparation of a Statement of Environmental Effects and requested inclusion of the following within the assessment:

- Detailed technical assessment with respect to noise, prepared in accordance with the NSW Noise Policy for Industry (2017), NSW Road Noise Policy (2011) and the Voluntary Land Acquisition and Management Policy (2018).

- Air quality assessment with dispersion modelling, prepared in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2016). The assessment should consider the air quality impacts on sensitive receivers with a particular focus on dust emissions, PM10 and PM2.5, having regard to the Voluntary Land Acquisition and Management Policy (2018).

- The potential social impacts arising from the modification, both positive and negative, with reference to the Social Impact Assessment Guideline for State Significant Mining, Petroleum Production and Extractive Industry Development, having particular regard to impacts on local amenity.

- Detailed justification of proposed changes to existing buffer zones and assessment of the potential impacts on groundwater.

- Visual impacts of the proposed extension to the extraction area, particularly on private landholders and key vantage points in the public domain.

- Consultation with all relevant stakeholders including government agencies, Registered Aboriginal Parties, Maroota Public School and affected residents including those who may hold a private noise agreement with Dixon Sand.

2.3 Ecological Qualifications

This application for a BDAR waiver request, including the completion of **Table 1** below, has been prepared by James Garnham and reviewed by Ryan Parsons. James is a Senior Ecologist who has over eight years ecological experience and has the following qualifications:

- Doctor of Philosophy – PhD Environmental Science

- Bachelor of Environmental Science and Management – Honours.

Ryan is a Principal Ecologist – Botanist with over 12 years of ecological experience and has the following qualifications:

- Bachelor of Environmental Science and Management – Honours

Both James and Ryan are Accredited BAM Assessors under the BC Act. Ryan is also an accredited BioBanking, Biodiversity Certification and Framework for Biodiversity Assessment Assessor under the former *Threatened Species Conservation Act 1995*.

3.0 Proposed MOD 3 Assessment Area Site Details

The Proposed MOD 3 Assessment Area is located at 6 Haerses Road, Maroota, NSW, 2756 and is located within the northern section of Lot 170 DP 664767.

The Proposed MOD 3 Assessment Area is within The Hills Shire Local Government Area on land zoning RU1 – Primary Production.

The Proposed MOD 3 Assessment Area is located on previously cleared land which has been used for agricultural purposes. The Proposed MOD 3 Assessment Area consists of an established olive plantation with exotic pasture dominating the ground layer.

The location of the proposed modification site is shown in **Figure 2** below with context to the surrounding area and landscape features.

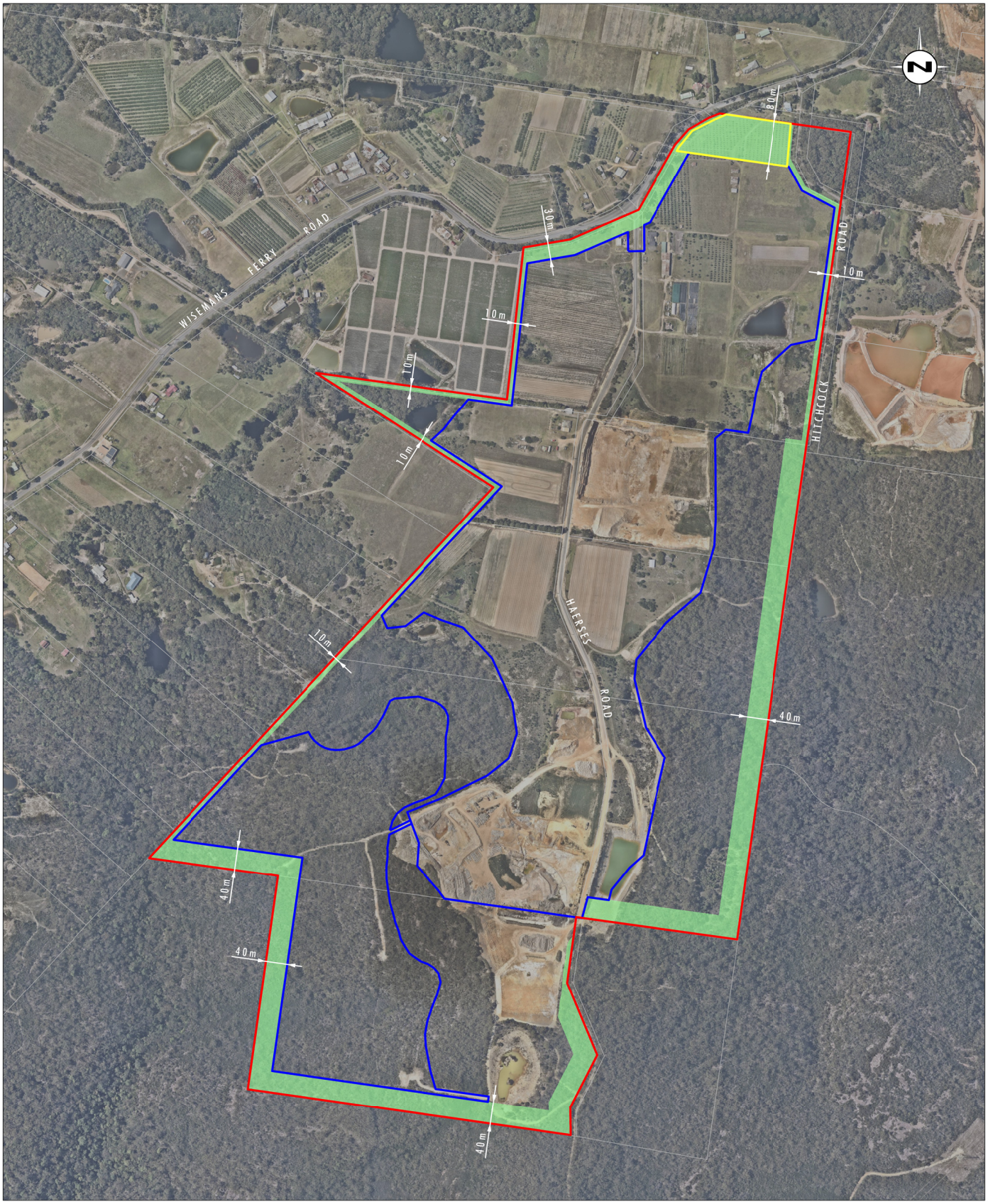


Image Source: Nearmap (Dec 2018)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

0 100 250 500m
1:10 000

Legend

- Quarry Site
- Approved Extraction Area
- Proposed MOD 3 Assessment Area
- Buffer Zone

FIGURE 1

Site Plan
Approved and Proposed Quarry Operations

File Name (A4): R03/4607_005.dgn
20190613 14.41

Image Source: Nearmap (Dec 2018)

0 20 40 80 m
1:1 500

Legend

- Proposed MOD 3 Assessment Area
- Survey Effort

FIGURE 2

Survey Effort of Proposed MOD 3 Assessment Area

4.0 Impacts on Biodiversity Values

An assessment of the impacts on biodiversity values as a result of the Proposed MOD 3 Assessment Area was conducted in the form of a detailed literature review and on-ground field inspection. The detailed literature review included the following sources:

- Office of Environment and Heritage (OEH) Atlas of NSW Wildlife
- Threatened Biodiversity Data Collection (TBDC)
- Department of the Environment and Energy (DoEE) Protected Matters Database.

The on-ground field inspection included floristic surveys that involved meandering across the site. Given the highly disturbed nature of the site, basic species-credit fauna habitat assessments and opportunistic fauna surveys were conducted. Photographs taken during the on-ground field inspection demonstrate the nature of the proposed modification site are provided in **Appendix A**. The survey effort and biodiversity values of the Proposed MOD 3 Assessment Area are shown in **Figure 1**.

Based on these field surveys, the Proposed MOD 3 Assessment Area represents an established olive plantation with exotic pasture dominating the ground layer.

The potential impacts to biodiversity values to which the biodiversity offsets scheme applies under Section 6.3 of the BC Act and additional impacts prescribed under the BC Regulation 2017 in relation to the Proposed MOD 3 Assessment Area have been addressed in **Table 1** below.

Table 1 Details of the Impacts of the Proposed MOD 3 Assessment Area on Biodiversity Values

Biodiversity Value and Relevant Legislation	Meaning	Relevant (✓or NA)	BDAR Waiver Requirements: Explain and document potential impacts including additional impacts prescribed under the BC Regulation	Response
Vegetation abundance - 1.4(b) BC Regulation	Occurrence and abundance of vegetation at a particular site.	✓	Where vegetation is present on the development site, provide a map on digital aerial photography or the best available imagery of the development site showing: • native vegetation (including grasslands and other non-woody vegetation types) and non-native vegetation, and • the area of land that is directly impacted by the proposed development, including related infrastructure such as roads, pipelines, access tracks, temporary material stockpiles, asset protection zones and powerlines, if applicable. Describe how the proposed development avoids impacts on native vegetation and identify the likelihood and extent of any remaining impacts including removal of isolated or cultivated native plants.	The landform and vegetation within the Proposed MOD 3 Assessment Area and surrounding land is highly modified (refer to **Appendix A** for photographs). The Proposed MOD 3 Assessment Area comprises cleared land dominated by exotic grassland and planted exotic common olives (*Olea europaea*) as part of a cultivated olive grove. Dominant exotic pasture grasses include paspalum (*Paspalum dilatatum*), kikuyu (*Cenchrus clandestinus*), African lovegrass (*Eragrostis curvula*) and Rhodes grass (*Chloris guyana*). Native plants species occur in low abundance, including several planted native bracelet honey myrtle (*Melaleuca armillaris*) shrubs. The Proposed MOD 3 Assessment Area has been restricted to previously cleared areas for the purpose of an olive grove. This avoids any impacts to the remnant treed vegetation that bounds the site to the north, east and west. The Proposed MOD 3 Assessment Area will involve the removal of approximately 1.6 hectares of exotic dominated grassland and common olive (*Olea europaea*) plantation.

Biodiversity Value and Relevant Legislation	Meaning	Relevant (✓or NA)	BDAR Waiver Requirements: Explain and document potential impacts including additional impacts prescribed under the BC Regulation	Response
Vegetation integrity – 1.5(2)(a) BC Act	Degree to which the composition, structure and function of vegetation at a particular site and the surrounding landscape has been altered from a near natural state.	✓	Describe the vegetation integrity and any impacts on vegetation integrity of identified plant communities.	The landform and vegetation within the Proposed MOD 3 Assessment Area and surrounding land is highly modified (refer to **Appendix A** for photographs of the site). The Proposed MOD 3 Assessment Area itself consists of a common olive (*Olea europaea*) plantation and exotic dominated grasslands. Vegetation within the Proposed MOD 3 Assessment Area does not conform to any described Plant Community Type (PCT) and therefore does not conform to any listed threatened ecological community (TEC). As a result, there will be no loss of native vegetation integrity as part of the proposed modification.

Biodiversity Value and Relevant Legislation	Meaning	Relevant (✓or NA)	BDAR Waiver Requirements: Explain and document potential impacts including additional impacts prescribed under the BC Regulation	Response
Habitat suitability – 1.5(2)(b) BC Act	Degree to which the habitat needs of threatened species are present at a particular site.	✓	Identify any threatened species or ecological communities or their habitat on the development site. Describe how the proposed development avoids impacts on habitat suitability and identify the likelihood and extent of any remaining impacts including the impacts of development on the following habitat of threatened species or ecological communities: (i) karst, caves, crevices, cliffs and other geological features of significance, (ii) rocks, (iii) human made structures, (iv) non-native vegetation, (prescribed under clause 6.1(1)(a) of the BC Regulation) Impacts may include the removal or modification (e.g. noise, light, etc.) of the habitat of threatened species or ecological communities.	The Proposed MOD 3 Assessment Area has been restricted to and will results in the removal of approximately 1.6 hectares of exotic dominated grassland and a common olive (*Olea europaea*) plantation. This avoids any impacts to the remnant native vegetation that bounds the site to the north, east and west. There are no occurrences of: (i) karst, caves, crevices, cliffs and other geological features of significance, (ii) rocks, or (iii) human made structures within the Proposed MOD 3 Assessment Area.

Biodiversity Value and Relevant Legislation	Meaning	Relevant (✓or NA)	BDAR Waiver Requirements: Explain and document potential impacts including additional impacts prescribed under the BC Regulation	Response
Threatened species abundance – 1.4(a) BC Regulation	Occurrence and abundance of threatened species or threatened ecological communities, or their habitat, at a particular site.	✓	Describe how the proposed development avoids impacts on threatened species abundance and identify the likelihood and extent of any remaining impacts including impacts of vehicle strikes on threatened species of animals or on animals that are part of a threatened ecological community (prescribed under clause 6.1(1)(f) of the BC Regulation).	The Proposed MOD 3 Assessment Area comprises exotic dominated grassland and a common olive (*Olea europaea*) plantation. It does not conform to any described PCT and therefore does not conform to any listed TEC. No threatened species were recorded as part of the site inspection and are considered unlikely to occur based on the lack of suitable habitat present. Increased impacts from vehicle strikes associated with the Proposed MOD 3 Assessment Area are also considered to be negligible, considering it is a minor extension to an existing quarry extraction approval. The Proposed MOD 3 Assessment Area avoids any impacts to the remnant native vegetation and potential threatened species habitat that bounds the site to the north, east and west.

Biodiversity Value and Relevant Legislation	Meaning	Relevant (✓or NA)	BDAR Waiver Requirements: Explain and document potential impacts including additional impacts prescribed under the BC Regulation	Response
Habitat connectivity – 1.4(c) BC Regulation	Degree to which a particular site connects different areas of habitat of threatened species to facilitate movement of those species across their range.	✓	Identify whether the development site contributes to habitat connectivity. Describe how the proposed development avoids impacts on habitat connectivity and identify the likelihood and extent of any remaining impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range (prescribed under clause 6.1(1)(b) of the BC Regulation).	Proposed MOD 3 Assessment Area site consists of a common olive (*Olea europaea*) plantation and exotic dominated grassland. The area to the south of the Proposed MOD 3 Assessment Area has been previously cleared and also comprises common olive (*Olea europaea*) plantations and pasture. The Proposed MOD 3 Assessment Area avoids remnant native vegetation to the north, east and west, including intact roadside trees along Hitchcock Road to the east and Wisemans Ferry Road to the north and west. Given the absence of native vegetation in the Proposed MOD 3 Assessment Area and the avoidance of surrounding remnant vegetation, impacts associated with the Proposed MOD 3 Assessment Area is considered unlikely to reduce connectivity that facilities of faunal movement in the local area.

Biodiversity Value and Relevant Legislation	Meaning	Relevant (✓or NA)	BDAR Waiver Requirements: Explain and document potential impacts including additional impacts prescribed under the BC Regulation	Response
Threatened species movement – 1.4(d) BC Act	Degree to which a particular site contributes to the movement of threatened species to maintain their lifecycle.	✓	Describe how the proposed development avoids impacts on threatened species movement and identify the likelihood and extent of any remaining impacts of development on movement of threatened species that maintains their lifecycle (prescribed under clause 6.1(1)(c) BC Regulation).	The Proposed MOD 3 Assessment Area consists of a common olive (*Olea europaea*) plantation and exotic dominated grassland. The area to the south of the proposed modification site has been previously cleared and also comprises a common olive (*Olea europaea*) plantation and exotic pasture. Proposed MOD 3 Assessment Area avoids remnant native vegetation to the north, east and west, including intact roadside trees along Hitchcock Road to the east and Wisemans Ferry Road to the north and west. Given that the Proposed MOD 3 Assessment Area has previously been cleared and is now dominated by exotic species, there is little in the way of habitat that would facilitate movement for threatened species. As a result, the Proposed MOD 3 Assessment Area is considered unlikely to impact the movement of threatened species that maintains their lifecycle.

Biodiversity Value and Relevant Legislation	Meaning	Relevant (✓or NA)	BDAR Waiver Requirements: Explain and document potential impacts including additional impacts prescribed under the BC Regulation	Response
Flight path integrity – 1.4(e) BC Regulation	Degree to which the flight paths of protected animals over a particular site are free from interference.	✓	Identify whether flight paths of protected animals occur over the development site. Protected animals are animals of a species listed or referred to in Schedule 5 of the BC Act. They include any species of birds, mammals, amphibians or reptiles that are native to Australia or that periodically or occasionally migrate to Australia. Describe how the proposed development avoids impacts on flight path integrity and identify the likelihood and extent of any remaining impacts. Note: The impacts of wind turbine strikes on protected animals are prescribed under clause 6.1(1)(e) of the BC Regulation. It is, therefore, unlikely that a BDAR waiver would be issued for a proposed wind farm.	The Proposed MOD 3 Assessment Area is highly disturbed, surrounded by a fragmented landscape. While the Proposed MOD 3 Assessment Area may be used as a flight path by birds and bat, the proposed extractive activities would not contribute to altering this area as a flight path of protected animals. Additionally, the surrounding area provides alternate areas to facilitate flying species. The Proposed MOD 3 Assessment Area will be restricted to a small area of limited flightpath habitat in the form of common olive (*Olea europaea*) plantation and exotic dominated grassland.

Biodiversity Value and Relevant Legislation	Meaning	Relevant (✓or NA)	BDAR Waiver Requirements: Explain and document potential impacts including additional impacts prescribed under the BC Regulation	Response
Water sustainability – 1.4(f) BC Regulation	Degree to which water quality, water bodies and hydrological processes sustain threatened species and threatened ecological communities at a particular site.	✓	Describe how the proposed development avoids impacts on water sustainability and identify the likelihood and extent of any remaining impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining or other development) (prescribed under clause 6.1(1)(d) of the BC Regulation).	The Proposed MOD 3 Assessment Area is unlikely to have any impact on water quality, water bodies or hydrological processes that sustain threatened species or threatened ecological communities. Given the relatively small area of impact associated with the Proposed MOD 3 Assessment Area, impacts to surface or groundwater are not anticipated to be substantial. Specialist studies are currently being undertaken to confirm this. There are also no threatened species or threatened ecological communities present within the Proposed MOD 3 Assessment Area which are dependent on waterbodies or hydrological processes. There are also no waterbodies or drainage lines within the immediate vicinity (100 m) of the Proposed MOD 3 Assessment Area. Two vegetation communities occur within 100 m of the Proposed MOD 3 Assessment Area, being Cattai Shale Cap Forest and Sandstone Gully Forest (Hills Shire Council 2008) according to regional vegetation mapping conducted by the Hills Shire Council and these vegetation communities are considered unlikely to be groundwater dependent.

5.0 Conclusions

Based on the information provided in **Table 1** and the five part test of significance prepared in **Appendix B**, it is unlikely that the proposed modification will have a significant impact on the biodiversity values of the site and that a BDAR is not required due to the following:

- The proposed development activity is unlikely to have a 'significant impact' on any threatened species, threatened populations or endangered ecological communities listed under the tests under *Section 7.3 of the NSW Biodiversity Conservation Act 2016*(refer to **Appendix B**)
- It does not exceed the biodiversity offsets scheme threshold as
    - no areas within the site are mapped as having 'high biodiversity value' as identified on the NSW Biodiversity Values Map. (**Appendix C**); and
    - vegetation clearing on the site will not exceed the native vegetation clearing thresholds identified in the Biodiversity Assessment Method as the site is not remnant vegetation and consists of a common olive (*Olea europaea*) plantation and exotic dominated grassland.
- The development is not being carried out in a declared area of outstanding biodiversity value.

Please do not hesitate to contact me on 49505322 if you require any further information on this project.

Yours sincerely

James Garnham
Senior Ecologist

APPENDIX A

Photographs of the Proposed MOD 3 Assessment Area

Appendix A – Photographs of the Proposed MOD 3 Assessment Area

The following photographs were taken during the on-ground site inspection and ecological survey of the Proposed MOD 3 Assessment Area conducted on 16 May 2019.

Plate A1 - Taken from north-west corner of Proposed MOD 3 Assessment Area, facing east.

The planted shrubs in the foreground of the photograph are native bracelet honey myrtle (*Melaleuca armillaris*) that have been planted as indicated by the plastic protection surrounding the base and evenly spaced straight rows of each individual.

The remnant native vegetation in the background has been avoided and occurs outside the Proposed MOD 3 Assessment Area.

Plate A2 - Taken from middle of Proposed MOD 3 Assessment Area, facing north-west.

The remnant native vegetation in the background occurs outside the Proposed MOD 3 Assessment Area.

Plate A3 - Taken from outside south-east corner of the proposed modification site, facing north-west.

The remnant native vegetation in the background occurs outside the Proposed MOD 3 Assessment Area.

The shed to the left of the photograph also occurs outside the Proposed MOD 3 Assessment Area.

Plate A4 - Taken from outside south-east corner of the Proposed MOD 3 Assessment Area, facing north.

The remnant native vegetation in the background occur outside the Proposed MOD 3 Assessment Area site boundary.

Plate A5 - Taken from middle of northern boundary of the Proposed MOD 3 Assessment Area, facing east.

The remnant native vegetation and residential dwelling in the background occur outside the Proposed MOD 3 Assessment Area.

Plate A6 - Taken within the powerline easement from middle of northern boundary of the Proposed MOD 3 Assessment Area, facing west.

The remnant native vegetation in the background occurs outside the Proposed MOD 3 Assessment Area.

APPENDIX B

Five Part Test of Significance under the BC Act

Appendix B – Five Part Test of Significance under the BC Act

A five part test is provided in **Table B.1** for the threatened species, endangered populations and TECs that have the potential to occur within the Proposed MOD 3 Assessment Area.

Table B.1 Five Part Test of Significance in accordance with the requirements of Section 7.3 of the BC Act

Five Part Test of Significance	Comment
a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	The Proposed MOD 3 Assessment Area would not clear and/or drain habitat that may be used by potentially occurring threatened species. Accordingly, the works associated with the Proposed MOD 3 Assessment Area are unlikely to have an adverse effect on the life cycle of this species such that a viable local population of these species is likely to be placed at risk of extinction.
b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.	The Proposed MOD 3 Assessment Area itself consists of a common olive (*Olea europaea*) plantation and exotic dominated grasslands. Vegetation within the Proposed MOD 3 Assessment Area does not conform to any described Plant Community Type (PCT) and does not conform to any listed threatened ecological community (TEC). As a result, the works associated with the Proposed MOD 3 Assessment Area are unlikely to directly impact a TEC as impacts will be confined to the common olive (*Olea europaea*) plantation and exotic dominated grassland. It is unlikely that the Proposed MOD 3 Assessment Area will place any TECs with potential to occur at risk of extinction. The works associated with the Proposed MOD 3 Assessment Area are not likely to have an adverse effect on the extent of an ecological community such that its local occurrence is likely to be placed at risk of extinction. The works associated with the Proposed MOD 3 Assessment Area are also not likely to substantially and adversely modify the composition of an ecological community such that its local occurrence is likely to be placed at risk of extinction.

Five Part Test of Significance	Comment
c) In relation to the habitat of a threatened species or ecological community: i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity; ii) whether an area of habitat is likely to become fragmented or isolated as a result of the proposed development or activity; and iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.	The works associated with the Proposed MOD 3 Assessment Area would involve the clearing of a common olive (*Olea europaea*) plantation and exotic dominated grassland. The Proposed MOD 3 Assessment Area has been restricted to and will result in the removal of approximately 1.6 hectares of exotic dominated grassland and a common olive (*Olea europaea*) plantation. This avoids any impacts to threatened species or ecological communities. Therefore, the works associated with the Proposed MOD 3 Assessment Area are unlikely to have significant impacts to any threatened species or ecological community in the Proposed MOD 3 Assessment Area. The landform and vegetation within the Proposed MOD 3 Assessment Area and surrounding land is highly modified. The Proposed MOD 3 Assessment Area has been restricted to previously cleared areas for the purpose of an olive grove and will avoid surrounding remnant vegetation. As a result, the works associated with the Proposed MOD 3 Assessment Area will not result in an area of habitat for threatened species becoming fragmented or isolated from other areas of habitat and will not negatively impact the long-term survival of threatened species or ecological communities in the locality.
d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).	There are no listed declared areas of outstanding biodiversity value in the vicinity of the Proposed MOD 3 Assessment Area. The works associated with the Proposed MOD 3 Assessment Area will not result in a direct or indirect impact on any declared area of outstanding biodiversity value.
e) Whether the proposed development or activity constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact or, a key threatening process.	The works associated with the Proposed MOD 3 Assessment Area may to contribute to the following key threatening processes through edge effects and the operation of the Proposed MOD 3 Assessment Area: • Aggressive exclusion of birds by noisy miners (*Manorina melanocephala*) (BC and EPBC Acts) • Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*) (BC and EPBC Acts) • Predation by the European red fox (*Vulpes vulpes*) (BC and EPBC Acts) The increase in these key threatening processes is considered to be negligible given the current disturbed condition of the Proposed MOD 3 Assessment Area and the surrounding fragmented landscape.

Given the small-scale nature and extent of the Proposed MOD 3 Assessment Area, the works associated with the Proposed MOD 3 Assessment Area are unlikely to result in a significant impact on any potentially occurring threatened or migratory species or ecological community listed under the BC Act.

