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Hodgson Quarries and Plant Pty Ltd

ROBERTS ROAD QUARRY MODIFICATION 4

Response to Submissions

FINAL

March 2020

Hodgson Quarries and Plant Pty Ltd

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FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Hodgson Quarries and Plant Pty Ltd

Project Director: Alex Irwin
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Report No. 4465/R05
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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
Final	Ruth Tapp	18/03/2020	Alex Irwin	19/03/2020
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Table of Contents

Figures

Appendices

1.0 Introduction

The Statement of Environmental Effects (SEE) for the Roberts Road Quarry Modification 4 (DA 267-11-99) (the Proposed Modification) was placed on public exhibition by the NSW Department of Planning, Industry and Environment (DPIE) from 13 January until 7 February 2020. This Response to Submissions (RTS) has been prepared by Umwelt (Australia) Pty Limited (Umwelt) on behalf of Hodgson Quarries and Plant Pty Ltd (the Applicant) to address the key issues raised in the submissions received during the public exhibition period.

During the exhibition period there were no submissions received from the community. Advice was received from six government agencies, including The Hills Shire Council.

This RTS includes:

- A brief summary of the Proposed Modification (**Section 2.0**)
- A detailed response to the government agency and Council comments (**Section 3.0**).

2.0 The Proposed Modification

The Applicant operates the Roberts Road Quarry (the Quarry) located on Roberts Road in Maroota, New South Wales (NSW) as shown in Figure 2.1. Development consent (DA 267-11-99), which provides for the extraction and on-site processing of sand and pebbles for a period of 25 years, was originally granted to the Quarry by the Minister for Urban Affairs and Planning in 2000.

The Applicant is seeking to modify DA 267-11-99 to allow for the importation of Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM) which would be used predominantly to backfill the extraction area to construct a free-draining final landform. Selective processing and blending of VENM and ENM with high sand content are also proposed.

The key components of the Proposed Modification are as follows:

- The importation of VENM and ENM, principally to backfill the extraction area and create a final landform which better integrates with the surrounding landforms
- On-site processing of selected, high sand content VENM and ENM for sale or blending with sand produced from the in-situ resources prior to sale
- While back loading of trucks would be encouraged, the proposed importation of VENM and ENM would require an increase in the number of traffic movements permitted each day (from 100 to 140)
- An extension to the period of approval of DA 267-11-99, from 2025 to 2030, to reflect the remaining sand resource to be extracted from within the existing approved extraction footprint
- Removal of a condition limiting the area of exposed and active quarry extents in order to allow for backfill and rehabilitation of the completed sections of the Quarry with VENM and ENM.

Approval for the proposed changes is being sought by under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

FIGURE 1.1

Locality Plan

Image Source: ESRI World Shaded Relief (2019) Data source: DPI (2019)

3.0 Agency Submissions

3.1 Introduction

The issues raised in the agency submissions are identified in text boxes in the following sections, with the response to each issue following:

Copies of the submissions are available on the DPIE Major Projects website:
https://www.planningportal.nsw.gov.au/major-projects/project/25871

3.2 Transport for NSW (TfNSW)

TfNSW requests that the attached TIA is updated to include the intersection of Old Northern/Wisemans Ferry roads in addition to the intersection of Old Northern/Roberts Roads. The study should include a traffic assignment diagram and SIDRA network modelling indicating the impacts from this development.

The *Traffic Impact Assessment* has been updated by Seca Solution and is included in **Appendix A**. The revised assessment includes modelling of the Old Northern Road/Wisemans Ferry Road intersection, including a traffic assignment diagram and SIDRA network modelling as requested by TfNSW.

The assessment demonstrates that the Old Northern Road/Wisemans Ferry Road intersection currently operates very well with minimal delays and no congestion. The impact of the additional truck movements associated with the Proposed Modification on the operation of this intersection were assessed. In addition, the future impact on this intersection of the proposed modification to Haerses Road Quarry (operated by Dixon Sand Pty Ltd), which seeks to increase the extraction rates and importation of VENM/ENM with an associated increase in the number of truck movements to 180 movements per day, was also assessed.