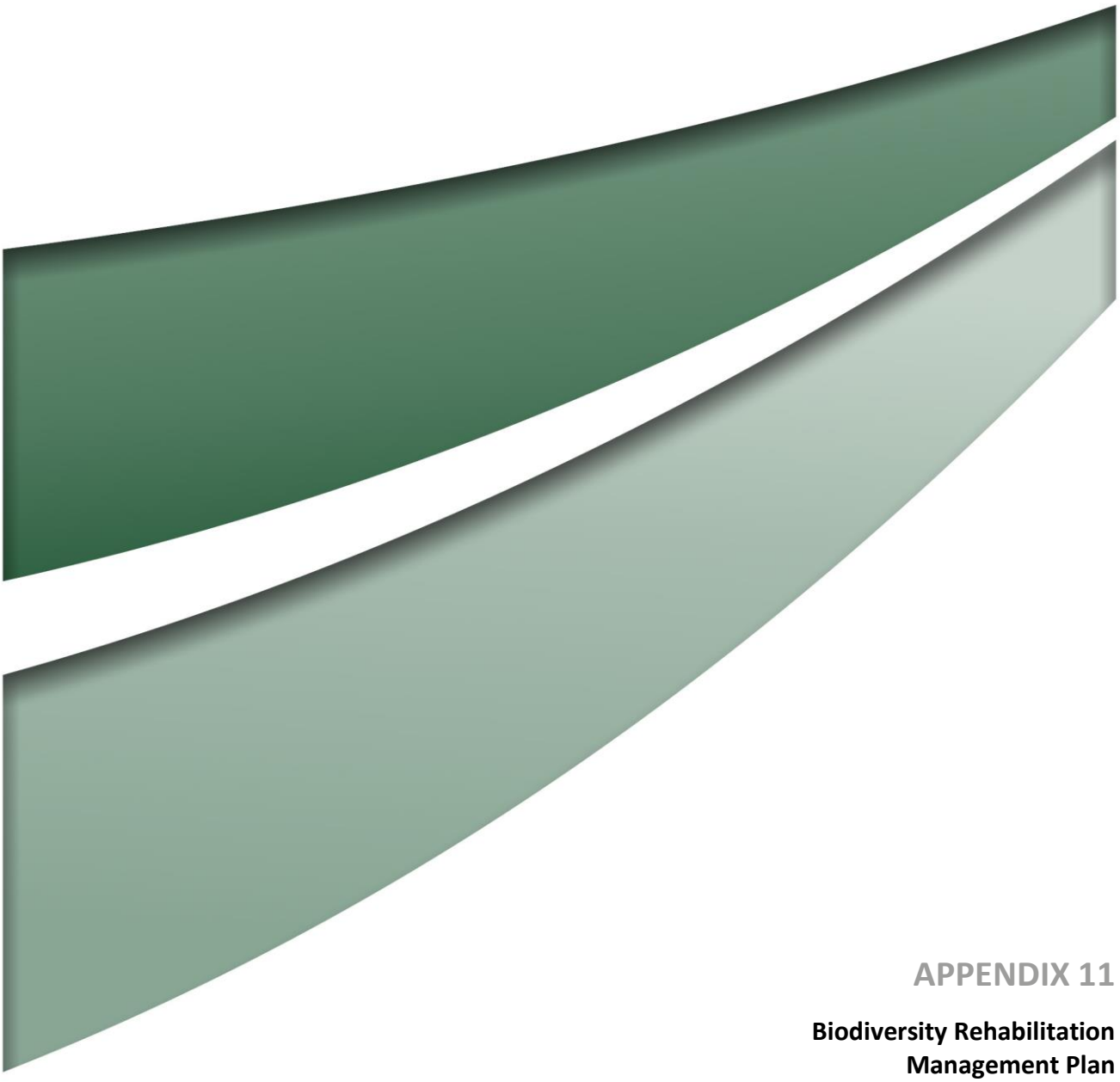
APPENDIX C

Biodiversity Values in vicinity of the Proposed MOD 3 Assessment Area Extension as shown on the NSW Biodiversity Values Map

Appendix C – Biodiversity Values Map of the Proposed MOD 3 Assessment Area

NSW Biodiversity Values Map taken from the NSW Biodiversity Values Map viewer (https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap) on 27 May 2019. This shows the approximate Proposed MOD 3 Assessment Area indicated in red as the northern parcel of Lot 170 DP 664647 and adjacent lands showing any mapped biodiversity values in purple.

Figure AC.1 – Biodiversity Values in vicinity of the approximate Proposed MOD 3 Assessment Area as shown on the Biodiversity Values Map

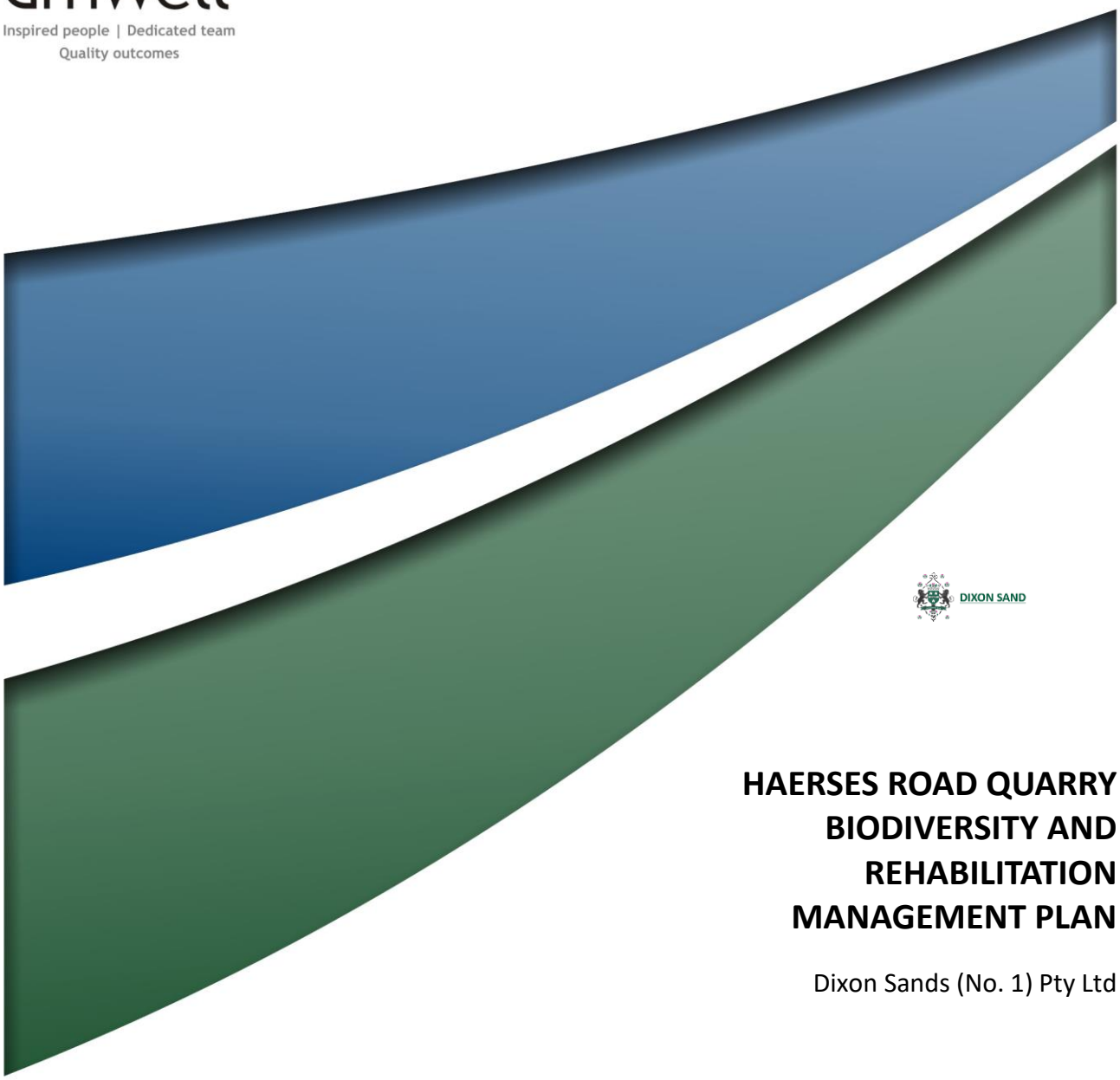


APPENDIX 11

Biodiversity Rehabilitation Management Plan

umwelt

Inspired people | Dedicated team
Quality outcomes



DIXON SAND

HAERSES ROAD QUARRY BIODIVERSITY AND REHABILITATION MANAGEMENT PLAN

Dixon Sands (No. 1) Pty Ltd

May 2019

DIXON SAND

HAERSES ROAD QUARRY BIODIVERSITY AND REHABILITATION MANAGEMENT PLAN

Dixon Sands (No. 1) Pty Ltd

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Dixon Sands (No. 1) Pty Ltd

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Document Status

Rev No.	**Reviewer**		**Approved for Issue**	
	Name	**Date**	**Name**	**Date**
V1a (submission for Agency consultation)	Allison Riley	4 June 2018	Luke Bettridge	2 July 2018
V2 (to DPE)	Allison Riley	29 August 2018	Luke Bettridge	29 August 2018
V2a (to DPE)	Allison Riley	17 September 2018	Luke Bettridge	17 September 2018
V3	Hunny Churcher	30 May 2019	David Dixon	30 May 2019

Table of Contents

Figures

Tables

Appendices

1.0 Introduction

1.1 Background

Dixon Sand (No. 1) Pty Limited (Dixon Sand) operates the Haerses Road Quarry (the Quarry), a sand extraction and processing operation located on Haerses Road in Maroota, NSW (refer to **Figure 1.1**). The Quarry has been in operation since 2006. The site is approximately 71 hectares (ha) and includes Lot 170 DP 664766, Lot 170 DP 664767, Lots A and B DP 407341, Lots 176 and 177 DP 752039 and Lot 216 DP 752039 (refer to **Figure 1.2**). The Quarry is located in the small rural community of Maroota which supports a number of other sand extraction operations, including the Old Northern Road Quarry which is also operated by Dixon Sand. The Quarry supplies concrete sand and specialty sands to the Sydney metropolitan market.

The Quarry operates in accordance with Development Consent (DA 165-7-2005) issued by the Minister for Planning on 14 February 2006. The Development Consent was modified under Section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act) on 22 January 2018 (Modification 1). The Development Consent was subsequently modified under Section 4.55(1) of the *Environmental Planning and Assessment Act 1979* (EP&A Act) on 29 January 2019 (Modification 2).

The Development Consent permits the extraction and processing of 250,000 tonnes per annum (tpa). Transport of up to 190,000 tpa of quarry product to the Old Northern Road Quarry for processing, located approximately 2 kilometres (km) to the north, is also permitted.

The Development Consent permits quarrying operations to be carried out on site until 14 February 2046.

1.2 Purpose and Scope

The purpose of this Biodiversity and Rehabilitation Management Plan (BRMP) is to describe the biodiversity and rehabilitation management strategies, procedures, controls and monitoring programs to be implemented for the management of approved biodiversity and rehabilitation impacts from the operation of the Quarry.

This BRMP addresses the relevant requirements of the Development Consent. The Development Consent conditions and Environmental Assessment (EA) Commitments relevant to this plan are provided in **Section 2.0**, including a checklist of where each condition has been addressed within this document.

The Development Consent requires the retirement of biodiversity credits (as per Condition 30, 31 and 32 of Schedule 3 of the Development Consent), this is being carried out under BioBanking agreements for Haerses Road and Porters Road BioBank Sites (referred to in greater detail in **Section 4.2** and **Section 4.3**) which are currently in the process of being implemented. As such, this document covers the management of the following areas (see **Figure 1.3**):

- Haerses Road Quarry Site
- Haerses Road BioBank Site (established as part of the Haerses Road Quarry Extraction Area Modification approval to meet biodiversity credit requirements)
- Porters Road BioBank Site (established as part of the Haerses Road Quarry Extraction Area Modification approval to meet biodiversity credit requirements).

The management of the Biodiversity Offset Area for Old Northern Road Quarry (required for a separate Dixon Sand held project approval for the Old Northern Road Quarry (DA 250-09-01) is not undertaken as part of this document and has its own management plan, however has been referred to on **Figure 1.3** for the purposes of provided context and so it can be integrated into overall landscape designs.

This BRMP has also been developed in accordance with the requirements of the Draft Department of Planning and Environment's (DPE) *Environment Management Plan Guidelines* (the guidelines). A checklist of where the guidelines have been addressed within this document is shown in **Appendix 1**.

1.2.1 Objectives of the BRMP

The objective of this BRMP is to provide direction for the short to long term management and enhancement of the biodiversity values of the Haerses Road Quarry site and its offsets, as well as provide a detailed description of the measures to be implemented to achieve this over the next 3 year period (2018-2020).

The objectives of the BRMP are to:

- identify and describe the areas of land that will be required to be managed in accordance with this BRMP
- provide clear and concise instructions for the management measures to be implemented in accordance with the Project Approval Conditions in order to achieve the conservation management objectives and minimise the impacts of key threats
- provide a working schedule for the implementation of activities required from the BRMP
- describe monitoring, performance evaluation and reporting procedures that are informative, practical and achievable.

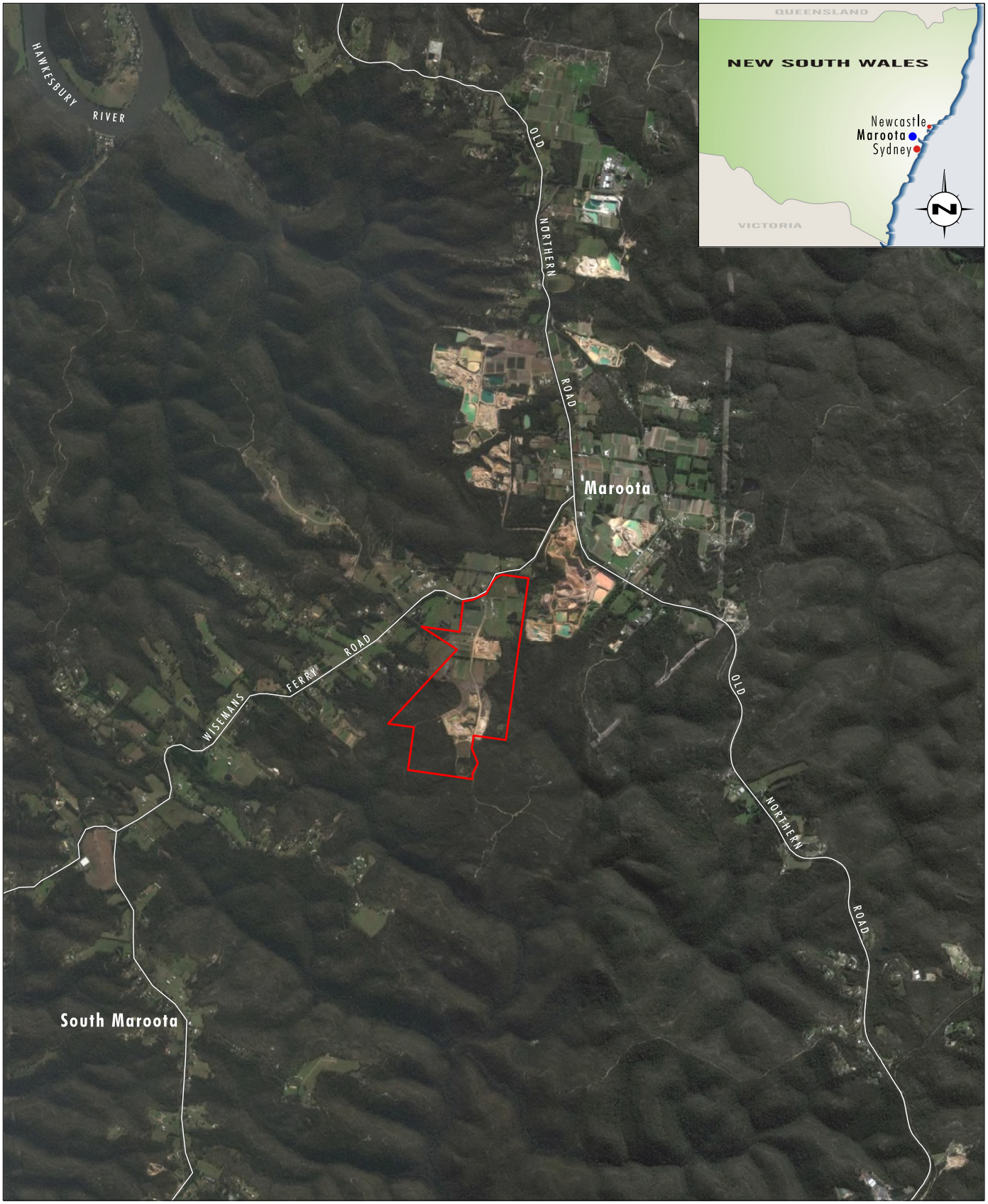

Image Source: Google Earth (2014)

0 0.5 1.0 2.0km
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Legend

Haerses Road Quarry Site

FIGURE 1.1

Locality Map

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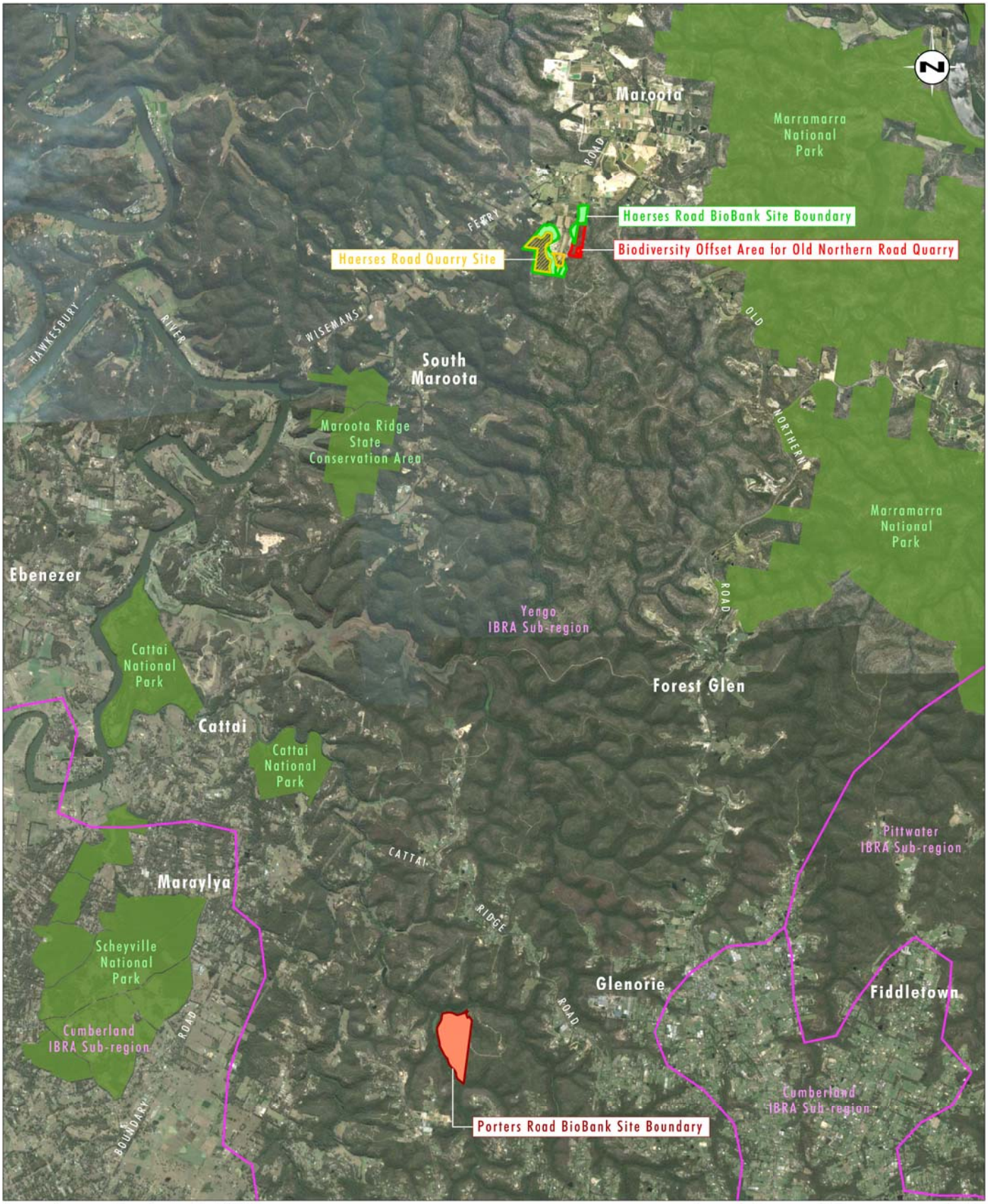

Legend

- Haerses Road Quarry Site
- Biodiversity Offset Area for Old Northern Road Quarry
- Haerses Road BioBank Site Boundary
- Porters Road BioBank Site Boundary
- National Park and Conservation Area
- IBRA Sub-region

FIGURE 1.3

Haerses Road and Porters Road BioBank Sites and Old Northern Road Biodiversity Offset Area

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20180525 10.58

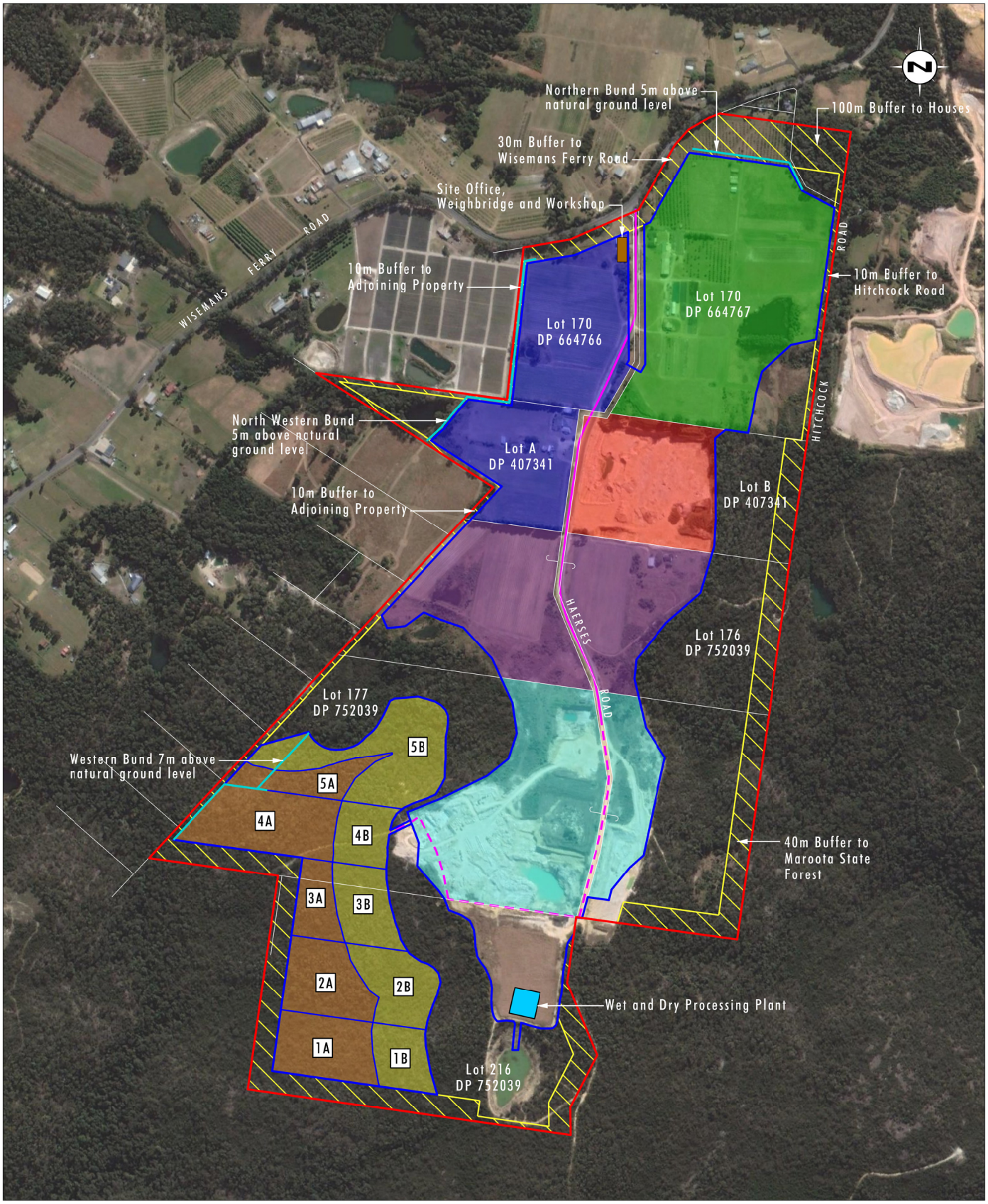

Image Source: Google Earth (Sep 2017)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

0 100 250 500m
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Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Extraction Area Stage 1
- Extraction Area Stage 2
- Extraction Area Stage 3
- Extraction Area Stage 4
- Extraction Area Stage 5
- Extraction Area A
- Extraction Area B
- 1 Extraction Cell Number
- Site Office, Weighbridge and Workshop
- Wet Processing Plant
- Indicative Unsealed Haul Road
- Sealed Haul Road
- Accoustic Bund
- Buffer Zone

FIGURE 1.2

Haerses Road Quarry

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20180608 10.10

2.0 Regulatory Requirements

2.1 Development Consent

Table 2.1 below outlines the relevant Development Consent conditions under DA 165-7-2005 and where they have been addressed within the BRMP.

Table 2.1 Biodiversity and Rehabilitation Related Development Consent Conditions

<table>
<tr><th>Condition</th><th>Description</th><th>Section/s Addressed</th></tr>
<tr><td colspan="3">Biodiversity Offset Strategy</td></tr>
<tr><td>30</td><td>The Applicant must retire the biodiversity credits specified in Table 4 to the satisfaction of the Secretary and OEH. The Applicant must retire the credits prior to commencing any vegetation clearing within the Mod 1 extraction area, except the minimum clearing required to comply with condition 16 of this Schedule.
Table 4: Biodiversity credits to be retired prior to the commencement of vegetation clearing
<table>
<tr><th>Credit type</th><th>Number of Credits</th></tr>
<tr><td colspan="2">Ecosystem Credits</td></tr>
<tr><td>HN560 Needlebush – Banksia Wet Heath on Sandstone Plateaux of the Sydney Basin Bioregion</td><td>3</td></tr>
<tr><td>HN566 Red Bloodwood – Scribbly Gum Heathy Woodland on Sandstone Plateaux of the Sydney Basin Bioregion</td><td>377</td></tr>
<tr><td>HN582 Scribbly Gum – Hairpin Banksia – Dwarf Apple Heathy Woodland on Hinterland Sandstone Plateaux of the Central Coast, Sydney Basin Bioregion</td><td>181</td></tr>
<tr><td>HN586 Smooth-barked Apple – Red Bloodwood – Sydney Peppermint Heathy Open Forest on Slopes of Dry Sandstone Gullies of Western and Southern Sydney, Sydney Basin Bioregion</td><td>44</td></tr>
<tr><td colspan="2">Species Credits</td></tr>
<tr><td>Darwinia biflora</td><td>360</td></tr>
<tr><td>Dural Land Snail (Pommerhelix duralensis)</td><td>98</td></tr>
<tr><td>Eastern Pygmy Possum (Cercartetus nanus)</td><td>148</td></tr>
<tr><td>Grevillea parviflora subsp. supplicans</td><td>338</td></tr>
<tr><td>Tetratheca glandulosa</td><td>288</td></tr>
</table></td><td>Section 3.0</td></tr>
<tr><td>31</td><td>The Applicant must retire the biodiversity credits specified in Table 5 to the satisfaction of the Secretary and OEH. The Applicant must retire the credits prior to commencing any vegetation clearing within in extraction cells 1B, 2B or 3B (As shown in Figure 2, Appendix 1), except the minimum clearing required to comply with condition 16 of this Schedule.
Table 5: Biodiversity credits to be retired prior to vegetation clearing in extraction cells 1B, 2B or 3B
<table>
<tr><th>Credit type</th><th>Number of Credits</th></tr>
<tr><td colspan="2">Species Credits</td></tr>
<tr><td>Dural Land Snail (Pommerhelix duralensis)</td><td>132</td></tr>
</table></td><td>Section 3.0</td></tr>
</table>

<table>
<tr><th>Condition</th><th>Description</th><th>Section/s Addressed</th></tr>
<tr><td>32</td><td>The Applicant must retire the biodiversity credits specified in Table 6 to the satisfaction of the Secretary and OEH. The Applicant must retire the credits prior to commencing any vegetation clearing within in extraction cells 1B, 2B or 3B; 4A, 4B and 5B (As shown in Figure 2, Appendix 1), except the minimum clearing required to comply with condition 16 of this Schedule.
Prior to commencing vegetation clearing in any of extraction cells 1B, 2B or 3B; 4A, 4B and 5B, the Applicant must demonstrate that the credits required in respect to that cell have been retired, to the satisfaction of the Secretary.
Table 6: Biodiversity credits to be retired progressively
<table><tr><th>Credit type</th><th>Number of Credits</th></tr><tr><td>Ecosystem Credits</td><td></td></tr><tr><td>HN582 Scribbly Gum – Hairpin Banksia – Dwarf Apple Heathy Woodland on Hinterland Sandstone Plateaux of the Central Coast, Sydney Basin Bioregion</td><td>357</td></tr><tr><td>Species Credits</td><td></td></tr><tr><td>Eastern Pygmy Possum (Cercartetus nanus)</td><td>75</td></tr></table></td><td>Section 3.0</td></tr>
<tr><td>33</td><td>In retiring the ecosystem and species credits set out in conditions 30 to 32 above, the Applicant may apply the Biodiversity Offset Strategy (see Appendix 4 of the Development Consent) or, with the agreement of the Secretary, may use other land or alternate mechanisms permitted under the Framework for Biodiversity Assessment: NSW Biodiversity Offsets Policy for Major Projects.</td><td>Section 3.2</td></tr>
<tr><td colspan="3">Rehabilitation Objectives</td></tr>
<tr><td>34</td><td>The Applicant must rehabilitate the site to the satisfaction of the Secretary. This rehabilitation must be generally consistent with the final landform in Appendix 6 and must comply with the objectives in Table 6.
Table 6: Rehabilitation Objectives
<table><tr><th>Feature</th><th>Objective</th></tr><tr><td>All areas of the site affected by the development</td><td>• Safe
• Hydraulically and geotechnically stable
• Non-polluting
• Fit for the intended final land use(s)
• Final landform integrated with surrounding natural landforms as far as is reasonable and feasible, and minimising visual impacts when viewed from surrounding land</td></tr><tr><td>Surface infrastructure</td><td>• Decommissioned and removed, unless otherwise agreed by the Secretary</td></tr><tr><td>Quarry benches and pit floor</td><td>• Landscaped and vegetated using native tree and understorey species</td></tr><tr><td>Final void</td><td>• Minimise the size, depth and slope of the batters of the final void
• Minimise the drainage catchment of the final void</td></tr></table></td><td>Section 6.0</td></tr>
<tr><td colspan="3">Progressive Rehabilitation</td></tr>
<tr><td>35</td><td>The Applicant must rehabilitate the site progressively, that is, as soon as reasonably practicable following disturbance. All reasonable measures must be taken to minimise the total area exposed for dust generation at any time. Interim stabilisation measures must be implemented where reasonable and feasible to control dust emissions in disturbed areas that are not active and which are not ready for final rehabilitation.
Note: It is accepted that parts of the site that are progressively rehabilitated may be subject to future re-disturbance.</td><td>Section 6.2</td></tr>
</table>

Condition	Description	Section/s Addressed
Biodiversity and Rehabilitation Management Plan		
36	The Applicant must prepare a Biodiversity and Rehabilitation Management Plan for the development to the satisfaction of the Secretary. This plan must:	Whole Document
	(a) Be prepared by a suitably qualified expert	
	(b) Be prepared in consultation with OEH and Council	TBA
	(c) Be submitted to the Secretary for approval within 6 months of the approval of Modification 1, unless otherwise agreed by the Secretary	TBA
	(d) Provide details of the conceptual final landform and associated final land use(s) for the site	Section 6.0
	(e) Describe how the implementation of the Biodiversity Offset Strategy will be integrated with the overall rehabilitation of the site	Section 3.3
	(f) Describe the short, medium and long term measures to be implemented to:	Section 7
	• Manage remnant vegetation and habitat on site, including within the Biodiversity Offset Strategy area; and	
	• Ensure compliance with the rehabilitation objectives and progressive rehabilitation obligations in this consent	
	(g) Include a detailed description of the measures described in paragraph (f) to be implemented over the next 3 years (to be updated for each 3 year period following initial approval of the plan) including the procedures to be implemented for:	Section 6.2
	• Maximising the salvage of environmental resources within the approved disturbance area, including tree hollows, vegetation and soil resources, for beneficial reuse in the enhancement of the offset area or site rehabilitation.	
	• Restoring and enhancing the quality of native vegetation and fauna habitat in the biodiversity offset and rehabilitation areas through assisted natural regeneration, targeted vegetation establishment and the introduction of fauna habitat features	Section 5.6
	• Protecting vegetation and fauna habitat outside the approved disturbance area on-site, paying particular attention to any occurrences of *Hibbertia superans* adjacent to the approved extraction areas	Section 5.1.1.1
	• Minimising the impacts on native fauna, including undertaking pre-clearance surveys and avoiding clearing activities during sensitive hibernation and breeding periods	Section 5.1.1
	• Establishing vegetation screening to minimise the visual impacts of the site on surrounding receivers	Section 5.3.3
	• Ensuring minimal environmental consequences for threatened species, populations and habitats	Section 5.2, Section 5.3 and Section 5.4
	• Collection and propagating seed	Section 5.1.3
	• Controlling weeds and feral pests	Section 5.2.2, and Section 5.2.3
	• Controlling erosion; and	Section 5.2.4
	• Managing bushfire risk	Section 5.2.5
	(h) Include a program to monitor the effects of the development on flora and fauna	Section 7.0

Condition	Description	Section/s Addressed
	(i) Include detailed performance and completion criteria for evaluating the performance of the Biodiversity Offset Strategy and the rehabilitation of the site (including progressive rehabilitation), including triggers for any necessary remedial action	Section 7
	(j) Include a program to monitor and report on the effectiveness of the measures described in paragraphs (f) and (g), and progress against the performance and completion criteria	Section 7.0
	(k) Identify the potential risks to the successful implementation of the plan, and include a description of the contingency measures to be implemented to mitigate against or address these risks, including specific measures to be implemented in the event that the performance and completion criteria are not satisfied	Section 10.0
	(l) Include details of who is responsible for monitoring, reviewing, and implementing the plan. The Applicant must implement the Biodiversity and Rehabilitation Management Plan as approved by the Secretary.	Section 11.0
Biodiversity and Rehabilitation Bond		
37	Within 6 months of the approval the Biodiversity and Rehabilitation Management Plan, the Applicant must lodge a Biodiversity and Rehabilitation Bond with the Department to ensure that the Biodiversity Offset Strategy and rehabilitation of the site are implemented in accordance with the performance and completion criteria set out in the Biodiversity and Rehabilitation Management Plan and the relevant conditions of this consent. The sum of the bond must be determined by: (a) Calculating the full cost of implementing the Biodiversity Offset Strategy (b) Calculating the cost of rehabilitating all disturbed areas of the site, taking into account the likely surface disturbance over the next 3 years of quarrying operations; and (c) Employing a suitably qualified surveyor or other expert to verify the calculated costs, to the satisfaction of the Secretary. *Notes:* • *Alternative funding arrangements for long term management of the Biodiversity Offset Strategy, such as provisions of capital and management funding as agreed by OEH as part of a BioBanking Agreement, or transfer to conservation reserve estate can be under to reduce the liability of the Biodiversity and Rehabilitation Bond* • *If capital or other expenditure required by the Biodiversity and Rehabilitation Management Plan is largely complete, the Secretary may waive the requirement for lodgement of a bond in respect of the remaining expenditure*	Section 3.4

Condition	Description	Section/s Addressed
	• *If the Biodiversity Offset Strategy and/or rehabilitation of the site area are completed (or partially completed) to the satisfaction of the Secretary, then the Secretary will release the bond (or relevant part of the bond). If the Biodiversity Offset Strategy and Rehabilitation of the site are not completed to the satisfaction of the Secretary, then the Secretary will call in all or part of the bond, and arrange for the completion of the relevant works* • *Any redundant rehabilitation or biodiversity bonds currently held by the Department in relation to the development may be released following acceptance of the Biodiversity and Rehabilitation bond required under this condition*	
38	The Biodiversity and Rehabilitation Bond must be reviewed and (if required), an updated bond must be lodged with the DPE within 3 months following: (a) An updated or revision to the Biodiversity and Rehabilitation Management Plan (b) The completion of an Independent Environmental Audit in which recommendations relating to the implementation of the Biodiversity Offset Strategy and/or rehabilitation of the site have been made; or (c) In response to a request by the Secretary.	Section 3.4

2.2 Rehabilitation and Biodiversity Related EIS Management Commitments

In accordance with Condition 2 Schedule 2 of the Development Consent, the Quarry must be developed and operated generally in accordance with the environmental impact assessment reports prepared for the development and subsequent modifications. **Table 2.2** summarises the safeguards and management controls relating to biodiversity and rehabilitation management that have been identified in the Environmental Assessment reports prepared for DA 165-7-2005.

Table 2.2 Relevant EIS Biodiversity and Rehabilitation Commitments

Reference	Description	Section/s Addressed
Haerses Road Quarry Extraction Area Modification Environmental Assessment (Umwelt 2016a)	**Section 7.1.5 Ecology** Dixon Sand will implement the following measures to minimise the potential impacts on the biodiversity of the Modification Area and the locality: ○ ongoing weed management ○ ongoing sediment and erosion controls ○ a tree felling procedure to minimise the potential for impacts on native fauna species (focusing on threatened species) as a result of the clearing of hollow-bearing trees ○ employee education and training including inductions for staff, contractors and visitors to the site, to inform personnel of the biodiversity issues present at the site and their role and responsibilities in relation to the protection and/or minimisation of impacts to biodiversity	Section 5.2

Reference	Description	Section/s Addressed
	○ demarcation of areas of biodiversity value outside the proposed extraction area, where appropriate, to prevent the unnecessary disturbance ○ traffic control measures/speed limits/signage will be utilised on haul roads and access roads to minimise fauna injury/road kills.	
	Dixon Sands will retire biodiversity credits as outlined in Haerses Road Quarry Extraction Area Modification Project Biodiversity Assessment Report (Umwelt 2016b) prior to the disturbance of native vegetation in the Modification area. The credits may be retired progressively based on the staging of native vegetation disturbance in line with the progressive development of the Quarry. The area of progressive disturbance and associated credits retired will be reported annually, along with an indication of when the next stage of disturbance requiring further credits will occur. Credit retirement will be undertaken in accordance with the Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects (OEH September 2014).	Section 3.0
	Section 7.1.9 Rehabilitation The Rehabilitation and Landscape Management Plan will be updated for the Modification to incorporate the rehabilitation of the proposed extraction area.	Section 6.0
	As part of the detailed quarry planning process, a detailed Quarry Closure Plan will be developed approximately three years prior to cessation of quarrying activities. The Quarry Closure Plan will describe in detail the proposed operational and progressive rehabilitation procedures for the remainder of the Quarry life and subsequent to the Quarry closure.	Section 7.1.3
	Rehabilitation monitoring and maintenance will be undertaken as outlined in Section 6.14.5 of the Haerses Road Quarry Extraction Area Modification Environmental Assessment (Umwelt, 2016a).	Section 7.1 and Section 7.3

2.3 Guidelines and Policies

Guidelines relevant to the BRMP include:

- Bush Fire Environmental Assessment Code for New South Wales (NSW Rural Fire Service, 2006a)
- Threatened Species Hazard Reduction Lists for the Bush Fire Environmental Assessment Code (NSW Rural Fire Service, 2006b)
- Guidelines for Ecologically Sustainable Fire Management (NPWS, 2004).

2.4 Stakeholder Consultation

In accordance with Condition 36 Schedule 3 of the Development Consent, this BRMP has been prepared in consultation with the Office of Environment and Heritage (OEH) and The Hills Shire Council. A copy of correspondence provided by these agencies is provided and a summary of how these issues have been addressed is provided in **Appendix 2**.

2.5 Further Studies and Approvals

No further studies or approvals relevant to this BRMP are specified under the Development Consent for the Quarry. Baseline studies relevant to this BRMP were undertaken as part of the initial EIS (ERM 2005) and subsequent Haerses Road Quarry Extraction Area Modification Environmental Assessment (Umwelt 2016).

2.6 Hold Points

Condition 30, 31 and 32 of Schedule 3 of the Development Consent requires the following hold point relating to the BioBank Sites (Haerses Road and Porters Creek):

- The Applicant must retire the biodiversity credits specified in Table 4 to the satisfaction of the Secretary and OEH. The Applicant must retire the credits prior to commencing any vegetation clearing within the Mod 1 extraction area, except the minimum clearing required to comply with condition 16 of this Schedule.

- The Applicant must retire the biodiversity credits specified in Table 5 to the satisfaction of the Secretary and OEH. The Applicant must retire the credits prior to commencing any vegetation clearing in extraction cells 1B, 2B or 3B (as shown in **Figure 2**, **Appendix 1**), except the minimum clearing required to comply with condition 16 of this Schedule.

- The Applicant must retire the biodiversity credits specified in Table 6 to the satisfaction of the Secretary and OEH. The Applicant must retire the credits prior to commencing any vegetation clearing in extraction cells 1B, 2B, 3A, 3B, 4A, 4B and 5B (as shown in **Figure 2**, **Appendix 1**), except the minimum clearing required to comply with condition 16 of this Schedule.

  Prior to commencing vegetation clearing in any of extraction cells 1B, 2B, 3A, 3B, 4A, 4B and 5B, the Applicant must demonstrate that the credits required in respect of that cell have been retired, to the satisfaction of the Secretary.

These credits will be retired once the BioBanking Agreements are finalised for the offset areas. The reports for these documents were submitted to OEH for review in February 2018. The Biobanking Agreement for the Porters Road Biobank site has been registered in February 2019. The Biobanking Agreement for the Hearses Road Biobank site is currently being processed by the Land and Registry Services.

3.0 Biodiversity Offset Strategy

The existing Quarry operates in accordance with Development Consent (DA) 165-7-2005 issued in 2006 and modified during 2016. Condition 30 of DA 165-7-2005 requires the implementation of a Biodiversity Offset Strategy (BOS) which is outlined in Tables 4, 5 and 6 of the Development Consent.

Table 3.1 below outlines the biodiversity offset credits which must be retired to the satisfaction of the Secretary and OEH prior to commencement of any vegetation clearing within the Mod 1 extraction area, except for the minimum clearing required to comply with Schedule 3 Condition 16 of the Development Consent, which relates to the installation of groundwater monitoring bores for the baseline monitoring program.

The disturbance area in which vegetation clearing can occur, subject to the Development Consent requirements, comprises both Extraction Area A and Extraction Area B approved as part of Mod 1.

Table 3.1 Biodiversity Offset Strategy - Schedule 3, Conditions 30, 31 and 32 of DA 165-7-2005

Credit Type	Number of Credits
Biodiversity Credits that must be retired prior to commencing vegetation clearing within the MOD1 Extraction Area (comprising western Approved Extraction Stages of Lot 177 DP 752039 and Approved Extraction Stages within Lot 216 DP 752039)	
Ecosystem Credits	
HN560 Needlebush – Banksia Wet Heath on Sandstone Plateaux of the Sydney Basin Bioregion	3
HN566 Red Bloodwood – Scribbly Gum Heathy Woodland on Sandstone Plateaux of the Sydney Basin Bioregion	377
HN582 Scribbly Gum – Hairpin Banksia – Dwarf Apple Heathy Woodland on Hinterland Sandstone Plateaux of the Central Coast, Sydney Basin Bioregion	181
HN586 Smooth-barked Apple – Red Bloodwood – Sydney Peppermint Heathy Open Forest on Slopes of Dry Sandstone Gullies of Western and Southern Sydney, Sydney Basin Bioregion	44
Species Credits	
Darwinia biflora	360
Dural Land Snail (*Pommerhelix duralensis*)	98
Eastern Pygmy Possum (*Cercartetus nanus*)	148
Grevillea parviflora subsp. *Supplicans*	338
Tetratheca glandulosa	288
Biodiversity Credits that must be retired prior to commencing vegetation clearing within extraction cells 1B, 2B or 3B	
Species Credits	
Dural Woodland Snail (*Pommerhelix duralensis*)	132
Biodiversity Credits that must be retired prior to commencing vegetation clearing within extraction cells 1B, 2B, 3A, 3B, 4A and 5B	
Ecosystem Credits	
HN582 Scribbly Gum – Hairpin Banksia – Dwarf Apple Heathy Woodland on Hinterland Sandstone Plateaux of the Central Coast, Sydney Basin Bioregion	357
Species Credits	
Eastern Pygmy Possum (*Cercartetus nanus*)	75

3.1 Security of Biodiversity Offset Strategy

Condition 30 Schedule 3 of the Development Consent requires Dixon Sand to retire credits prior to undertaking vegetation activities (with the exception of the minimum amount required to comply with Condition 16). Dixon Sand is in the process of implementing this Biodiversity Offset Strategy; however is awaiting comment on the following documentation provided to OEH:

- Haerses Road BioBank Site Biodiversity Assessment Report (Umwelt 2018a)
- Porters Road BioBank Site Biodiversity Assessment Report (Umwelt 2018b).

The Biobanking Agreement for the Porters Road Biobank site has been approved and registered in February 2019. The Biobanking Agreement for the Hearses Road Biobank site is currently being processed by the Land and Registry Services. The credits will be retired once both Biobanking agreement has been approved and registered.

Biodiversity management, maintenance and monitoring activities within the two BioBank sites will be implemented by Dixon Sand in accordance with the approved BioBanking Agreements. **Section 3.3** outlines how the implementation of the Biodiversity Offset Strategy will be integrated with the overall rehabilitation of the site.

3.2 Integration of Biodiversity Offset Strategy with Quarry Rehabilitation

Quarry rehabilitation aims to improve the environmental quality of the site by protecting and enhancing habitat for threatened species. A key component of the BOS is revegetation of rehabilitated land to reinstate, to the greatest extent practicable, the vegetation communities, threatened species and fauna habitats which were present prior to disturbance. The rehabilitation once established, also aims to improve connectivity between vegetated areas and BioBanking sites established as part of the Project to the east and west.

These aims will be achieved through the implementation of a range of operational management controls which will be implemented consistently across the operational and rehabilitation areas more broadly (refer to **Section 6.3**), as well as specific management controls relating to regeneration and targeted revegetation (refer to **Section 6.4**). The final landform which demonstrates the integration of the quarry rehabilitation and BioBanking sites is described in **Section 6.3**.

3.3 Biodiversity and Rehabilitation Bond

In accordance with Schedule 3 Condition 37 of the Development Consent, within 6 months of the approval of the BRMP, Dixon Sand will lodge a Biodiversity and Rehabilitation Bond with the Department to ensure that the BOS and rehabilitation of the site are implemented in accordance with the performance and completion criteria set out in the BRMP and the relevant conditions of this consent.

The sum of the bond will be determined by:

a) calculating the full cost of implementing the BOS;

b) calculating the cost of rehabilitating all disturbed areas of the site, taking into account the likely surface disturbance over the next 3 years of quarrying operations; and

c) employing a suitably qualified quantity surveyor or other expert to verify the calculated costs.

to the satisfaction of the Secretary.

The Biodiversity and Rehabilitation Bond will be reviewed and (if required), an updated bond will be lodged with the Department within 3 months following:

a) an update or revision to the BRMP;

b) the completion of an Independent Environmental Audit in which recommendations relating to the implementation of the BOS and/or rehabilitation of the site have been made; or

c) in response to a request by the Secretary.

4.0 Existing Biodiversity Values

The key biodiversity values that will be managed under this BRMP are described in **Section 4.1** to **Section 4.3** below. Further detail regarding the biodiversity features and values of the Quarry and associated offset site can be found in Section 6.7 of the Environmental Assessment (Umwelt, 2016a), Framework for Biodiversity Assessment (Umwelt,2016b), the Biodiversity Offset Strategy (Umwelt, 2017) and the Haerses Road EIS (ERM,2005).

4.1 Haerses Road Quarry Site

The Quarry site is located within the Sydney Basin Interim Biogeographic Regionalisation of Australia (IBRA) bioregion and the Yengo IBRA subregion. Two BioBank sites (Haerses Road and Porters Road) are managed as part of this Quarry. The location of these sites relative to each other is provided in **Figure 1.3**. The Modification Area contains four biometric vegetation types as identified in Umwelt (2016b). These vegetation types are shown in **Figure 4.1** and include:

- HN560 – Needlebush – Banksia Wet Heath on Sandstone Plateaux of the Sydney Basin Bioregion (consistent with *Coastal Upland Swamp in the Sydney Basin Bioregion* endangered ecological community (EEC) (listed under the *Biodiversity Conservation Act 2016* (BC Act) and the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act))
- HN566 – Red Bloodwood – Scribbly Gum Heathy Woodland on Sandstone Plateaux of the Sydney Basin Bioregion
- HN582 – Scribbly Gum – Hairpin Banksia – Dwarf Apple Heathy Woodland on Hinterland Sandstone Plateaux of the Central Coast, Sydney Basin Bioregion and
- HN586 – Smooth-barked Apple – Red Bloodwood – Sydney Peppermint Heathy Open Forest on Slopes of Dry Sandstone Gullies of Western and Southern Sydney, Sydney Basin Bioregion.

The following threatened flora and fauna species have also been identified in the vicinity of the Approved Extraction Area as part of ERM (2005) and Umwelt (2016b) (see **Figure 4.1** and **Figure 4.2**):

- Koala (*Phascolarctos cinereus*)(listed as vulnerable under the BC Act and the EPBC Act)
- Little bentwing-bat (*Miniopterus australis*) (listed as vulnerable under the BC Act)
- *Tetratheca glandulosa* (listed as vulnerable under the BC Act)
- *Darwinia biflora* (listed as vulnerable under the BC Act and the EPBC Act)
- *Hibbertia superans* (listed as endangered under the BC Act)
- *Grevillea parviflora* subsp. *supplicans* (listed as endangered under the BC Act).

Existing operations are located within the west of Lot B DP 407341 and central Lot 177 DP752039 (see **Figure 1.2**).