Results, provided in Table 5 of **Appendix A**, confirm that the intersection of Wisemans Ferry Road and Old Northern Road will continue to operate well with minimal delays and queues. The impact of the proposed extension of operations to 2030 was also assessed using an annual increase of 2.0% per annum for through movements along Old Northern Road. This rate accounts for increased flows associated with the growth of other quarry operations in the area. Results confirm that the intersection of Old Northern Road and Wisemans Ferry Road will continue to operate to an acceptable level for the future design year of 2030.

Refer to **Appendix A** for full details of the assessment.

3.3 Environment Protection Authority

3.3.1 Air

The *Air Quality Impact Assessment for Proposed Modification 4* (Jacobs Group (Australia) Pty Limited, 2020) has been updated (F0v2) and is included in **Appendix B**. To assist in the review of the revised Air Quality Impact Assessment ('the revised AQIA'), revised or additional information is identified by blue underlined text. Individual issues raised by the EPA in relation to air quality are included below, along with a summary as to how each has been addressed and reference to the relevant sections, tables or figures in F0v2.

The AQIA adopts a silt content of 2% for estimating emissions from haul roads. The AQIA does not include a justification for the adopted 2%, noting the Chapter 13 of US EPA AP42 includes silt content for unpaved roads for various industries, and the mean silt contents for various industries are all greater than 2%. Hence the adopted value of 2% potentially underestimates emissions from haul roads, and hence potentially underpredicts the predicted ground level concentrations of particulate matter.

Recommendation: Revise the Air Quality Impact Assessment to ensure emission estimates are robustly justified and represent a reasonable worst-case emission estimate.

Emissions calculations have been updated in the revised AQIA (Jacobs, 2020) and revised estimates of silt content introduced. Silt content percentages for overburden ripping and internal haul routes were adopted from the US EPA (1985) AP-42, Chapter 13.2.4, Table 4-1 and AP-42, Chapter 13.2.2, Table 2-1 respectively. The revised silt content percentages provided in Appendix A of the AQIA (refer to **Appendix B** of this RTS) are:

- Dozers ripping material – 7.5% silt
- Dozers placing material – 7.5% silt
- Hauling product on internal haul routes – 4.8% silt

… the assessment does not include a detailed discussion on the adopted emission factors for screening activities (including specific information on where emission factors have been referenced), hence it is unclear as why there is a difference in estimated emissions between scenarios when the material throughput used to derive emission estimates remains constant.

Furthermore Section 3.2 of the SEE states "The Applicant is proposing to import VENM and ENM, both as a backfill material to assist in the rehabilitation of the Quarry, as well as a feed stock for crushing, screening and washing to produce sand products". It is not clear if the assessment has accounted for any proposed increases in quantity of material throughput to screening activities, as the emission estimate is based on the same throughput for each assessed scenario.

Recommendation: The proponent review the emission estimates for screening activities and revise the Air Quality Impact Assessment to include:

- **Further information and justification for the adopted emission factors, and throughputs**
- **A demonstration that screening activities have adequately accounted for any additional increase in material throughput associated with the proposed modification**

A higher emission factor had previously been used for 'crushing/screening' for the two proposed scenarios. Further details are included in Section 6.1 and Appendix A of the updated AQIA (refer to **Appendix B**).

The TSP, PM_{10}, and $PM_{2.5}$ inventories applied for the following operational scenarios are summarised in Tables 6-1 to 6-3 of the AQIA (refer to **Appendix B**):

- Existing, i.e. no change to operations,
- proposed modification with VENM/ENM filling in the north, and
- proposed modification with VENM/ENM filling in the south.

The key change in these inventories between the assessment scenarios for the two modification options and existing operations are additional emissions associated with the hauling, unloading, and placement of VENM/ENM materials. Full details of how these inventories were developed is provided in Appendix A of the AQIA (refer to **Appendix B**). It is noted that these inventories, including the variables and assumptions applied were reviewed and updated following the EPA's review of the initial (F0v0) version of the AQIA.

It is noted that there would not be any change in throughput as a result of the proposal with the additional truck movements proposed being a result of the VENM and ENM importation.