Exotic flora species within the site occur predominately within agricultural areas and surrounding dams, including species such as Crofton weed (*Ageratina adenophora*) (a declared weed under the NSW *Biosecurity Act 2015*) as well as exotic grasses.

Remnant vegetation areas tended to comprise low levels of introduced species and where present were dominant by relatively innocuous species such as catsear (*Hypochaeris radicata*), *Centaurium* sp. and paspalum (*Paspalum dilatatum*).

Feral animal species identified include:

- Domestic dog (*Canis lupus familiaris*)
- Red fox (*Vulpes vulpes*)
- Brown hare (*Lepus capensis*)
- Sheep (*Ovis aeries*) and
- Black rats (*Rattus rattus*).

4.2 Haerses Road BioBank Site

The Haerses Road BioBank Site is comprised of part of Lot 216/DP752039, Lot 170/DP664767, Lot 177/DP752039, Lot 176/DP752039 and Lot B/DP407341; and is 28.18 ha in size (see **Figure 4.1**). It occurs in the Hawkesbury/Nepean catchment within The Hills LGA. Although zoned as RU1 – Primary Production, there is no evidence of recent grazing or fire in this site. Only 0.65 ha of this site comprises cleared vegetation, with the remainder comprising intact vegetation with disturbance limited to fire trails and access trails.

The site is underlain by soils derived from Hawkesbury Sandstone and rocky outcrops, a prominent ridgeline and several gullies. This site is connected to expansive areas of remnant vegetation. Four vegetation communities were identified in this site being:

- PCT978/HN560 – Needlebush – Banksia Wet Heath on Sandstone Plateaux of the Sydney Basin Bioregion (consistent with *Coastal Upland Swamp in the Sydney Basin Bioregion* EEC (BC Act and EPBC Act)) – 0.95 ha
- PCT 1083/HN566 – Red Bloodwood – Scribbly Gum Heathy Woodland on Sandstone Plateaux of the Sydney Basin Bioregion – 10.53 ha
- PCT 1134/HN852 – Scribbly Gum – Hairpin Banksia – Dwarf Apple Heathy Woodland on Hinterland Sandstone Plateaux of the Central Coast, Sydney Basin Bioregion – 12.32 ha and
- PCT 1181/HN586 – Smooth-barked Apple – Red Bloodwood – Sydney Peppermint Heathy Open Forest on Slopes of Dry Sandstone Gullies of Western and Southern Sydney, Sydney Basin Bioregion – 2.98 ha.

The following threatened flora and fauna species have been recorded within the Haerses Road BioBank site:

- Dural land snail (*Pommerhelix duralensis*) (listed as endangered under the BC Act and the EPBC Act)
- Eastern pygmy possum (*Cercartetus nanus*) (listed as vulnerable under the BC Act)
- *Darwinia biflora* (listed as vulnerable under the BC Act and the EPBC Act)
- *Tetratheca glandulosa* (listed as vulnerable under the BC Act) and
- *Grevillea parviflora* subsp. *supplicans* (listed as endangered under the BC Act).

Several weed species are known to occur within the wider Haerses Road BioBank Site in low densities, including introduced grasses such as whisky grass (*Andropogon virginicus*). No weeds listed under the *Biosecurity Act 2015* were identified.

Two feral fauna species have been identified at this site being the:

- Pig (*Sus scrofa*) and
- Fox (*Vulpes vulpes*).

4.3 Porters Road BioBank Site

The Porters Road BioBank Site is approximately 54.7 ha and comprises Lot 1 DP565423 (see **Figure 4.3**). Although zoned as RU2 rural landscape there is no evidence of recent grazing or fire. This site comprises intact vegetation with disturbance limited to fire trails and access tracks.

The site is underlain by soils derived from Hawkesbury Sandstone with rocky outcrops, a prominent ridgeline and a gully. This site is connected to expansive areas of remnant native vegetation to the north. Four vegetation communities were identified in this site being:

- PCT 1083/HN566 – Red Bloodwood – Scribbly Gum Heathy Woodland on Sandstone Plateaux of the Sydney Basin Bioregion – 29.65 ha
- PCT 1134/HN852 – Scribbly Gum – Hairpin Banksia – Dwarf Apple Heathy Woodland on Hinterland Sandstone Plateaux of the Central Coast, Sydney Basin Bioregion – 7.04 ha
- PCT 1181/HN586 – Smooth-barked Apple – Red Bloodwood – Sydney Peppermint Heathy Open Forest on Slopes of Dry Sandstone Gullies of Western and Southern Sydney, Sydney Basin Bioregion – 15.68 ha
- PCT 1237/HN596 – Sydney Blue Gum – Blackbutt – Smooth-barked Apple Moist Shrubby Open Forest on Shale Ridges of the Hornsby Plateau, Sydney Basin Bioregion (consistent with *Blue Gum High Forest of the Sydney Basin Bioregion* CEEC under the BC Act and the EPBC Act) – 1.52 ha.

The following threatened flora and fauna species have been recorded within the Porters Road BioBank site:

- Dural land snail (*Pommerhelix duralensis*) (listed as endangered under the BC Act and the EPBC Act)
- Eastern pygmy possum (*Cercartetus nanus*) (listed as vulnerable under the BC Act)
- *Darwinia biflora* (listed as vulnerable under the BC Act and the EPBC Act)
- *Tetratheca glandulosa* (listed as vulnerable under the BC Act).

Several weed species are known to occur within the wider Porters Road BioBank Site in low densities, including lantana (*Lantana camara*) which is listed under the *Biosecurity Act 2015* in low numbers. Exotic grasses narrow-leaved carpet grass (*Axonopus fissifolius*) and *Setaria parviflora* were also identified in low numbers, however are both relatively innocuous.

Two feral fauna species were identified as requiring control at this site being the:

- Pig (*Sus scrofa*)
- Fox (*Vulpes vulpes*).

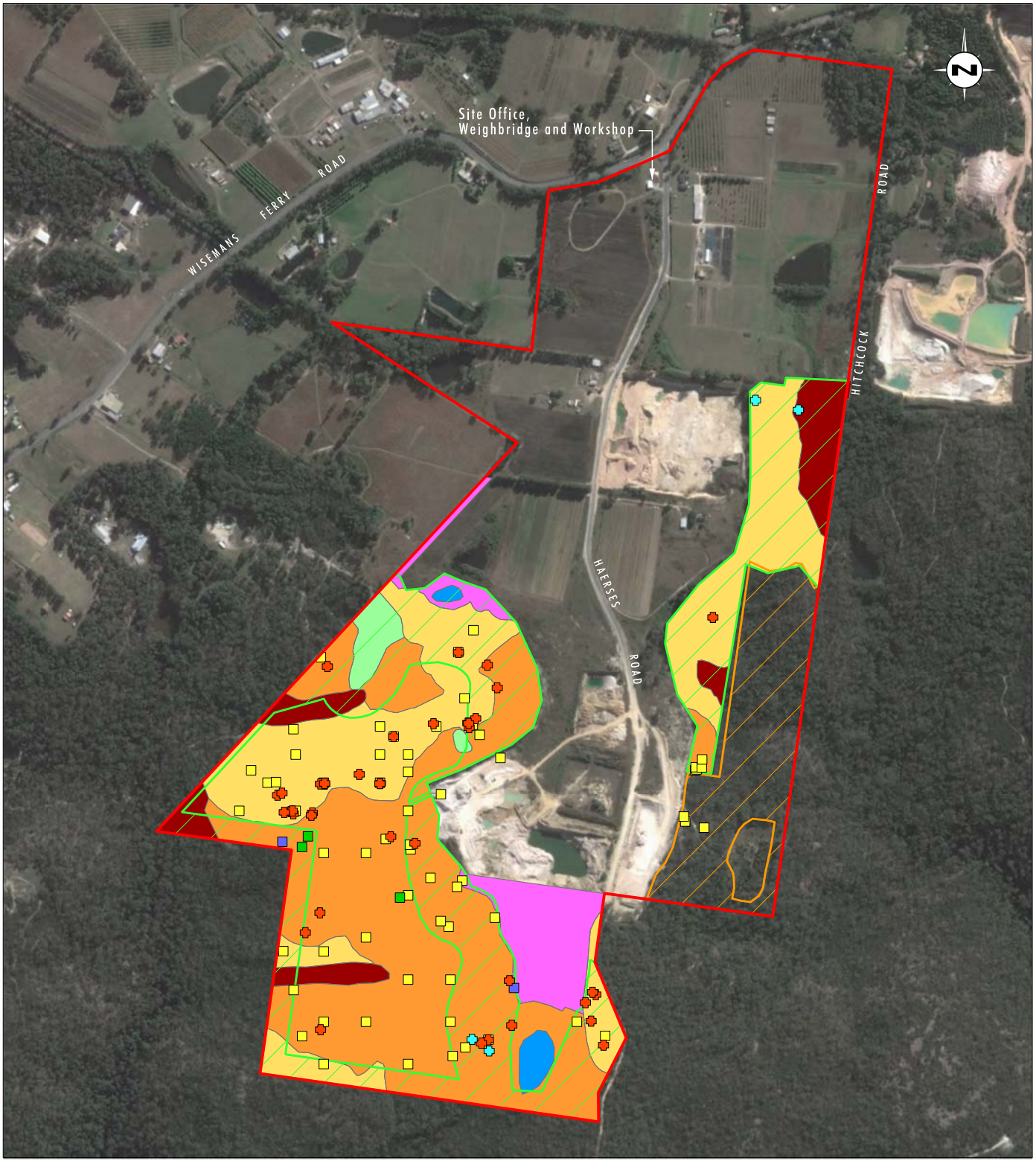


Image Source: Google Earth - DigitalGlobe (May 2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

0 100 250 500m
1:10 000

Legend

- Haerses Road Quarry Site
- Biodiversity Offset Area for Old Northern Road Quarry
- Haerses Road BioBank Site Boundary
- Cleared
- Dam
- Zone 1: PCT 978 - HN560 – Needlebush – Banksia Wet Heath on Sandstone Plateaux of the Sydney Basin Bioregion – Moderate to Good Condition
- Zone 2: PCT 1083 - HN566 – Red Bloodwood – Scribbly Gum Heathy Woodland on Sandstone Plateaux of the Sydney Basin Bioregion – Moderate to Good Condition
- Zone 3: PCT 1134 - HN582 – Scribbly Gum – Hairpin Banksia – Dwarf Apple Heathy Woodland on Hinterland Sandstone Plateaux of the Central Coast, Sydney Basin Bioregion – Moderate to Good Condition
- Zone 4: PCT 1181 - HN586 – Smooth-barked Apple – Red Bloodwood – Sydney Peppermint Heathy Open Forest on Slopes of Dry Sandstone Gullies of Western and Southern Sydney, Sydney Basin Bioregion – Moderate to Good Condition
- Dural Land Snail
- Eastern pygmy-possum
- *Darwinia biflora*
- *Grevillea parviflora subsp supplicans*
- *Tetratheca glandulosa*

FIGURE 4.1

Biometric Vegetation Types and Threatened Species of Haerses Road Quarry Modification Area and Haerses Road Biobank Site

File Name (A4): R06/4272_010.dgn
20180525 11.10

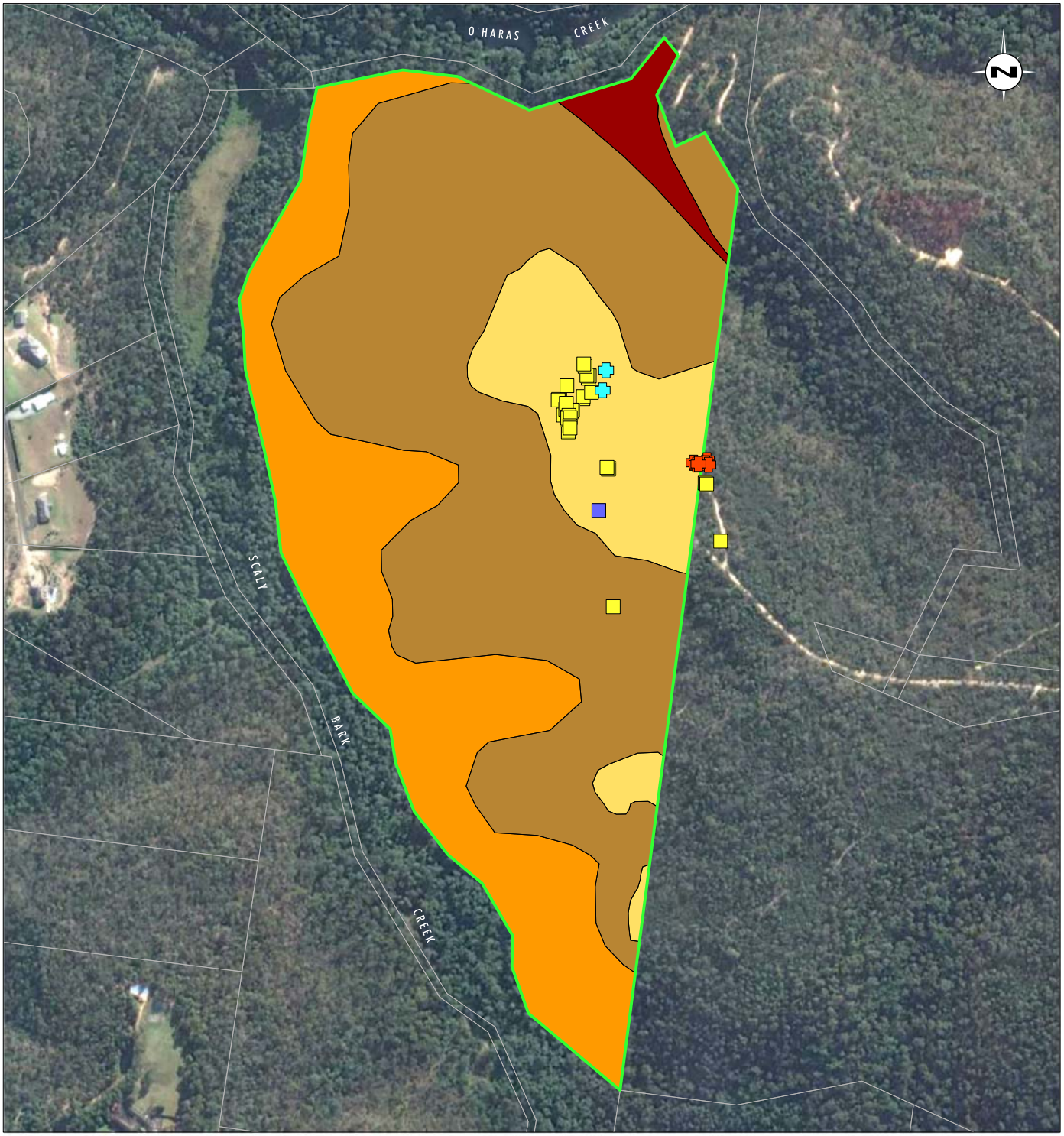


Image Source: Google Earth (2015)
Data Source: LPI (2011), Umwelt (2017), South East Environmental (2016, 2017)
Note: Site within Baulkham Hills Local Government Area and Yengo IBRA Subregion Boundary

0 100 200 400m
1:7 500

Legend

- Porters Road BioBank Site Boundary
- Zone 1: PCT 1083 - HN566 - Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux of the Sydney Basin - Moderate to Good Condition
- Zone 2: PCT 1134 - HN582 - Scribbly Gum - Hairpin Banksia - Dwarf Apple heathy woodland on hinterland sandstone plateaux of the Central Coast, Sydney Basin Bioregion - Moderate to Good Condition
- Zone 3: PCT 1181 - HN586 - Smooth-barked Apple - Red Bloodwood - Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney Basin Bioregion - Moderate to Good Condition
- Zone 4: PCT 1237 - HN596 - Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion - Moderate to Good Condition
- Dural Land Snail
- Eastern pygmy-possum
- *Darwinia biflora*
- *Tetratheca glandulosa*

FIGURE 4.3

Biometric Vegetation Types and Threatened Species of Porters Road BioBank Site

File Name (A4): R06/4272_006.dgn
20180525 11.08

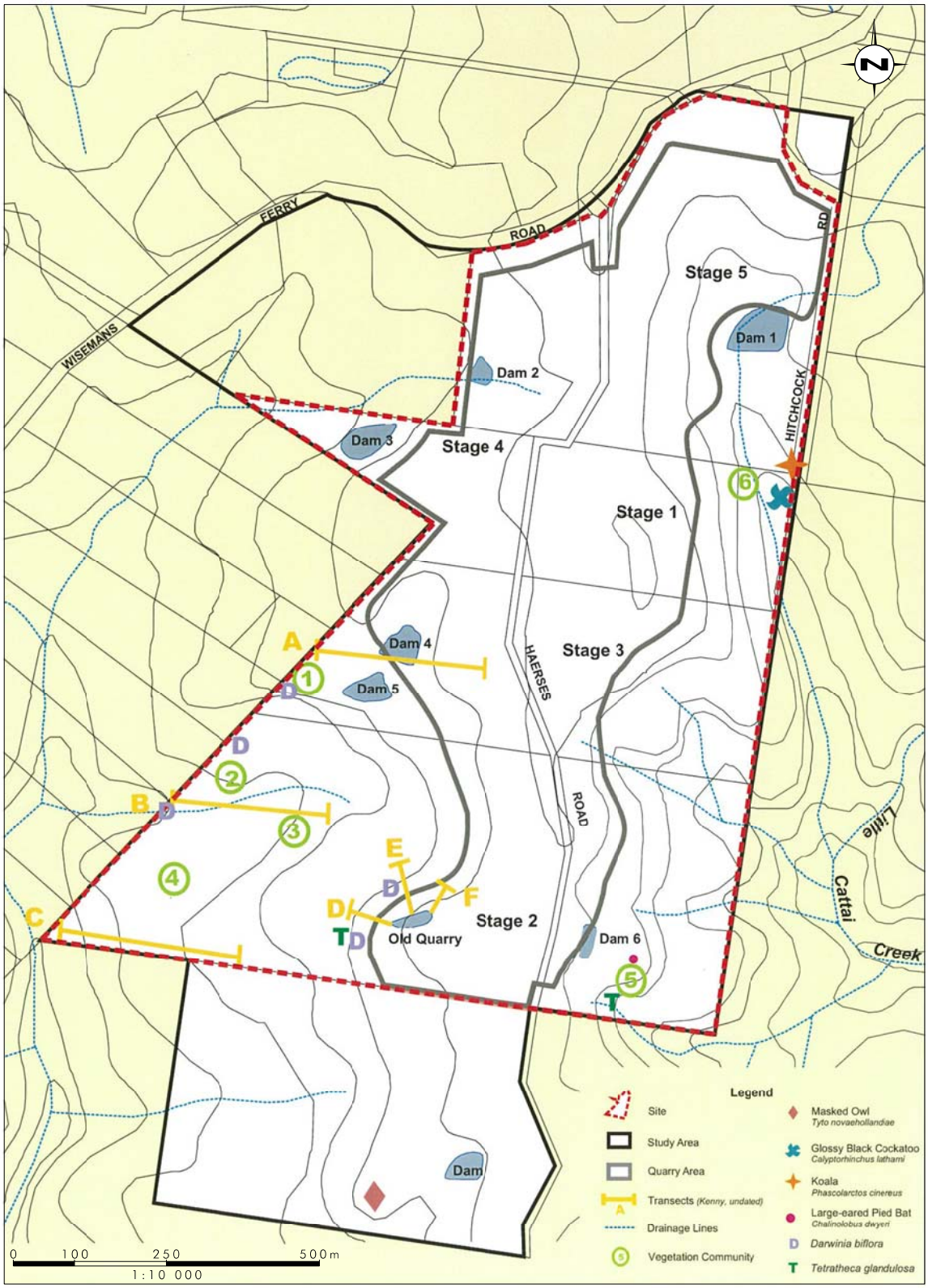


FIGURE 4.2

Vegetation Communities and Threatened Species in the Approved Extraction Area

Image Source: ERM (2016)

File Name (A4): R06/4272_011.dgn
20180606 15.50

5.0 Biodiversity Management Measures

As noted in **Section 1.2**, this BRMP identifies the biodiversity and rehabilitation management and monitoring measures that will be implemented for the Quarry. A range of controls and strategies have also been formulated to minimise and mitigate direct impacts associated with the Quarry, particularly in relation to land clearing and ground-disturbance and minimising impacts on the range of threatened species that are known to occur on the site. These management controls are aimed at ensuring that the purpose of the BRMP described in **Section 1.2.1** is met.

These impact mitigation measures will be implemented for the next 3 years (2018 – 2020) and for the life of the Quarry. Potential for continuous improvements in the type and way mitigation measures are implemented will be regularly reviewed. These improvements will be taken into consideration in future revisions of this BRMP.

5.1 Extraction Area Biodiversity Management Controls

During the next 3 years (2018 – 2020), the primary activities within the Quarry will involve ongoing development of quarrying areas and control of weed and feral species. The objective will be to undertake pre-disturbance activities that aim to minimise the ecological impacts of the quarrying operation as well as commence rehabilitation as soon as practical behind the quarrying activities so as to minimise the extent of disturbance on site. As such, the key biodiversity management controls to be adopted during this time include:

- Definition of clearing limits and install fencing to mark the extent of extraction (**Section 5.1.1.1**)
- Pre-clearance surveys ahead of vegetation clearing in accordance with **Section 5.1.1.2.** Based on the outcomes of these inspections, undertake the following where required:
    - specific tree felling procedures as outlined in **Section 5.1.1.4**, in order to minimise the impacts to flora and fauna from clearing
    - collect seed and regenerative material for use in rehabilitation, as per **Section 5.1.2**
    - salvage of habitat features as outlined in **Section 5.1.3**
    - salvage soil resources for use in rehabilitation as outlined in **Section 5.1.4**
- undertake feral animal and weed monitoring works as required (see **Section 5.2.2** and **Section 5.2.3**)
- undertake rehabilitation activities in accordance with the requirements of **Section 6.0**
- undertake rehabilitation and ecological monitoring activities as per the monitoring program outlined in **Section 7.0**.

The key rehabilitation and ecological management and mitigation measures to be adopted over this time are detailed in **Table 5.1**.

Table 5.1 Key Biodiversity Management Controls

Management or Mitigation Measure	Actions	Section/s Addressed
Short Term – over the next 3 years		
Protecting vegetation and fauna habitat outside the approved disturbance area on-site	• Demarcation of clearing limits to be maintained throughout the 3 year period • Demarcation of revegetation areas to be installed and maintained throughout the 3 year period	Section 5.1.1.1 Section 6.2
Minimising the impacts of clearing on native fauna, including undertaking pre-clearance surveys and avoiding clearing activities during sensitive hibernation and breeding periods	• Implementation of pre-clearance surveys and tree felling procedure prior to clearing • Where possible, timing clearing works outside sensitive periods for local threatened fauna	Section 5.1.1.2 and Section 5.1.1.4 Section 5.1.1.3
Ensuring minimal environmental consequences for threatened flora species, populations and habitats	• Defining clearing limits • Pre-clearance surveys and tree felling procedures • Seed collection and propagation of local flora species • Assisted regeneration and targeted vegetation establishment within buffers and rehabilitation areas	Section 5.1.1.1 Section 5.1.1.2 and Section 5.1.1.4 Section 5.1.2 Section 5.3
Maximising the salvage of environmental resources within the approved disturbance area, including tree hollows, vegetative and soil resources, for beneficial reuse in the enhancement of site rehabilitation	• Salvage of habitat features and placement within rehabilitation areas • Direct transfer of topsoil and associated seedbank from quarried areas	Section 5.1.3 Section 5.1.4
Restoring native vegetation and fauna habitat in the rehabilitation areas through targeted vegetation establishment and the introduction of fauna habitat features	• Rehabilitation of former quarried areas • Salvage and placement of habitat features in rehabilitated areas	Section 6.0 Section 6.7.4
Collecting and propagating seed	• Direct transfer of topsoil and brushmatting • Seed collection and propagation of local native and threatened species	Section 6.7.1 Section 5.1.2
Controlling weeds and feral pests	• Annual inspections with implementation of control programs as required • Monthly targeted weed control activities within buffers and rehabilitation areas	Section 5.2.2, 5.2.3
Controlling erosion	• Continued erosion and sediment control in accordance with the Haerses Road Soil and Water Management Plan	Section 5.2.4
Managing bushfire risk	• Continued implementation of bushfire control measures in accordance with the Haerses Road Bushfire Management Plan	Section 5.2.5

Management or Mitigation Measure	Actions	Section/s Addressed
Medium Term Measures (3-8 years)		
Protecting vegetation and fauna habitat outside the approved disturbance area on-site (where required)	• Demarcation of clearing limits to be maintained for the life of the Quarry • Fencing of revegetation areas to be installed and maintained for the life of the Quarry	Section 5.1.1.1 Section 5.1.1.1
Controlling weeds and feral pests	• Annual inspections with implementation of control programs as required • Targeted weed control activities within rehabilitation areas • Weed and feral pest control (if necessary)	Section 5.2.2, 5.2.3
Controlling erosion	• Inspection and maintenance of erosion and sediment controls in accordance with the Haerses Road Soil and Water Management Plan	Section 5.2.4
Reporting	• Annual reporting of any significant environmental impacts or disturbance within the rehabilitations areas or the Biodiversity Offset Area	Section 8
Long Term Measures (8 + Years)		
Protecting vegetation and fauna habitat outside the approved disturbance area on-site (where required)	• Demarcation of clearing limits to be maintained for the life of the Quarry • Fencing of revegetation areas to be installed and maintained for the life of the Quarry	Section 5.1.1.1 Section 5.1.1.1
Controlling weeds and feral pests	• Annual inspections with implementation of control programs as required • Targeted weed control activities within rehabilitation areas • Weed and feral pest control (if necessary)	Section 5.2.2, 5.2.3
Controlling erosion	• Inspection and maintenance of erosion and sediment controls in accordance with the Haerses Road Soil and Water Management Plan	Section 5.2.4
Reporting	• Annual reporting of any significant environmental impacts or disturbance within the rehabilitations areas or the Biodiversity Offset Area	Section 8

5.1.1 Land Disturbance Management Controls

The following measures apply to works associated with land clearing and ground-disturbance within the Quarry extraction area.

5.1.1.1 Defining Limits of Clearing

The limits of clearing for each stage of clearing works will be clearly delineated prior to clearing. To avoid unnecessary or inadvertent vegetation and habitat removal, disturbance must be restricted to the delineated area and no stockpiling of equipment, machinery, soil or vegetation will occur beyond this boundary.

Particular attention will be paid to demarcation of records of *Hibbertia superans* records located adjacent to the approved extraction areas.

The person/s responsible for the clearing activities will be responsible for ensuring that the boundary markers, barriers and signs are installed to enable the suitable environmental and technical inspections of the proposed disturbance to be undertaken. Site inductions are to be given to ensure all site workers and visitors are aware of any sensitive vegetation. Prior to clearing the Quarry Manager (or their delegate) will check the marked clearing limits and provide approval of the disturbance boundary. Approval must be granted before clearing commences.

5.1.1.2 Pre-Clearance Surveys

Comprehensive pre-clearing surveys will be undertaken by a suitably experienced and licensed ecologist, no more than 2 weeks prior to felling. This will include marking of hollow-bearing trees, as well as any other notable features such as fallen timber, hollow logs or boulders suitable for salvage; active nests, dreys or dens requiring consideration, and seed-bearing trees for salvage. Surveys will include detailed searches for threatened flora and fauna species. An additional pre-clearance survey of the vegetation to be cleared will be undertaken by the Environmental Officer on the day of clearing (within 24 hours of clearing).

5.1.1.3 Timing of Clearing

As far as practicable, vegetation clearing is to be planned for periods outside of the breeding season for threatened species known to nest in the site and outside of torpor periods for hollow-roosting microbat species known to occur within the site. **Table 5.2** identifies the critical periods of use for threatened species recorded on site.

Clearing of hollow resources suitable for breeding will also be conducted outside of the winter period (June and July) and will not be cleared during the suspected breeding period for these species. This is generally between November and January.

Table 5.2 Critical Periods of use for Threatened Species known to occur within the Site

Species	Resource Utilised in Extraction Area	Critical Periods of Use
Masked owl (Tyto novaehollandiae)	Roosts and breeds in large tree hollows (or sometimes caves)	Capable of breeding during any time of year.
Glossy black cockatoo (Calyptorhynchus lathami)	Requires large hollow-bearing eucalypts as nest sites	Breeds from March to August.
Little Bentwing-bat (Miniopterus australis)	Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings.	Maternity colonies form in spring and birthing occurs in early summer. Males and juveniles disperse in summer.
Other (Non-hollow Dwelling) threatened species		
Koala (Phascolarctos cinereus)	Not hollow dependent, however slower moving than other local threatened species and less capable or readily evacuating trees. Inactive during the day.	Breeding season occurs from approximately August to February.

5.1.1.4 Tree Felling Procedure

A robust tree felling procedure will be implemented at the Quarry to minimise the potential for impacts on native fauna species (including threatened species) as a result of the clearing of hollow-bearing trees. The tree felling procedure is designed to minimise impacts to hollow-dependent fauna. The procedure includes the following:

- Comprehensive pre-clearing surveys by a suitably experienced and licensed ecologist, no more than 2 weeks prior to felling. This will include marking of hollow-bearing trees, as well as any other notable features such as fallen timber, hollow logs or boulders suitable for salvage; active nests, dreys or dens requiring consideration; and seed-bearing trees for salvage. Surveys will include detailed searches for threatened flora and fauna species, including micro-bats.

- Removal of non-hollow-bearing trees/vegetation on the day or as close to the date of clearing as possible (in order to discourage fauna usage of the area). Removal of vegetation identified as not providing tree-hollows during pre-clearing surveys encourages hollow-dependent fauna to vacate clearing areas prior to the clearing of habitat trees, reducing the likelihood of mortality during clearing.

- Visual canopy inspection of all trees to be removed on the day of clearing by suitably experienced and licensed person to ensure that fauna is not injured during tree felling operations on the day of clearing.

- Detailed hollow-bearing tree felling procedures, including (but not limited to):
    - supervision of all hollow-bearing tree felling works by a suitably experienced and licensed person. Where necessary, this can be undertaken by the Environmental Officer with instruction by a suitably experience and licensed person off site
    - visual canopy inspection on the day of the felling of hollow-bearing trees for fauna species and active nests
    - shaking of hollow-bearing tree (with heavy machinery) for at least 30 seconds to encourage resident fauna to abandon tree, prior to felling
    - lowering of hollow-bearing trees as gently as possible with heavy machinery
    - inspection of all hollows in felled trees
    - capture of any displaced/injured fauna. Any injured fauna will be taken to a wildlife carer or vet
    - release of unharmed fauna into nearby secure habitats
    - felled trees to be rolled so that the number of hollows blocked against the ground are minimised
    - all felled trees to remain in place overnight to allow any unidentified fauna to escape
    - salvage of suitable hollows (i.e. hollows of appropriate size and structural integrity and that can be salvaged safely) for treatment and installation within rehabilitation and revegetation areas as compensatory habitat.

In the event that threatened fauna are located within hollow-bearing trees during pre-clearance surveys or tree felling, no works will be undertaken within 5 m of the identified tree until the species is captured and relocated, or moves from within the clearing area of its own volition.

5.1.2 Seed Collection and Propagation

The primary seed source utilised for quarry rehabilitation will be the direct transfer of topsoil and brush-matting from cleared strips during their excavation. Propagation of locally sourced seed and plant material will also be used for windrows. To this end, Dixon Sand will implement a seed collection and propagation procedure in order to use local provenance species in rehabilitation. Seed from the site will be collected prior to or during clearing (in order to meet the requirements of Condition 36 (g)), or from within adjacent buffer zones and biodiversity offset areas (in order to facilitate that the biodiversity values of the offset areas are protected).

Locally sourced seed will be used in rehabilitation on site where possible using brush-matting techniques. When local seed cannot be sourced due to prevailing environmental conditions, other seed sources will be utilised to ensure that degraded areas are rehabilitated within one month of final landform shaping.

5.1.3 Salvage of Habitat Features

Where feasible, the salvage and relocation of hollow logs, fallen timber and boulders will be undertaken to augment habitat complexity within areas being rehabilitated. The purpose of this will be to increase habitat complexity in these areas, to make them more habitable for native species, particularly threatened fauna species.

Habitat features suitable for salvage will be identified and marked in the field as part of pre-clearance surveys. It is intended that any salvaged hollow bearing trees will either be incorporated in the final landform as ground level habitat or will have suitable hollow sections removed and attached to trees. The procedure for salvaging and reinstating habitat features is as follows:

- Hollow bearing trees will be considered for salvage based on structural integrity, number and size of hollows. Hollows to be salvaged will include a range of diameter sizes. Ideally, hollows should be in trunks or solid living branches to maximise the chance that they would survive the felling process.
- Woody ground debris will be selected based on size, structural integrity and presence of good hollows. Larger logs (in both length and girth) will be typically selected with large hollows (i.e. large diameter hollows through the length of the stem or at least a significant portion) through the stems.
- Bush rock and boulders will be selected based on size, structural integrity and provision of habitat. Larger rocks and boulders will typically be selected to provide habitat for fauna species.

Salvaged habitat features will be moved to a rehabilitation area as soon as possible after clearing to maintain habitat connectivity between cleared areas and remnant bushland. This will provide for the continuation of runways and refuge sites for native fauna for the duration of clearing works.

5.1.4 Topsoil Management

The key method of rehabilitation involves the transfer of topsoil and brush material obtained directly from cleared strips prior to their excavation. This material will be utilised in rehabilitation as:

- a seed source
- mulch
- erosion control and
- habitat for small fauna.

The direct return (within a 4 - 6 week period of clearing) of topsoil and brush matting is the chief method employed for revegetation of native vegetation in the existing extraction area. The timing of the clearing and return of soil and brush material is programmed to ensure that the maximum amount of viable seed and the best growing conditions coincide to produce the best chance of achieving high species diversity.

Topsoil extracted during the operation of the Quarry will be managed in accordance with the topsoil management measures outlined below in order to protect topsoil quality and enhance rehabilitation outcomes:

- where possible, topsoil will be stripped when moist to help maintain viability and to reduce dust generation
- the topsoil stripped will be between 100 - 300 mm in depth (dependent on the soil type present)
- where practical, topsoil will be direct-returned to reshaped areas within the existing Quarry which are available for revegetation
- topsoil stockpiles are to be located away from quarrying, traffic areas and watercourses and positioned within the perimeter of the closed water management system
- topsoil stockpiles will be located within the Quarry disturbance area and not within conservation areas adjacent to the Quarry
- level or gently sloping areas will be selected as stockpiles sites to minimise erosion and potential soil loss
- silt fences will be established clear of drainage lines and will be installed at the base of stockpiles to prevent soil loss to the surrounding area
- stockpiles will be generally less than 3 m high and will be set out in windrows to maximise surface exposure and biological activity
- stockpiles to be kept longer than 3 months (i.e. approximately how long it will take to establish a stable vegetative cover) will be sown with a suitable cover crop to minimise soil erosion and invasion of weed species
- weed growth will be monitored on a monthly basis and controlled either by removing by hand or spraying if large areas (i.e. >40 m^2) are observed
- prior to re-spreading, weed growth will be scalped from the top of the stockpiles to minimise the transport of weeds into rehabilitated areas.

5.2 Operational Controls

5.2.1 Controlling Access and Traffic

Measures to be implemented to minimise unauthorised access to the site will include the following:

- the extraction area will be demarcated where appropriate and vehicular access to the extraction area will be restricted
- existing Quarry site boundary fencing will be maintained

Onsite vehicular movements will be limited to 20 km/hour and will be indicated through the presence of signage installed on haul roads and access roads to minimise fauna injury/road kills.

5.2.2 Weed Management

Consistent with the Development Consent conditions, an effective weed control program will be implemented to limit the spread and colonisation of noxious and environmental weeds within the Quarry.

In general, the weed control program for the Quarry will include:

- annual inspections across the site (with a focus on rehabilitation areas) to;
    - undertake appropriate, targeted weed control activities (including minimum disturbance techniques such as hand removal where feasible), specific to the weed species identified
    - assess the effectiveness of the control programs and in response make any necessary modifications
- general observations of the presence of weeds will also be made as part of monthly inspections of the drainage lines and closed water management system
- monthly targeted weed control activities across the site.

In particular, the presence of Crofton weed (*Ageratina adenophora*) has been recorded on the site and is a declared weed under the NSW *Biosecurity Act 2015*. Under the NSW *Biosecurity Act 2015*, this plant is regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk it poses. Any person who deals with this plant has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practical. The specific methodologies for the control of Crofton weed within the site are as follows:

- all areas of Crofton weed will be removed mechanically and/or chemically (depending on the most suitable method for the maturity of the weed) and stockpiled within the area of infestation to ensure it is isolated from native vegetation
- stockpiled areas of Crofton weed are to be dealt with either by use of herbicides or through burning
- topsoil within areas of Crofton weed can only be translocated into rehabilitation areas of the site after being treated with the measures listed above
- no Crofton weed or topsoil within Crofton weed infestations will be transferred offsite.

Weed control works will include the development and implementation of an eradication plan applicable to the circumstances, which may include manual removal, spot spraying or biological control. The specific method selected will consider the known locations of threatened flora and fauna species. Low impact weed management techniques such as manual removal will be used within 40 m of known threatened species records.

The weed control works will also consider:

- minimisation of vegetation disturbance by reducing the number of tracks
- minimisation of clearing and other disturbance of vegetation associated with civil works
- maintenance of topsoil stockpiles to eradicate weed infestation.

Weed management will be undertaken in accordance with most recent information available on the NSW WeedWise online resource (DPI, 2018). Actual control measures will be determined based upon the area in which activities are being undertaken (i.e. herbicides will be avoided where possible near water bodies) and the size of infestation present (mechanical removal may be more appropriate for small scale infestations). Where required, herbicide types and application rates will be informed by the control specifications from the NSW WeedWise recommendations (DPI, 2018). Herbicide application will be undertaken by suitably qualified personnel (Level 3 Chemical Accreditation).

5.2.3 Pest Management

Pest management will be conducted as required based on annual survey results or reports from neighbours or other authorities. Experienced pest control contractors will be engaged to perform any control programs required, including baiting, trapping, warren ripping and open range shooting. Where possible, Dixon Sand will work in collaboration with neighbouring land-owners to develop a strategic approach to pest management. Pest management will be undertaken across both operational and rehabilitation areas.

Monitoring of pest species populations and the effectiveness of the control program will be undertaken and reported annually as part of general biodiversity monitoring. Recommendations and the proposed control program for subsequent years will also be included as an outcome of the monitoring.

5.2.4 Sediment and Erosion Control

Erosion and migration of sediment from within the site into adjacent vegetation has the potential to facilitate weed invasion through the introduction of weed seeds and nutrients that favour weed species.

This potential impact will be avoided through the implementation of appropriate erosion and sediment control measures in accordance with the Soil and Water Management Plan. This will include:

- Clearly identifying and delineating areas required to be disturbed and ensuring that disturbance is limited to those areas;
- clearing as little vegetation as required and minimising machinery disturbance outside of these areas;
- installing appropriate erosion and sediment controls prior to stripping topsoil or disturbing areas;
- limiting the number of roads and tracks established;
- stabilising site entry/exit points to ensure sediment is not tracked onto sealed roadways;
- construction of drains upslope of areas to be disturbed to convey clean runoff away from most disturbed areas where required;
- reshaping, topsoiling and vegetating road and cut and fill batters as soon as practical;
- construction of sediment dams where required to capture and treat runoff from disturbed catchment areas;
- Diversion of surface and road runoff away from disturbed areas;
- Regular maintenance of all erosion control works and rehabilitated areas; and
- Revegetation of areas as soon as practical following the completion of earthworks or operations.

5.2.5 Fire Management

Bushfire prevention is required under the *Rural Fires Act 1997*. The absence of fire will lead to a build-up of fire fuel and risk of high intensity bushfire. Dixon Sand as the owner of the land is required to take practicable steps to prevent the occurrence of bushfires on the land and minimise the spread of bushfire.

The primary management objective in relation to fire management is to protect lives, biodiversity values and infrastructure assets from the impacts of bushfires.

Key control measures will focus on:

- documentation of access and water supply points for suppression activities as detailed in the Bushfire Management Plan (Umwelt, 2018c)
- use of cool burns when deemed necessary (with any required approvals and/or permits from Rural Fire Service) to reduce fuel build-up to protect biodiversity and conservation values
- inspect and monitor firefighting equipment on site, as detailed in the Bushfire Management Plan Part 1 : Environmental Management (Umwelt, 2018c), refer to http://www.dixonsand.com.au/environment
- communication of bushfire control measures and response procedures for provision to key stakeholders, including land managers, neighbours, consultants, contractors and employees.

Any fuel hazard reduction burns will be planned in accordance with the *Bush Fire Environmental Assessment Code for New South Wales* (NSW Rural Fire Service, 2006a) and the guidelines contained in the *Threatened Species Hazard Reduction Lists for the Bush Fire Environmental Assessment Code* (NSW Rural Fire Service, 2006b). Burn intervals will consider the guidelines contained within the *Threatened Species Hazard Reduction Lists* as well as the OEH recommendations in the *Guidelines for Ecologically Sustainable Fire Management* (NPWS, 2004).

Current recommendations under the Code and Guidelines are:

- In woodland vegetation, fire should not occur within 5 years of a previous fire and consideration will be given to burning within 30 years of any previous fire, with occasional intervals greater than 25 years being desirable and
- In grassland vegetation derived from the woodland vegetation, the recommended fire intervals are the same as woodland vegetation.

5.2.6 Buffer Zones and Set-backs

The following buffer zones and set backs will be established and maintained (as per Baulkham Shire Council Extractive Industries Development Control Plan 16):

- 10 m from adjoining property boundaries
- 30 m from Wisemans Ferry Road
- 40 m from the Maroota State Forest
- 40 m from archaeological site # 45-2-0081
- 40 m from the top bank of Little Cattai Creek
- 100 m from the dwellings adjacent to Hitchcock Road and Wisemans Ferry Road.

All effort will be made to retain any mature vegetation in the designated buffer zones. These areas will be used as supply zones for seeds, brush seedlings (for transplanting) and cuttings for extraction strips if required.

5.2.7 Training and Awareness

All site personnel working at the Quarry will undergo an induction. The induction includes information on managing the biodiversity values of the site, the requirements of the land disturbance management controls and operational controls set out in this BRMP. After completing the induction, workers will sign a statement of attendance and records of this are kept in the administration office.

Tool-box meetings are held to discuss whole-of-site production, management, safety and environmental issues. Matters relating to rehabilitation and biodiversity management are raised during these meetings when necessary.

5.3 Onsite Revegetation Strategies and Locations

The following are revegetation strategies that will be employed in non-rehabilitation areas. These methods are less involved than those that will be required for rehabilitation strategies in areas that have previously been subject to quarrying activities.

Revegetation activities will be undertaken in the following areas:

- 30 m buffer from Wisemans Ferry Road
- 100 m from the dwellings adjacent to Hitchcock Road and Wisemans Ferry Road during Stage 3 (2006 consent) quarrying
- within drainage lines
- along windrows
- previously disturbed area (1.1 ha) in the south-east of the 40 m buffer with Maroota State Forest
- Environmental Bunds – Visual and Noise areas at the following locations:
    - along the western boundary of the site during extraction of Stage 3 (2006 consent)
    - Along the north-east boundary of the site prior to extraction of Stage 5 (2006 consent)
    - along the western boundary of Cell 4, prior to early extraction works in Cell 4 (Mod 1 consent)
    - set back a minimum of 50 m from the western boundary of Cell 5 prior to early extraction works in Cell 5 (Mod 1 consent).

The vegetation and revegetation management measures described in this plan aim to restore the ecological integrity and functioning of the site as close as possible to its condition prior to clearing and quarrying works. This will be accomplished by preserving the flora and fauna habitat outside the clearing footprint and providing measures to effectively revegetate areas to be cleared. The strategies for regeneration and revegetation are outlined below.

5.3.1 Defining Buffer Areas and Revegetation Areas

The buffer and supplementary planting areas will be clearly defined and be marked either by high visibility tape, fencing or an equivalent boundary marker that will be installed any time prior to the commencement of clearing works. Clearly defined boundaries will prevent unnecessary and inadvertent clearing of vegetation and/or habitats and unauthorised access by grazing stock or people.

No stockpiling of equipment, machinery, soil or vegetation will occur within these areas.

5.3.2 Windrows and Drainage Lines

Stands of native vegetation will be progressively re-established within the drainage lines and in windrows along the lot boundaries. Windrows will provide wind protection for agricultural land, while additional planting in drainage lines will act as soil stabilisers and decrease runoff rates into waterbodies. Plantings in drainage lines will be appropriate to these areas of higher flow and moisture, and will assist in improving the quality of surface water leaving the site.

5.3.3 Environmental Bunds

The purpose of construction of Environmental (noise and visual) bunds are to act as a screen to operational noises and local visual amenity for nearby residents (refer to Acoustic Bund Construction Noise Management Plan (CNMP)). Environmental bunds constructed for Stage 3 and Stage 5 will be 5 m in height and have maximum final gradients of 1 in 3 (vertical : horizontal). Environmental bunds for Cell 4 and Cell 5 (Mod 1 extraction area) will be a minimum of 7 m high with a minimum 80 m return and 50 m setback respectively. These must be installed prior to their respective early extraction works.

Bunds will initially be seeded with cover crops (refer to **Section 6.10**), to reduce the potential for soil erosion. These areas will then be subject to planting of native trees and shrubs to provide further ongoing screening. If necessary for screening purposes, temporary bunds may also be constructed by pushing cleared topsoil to the boundaries of extraction.

Bunds will be retained until they no longer act to minimise visual/noise impacts. Remaining bunds will be removed when the area they are in is due for reshaping to final landform. Bunds with established revegetation will have their topsoil retained for spreading over the final reshaped landform, with the remainder of the bund flattened and reshaped to make the final landform.

5.3.4 30 metre Buffer from Wisemans Ferry Road

Appendix 2 of the Development Consent shows the buffer zones around the Quarry. The 30 m buffer to Wisemans Ferry Road contains fragmented stands of mature vegetation including *Angophora* spp., *Eucalyptus* spp., and *Acacia* spp. This area will be subject to the following additional revegetation activities (ERM, 2007):

- Additional planting within the 30 m buffer to Wisemans Ferry Road to minimise visual impacts of the Quarry on motorists.
- Be dense enough to form a viable forested buffer to onsite activities.
- Seeds will be collected from this area and other areas of native vegetation surrounding Haerses Road, and propagated prior to planting. Supplementary planting will be undertaken using local provenance plants where possible.
- Rehabilitation and weeding in the area will be progressive throughout the life of the operation and will continue until the rehabilitated areas are established.

5.3.5 Buffer to Maroota State Forest

This is a previously disturbed area of land identified as suitable for rehabilitation, located to the south east of Haerses Road, within the buffer area to Maroota State Forest (refer to **Figure 1.2**). It is 1.1 ha in size and was subject to disturbance prior to Dixon Sand's acquisition of the land. This area has undergone some natural regeneration (*Hakea* spp., *Acacia* spp., *Leptospermum* spp., *Eucalyptus* spp. and various ferns and grasses) since Dixon Sand's acquisition. However, the area is heavily weed infested (particularly with pampas grass (*Cortaderia selloana*), whiskey grass (*Andropogon virginicus*), *Paspalum* sp., Crofton weed (*Ageratina adenophora*) and kikuyu (Pennisetum clandestinum), and requires assistance to ensure it returns to sustainable native vegetation and habitat. The method proposed by Dixon Sand's qualified revegetation manager (Bush-It Pty Ltd) in November 2007 (in ERM, 2007) is as follows:

- use topsoil from the area upslope of the site that is the remnant vegetation cleared for quarrying activities
- translocate the soil to cover the groundcover vegetation, starting from the western section and moving to the east in stages, as soil becomes available from areas cleared above the site adjacent to Haerses Road
- spread soil to a depth of 200mm over this area (this will provide a good base for plant generation, while also smothering weed species)
- ongoing weeding of the site whilst regeneration is occurring on an as needed basis.

5.3.6 Tubestock Planting

Supplementary planting areas identified above will be subject to targeted tube-stock planting activities. Tube-stock will comprise local tree and shrub species from the list identified in **Appendix 3**. These tubestock will where possible be sourced from local seed collection.

5.4 Haerses Road and Porters Road BioBank Sites

The Haerses Road and Porters Road BioBank Sites will be managed in accordance with the approved BioBanking Agreements. No management or monitoring actions are required to be completed under this management plan.

6.0 Rehabilitation Strategy

Rehabilitation strategies will be undertaken within areas that have previously been subject to quarrying.

Extraction and rehabilitation of each quarry stage will occur progressively following cessation of quarrying, with cleared vegetation and topsoil from one strip transferred directly for use in rehabilitation of the next progressively extracted strip.

6.1 Rehabilitation Objectives

Rehabilitation of the Quarry will be undertaken in accordance with the Development Consent, refer to **Table 6.1**.

Table 6.1 Haerses Road Quarry Rehabilitation Objectives

Feature	Objective
All areas of the site affected by the development	• Safe • Hydraulically and geotechnically stable • Non-Polluting • Fit for the intended final land uses • Final landform integrated with surrounding natural landforms as far as is reasonable and feasible, and minimising visual impacts when viewed from surrounding land.
Surface Infrastructure	• Decommissioned and removed, unless otherwise agreed by the Secretary
Quarry benches and pit floor	• Landscaped and vegetated using native trees and understory species
Final void	• Minimise the size, depth and slope of the batters of the final void • Minimise the drainage catchment of the final void

6.2 Rehabilitation Strategy for the next 3 years (2018 – 2020)

During the next 3 years, the primary rehabilitation activities within the Quarry will involve ongoing development of quarrying areas and control of weed and feral species. The objective will be to undertake pre-disturbance activities that aim to minimise the ecological impacts of the quarrying operation as well as commence rehabilitation as soon as practical behind the quarrying activities so as to minimise the extent of disturbance on site. As such, the key rehabilitation and ecological management strategies to be adopted over this time include:

- Define the limits of clearing for and install survey pegs to mark the extent of extraction
- Conduct pre-clearance surveys ahead of the vegetation clearing and quarrying operations in accordance with **Section 5.1.1.2**. Based on the outcomes of these inspections, undertake the following where required:
    - implement specific tree felling procedures as outlined in **Section 5.1.1.4**, in order to minimise the impacts to flora and fauna from the quarrying operation
    - collect seed and regenerative material for use in rehabilitation, as per **Section 5.1.2**
    - salvage soil resources for use in rehabilitation of earlier strips as outlined in **Section 6.7.1**

- undertake ongoing feral animal and weed monitoring and treatment works as required as outlined in **Sections 5.2.2** and **5.2.3**.