> … the EPA notes that the emissions inventory as per Appendix A of the AQIA does not include emission estimates for proposed crushing activities. Hence it appears that the assessment has not accounted for proposed crushing activities as advised within the SEE.
>
> **Recommendation: Revise the assessment to account for emissions from proposed crushing activities.**

Emissions from occasional crushing activities have been included as a separate item in the emissions estimates of the revised AQIA (Jacobs, 2020) (rather than as a combined crushing/screening item as had been used in the previous AQIA) (refer to Tables 6-1 to 6-3 of the revised AQIA). Crushing emission estimates were adopted from the *National Pollutant Inventory Emission Estimation Technique Manual for Mining. Version 3.1* (2012) section 5.2.2. Emission estimates and calculation techniques are described in Appendix A of the revised AQIA (refer to **Appendix B**).

> Section 5.1.3 of the Approved Methods for Modelling and Assessment of Air Pollutants provides guidance when exceedances of the impact assessment criteria are predicted. The guidance advises that proponents must demonstrate that best management practices will be implemented to minimise emissions of air pollutants as far as practical. The AQIA does not benchmark mitigation measures against best management practices noting that exceedances of impact assessment criteria are predicted, and there are unmitigated particulate emission sources.
>
> **Recommendation: The proponent:**
>
> - **Benchmark mitigation measures against best management practices;**
> - **Revise the Air Quality Impact Assessment incorporating all feasible and reasonable best practice mitigation measures.**

In consultation with Hodgson Quarries, and based on the outcomes of the revised AQIA (Jacobs, 2020) the controls listed in Table 6 4 of the revised AQIA (refer to **Appendix B**) were applied in the existing and proposed emissions inventories. Control efficiency values were applied consistent with guidance presented in Table 4 of NPI, 2012. These are considered the most reasonable and feasible measures which can practically be applied and notably the modelling of the revised AQIA predicts compliance with annual average criteria and no additional exceedances of average daily maximum criteria.

It is further noted that the Applicant is committed to continuing the monitoring of airborne particulate matter and deposited dust and should this approach or exceed criteria as a result of Quarry activities, further adaptive management will be implemented to reduce emissions. The Quarry Air Quality Management Plan will be updated to reflect the modified operations and commitment to adaptive response and management of air emissions.

… the AQIA does not include tabulated results for maximum predicted incremental 24-hour average PM10 and PM2.5 for each scenario assessed (existing, VENM/ENM importation to the north, VENM/ENM importation to the south). Hence it is unclear as to the potential increase in incremental 24-hour average PM10 and PM2.5 ground level concentrations from existing operations and the potential for additional exceedance days above existing operations (as the assessment does not clearly advise on any predicted exceedances for the existing operations).

Recommendation: Revise the Air Quality Impact Assessment to include tabulated results articulating:

- **Maximum incremental and cumulative ground level concentrations at each sensitive receptor for 24-hour average PM10 and PM2.5 for each scenario (existing, VENM/ENM importation to the north, VENM/ENM importation to the south)**
- **Number of additional exceedances for each scenario (existing, VENM/ENM importation to the north, VENM/ENM importation to the south) at each sensitive receptor.**

Tabulated maximum incremental and cumulative PM_{10} and $PM_{2.5}$ concentrations from the proposal at all identified surrounding sensitive receiver locations are presented (refer to Section 8.2, Section 8.3, Appendices B and C of the revised AQIA provided in **Appendix B**). Changes in the number of exceedances are also presented in tables. Results are also presented as contour plots and as time-series.

3.3.2 Noise

A response to the noise issues raised by the EPA has been prepared by Mr Dave Davis, Umwelt Acoustician of Umwelt and is provided in full as **Appendix C**. This response was internally peer reviewed by Mr Tim Proctor, Umwelt's Principal Acoustician. Combined Mr Davis and Mr Proctor have over 60 years' experience in noise assessment. Individual issues are identified and addressed below.

The Wilkinson Murray noise monitoring was based on short term attended monitoring only. An analysis of the data presented within the report shows that the quarry operation at the time of the monitoring significantly increased the background noise level in the area by 5 - 10 dBA. Providing licence limits for the current modification application will need to be based on up to date noise levels that are obtained as per the most recent EPA noise policy documentation, namely the *Noise Policy for Industry* (NPfI) (EPA, 2017).The [Umwelt] Report has been not based on the NPfI. It is possible that there would be significant changes in the Project Noise Trigger Levels (PNTLs) derived under NPfI assessment.