- undertake rehabilitation activities in accordance with the general requirements of **Sections 6.2** and **6.3**

- undertake rehabilitation and ecological monitoring activities as per the monitoring program outlined in **Sections 7.1 and 7.2**.

Following native vegetation establishment in rehabilitation areas fauna habitat features such as rock piles, reinstated logs and nest-boxes for hollow dependent fauna will be incorporated into the rehabilitation.

6.3 Conceptual Final Landform

The conceptual final landform for the Quarry site is shown in **Figure 6.1** and will generally integrate into the surrounding terrain across the site and adjoining land. The final landform aims to restore native vegetation and fauna habitat in rehabilitation areas through targeted vegetation establishment and the introduction of fauna habitat features. The conceptual final landform will include the following:

Native Vegetation

- The west of Lot 177 DP 752039 and Lot 216 DP 752039 will slope generally to the west and be planted with native flora species consistent with the following vegetation communities:
    - HN582 – Scribbly Gum – Hairpin Banksia – Dwarf Apple Heathy Woodland on Hinterland Sandstone Plateaux of the Central Coast, Sydney Basin Bioregion
    - HN566 – Red Bloodwood – Scribbly Gum Heathy Woodland on Sandstone Plateau of the Sydney Basin Bioregions
    - HN586 – Smooth-barked Apple – Red Bloodwood – Sydney Peppermint Heathy Open Forest on Slopes of Dry Sandstone Gullies of Western Sydney and Southern Sydney, Sydney Basin Bioregion
- Fauna habitat features such as rock piles, reinstated logs and nest-boxes for hollow dependent fauna will be incorporated into the rehabilitation, providing for the colonisation of native fauna species

Agricultural Land

- Lots 176 and east of Lot 177 DP 752039, Lot A and Lot B DP 407341 and Lot 170 DP 664767 final landform will:
    - Slope west or north-west and maintain existing water flow paths to adjacent properties.
    - Be regenerated with vegetation consistent with an agricultural landscape, primarily consisting of horticultural crops.

6.4 Intended Final Land Use

The land uses intended for the rehabilitated landform is a mix of Class 4 agricultural land and native vegetation, consistent with the surrounding landscape. Permanent water storage will also be retained on Lot 177 DP 752039 to support the proposed agricultural land uses. The rehabilitation areas provide an opportunity to link rehabilitation with existing remnant vegetation to the east and west. The intended final land use for the site is presented in **Figure 6.2**. A detailed Quarry Closure Plan will be completed approximately 3 years prior to closure. Dixon Sand will consult with relevant stakeholders including The Hills Shire Council and DPE in regards to the development of the Quarry Closure Plan.

6.5 Preliminary Rehabilitation Performance and Completion Criteria

Rehabilitation performance and completion criteria will be utilised to demonstrate achievement of rehabilitation objectives. The preliminary rehabilitation performance and completion criteria, trigger actions and responses for the Quarry are outlined in **Table 6.2**.

The preliminary rehabilitation performance and completion criteria will be reviewed and revised throughout the life of the Quarry and used as the basis for further refinement following the commencement of rehabilitation activities, consideration of the results of rehabilitation monitoring programs and stakeholder feedback.

Table 6.2 Preliminary Rehabilitation Performance and Completion Criteria

Aspect	Preliminary Rehabilitation Performance and Completion Criteria	Trigger	Potential Corrective Action
Decommissioning	• All surface infrastructure will be decommissioned and removed.	• Surface infrastructure not removed.	• Decommission and remove any remaining infrastructure.
Landform	• Rehabilitated slopes are stable. • No significant erosion is present that would constitute a safety hazard or compromise the capability of supporting the end land use. • Contour banks are stable and there is no evidence of overtopping or significant scouring as a result of runoff. • Surface layer is free of any hazardous materials.	• Rehabilitated slope are unstable. • Erosion causing a safety issue or impacting final land use. • Unstable contour banks, evidence of overtopping or scouring as a result of runoff • Hazardous material present on surface.	• Stabilise slopes via erosion control or earthworks • Adapt erosion control strategy to stabilise landform. • Undertake repairs of erosion control structure, modify erosion control strategy as appropriate • Remove hazardous material in accordance with legislative requirements.
Soil	• Topsoil or a suitable alternative has been spread uniformly over the rehabilitation surface. • Monitoring demonstrates soil profile development in rehabilitated areas (e.g. development of organic layer, litter layer).	• Non-uniform spreading of topsoil or alternative on rehabilitated surface. • No evidence of soil profile development in rehabilitated areas.	• Monthly rehabilitation inspection to identify need for corrective action. Topsoil to be re-worked to achieve unfirm distribution • Soil profile development influenced by original placement techniques and vegetation growth. Corrective actions to be developed based on specific conditions.
Water	• Runoff water quality from the site does not pose a threat to downstream water quality.	• Poor quality runoff downstream.	• Review water quality results and determine activities/site locations contributing to water quality. Modify erosion control/water treatment measures as required.

Aspect	Preliminary Rehabilitation Performance and Completion Criteria	Trigger	Potential Corrective Action
Native Vegetation	• Revegetation areas contain flora species assemblages and ground cover is within OEH benchmark of the target native vegetation communities (refer to BioNet Vegetation Information System (BioNet VIS)).	• Flora species and ground cover not in line with OEH benchmark for target native species.	• Undertake supplementary seeding/planting.
	• Second generation tree seedlings are present or likely to be, based on monitoring in comparable older rehabilitation sites (i.e. evidence of fruiting of native species observed).	• Limited or no second generation tree seedlings present.	• To be assessed during rehabilitation monitoring and undertake active revegetation if required. Review planting techniques to confirm they are appropriate.
	• More than 75% of trees are healthy and growing as indicated by long term monitoring.	• Long term monitoring shows less than 75% of trees are healthy and growing.	• Implement works to improve ecosystem health. Actions implemented contingent upon cause of identified issue.
	• Ground cover species are characteristic of target vegetation communities	• Low species diversity in ground cover, not characteristic of target vegetation communities.	• Implement actions to improved ground cover. These actions may include thinning of understory or supplementary ground cover seeding/planting.
	• The presence of weeds is within OEH benchmark of the target native vegetation communities (refer to BioNet VIS).	• Weeds greater than OEH benchmark for target native vegetation communities.	• Increase targeted weed control measures.
Agricultural Land	• Rehabilitated land is compatible with proposed agricultural land use) as demonstrated by soil assessment	• Soil unsuitable for agricultural land use.	• Implement remediation actions as identified by soil assessment.
	• Landform comprises broad gentle slopes between 2 - 5%	• Slopes greater than 2 - 5%.	• Slopes to be re-worked to appropriate grade
	• Land capable of supporting suitable sterile cover crop	• Land not supporting suitable crop cover.	• Undertake soil treatment if required and reseed cover crop.

Aspect	Preliminary Rehabilitation Performance and Completion Criteria	Trigger	Potential Corrective Action
Weed and Pests	• Regular inspections indicate declining weed diversity, density and abundance and a decline in signs of feral animal activity. • The presence of weeds is within OEH benchmark of the target native vegetation communities (refer to BioNet VIS). • There is no evidence of significant damage resulting from feral animal activity	• Increased noxious or environmental weeds and evidence of feral animal activity. • Presence of weeds above OEH benchmark of the target native vegetation. • Evidence of significant feral animal damage to rehabilitation area.	• Undertake weed/feral animal control as required • Undertake weed/feral animal control as required • Adapt/modify feral animal control strategy.
Bushfire Hazard	• Appropriate bushfire hazard controls have been implemented.	• Increased bushfire hazards identified.	• Liaise with RFS and adapt bushfire control measures. Update Bushfire Management Plan as required.
Ongoing Public Safety	• Appropriate mechanisms are established to control access and manage public safety post-closure.	• Evidence of unauthorised access.	• Review site security and re-secure site access points where possible

FIGURE 6.1

Proposed Final Landform

0 100 250 500m

1:10 000

Image Source: ERM (2016)

Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

File Name (A4): R06/4272_007.dgn

20180403 15.21

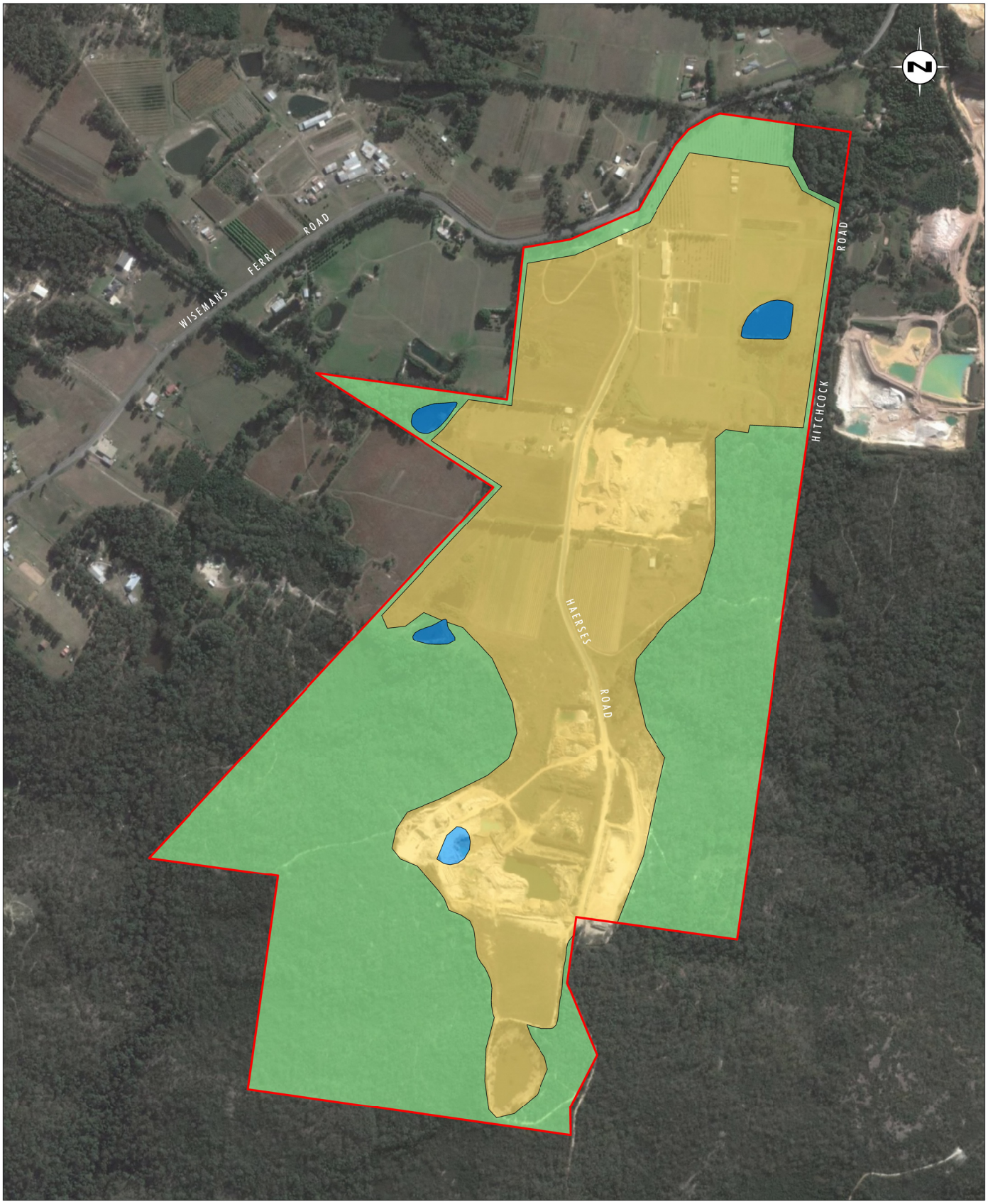


Image Source: Google Earth - DigitalGlobe (May 2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

0 100 250 500m
1:10 000

Legend

- Haerses Road Quarry Site
- Agricultural Land
- Native Vegetation
- Dam

FIGURE 6.2

Intended Final Landuse

6.6 Rehabilitation Species Selection

Two types of rehabilitation plantings will be undertaken, being agricultural land and native vegetation as described in greater detail below. The intended final land use and the proposed portions of the suite to be returned to agricultural and a native vegetation final land use are detailed on **Figure 6.2**.

6.6.1 Agricultural Land

Rehabilitation works undertaken in Lots 176 and east of Lot 177 DP 752039, Lot A and Lot B DP 407341 and Lot 170 DP 664767 will utilise cover crop species for initial stabilisation and to increase organic content of soils. Initial agricultural area rehabilitation species mixes will include legume species to encourage nitrogen accumulation of soil and increase soil fertility. Agricultural crops to be established are likely to include those grown throughout the Maroota area, including oats, sorghum and sunflowers. A typical pasture mix will be sown at a rate of 50 kilograms per hectare during the autumn months, while seeding rates will be increased in areas of limited topsoil to establish a satisfactory cover of plants.

6.6.2 Native Vegetation

Native communities will be planted as described in **Section 6.3** with the species selected from the list provided in **Appendix 3**.

6.7 Regeneration and Revegetation Strategies

6.7.1 Direct Transfer of Topsoil and Brush Materials

The key method of rehabilitation involves the transfer of topsoil and brush material obtained directly from cleared strips prior to their excavation. This material will be utilised as a seed source, mulch, erosion control, and will provide some habitat for fauna. This technique will ensure that the topsoil used will contain a native seedbank that will represent the original vegetation communities of the site prior to clearing. Cleared logs, large boulders and felled trees will also be utilised for ground fauna habitat, threatened flora habitat (providing areas of open ground in the heath habitats) and soil stabilisation.

The timing of the clearing and return of soil and brush material is programmed to ensure that the maximum amount of viable seed and the best growing conditions coincide to produce the best chance of achieving high species diversity.

6.7.2 Direct Planting

The species composition will initially be determined by germination of the direct transfer of topsoil and brush material, and later added to by direct planting using local plant material where possible, to achieve a similar diversity and structure as the community previously existing on the site.

Seeds and plant material (cuttings) used to augment the rehabilitation areas will be sourced locally. Tubestock utilised will preferentially be 6 - 9 months old at the time of planting to maximise the potential for successful rehabilitation. Seeds and tubestock will comprise species consistent with vegetation communities identified in **Section 6.3**.

6.7.3 Cover Crops

The use of cover crops will be utilised in areas proposed as Class 4 Agricultural land rehabilitation and/or where a lack of transferable weed free topsoil and/or brush material occurs, and will be required for the stabilisation and mulching of new areas prior to further regeneration. These will comprise short lived, non-invasive and sterile seasonal species for this use. Where appropriate, these crops will also be used to assist in stabilising any temporary stockpiles or bund walls as required.

6.7.4 Habitat Augmentation

Habitat features salvaged during tree-felling such as hollow-bearing trees and logs will be used for habitat augmentation. When habitat features are being relocated, care will be taken not to damage the native vegetation at the location it is being relocated to.

The salvage process will be an ongoing one, as it relies on the progress of the clearing within the approved modification area. In a similar manner, the deployment of stockpiled habitat features will be dependent on the progress of rehabilitation/regeneration works. This will be completed progressively, once rehabilitation/regeneration works are completed within discrete areas.

7.0 Biodiversity and Rehabilitation Monitoring

Biodiversity and rehabilitation monitoring is required by Condition 36 (h) Schedule 3 of the Development Consent. The following sections outline the biodiversity and rehabilitation monitoring undertaken at the Quarry.

7.1 Rehabilitation Monitoring

7.1.1 Rehabilitation Inspections

Visual inspections of all rehabilitated areas will be undertaken monthly as part of water management system inspections. These will be complemented with more detailed 6-monthly (or other frequency as agreed with DPE) rehabilitation inspections that will be undertaken over the life of the quarrying operations to assess:

- soil conditions and erosion (i.e. stability)
- drainage and sediment control structures
- runoff water quality
- germination rates
- plant health
- natural regeneration
- weed diversity and abundance
- evidence of feral animals.

This will be done by visual inspection and photographing of all rehabilitation areas where necessary. Water quality of runoff from the Quarry disturbance area will be monitored in accordance with procedures set out in the Water Management Plan, including monitoring of licenced discharge water quality prior to discharge, and quarterly monitoring of receiving water quality.

Outcomes of the rehabilitation inspections will be recorded and any required management actions that are identified as part of the inspection, are to be implemented within one month of issue identification. Where necessary, rehabilitation and revegetation procedures will be amended accordingly with the aim of continually improving standards. The results of the rehabilitation inspections will be compared with the rehabilitation objectives and performance indicators.

Dependent upon the outcomes of the rehabilitation inspection as outlined above, the scope of the rehabilitation care and maintenance phase will include the following:

- re-seeding/planting of rehabilitation areas that may have failed
- weed and feral animal control
- fire management
- additional watering requirements for dry areas
- thinning of colonising species to reduce competition, if required

- erosion control works
- maintenance fertilising
- repair of fence lines, access tracks and other general related land management activities.

It is envisaged that this program will be continued as required until it can be demonstrated that the rehabilitation of the Quarry has satisfied the completion criteria.

7.1.2 Rehabilitation and Revegetation Methodology Records

Dixon Sand will record the details of each rehabilitation and revegetation campaign so that they are available for later interpretation of rehabilitation monitoring results. This will allow the continual improvement of rehabilitation and revegetation standards on site. Some of the key monitoring parameters to be included in the strategy are:

- Landform design details
- Drainage design details
- Substrate characterisation
- Site preparation techniques such as topsoil preparation, time of sowing, soil ameliorate used and so on
- Revegetation methodologies such as cover crop and rate, seed viability
- Weather conditions
- Photographic records
- Initial follow-up care and maintenance works.

7.1.3 Monitoring Rehabilitation against Completion Criteria

Preliminary completion criteria for the Quarry are provided in **Table 6.2**. Rehabilitation monitoring against completion criteria will be undertaken progressively during rehabilitation of site areas. Refinement of the completion criteria will be undertaken throughout the development of a Quarry Closure Plan, which will be developed 3 years from closure.

It is envisaged that the review of rehabilitation monitoring against completion criteria will occur as part of subsequent reviews of this BRMP. The progressive achievement (or otherwise) of these completion criteria will also be assessed and discussed in the Annual Review, which will include the identification of instances where criteria is not met, and measures taken to address any such issue.

7.2 Ecological Monitoring

Dixon Sand will implement an ecological monitoring program that is intended to monitor the effects of the development on the biodiversity values of the site and the success of revegetation works. Ecological monitoring is undertaken 6-monthly for the first 3 years with the monitoring frequency reviewed following review of monitoring results.

This monitoring program includes 10 monitoring locations:

- 5 agricultural monitoring sites (for extractions Stages 1 - 5 as per the 2006 Development Consent). Monitoring will occur progressively as each extraction Stage is completed and rehabilitated.

- 5 Ecological rehabilitation monitoring sites (for extraction Cells 1 - 5 as per Mod 1) (with at least one baseline monitoring event to occur in the four different vegetation communities prior to clearing).

Each monitoring site will include floristic monitoring, photo monitoring and a habitat assessment. The details of these monitoring methodologies are provided in **Appendix 4**.

7.3 Summary of Rehabilitation and Biodiversity Monitoring

A summary of rehabilitation and biodiversity monitoring requirements is provided in **Table 7.1**. The monitoring program outlined below provides for the completion of monitoring on a 6-monthly basis where there is potential for changes to the ecosystem health to occur during a 6 month period. The monitoring program and frequency below is supported by a detailed program of rehabilitation inspections which are undertaken on a monthly basis to identify any issues which need to be addressed. The outcome of the Rehabilitation Inspection as referenced in **Table 7.1** below may lead to the initiation of the corrective action process as defined in **Table 10.1.**

Table 7.1 Biodiversity and Rehabilitation Monitoring Regime

Monitoring Type	Location	Parameters Monitored	Frequency of Monitoring	Season/ Month	Monitoring Method	Responsibility
Rehabilitation Inspections	Rehabilitation Areas	General status of rehabilitation areas	Monthly	NA	Observation	Environmental Officer or Delegate
		Weed and pest inspections	6-monthly	NA	Observation	Environmental Officer or Delegate
		Soil conditions and erosion, drainage and sediment control structures, runoff water quality, germination rates, plant health, natural regeneration, weed infestation, evidence of feral animals.	6-monthly	NA	Field survey and photo monitoring	Environmental Officer or Delegate
Agricultural Rehabilitation Monitoring	Stage 1 - 5 Rehabilitation Areas (2006 Development Consent)	Pasture composition and biomass, erosion, rock cover, soil exposure, weed infestation, evidence of feral animals.	6-monthly	Spring	Field survey and photo monitoring	Environmental Officer or Delegate
Ecological Rehabilitation Monitoring	Cell 1 - 5 Rehabilitation Areas (Mod 1)	Evidence of natural regeneration, evidence of disturbance by pests or weed invasion, habitat and fauna assessment (undertaken 6-monthly), floristic structure (undertaken annually)	6- monthly/ Annually (for floristic monitoring)	Spring (floristic monitoring)	Field survey and photo monitoring	Environmental Officer or Delegate

8.0 Reporting

8.1 Annual Review

A summary of biodiversity and rehabilitation monitoring results will be provided in the Quarry Annual Review. The Annual Review will be prepared and submitted to the Secretary, in accordance with Condition 12, Schedule 5 of the Development Consent. The Annual Review will be made available to the public through the Community Consultative Committee (CCC) and the Dixon Sand web site http://www.dixonsand.com.au.

A discussion of the effectiveness of the biodiversity and rehabilitation management controls utilised at the Quarry will be reported to DPE in the Annual Review. The Annual Review will also identify whether any change to existing or additional management controls are required to be implemented at the Quarry in order to achieve the rehabilitation objectives or completion criteria.

8.2 External Reporting

In accordance with Schedule 5, Condition 11 of the Development Consent, Dixon Sand will provide regular reporting on the environmental performance of the operations on its website. This will include outcomes of plans and programs as contained within this BRMP.

8.3 Incident and Non-Compliance reporting

Incidents that have caused, or threaten to cause material harm to the environment will be reported to the Secretary, EPA and relevant stakeholders immediately once the Quarry becomes aware of the incident in accordance with the Quarry's Pollution Incident Response Management Plan (PIRMP). Reporting for material harm incidents will be undertaken in accordance with Schedule 5, Condition 9 and 10 of the Development Consent.

Condition 9 Schedule 5 of the Development Consent requires Dixon Sand to report any incident to DPE and any other relevant agencies immediately after it becomes aware of the incident. The notification must be in writing to compliance@planning.nsw.gov.au and identify the development (including the development application number and name) and set out the location and nature of the air quality exceedance.

Condition 10 Schedule 5 of the Development Consent specifies that within 7 days of becoming aware of the non-compliance, Dixon Sand must notify the Department in writing to compliance@planning.nsw.gov.au and identify:

- the Development Consent number and name
- the condition of the consent relevant to the exceedance
- the nature and details of the exceedance
- the time and date of the exceedance
- measures that have been , or will be, implemented to prevent re-occurrence

Note: A non-compliance which has been notified as an incident does not need to also be notified as a non-compliance.

8.4 Adaptive Management

In accordance with Schedule 5, Condition 7 of the Development Consent, Dixon Sand will assess and manage biodiversity and rehabilitation related risks to ensure compliance with the objectives and completion criteria outlined in this plan.

Where a non-compliance relating to biodiversity and rehabilitation impact has occurred, Dixon Sand, at the earliest opportunity will:

- take all reasonable and feasible steps to ensure the exceedance ceases and does not reoccur
- consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Secretary describing those options and any preferred remediation measures or other course of action
- implement remediation measures as directed by the Secretary, to the satisfaction of the Secretary.

Contingency measures that will be implemented while reasonable and feasible options are being explored include demarcating affected areas to prevent further access, implementing additional sediment and erosion controls to minimise potential for further disturbance.

9.0 Review and Improvement

Ongoing monitoring and review on the performance and implementation of this BRMP will be undertaken in accordance with the Quarry EMS and Development Consent, which require review of the plan within 3 months of the submission of:

- an incident report under Schedule 5 Condition 10;
- an annual review under Schedule 5 Condition 12;
- an Independent Environmental Audit report under Schedule 5 Condition 13; and
- any modifications to this consent.

The Quarry will notify DPE in writing of any review of this BRMP. Should a review lead to any revisions to this BRMP, the revised document will be submitted to DPE within 6 weeks of the review. Updated versions of this BRMP will be made publicly available on the Dixon Sand website in accordance with Schedule 5 Condition 15 of the Development Consent.

10.0 Threats and Corrective Actions

10.1 Threats and Corrective Actions

There are risks associated with successful implementation of the BRMP. In order to ensure delivery of the stated outcomes, and compliance with the approval conditions, a range of further actions are to be undertaken if monitoring identifies performance indicators/completion criteria are trending towards not being met.

The results of monitoring detailed in **Section 7** will feed into the adaptive management process (refer to **Section 8.4**). The Environmental Officer will utilise the results of the monitoring activities to identify any corrective actions required to meet the objectives and targets. The indicative triggers and corrective actions outlined in **Table 10.1** that have been identified would be subject to review based on the adaptive management process.

Table 10.1 Potential Threats Identified and Recommended Corrective Actions

Threat	Potential Corrective Actions	Timing/Frequency
Inadequate resourcing	• Review and reallocate budget or resources to provide for the implementation of the BRMP	• Within 2 weeks of identification
Noxious or environmental weeds leading to degradation of biodiversity values in the biodiversity offset area, buffer areas and/or rehabilitation areas	• Adapt weed management strategy and modify accordingly • Actively monitor the results of modifying strategy.	• Strategy to be developed within 2 weeks of identification • Control works to be undertaken within 1 month of identification • Monitoring to be undertaken 3 months following identification
Feral animal species leading to degradation of biodiversity values in the biodiversity offset area, buffer areas and/or rehabilitation areas	• Adapt feral animal control strategy and modify accordingly • Actively monitor the results of modifying strategy.	• Strategy to be developed within 2 weeks of identification • Control works to be undertaken within 1 month of identification • Monitoring to be undertaken 3 months following identification
Unauthorised access resulting in damage	• Identify access points and repair as required • Rehabilitate any damaged areas • Review site security.	• Within 1 week of identification during site operations or monitoring
Erosion	• Adapt erosion control strategy and modify accordingly • Supplementary planting of native plants • Actively monitor the results of modifying strategy	• Strategy to be developed within 2 weeks of identification • Control works to be undertaken within 1 month of identification • Monitoring to be undertaken within 3 months following identification
Low species diversity in the rehabilitation areas	• Targeted weed control • Consider the need for active revegetation techniques including direct seeding or tubestock planting, following appropriate ground preparation such as weed control, ripping and augering.	• Undertake weed control within 1 month of issue identification • Implement active revegetation within 1 month of identifying requirement

Revegetation survival	• Identify why survival is not being achieved and replace plants that have not survived, such as:
	  ○ Assess planting methods (i.e. timing/use of tree guards)
	  ○ Assess nursery methods (i.e. watering/hardening methods)
	• Implement appropriate control measures to minimise potential for further losses
		• Within 1 month of identification
		• Within 3 months of identification

Threat	Potential Corrective Actions	Timing/Frequency
Environmental conditions affecting establishment or growth of planted or seeded vegetation	• Undertake supplementary watering of rehabilitation • Review species diversity and provide supplementary seeding/planting	• Within 1 week of identification and ongoing as required • Review as part of annual monitoring
Poor survival rate of propagated threatened flora specimens	• Identify why death occurred • Implement appropriate control measures such as establishing additional no-go areas • Review and trial alternative propagation methods • Provide supplementary planting of propagated specimens	• Within 1 month of identification • Within 3 months of identification
Bushfire	• Implementation of controls as described in the Bushfire Management Plan Part 1: Environmental Management	• As directed by the Bushfire Management Plan

11.0 Accountabilities

Environmental management at Dixon Sand will be the responsibility of all employees and contractors, with the Dixon Sand Quarry Manager having overall responsibility for environmental management of the operations. Environmental roles and responsibilities related to biodiversity and rehabilitation management for the project personnel are outlined in **Table 11.1**.

Table 11.1 Roles and Responsibilities

Role	Accountabilities for this document
Quarry Manager	Approve appropriate resources for the effective implementation of this plan. Coordinate and assist with the review of this plan in accordance with the requirements of the Development Consent. Schedule rehabilitation activities as per this plan. Coordinate the implementation of biodiversity and rehabilitation management controls and strategies in accordance with this Plan.
Environmental Officer	Coordinate the biodiversity and rehabilitation monitoring requirements of this plan. Ensure monitoring records are effectively maintained on site. Ensure that the personnel involved in carrying out and monitoring of the activities required under this plan are suitably qualified, licensed and experienced to undertake the task. Ensure all internal and external biodiversity and rehabilitation reporting requirements are met. Periodically review monitoring results and progress against targets and performance indicators in accordance with the requirements of this plan. Assess the effectiveness of the management strategies and instigate the adaptive management process as required. Identify any corrective actions required to meet the objectives and targets of this plan. Coordinate biodiversity and rehabilitation related incident investigations and reporting as required by legislation and internal standards and guidelines. Review of this plan as required by the Development Consent.
All employees and contractors	Comply with all requirements in this Plan. Report all potential environmental incidents to the Quarry Manager immediately. Seek approval from the Quarry Manager prior to making changes to infrastructure/ processes which may result in increased biodiversity and rehabilitation risks.

12.0 Definitions

The terminology utilised within this BRMP is defined in **Table 12.1** below.

Table 12.1 Definitions

Term	Definition
BioNet VIS	BioNet Vegetation Information System
BRMP	Biodiversity and Rehabilitation Management Plan
CCC	Community Consultative Committee
Development Consent	DA 165-7-2005 Mod 2
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EIS	Environmental Impact Statement
DA	Development Application
DPE	Department of Planning and Environment
Incident	An occurrence or set of circumstances that: Causes, or threatens to cause material harm to the environment; or results in non- compliance with the consent
OEH	Office of Environment and Heritage
Secretary	The Secretary of the NSW Department of Planning and Environment, including any authorised delegate or nominee.

13.0 References

DLWC (Department of Land and Water Conservation), 2000. Rehabilitation and Revegetation Strategy prepared by Soil Service.

Environmental Resource Management Australia (ERM) 2005. Proposed Sand Quarry at Haerses Road, Maroota – Environmental Impact Statement. Prepared on behalf of Dixon Sand (Penrith) Pty Ltd

Environmental Resource Management Australia (ERM) 2007. Haerses Road Sand Quarry Rehabilitation and Landscape Management Plan. Prepared on behalf of Dixon Sand (Penrith) Pty Ltd

NSW Department of Primary Industries (DPI), 2018. NSW WeedWise web page. http://weeds.dpi.nsw.gov.au/

NSW Rural Fire Service, 2006a. *Bush Fire Environmental Assessment Code for New South Wales*

NSW Rural Fire Service, 2006b. *Threatened Species Hazard Reduction Lists for the Bush Fire Environmental Assessment Code*

National Parks and Wildlife Services (NPWS) 2004. *Guidelines for Ecologically Sustainable Fire Management*

Office of Environment and Heritage (OEH) 2017. *Biodiversity Assessment Method*. 59 Goulburn Street, Sydney NSW 2000 PO Box A290, Sydney South NSW 1232

Office of Environment and Heritage (OEH) 2018. *BioNet – gateway to NSW Biodiversity Information* webpage. Accessed April 2018 from http://www.environment.nsw.gov.au/AtlasApp/UI_Modules/TSM_/Default.aspx

Office of Environment and Heritage (OEH) 2018. *BioNet Vegetation Information System.* Accessed August 2018 from https://www.environment.nsw.gov.au/research/Vegetationinformationsystem.htm

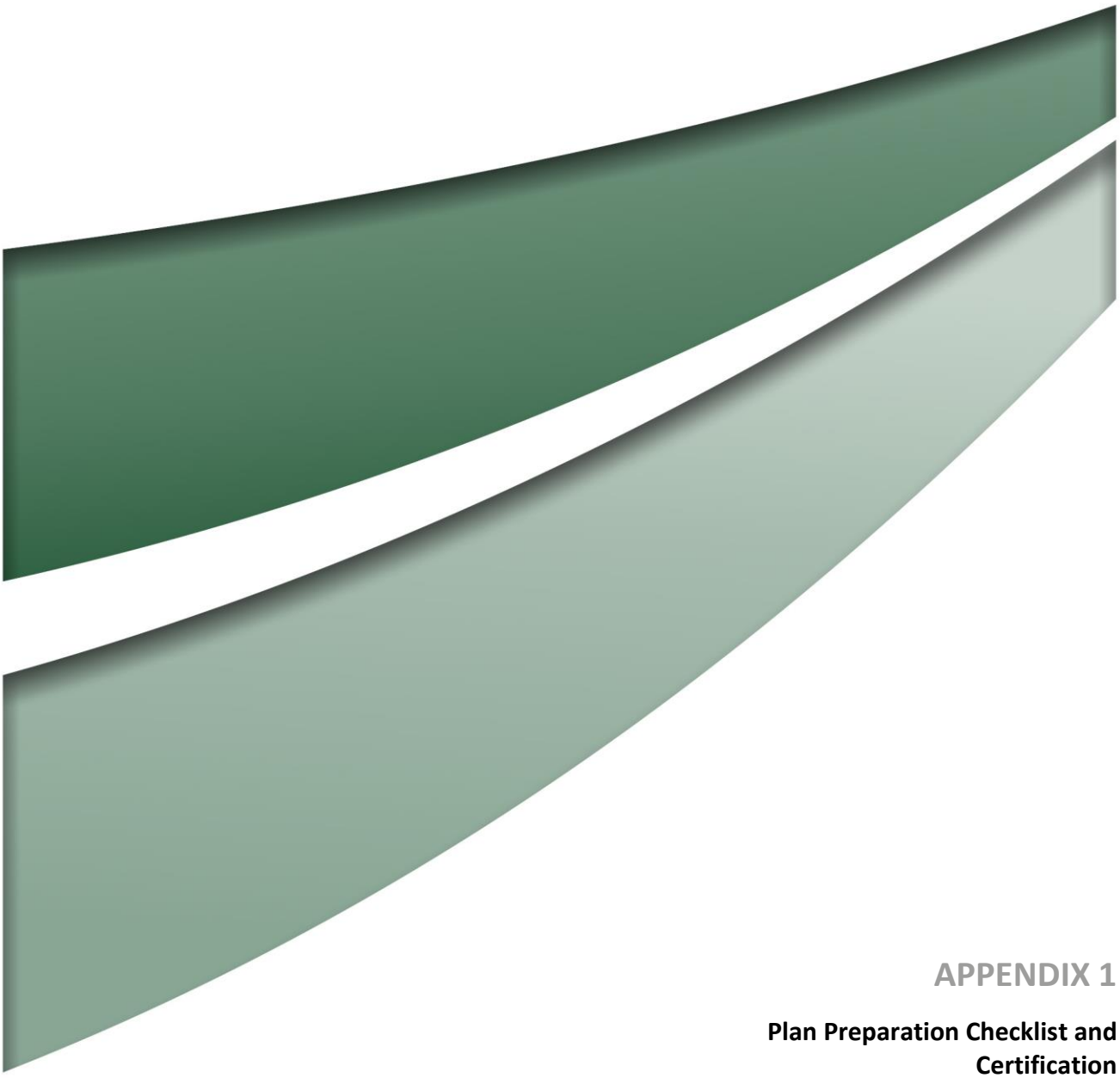
Umwelt (Australia) Pty Limited 2016a. *Haerses Road Quarry Extraction Area Modification – Environmental Assessment*. Prepared on behalf of Dixon Sand (Penrith) Pty Ltd

Umwelt (Australia) Pty Limited 2016b. *Haerses Road Quarry Extraction Area Modification – Biodiversity Assessment Report*. Prepared on behalf of Dixon Sand (Penrith) Pty Ltd

Umwelt (Australia) Pty Limited 2018a. *Haerses Road Biobank Site Biodiversity Assessment Report*. Prepared on behalf of Dixon Sand (Penrith) Pty Ltd

Umwelt (Australia) Pty Limited 2018b. *Porters Road BioBank Site Biodiversity Assessment Report*. Prepared on behalf of Dixon Sand (Penrith) Pty Ltd

Umwelt (Australia) Pty Limited 2018c. *Haerses Road Quarry Bushfire Management Plan Part 1: Environmental Management*. Prepared on behalf of Dixon Sand (Penrith) Pty Ltd



APPENDIX 1

Plan Preparation Checklist and Certification

Appendix 1 – Plan Preparation Checklist & Certification

The Environmental Management Plan Requirements guidelines state that the following checklist must be completed and supplied to the Department with an Environmental Management Plan (EMP) and Sub-plans. *(Note: the items marked as NA are not required to be included in the Sub-plan).*

Requirement	Plan Reference	Yes/No/NA
Document preparation and endorsement		
Has the Plan been prepared in consultation with all relevant stakeholders? (Section 3.1)	Section 2.4	Yes
Have the views of the relevant stakeholders been taken into consideration, have appropriate amendments been made to the Plan and does the Plan clearly identify the location of any changes? (Section 3.1)	Appendix 2	Yes
Has the Plan been certified on behalf of the proponent? (Section 3.2)	Appendix 1	Yes
Version content		
Does the Plan include the required version control information? (Section 2.3)	Before Table of Contents	Yes
Does the Plan reference the project description as required in Section 2.4?	Section 1.0	Yes
Does the Plan identify the components of the project to which it applies (i.e. scope)? (Section 2.5).	Section 1.2	Yes
Does the Plan describe the proponent's Environmental Management System (EMS), and identify how the Plan relates to other documents required by the conditions of consent? (Section 2.6)	NA (Sub-plan)	NA (Sub-plan)
Does the Plan identify continuous improvements processes from the EMS that will be adopted? (Section 2.6)	NA (Sub-plan)	NA (Sub-plan)
Does the Plan include (unaltered) all the conditions of consent to the addressed by the Plan and identify where in the Plan each requirement has been addressed? (Section 2.7.1)	Section 2.1	Yes
Have all other additional approvals been identified? Has appropriate information been provided regarding how each additional approval is relevant? (Section 2.7.2)	Section 2.5	Yes
Have all relevant guidelines, policies and standards been identified, including details of how they are relevant? (Section 2.7.3)	Section 2.3	Yes
Has the project's organisational structure been included? (Section 2.8)	NA (Sub-plan)	NA (Sub-plan)
Are the roles and responsibilities of key positions or personnel (including any specialists required by the conditions of consent) outlined? (Section 2.8)	Section 11	Yes
Is the process that will be adopted to identify and analyse the environmental risks included? (Section 2.9)	NA (Sub-plan)	NA (Sub-plan)
Does the Sub-plan identify the relevant sections of the EIA documents that contain the assessment of the matter/s addressed by the Plan? (Section 2.10)	Section 2.2	Yes
Have all further studies required to support mitigating measures been identified and included? (Section 2.11)	Section 2.5	Yes

Requirement	Plan Reference	Yes/No/NA
Have project hold points been identified and included? (Sections 2.7.2 and 2.12)	Section 2.6	Yes
Have all mitigation measures from conditions of consent been included unaltered? (Section 2.13)	Section 2.1	Yes
Have any new mitigation measures been written in committed language and all relevant information included? (Section 2.13)	Section 5.0	Yes
Have the tools that will be used to communicate Plan requirements to project personnel been included? (Section 2.14)	Section 5.2.7	Yes
Is an environmental inspection program described as required? (Section 2.15.1)	NA (Sub-plan)	NA (Sub-plan)
Are relevant details of environmental monitoring that will be carried out included? (Section 2.15.2)	Section 7.0	Yes
Is a compliance monitoring and reporting program (or similar) referenced? (Section 2.15.3)	NA (Sub-plan)	NA (Sub-plan)
Is an independent auditing program referenced? (Section 2.16)	NA (Sub Plan)	NA (Sub Plan)
Are project status notification protocols that comply with conditions included? (Section 2.17.1)	NA (Sub-plan)	NA (Sub-plan)
Does the Plan reference a Community and Stakeholder Engagement Plan (or similar) or include community and stakeholder engagement actions (if required)? (Section 2.17.2)	NA (Sub Plan)	NA (Sub Plan)
Does the document include the incident notification and reporting protocols that comply with the relevant conditions of consent? (Section 2.17.3)	Section 8.3	Yes
Does the document identify the project person or position that is responsible for deciding whether an occurrence is an incident? (Section 2.17.3)	Section 11.0	Yes
Does the document describe corrective and preventative action protocols that address the requirements? (Section 2.18)	Section 10.0	Yes
Does the document identify training and awareness programs as required? (Section 2.19)	Section 5.2.7	Yes
Does the document include details of a document review and revision process that complies with the requirements? (Section 2.20)	Section 9.0	Yes
Does the document include details of public availability requirements? (Section 2.21)	Section 8.0	Yes

Plan Preparation Certification

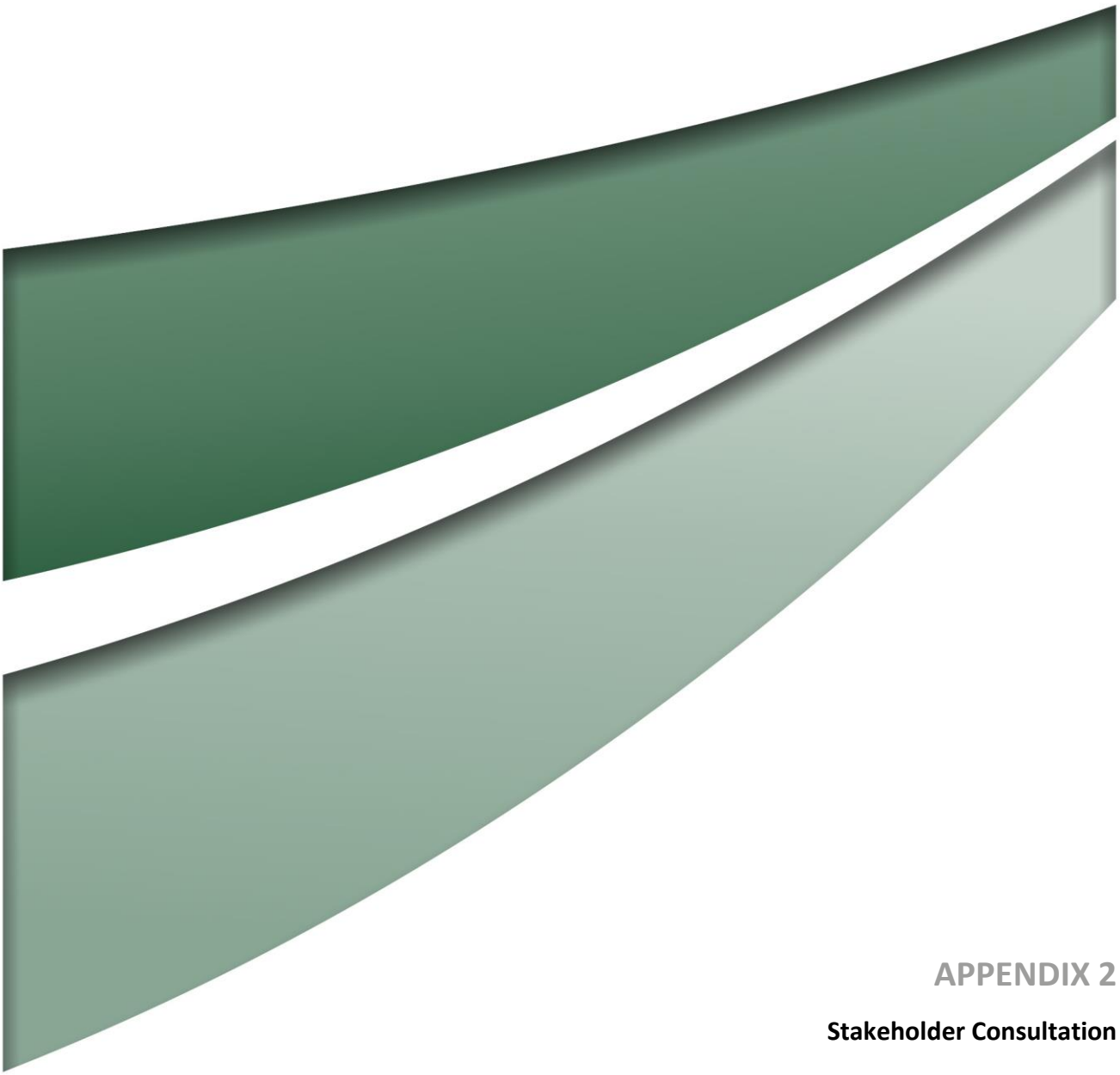
Document Certification Form	
Project Name	Haerses Road Quarry
Project Application Number	DA 165-7-2005
Proponent	Dixon Sand (No.1) Pty Ltd
Document Title	Haerses Road Quarry Biodiversity and Rehabilitation Management Plan
Document Version	V3
Date of Issue	**30 May 2019**

Haerses Road Quarry Biodiversity and Rehabilitation Management Plan has been prepared by Umwelt (Australia) Pty Ltd in response to conditions of consent Schedule 3 Condition 36 DA 165-7-2005 for the Haerses Road Quarry. I am authorised to and have reviewed the document on behalf of Dixon Sand (Penrith) Pty Ltd.

I certify that the Old Northern Road Quarry Haerses Road Quarry Biodiversity and Rehabilitation Management Plan:

- has been prepared in accordance with the relevant condition/s and the Department's Environmental Management Plan
- adequately identifies and addresses all relevant conditions of consent
- has been prepared in accordance with relevant requirements of the conditions of consent regarding stakeholder consultation.

Name of Certifier	**Hunny Churcher**
Position	**Environmental Officer**
Company	**Dixon Sand Pty Ltd**
Date	**30 May 2019**



APPENDIX 2

Stakeholder Consultation

Appendix 2 – Summary of the issues raised during Agency consultation and how these were addressed

Issue	Response
The Hills Shire Council	
No objections raised with the draft plan.	Noted.
Office of Environment and Heritage	
Consent conditions 30 to 32 require the retirement of biodiversity credits (in accordance with condition 33). It is noted the proponent has submitted applications for the Haerses Road and Porters Road Biobank sites to OEH for the purpose of generating the required biodiversity credits. However, OEH has not yet completed the review of these applications and, therefore, cannot comment on whether they will provide the correct type and number of required biodiversity credits.	Noted, waiting for OEH to review biodiversity credits. The Conditions of Consent require these biodiversity credits to be retired prior to the commencement of activities within the MOD 1 extraction area (refer to **Section 3, Table 3.1**).
Table 2.1 lists which sections of the BRMP addresses each of the specified consent condition. For conditions 36 (f) and 36 (i) it is stated they are addressed in Appendix 7.0 (which does not exist). It is assumed the reference for these conditions should be Section 7.0.	Updated in document
Consent condition 36 (h) requires "a program to monitor the effects of the development on flora and fauna". The only proposed monitoring of fauna is in relation to monitoring of feral animals. The results of this monitoring will give some indication of the potential for native fauna to be present on site, but will not provide data that demonstrates the effects of the development on native fauna. Regular, comprehensive fauna surveys are required to do this adequately. Given that fauna surveys are not proposed, justification should be provided on why surveys will not be undertaken, as well as an explanation of how the data to be collected will nevertheless be compliant with the condition to monitor the effects of the development on fauna.	The effect of development on native fauna is the direct removal of habitat within the Mod 1 extraction area followed by progressive rehabilitation activities to return the area to native vegetation. Biodiversity monitoring aims to record the progression/restoration of ecosystem function and establishment of habitat for native fauna species.

A copy of the Agency correspondence is also provided in **Appendix 2**.

From: Kristine McKenzie <kmckenzie@thehills.nsw.gov.au>
Sent: Friday, 13 July 2018 10:30 AM
To: Trish McDonald
Cc: Hunny Churcher - Dixon Sand

Hi Trish,

In regard to DA 165-7-2005 Mod 1 and the information you have referred to ne for review, I advise as follows:

1. The draft Bushfire Management Plan has been reviewed. Council's bushfire mapping has recently been updated (29 June 2018) and as such the mapping you have used in your report is outdated. The report is required to be updated to include and address the new mapping. That said, the information submitted has been reviewed and no objection is raised in principle to the draft report subject to the updated mapping.

2. The draft Biodiversity and Rehabilitation Management Plan has been reviewed. No objection is raised to the draft plan.

Regards, Kristine

Kristine McKenzie
Principal Executive Planner
+61298430319 | kmckenzie@thehills.nsw.gov.au
Administration Centre, 3 Columbia Court Norwest NSW 2153
PO Box 7064, NORWEST NSW 2153 | DX 9966 Norwest
www.thehills.nsw.gov.au

From: Richard Bonner <Richard.Bonner@environment.nsw.gov.au>
Sent: Thursday, 19 July 2018 1:13 PM
To: Trish McDonald
Subject: RE: 4272 - Haerses Road Quarry DA 165-7-2005 Mod 1 - Draft Biodiversity & Rehabilitation Management Plan for Consultation

Hi Trish,

Apologies for not being able to provide the following OEH comments on the draft BRMP earlier. Let me know if we need to refer these directly to DPE.

Regards

Richard Bonner
Senior Conservation Planning Officer
Greater Sydney Branch
Regional Operations Division
Office of Environment and Heritage
T: 02 9995 6917

OEH comments on Draft Biodiversity & Rehabilitation Management Plan for Haerses Road Quarry (DA 165-7-2005 Mod 1)

- Consent conditions 30 to 32 require the retirement of biodiversity credits (in accordance with condition 33). It is noted the proponent has submitted applications for the Haerses Road and Porters Road Biobank sites to OEH for the purpose of generating the required biodiversity credits. However, OEH has not yet completed the review of these applications and, therefore, cannot comment on whether they will provide the correct type and number of required biodiversity credits.
- Table 2.1 lists which sections of the BRMP addresses each of the specified consent condition. For conditions 36 (f) and 36 (i) it is stated they are addressed in Appendix 7.0 (which does not exist). It is assumed the reference for these conditions should be Section 7.0.
- Consent condition 36 (h) requires “a program to monitor the effects of the development on flora and fauna”. The only proposed monitoring of fauna is in relation to monitoring of feral animals. The results of this monitoring will give some indication of the potential for native fauna to be present on site, but will not provide data that demonstrates the effects of the development on native fauna. Regular, comprehensive fauna surveys are required to do this adequately. Given that fauna surveys are not proposed, justification should be provided on why surveys will not be undertaken, as well as an explanation of how the data to be collected will nevertheless be compliant with the condition to monitor the effects of the development on fauna.