The Project noise limits are specified in the Development Consent Conditions for the quarry (DA 267-11-99). It is not necessary to derive Project Noise Trigger Levels in accordance with the *Noise Policy for Industry* (NPfI) (EPA, 2017) if the proposed modification can achieve the currently approved noise limits.

The Wilkinson Murray report recommended changing the licence conditions from the outdated L_{10} metric to an L_{Aeq} level. However, this was not adopted at the time. As outlined within the NPfI transition policy, the NPfI should be applied to this application.

…

we would expect that Umwelt undertake an assessment as per the NPfI for this development, including derivation of Project Noise Trigger Levels in L_{Aeq}.

The noise limits in the Development Consent Conditions (DA 267-11-99) are given in terms of the contemporary noise level descriptor $L_{Aeq(15\ minute)}$. The Environment Protection Licence (EPL 6535), if

updated to reflect the current Development Consent Conditions, will also present the noise limits in terms of the current noise level descriptor.

All of the recommendations contained within the Wilkinson Murray report were to enable compliance with their assessment under the *Industrial Noise Policy* (INP, EPA, 2000). As an assessment under the NPfI may lead to different/lower PNTLs, Umwelt's assumption of existing compliance may not be valid because the existing noise levels from the site may be over the targets that would be derived from the NPfI.

The Project noise trigger levels (PNTLs) are not relevant to Modification 4 as the Project noise limits are specified in the Development Consent Conditions (DA 267-11-99).

The modelled noise levels in the Wilkinson Murray report have been used as a basis for the Umwelt NIA assessment. We also note that the Umwelt NIA has used the "typical" noise level assessment from the Wilkinson Murray report, rather than the worst case scenario. Umwelt have not addressed the frequency or impact of the worst-case noise levels presented within Table 5.5 of the Wilkinson Murray report. The proposed additional operations, in conjunction with the worst case noise levels may lead to significant increases over the NPfI PNTLs.

The Wilkinson Murray report presented the 'typical' worst-case noise levels when the combination of noise sources in alternative locations resulted in the highest total noise levels at receivers, and Umwelt has adopted those predictions as the basis for the Modification 4 NIA (Section 4.1.2, paragraph 2).

The noise sources considered in the Wilkinson Murray report in the rightmost two columns in Table 5-5 (the dozer and the excavator) are the same items of plant that have been modelled in different locations for the current proposed Modification 4 NIA. Since these noise sources cannot be in both places at the same time, Umwelt's noise modelling has correctly combined the 'typical worst-case' noise levels from the Wilkinson Murray modelling with noise from the proposed new locations of the dozer and the excavator.

The predicted combined noise levels in the Umwelt Noise report Table 5.1 are substantially less than the noise levels in the rightmost two columns of the Wilkinson Murray report Table 5-5, which were predicted with the same noise sources in different locations.

Neither of the assessments consider adverse meteorological conditions. Assessment of all meteorological conditions is important as they can affect the noise levels at the receivers (by increasing them). Due to the distances between the development and the receivers, this may impact some residents more than others. However, this has not been assessed within either report.

The Wilkinson Murray report Section 5.1 provided justification for predicting noise levels under neutral meteorological conditions only, based on analysis of weather data collected near the site (Maroota). The Proponent is not seeking to modify the project noise limits or the specified meteorological conditions under which the noise compliance measurements are considered to be valid.

Recommendation: Based on the above, we recommended that the noise assessment be updated to reflect the Noise Policy for Industry (NPfI). Please note that the updated noise assessment should include new noise levels that will need to be included in the licence.

As noted previously, $L_{eq(15\ minute)}$ noise limits for the Quarry are specified in the Consent Conditions of DA 267-11-99 and it is not necessary to derive Project Noise Trigger Levels in accordance with the *Noise*

Policy for Industry (NPfI) (EPA, 2017) if the proposed modification can achieve the currently approved noise limits.

The responses above, prepared after review of the EPA's comments by Umwelt's experienced acousticians, confirm that the approach taken to the modelling was appropriate and representative, with further justification provided to address the specific matters raised by the EPA.

Noting the above, it is reiterated that with the exception of a minor 1 dB(A) exceedance under worst-case operating conditions at a single receiver (Receiver RR10), compliance with the existing Quarry noise limits is predicted. However, this prediction does not account for the implementation of the ongoing noise control strategies in the Quarry Quarry's *Operational and Road Noise Management Plan* (ORNMP) (Muller Acoustic Consulting Pty Ltd, 2016). The most relevant of these, with modifications recommended to reflect the VENM and ENM management identified in *underlined italics*.

> *"… use overburden to establish perimeter bunds to shield mobile plant from surrounding receivers as much as possible. As works progress, plant work below the surface and hence noise attenuation is increased.*
>
> *In addition to the above controls, … implement temporary noise shielding such as temporary bunds when extraction or VENM and ENM placement and profiling occurs in close proximity to the property boundary of neighbouring receivers. Prior to constructing the bunds, consultation with the neighbouring residence is sought which provided clear lines of communication between the quarry and community."*

As discussed in the NIA completed by Umwelt for Modification 4, continued compliance with the noise limits specified in DA267-11-99 is expected as a result of adherence to the noise control strategies outlined in the Quarry's ORNMP, which will be updated as necessary.

Accordingly, the Applicant requests that the EPL 6535 be updated to reflect the noise limits specified in DA 267-11-99.

3.3.3 Water

Recommendation: Given that the EPA will need to provide discharge criteria for inclusion in the modification consent, the following information is required to enable the EPA to provide conditions of approval, to address residual water quality risks:

1. The applicant should prepare a water quality impact assessment. This assessment should:

- **demonstrate that all practical and reasonable measures will be implemented to avoid discharges and minimise pollution**
- **identify and estimate the quality and quantity of all pollutants that may be introduced into the water cycle by source and discharge point including residual discharges after mitigation and waste avoidance measures are implemented (where possible, this should be based on monitoring at the site)**
- **describe the nature and degree of impact that any residual discharges will have on the environmental values of the receiving waterways with reference to the relevant guideline values from the national Water Quality Guidelines**
- **where relevant, consider practical measures to address identified impacts.**

The assessment should adopt the guideline values for slightly to moderately disturbed ecosystems. If site-specific guideline values are used, these should be derived consistent with the national Water Quality Guidelines, including being based on at least 24 months of contiguous monitoring data from a suitable reference site/s, representative of slightly disturbed condition.

Water balance modelling indicates that discharges from the sediment basin will likely be required when construction of the proposed final landform is approaching completion and throughout the stabilisation (revegetation) phase. This is due to the absence of operational water demands and the diminishing storage capacity of the Quarry void as backfilling progresses. No discharges are expected to occur during the operational life of the Quarry.

During final landform construction, the primary pollutant of concern will be sediment. As such, the final landform construction site will be managed in accordance with *Managing Urban Stormwater Volume 1* (Landcom, 2004) and *Volume 2E Mines and Quarries* (DECC, 2008) (the Blue Book).

The EPA indicates that it is unclear whether discharges from the sediment basin may contain other pollutants of concern at non-trivial levels such as metals, nutrients and chlorine. During the construction of the final landform, site runoff may entrain significant quantities of sediment from areas where stabilisation (revegetation) is limited. The entrained sediments will be associated with soils that are classified in accordance with NSW EPA guidelines as either VENM and/or ENM. While heavy metals and nutrients may be transported with sediments dislodged and mobilised during rainfall events, the sediments associated with runoff from VENM and ENM are not expected to pose a threat of environmental harm beyond that of a typical construction site where VENM and ENM soils are exposed. As such, the environmental risks associated with metals and nutrients will be managed by the application of best practise erosion and sediment control measures in accordance with the Blue Book. This includes the construction of a sediment basin (Sediment Basin 1) with the capacity to contain a 5 day 95th percentile rainfall event and a sediment storage capacity equal to 50% of the settling zone capacity. It should also be noted that the results presented in the *Roberts Road Quarry Modification 4 Statement of Environmental Effects* (Umwelt, 2019) contained a typographical error indicating **chlorine (an aquatic toxicant)** concentrations when the results are for **chloride**.

The Applicant will prepare a detailed Soil and Water Management Plan (SWMP) in accordance with the Blue Book prior to the completion of extraction activities at the Quarry for final landform construction. This SWMP will be flexible and be based on the anticipated climate, soil and construction conditions at the time the plan is prepared. The SWMP will be updated as required to address changes in construction conditions and ineffective drainage erosion of sediment controls.