From: Trish McDonald [mailto:tmcdonald@umwelt.com.au]
Sent: Wednesday, 18 July 2018 8:31 AM
To: 'Sarah.Burke@environment.nsw.gov.au'; 'gs.planning@environment.nsw.gov.au'
Cc: Hunny Churcher (environment@dixonsand.com.au); Mark; Luke Bettridge
Subject: 4272 - Haerses Road Quarry DA 165-7-2005 Mod 1 - Draft Biodiversity & Rehabilitation Management Plan for Consultation

Hi morning Sarah

This is just a courtesy email to advise that the Biodiversity and Rehabilitation Management Plan (BRMP) for the Haerses Road Quarry will be submitted today to DPE in line with the timeframe for submission required by the development consent (DA 165-7-2005 MOD 1).

Any comments that OEH may provide in due course as part of the consultation regarding the BRMP (as per email below) will still be addressed. But this will now occur following submission to DPE.

Kind regards

Trish McDonald
Senior Environmental Consultant

Umwelt (Australia) Pty Limited
75 York Street
Teralba, NSW 2284

Phone: (02) 4950 5322
Mobile: 0436 694 644

www.umwelt.com.au

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Newcastle ph. 02 4950 5322 | **Perth** ph. 08 6260 0700 | **Canberra** ph. 02 6262 9484 | **Sydney** ph. 1300 793 267 | **Brisbane** ph. 1300 793 267

From: Trish McDonald
Sent: Tuesday, 3 July 2018 12:15 PM
To: 'Sarah.Burke@environment.nsw.gov.au'; 'gs.planning@environment.nsw.gov.au'
Subject: 4272 - Haerses Road Quarry DA 165-7-2005 Mod 1 - Draft Biodiversity & Rehabilitation Management Plan for Consultation

Good afternoon Sarah

Dixon Sand (Penrith) Pty Ltd operates the Haerses Road Quarry, a sand extraction and processing operation, located on Haerses Road, Maroota in NSW.

A recent modification to the quarry's development consent (DA 165-7-2005 MOD 1) requires a Biodiversity and Rehabilitation Management Plan (BRMP) to be prepared for the quarry in consultation with Office of Environment & Heritage.

On behalf of Dixon Sand, please find attached the draft BRMP. It would be appreciated if you could review and provide any comments on the plan by **Tuesday 17 July 2018**.

A copy of the development consent and associated environmental impact assessment documentation can be found on the Department of Planning website at
http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=7377

If you require any further information, please contact myself (details below) or Hunny Churcher of Dixon Sand on 0405 844 207.

Kind regards

Trish

Trish McDonald
Senior Environmental Consultant

Umwelt (Australia) Pty Limited
75 York Street
Teralba, NSW 2284

Phone: (02) 4950 5322
Mobile: 0436 694 644

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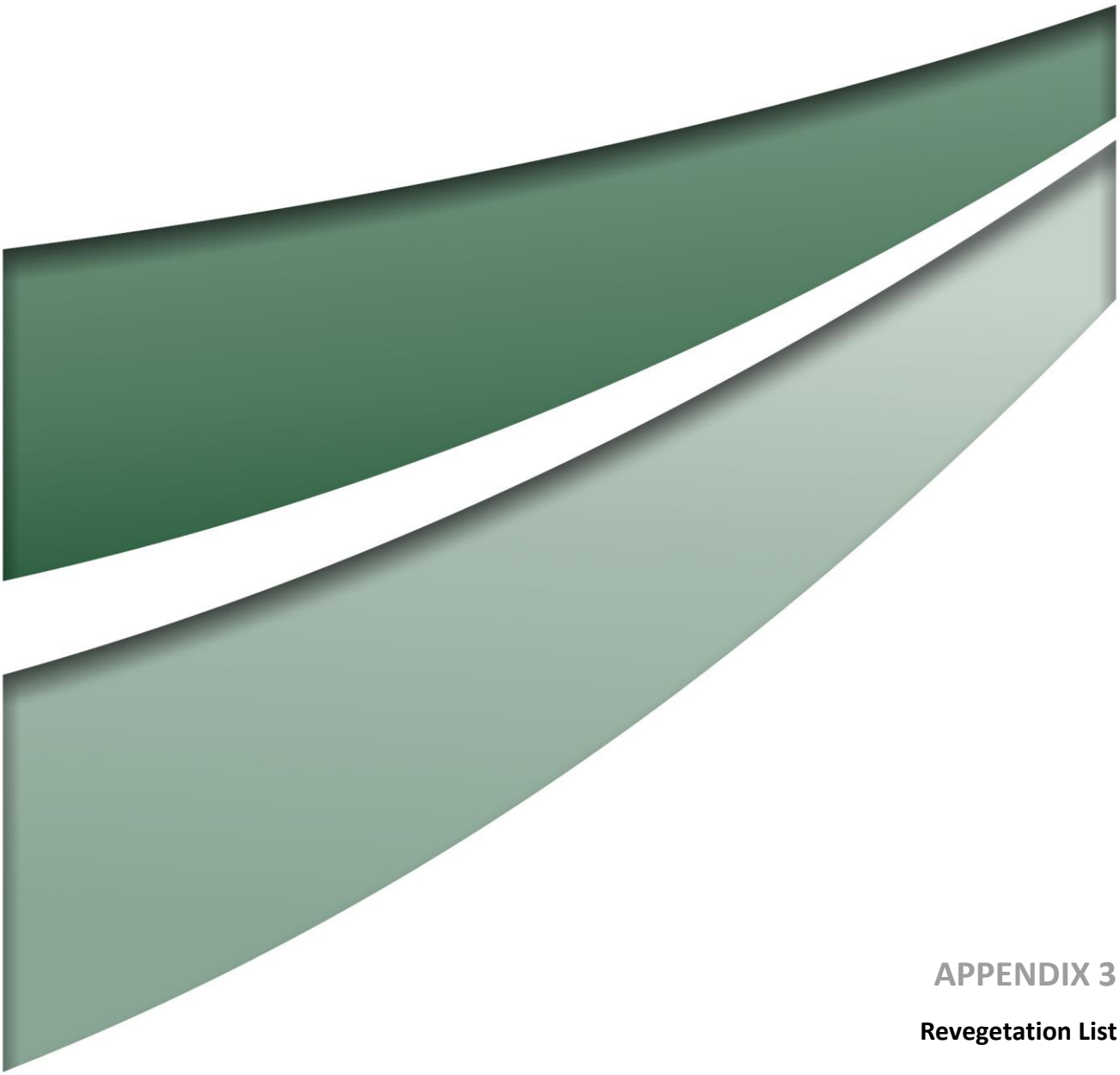


APPENDIX 3

Revegetation List

Proposed revegetation species list (derived from flora known to occur in Haerses Road Quarry Site)

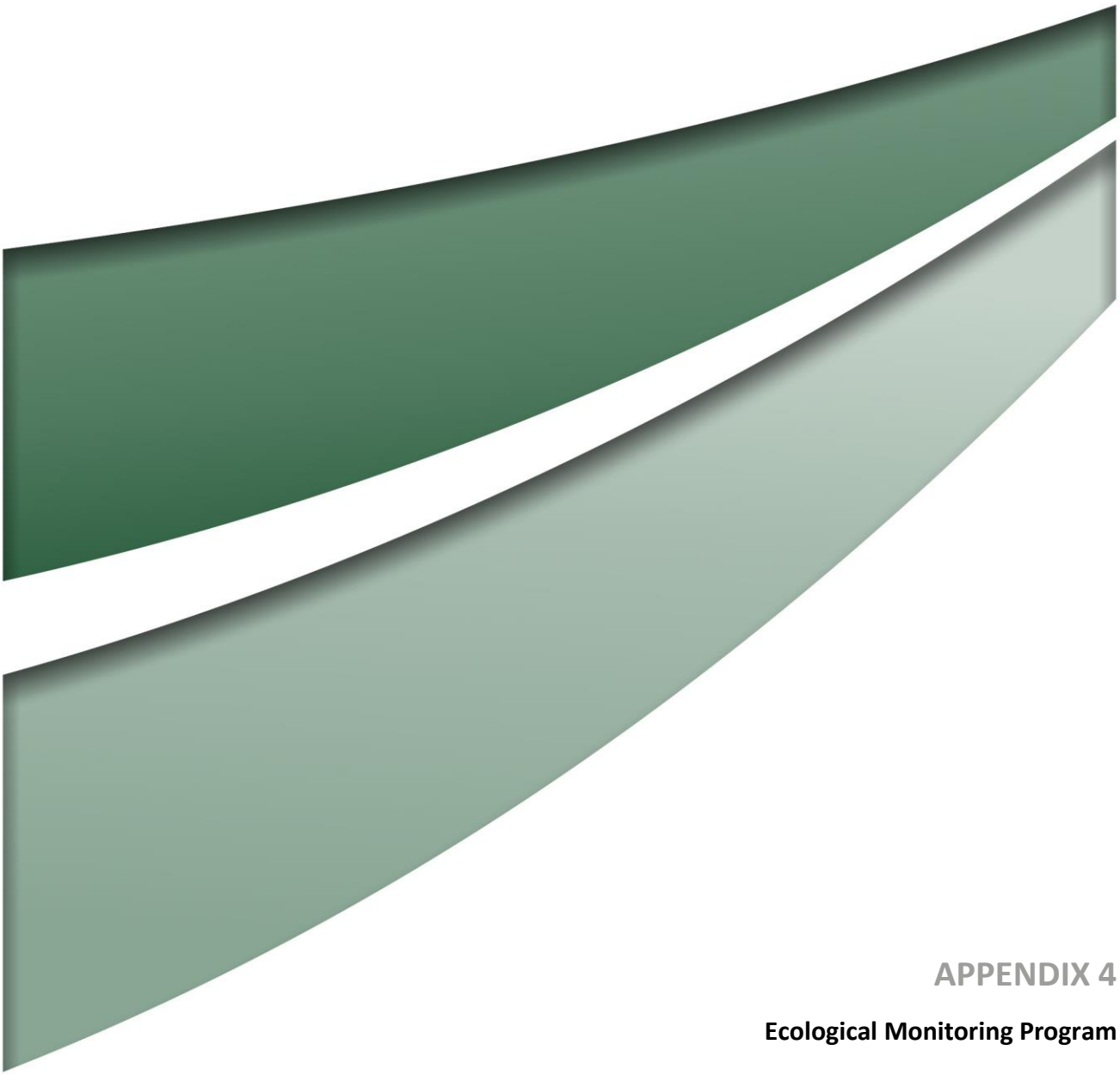
Family	Scientific Name	Common Name	Vegetation Community			
			HN560	HN566	HN582	HN586
Groundcover vegetation						
Ferns						
Adiantaceae	*Adiantum aethiopicum*	common maidenhair			X	
Aspleniaceae	*Asplenium flabellifolium*	necklace fern		X		X
Dennstaedtiaceae	*Pteridium esculentum*	bracken	X			X
Gleicheniaceae	*Gleichenia dicarpa*	pouched coral fern	X			
Lindsaeaceae	*Lindsaea microphylla*	lacy wedge fern			X	
Schizaeaceae	*Schizaea bifida*	forked comb fern				X
Herbs - Monocots						
Anthericaceae	*Caesia parviflora* var. *parviflora*			X		
Anthericaceae	*Thysanotus tuberosus*	common fringe-lily		X		
Colchicaceae	*Burchardia umbellata*	milkmaids	X			X
Haemodoraceae	*Haemodorum planifolium*				X	
Orchidaceae	*Cryptostylis erecta*	tartan tongue orchid				
Orchidaceae	*Cryptostylis subulata*	large tongue orchid			X	
Phormiaceae	*Dianella prunina*			X	X	X
Sedges/Rushes - Monocts						
Cyperaceae	*Caustis pentandra*	thick twist rush			X	
Cyperaceae	*Caustis recurvata*				X	X
Cyperaceae	*Gahnia sieberiana*	red-fruit saw-sedge				X
Cyperaceae	*Lepidosperma gunnii*			X	X	X
Cyperaceae	*Ptilothrix deusta*		X	X	X	
Cyperaceae	*Schoenus brevifolius*		X			
Cyperaceae	*Schoenus ericetorum*			X	X	X
Restionaceae	*Empodisma minus*		X			
Restionaceae	*Leptocarpus tenax*		X			
Restionaceae	*Lepyrodia scariosa*			X	X	X
Grasses/Graminoids - Monocots						
Lomandraceae	*Lomandra cylindrica*			X		
Lomandraceae	*Lomandra glauca*	pale mat-rush		X	X	
Lomandraceae	*Lomandra longifolia*	spiny-headed mat-rush		X		X
Lomandraceae	*Lomandra multiflora* subsp. *multiflora*	many-flowered mat-rush		X		
Lomandraceae	*Lomandra obliqua*			X	X	
Poaceae	*Anisopogon avenaceus*	oat speargrass				X
Poaceae	*Aristida calycina* var. *calycina*				X	
Poaceae	*Austrostipa pubescens*					X
Poaceae	*Cynodon dactylon*	common couch				
Poaceae	*Entolasia stricta*	wiry panic	X	X	X	X

Family	Scientific Name	Common Name	Vegetation Community			
			HN560	HN566	HN582	HN586
Poaceae	*Paspalidium distans*			X		
Poaceae	*Themeda australis*	kangaroo grass		X		
Herbs - Dicots						
Apiaceae	*Actinotus helianthi*	flannel flower				
Apiaceae	*Actinotus minor*	lesser flannel flower	X	X		X
Apiaceae	*Platysace ericoides*			X		
Apiaceae	*Platysace linearifolia*			X	X	X
Apiaceae	*Xanthosia pilosa*					X
Apiaceae	*Xanthosia tridentata*	rock xanthosia		X		
Campanulaceae	*Wahlenbergia gracilis*	sprawling bluebell				
Droseraceae	*Drosera peltata*	a sundew			X	
Droseraceae	*Drosera spatulata*		X			
Elaeocarpaceae	*Tetratheca glandulosa*			X		
Goodeniaceae	*Dampiera stricta*		X	X	X	X
Goodeniaceae	*Goodenia bellidifolia*				X	
Goodeniaceae	*Goodenia bellidifolia* subsp. *bellidifolia*				X	
Goodeniaceae	*Scaevola ramosissima*	purple fan-flower		X		X
Haloragaceae	*Gonocarpus tetragynus*	poverty raspwort		X		
Ericaceae	*Melichrus procumbens*	jam tarts		X		
Pittosporaceae	*Billardiera scandens*	hairy apple berry		X		
Rubiaceae	*Pomax umbellata*	pomax		X		
Stackhousiaceae	*Stackhousia nuda*		X			
Stackhousiaceae	*Stackhousia viminea*	slender stackhousia			X	
Stylidiaceae	*Stylidium graminifolium*	grass triggerplant				X
Violaceae	*Hybanthus monopetalus*	slender violet-bush			X	
Vines						
Smilacaceae	*Smilax glyciphylla*	sweet sarsparilla		X		X
Lauraceae	*Cassytha glabella*			X	X	
Lauraceae	*Cassytha pubescens*	downy dodder-laurel				X
Shrubs/Small Trees						
Xanthorrhoeaceae	*Xanthorrhoea* spp.			X	X	
Araliaceae	*Astrotricha obovata*					X
Casuarinaceae	*Allocasuarina distyla*				X	
Cunoniaceae	*Ceratopetalum gummiferum*	Christmas bush		X		X
Dilleniaceae	*Hibbertia empetrifolia* subsp. *empetrifolia*			X		X
Dilleniaceae	*Hibbertia fasciculata*				X	
Ericaceae	*Epacris microphylla*	coral heath				
Ericaceae	*Epacris pulchella*	Wallum heath		X	X	X

Family	Scientific Name	Common Name	Vegetation Community			
			HN560	HN566	HN582	HN586
Ericaceae	*Leucopogon attenuatus*	a beard-heath			X	
Ericaceae	*Leucopogon ericoides*	pink beard-heath		X		
Ericaceae	*Leucopogon esquamatus*		X			
Ericaceae	*Leucopogon microphyllus*				X	
Ericaceae	*Lissanthe strigosa*	peach heath				
Ericaceae	*Monotoca scoparia*				X	X
Ericaceae	*Woollsia pungens*				X	
Euphorbiaceae	*Amperea xiphoclada* var. *xiphoclada*					X
Fabaceae (Faboideae)	*Aotus ericoides*			X		
Fabaceae (Faboideae)	*Bossiaea ensata*	sword bossiaea			X	
Fabaceae (Faboideae)	*Bossiaea heterophylla*	variable bossiaea			X	X
Fabaceae (Faboideae)	*Bossiaea lenticularis*			X		X
Fabaceae (Faboideae)	*Bossiaea obcordata*	spiny bossiaea		X		
Fabaceae (Faboideae)	*Bossiaea scolopendria*					X
Fabaceae (Faboideae)	*Dillwynia retorta*			X	X	
Fabaceae (Faboideae)	*Gompholobium glabratum*	dainty wedge pea			X	
Fabaceae (Faboideae)	*Gompholobium grandiflorum*	large wedge pea		X		X
Fabaceae (Faboideae)	*Hovea linearis*			X		
Fabaceae (Faboideae)	*Hovea purpurea*				X	
Fabaceae (Faboideae)	*Mirbelia rubiifolia*	heathy mirbelia		X		X
Fabaceae (Faboideae)	*Phyllota grandiflora*	heath phyllota			X	
Fabaceae (Faboideae)	*Phyllota phylicoides*	heath phyllota			X	
Fabaceae (Faboideae)	*Pultenaea retusa*		X			
Fabaceae (Faboideae)	*Pultenaea tuberculata*				X	
Fabaceae (Mimosoideae)	*Acacia echinula*	hedgehog wattle			X	
Fabaceae (Mimosoideae)	*Acacia elongata*	swamp wattle	X			
Fabaceae (Mimosoideae)	*Acacia linearifolia*	narrow-leaved wattle		X		
Fabaceae (Mimosoideae)	*Acacia linifolia*	white wattle		X		
Fabaceae (Mimosoideae)	*Acacia longifolia*				X	
Fabaceae (Mimosoideae)	*Acacia suaveolens*	sweet wattle		X	X	X
Fabaceae (Mimosoideae)	*Acacia ulicifolia*	prickly moses				X
Lamiaceae	*Hemigenia purpurea*				X	
Myrtaceae	*Baeckea diosmifolia*	fringed baeckea		X	X	X
Myrtaceae	*Baeckea imbricata*		X			
Myrtaceae	*Callistemon citrinus*	crimson bottlebrush	X			X
Myrtaceae	*Callistemon linearis*	narrow-leaved bottlebrush		X		
Myrtaceae	*Calytrix tetragona*	common fringe-myrtle			X	
Myrtaceae	*Darwinia biflora*			X	X	
Myrtaceae	*Darwinia fascicularis*			X		

Family	Scientific Name	Common Name	Vegetation Community			
			HN560	HN566	HN582	HN586
Myrtaceae	*Kunzea ambigua*	tick bush			X	
Myrtaceae	*Leptospermum parvifolium*			X		
Myrtaceae	*Leptospermum polygalifolium*		X	X	X	X
Myrtaceae	*Leptospermum squarrosum*		X			
Myrtaceae	*Leptospermum trinervium*	slender tea-tree				X
Olacaceae	*Olax stricta*				X	
Phyllanthaceae	*Phyllanthus hirtellus*	thyme spurge		X		
Proteaceae	*Banksia ericifolia*	heath-leaved banksia	X	X	X	
Proteaceae	*Banksia marginata*	silver banksia			X	
Proteaceae	*Banksia oblongifolia*	fern-leaved banksia	X	X	X	
Proteaceae	*Banksia serrata*	old-man banksia				X
Proteaceae	*Banksia spinulosa*	hairpin banksia		X		X
Polygalaceae	*Comesperma defoliatum*		X			
Proteaceae	*Grevillea buxifolia*	grey spider flower		X	X	
Proteaceae	*Grevillea mucronulata*			X		X
Proteaceae	*Grevillea speciosa*	red spider flower			X	X
Proteaceae	*Hakea dactyloides*	finger hakea		X	X	
Proteaceae	*Hakea gibbosa*			X	X	
Proteaceae	*Hakea sericea*	needlebush		X		
Proteaceae	*Isopogon anemonifolius*	broad-leaf drumsticks			X	
Proteaceae	*Isopogon anethifolius*	narrow-leaf drumsticks		X		
Proteaceae	*Lambertia formosa*	mountain devil		X	X	X
Proteaceae	*Lomatia silaifolia*	crinkle bush		X		X
Proteaceae	*Persoonia lanceolata*	lance leaf geebung		X	X	
Proteaceae	*Persoonia levis*	broad-leaved geebung		X	X	X
Proteaceae	*Petrophile pulchella*	conesticks	X	X	X	X
Rutaceae	*Boronia ledifolia*	Sydney boronia		X	X	X
Rutaceae	*Boronia pinnata*				X	X
Rutaceae	*Philotheca salsolifolia*				X	
Santalaceae	*Exocarpos cupressiformis*	cherry ballart		X		
Sterculiaceae	*Lasiopetalum parviflorum*			X		
Thymelaeaceae	*Pimelea linifolia*	slender rice flower			X	
Thymelaeaceae	*Pimelea linifolia* subsp. *linifolia*					X
Trees						
Elaeocarpaceae	*Elaeocarpus reticulatus*	blueberry ash				X
Myrtaceae	*Angophora costata*	Sydney red gum				X
Myrtaceae	*Angophora hispida*	dwarf apple		X	X	
Myrtaceae	*Eucalyptus haemastoma*	broad-leaved scribbly gum		X		
Myrtaceae	*Eucalyptus piperita*	Sydney peppermint				X
Myrtaceae	*Eucalyptus punctata*	grey gum		X		X

Family	Scientific Name	Common Name	Vegetation Community			
			HN560	HN566	HN582	HN586
Myrtaceae	*Eucalyptus sparsifolia*	narrow-leaved stringybark		X	X	
Myrtaceae	*Eucalyptus squamosa*	scaly bark		X		
Myrtaceae	*Corymbia eximia*	yellow bloodwood		X		
Myrtaceae	*Corymbia gummifera*	red bloodwood		X	X	X
Myrtaceae	*Syncarpia glomulifera*	turpentine		X		X
Rutaceae	*Nematolepis squamea* subsp. *squamea*	satinwood			X	



APPENDIX 4

Ecological Monitoring Program

Details of monitoring methodologies required are provided in the following sections

Agricultural Rehabilitation Monitoring

At the 5 agricultural monitoring sites (former extraction Stages 1 to 5, 2006 Development Consent), a transect will be assessed each of 50 m in length. The following information was collected at each 10 m interval along the transect for a 1 m² sub-plot area:

- pasture composition (species list, annual and perennial pastures, legume content)
- weed species (species list and percent cover)
- percent of groundcover/bare ground and
- pasture biomass (as a photograph).

The following general observations were also made along the 50 m transect:

- Photo monitoring from a single standard monitoring point facing along the transect
- erosion, using the following scale
    - 1 - (no erosion)
    - 2 - sheet erosion
    - 3 - rill erosion (<0.3m deep)
    - 4 - gully erosion (>0.3m<1m deep)
    - 5 - gully erosion (>1 m deep) and
    - tunnel erosion adapted from rating of National Committee on Soil and Terrain (2009) noting the distance along the transect
- rocks present
- presence/absence of topsoil and
- other factors likely to influence rehabilitation development.

Ecological Rehabilitation Monitoring

The five Ecological Rehabilitation Monitoring sites (extraction Cells 1 to 5 as per Mod 1) will be established progressively in areas proposed to be returned to native vegetation. These will comprise floristic monitoring, photo monitoring and habitat assessment as described below.

Floristic Monitoring

Floristic monitoring will be undertaken at each permanent flora monitoring site in a manner consistent with the Biodiversity Assessment Method (OEH 2017) and will consist of a 50 m transect, 50 m x 20 m plot, with a 20 m x 20 m sub-plot, a 10 m x 10 m sub-plot and a 2 m x 2 m subplot.

- Composition - native plant species richness by growth form (within the 20 m x 20 m plot)
- Structure – estimate foliage cover of native and exotic species by growth form (within the 20 m x 20 m plot)
- Function (within the 20 m x 50 m plot):

- Number of large trees
- Presence or otherwise of tree stem size classes
- Presence or otherwise of canopy species regeneration
- Length of fallen logs
- Percentage cover for litter as recorded from five 1 m x 1 m plots
- Number of trees with hollows
- High threat exotic cover

Photo Monitoring

Photo monitoring will be undertaken at each permanent flora monitoring location facing left, centre and right at the start of the 50 m transect.

Habitat Assessment

Habitat assessment will also be undertaken in each 50 m x 20 m plot. Habitat features recorded at each site will include:

- General vegetation health;
- Evidence of natural seedling recruitment;
- Occurrence and abundance of weed species;
- Structure and floristics of vegetation cover;
- Signs of disturbance (by stock, people or feral animals);
- Nature and extent of erosion
- Evidence of fire
- Characteristic of ground cover (e.g. leaf litter, rocks, logs and soil)
- Nectar or fruit resources and perch sites
- Hollow resources
- Water resources; and
- Secondary evidence of fauna use such as scats, tree scratches or diggings.

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