Notwithstanding the above, Hodgson Quarry Products will undertake water quality monitoring in the drainage line downstream of the Quarry which will ultimately receive any water discharged from the Quarry. The water quality data collected will be used to inform future EPL licensed discharge point limits. Given the nature of the materials (VENM and ENM) being used for the construction of the final landform it is considered that limits for TSS, turbidity, pH and EC would provide adequate protection of the downstream drainage line.

3.4 The Hills Shire Council

Concerns are raised that the proposal includes the importation of a significant amount 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.

As DA 267-11-99 was granted under Part 4 of the EP&A Act in May 2000 and classified as State Significant Development (SSD), modification to the Development Consent is sought under Section 4.55(2) of the EP&A Act. Modification under Section 4.55(2) requires that the consent authority is '*satisfied that the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified (if at all)*'.

As discussed in Section 5.2.1 of the *Roberts Road Quarry Modification 4 Statement of Environmental Effects* (Umwelt, 2019), while the importation of VENM and ENM represents an additional development activity on the Quarry Site, i.e. operation of a waste management facility, the proposed importation and application of the VENM and ENM represents an ancillary operation to that of the extractive industry and one which provides for a net environmental benefit (both in relation to the creation of a final landform more sympathetic to the surrounds and providing a beneficial use for material which otherwise could be sent to a licensed landfill).

With respect to the intensity of operation at the Quarry, the maximum approved production level would remain the same and no increase in the maximum approved disturbance footprint of the Quarry is proposed. A small increase in truck movements is proposed, however, this has been assessed as not significantly impacting on road condition, capacity or performance (refer to Section 7.6 of the *Roberts Road Quarry Modification 4 Statement of Environmental Effects* (Umwelt, 2019)). The management of VENM and ENM would require the operation of equipment on the Quarry Site for longer periods, however, this increase in activity has been assessed and are to be managed by implementation of operational and environmental controls to ensure that these modifications do not to impact on 'material and essential' elements of the development as originally approved.

On the basis that the additional development activity (VENM and ENM management) is ancillary and beneficial to the extractive industry development, does not require any significant intensification of operations and would be managed to limit impacts on the environment and surrounding landholders, it is concluded that the modified development will be substantially the same as the Quarry development and can be modified under section 4.55(2) of the EP&A Act.

The proposed increase in vehicle movements and extension to the timeframe for extraction may also potentially impact on amenity to adjoining property owners and further add to the need for a new application.

Increases in vehicle movements have been addressed by the Traffic Impact Assessment, included as **Appendix A**. The Assessment concluded that the on-going use of the site as a quarry operation with 140 truck movements per day and 20 truck movements per hour, can continue to occur in a safe and appropriate manner with an acceptable impact upon the local road network to the future design year of 2030.

An assessment of social impact of the Proposed Modification was also included as Section 7.11 of the *Roberts Road Quarry Modification 4 Statement of Environmental Effects* (Umwelt, 2019). This assessment concluded that it is unlikely that the broader community will be greatly impacted by the Proposed Modification above and beyond current levels, given that:

- The area of impact will remain unchanged,
- The scale of operations will not change significantly, and
- The level of impact (as predicted by assessment of emissions, traffic levels and amenity) will remain below existing limits, criteria or not change significantly.

The assessment of social impact concluded that as a result of the proposed design features, operational safeguards, controls and management measures, the impacts on local amenity associated with the Proposed Modification have been appropriately considered and addressed.

Employment opportunities would be sustained and increased as a result of the Proposed Modification which has potential to have a positive impact for local businesses through incidental spending in the local area. Furthermore, the proposed incorporation of the VENM/ENM importation, selective processing and disposal to the completed extraction area would enable the benefits associated with the Quarry to be continued over a longer period of time.

The impact of the Proposed Modification on current and future land uses on and surrounding the Quarry Site has been considered. Importantly, as impacts would be restricted to the Quarry, the Proposed Modification would not adversely impact on the current land use(s) of surrounding properties. Furthermore, the Proposed Modification would provide for a landform more sympathetic and therefore of greater aesthetic appeal and allow for more productive future use of the landform.

The broader economic impact of the Proposed Modification will be the provision of high-quality sand materials for the Sydney and regional markets which will largely be used in the construction of new homes. The Proposed Modification would also provide an additional and alternative location for the disposal of VENM and ENM from Sydney construction projects which, depending on the location of the construction site, may be more cost effective than other existing locations.

Considering the potential direct and indirect socio-economic benefits against those deemed to be adverse, the SIA assessed that there would be a net socio-economic benefit resultant from the approval of the Proposed Modification.

3.5 Division of Resources and Geoscience

The Division has no concerns with the Modification however requests the proponent continue to provide annual production data for the subject site to the NSW Division of Resources and Geoscience as a condition of any new or amended development consent.

This requirement is noted and the Applicant will continue to provide this information to the Division as requested.

3.6 DPI Agriculture

No comments

3.7 Crown Lands

No comments

3.8 DPIE Water and Natural Resources Access Regulator

The proponent should:

- **Continue and maintain groundwater and surface water monitoring and management (as outlined in the approved Water Management Plan).**
- **Ensure all Virgin Excavated Natural Material and Excavated Natural Material is appropriately certified in accordance with the *Protection of the Environment Operations Act 1997*.**

These recommendations are noted and accepted by the Applicant.

4.0 Conclusion

Each of the submissions received have been reviewed and addressed, either through clarification of information presented in the *Roberts Road Quarry Modification 4 Statement of Environmental Effects* (Umwelt, 2019), through supplementary assessment and analysis prepared specifically for this RTS or through commitments on future performance management and documentation.

In most cases, the recommendations of the consulted public authorities have been accepted and addressed, however, the attention of the DPIE is drawn to the following where the Applicant has justified alternative management.

- The Proponent understands the implication of the noise modelling results and proposes to operate the facility, including Modification 4, within the noise limits currently imposed in DA 267-11-99. This will be achieved through adherence to the noise control strategies outlined in the Quarry's *Operational and Road Noise Management Plan*, which will be updated as necessary. Accordingly, the Proponent requests that the EPL be updated to reflect the noise limits specified in DA 267-11-99.

5.0 References

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US EPA, 1985 (and updates). *Compilation of Air Pollutant Emission Factors, AP-42.* Fourth Edition United States Environmental Protection Agency, Office of Air and Radiation Office of Air Quality Planning and Standards. Now a web-based document.

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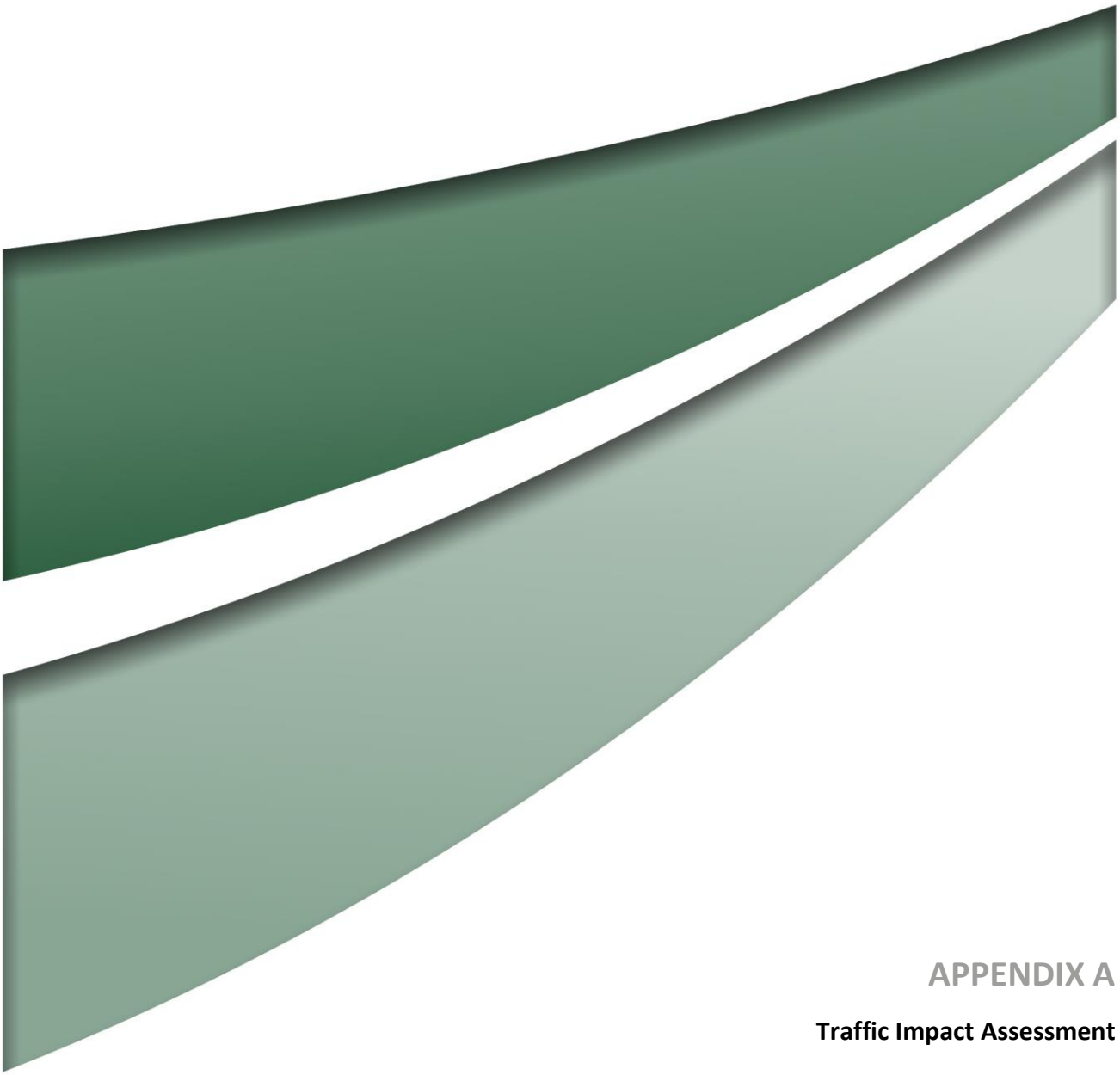

APPENDIX A

Traffic Impact Assessment

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27 February 2020

P1340 Umwelt Roberts Road Quarry

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Attn: Alex Irwin

Dear Alex,

Proposed modification to Roberts Road Quarry, Maroota, NSW

Further to our recent correspondence, we have reviewed the previous traffic assessment completed by Lyle Marshall and Associates (May 2015) and have discussed the proposed modifications to consent for the existing Roberts Road Quarry to obtain an understanding of the project requirements. We have completed a site visit and collected traffic data via traffic surveys in the surrounding area to obtain the current traffic flows.

Hodgson Quarry Products Pty Ltd operates the Roberts Road Quarry, a sand extraction and processing operation, located at the corner of Roberts Road and Old Northern Road, Maroota. The quarry obtained original consent in 2000, with this being modified three times to accommodate change to the extraction process, sequence of extraction and to extend the life of the quarry.

The existing consent allows for operation until 2025 for the extraction and processing of up to 480,000 tonnes of quarry products per annum and up to 100 truck movements per day, with a maximum of 20 truck movements per hour. This proposal seeks to increase the truck movements to 140 per day, including 30-40 movements associated with the importation of Excavated Natural Material (ENM) and Virgin Excavated Natural Material (VENM), and extend the quarry life by 5 years to 2030. No change to the existing quarry hours of operation are proposed.

The following assessment has been undertaken to determine the traffic impacts of the proposed increase in daily truck movements. This assessment has taken into consideration the Austroads Guidelines and Section 2.3 of the RMS Guide to Traffic Generating Developments, which provides the structure for the reporting of key issues to be addressed when determining the impacts of traffic associated with a development.

Existing situation

The subject site is located at the corner of Roberts Road and Old Northern Road, Maroota incorporating Lots 1 and 2 DP228308 and Lot 2 DP 312327 (Figure 1). Access is available via a single vehicle access direct off Roberts Road. Roberts Road is a local rural road which provides access to the subject site, an additional quarry and several land holdings. Roberts Road intersects with Old Telegraph Road to the east, which provides access to further landholdings.

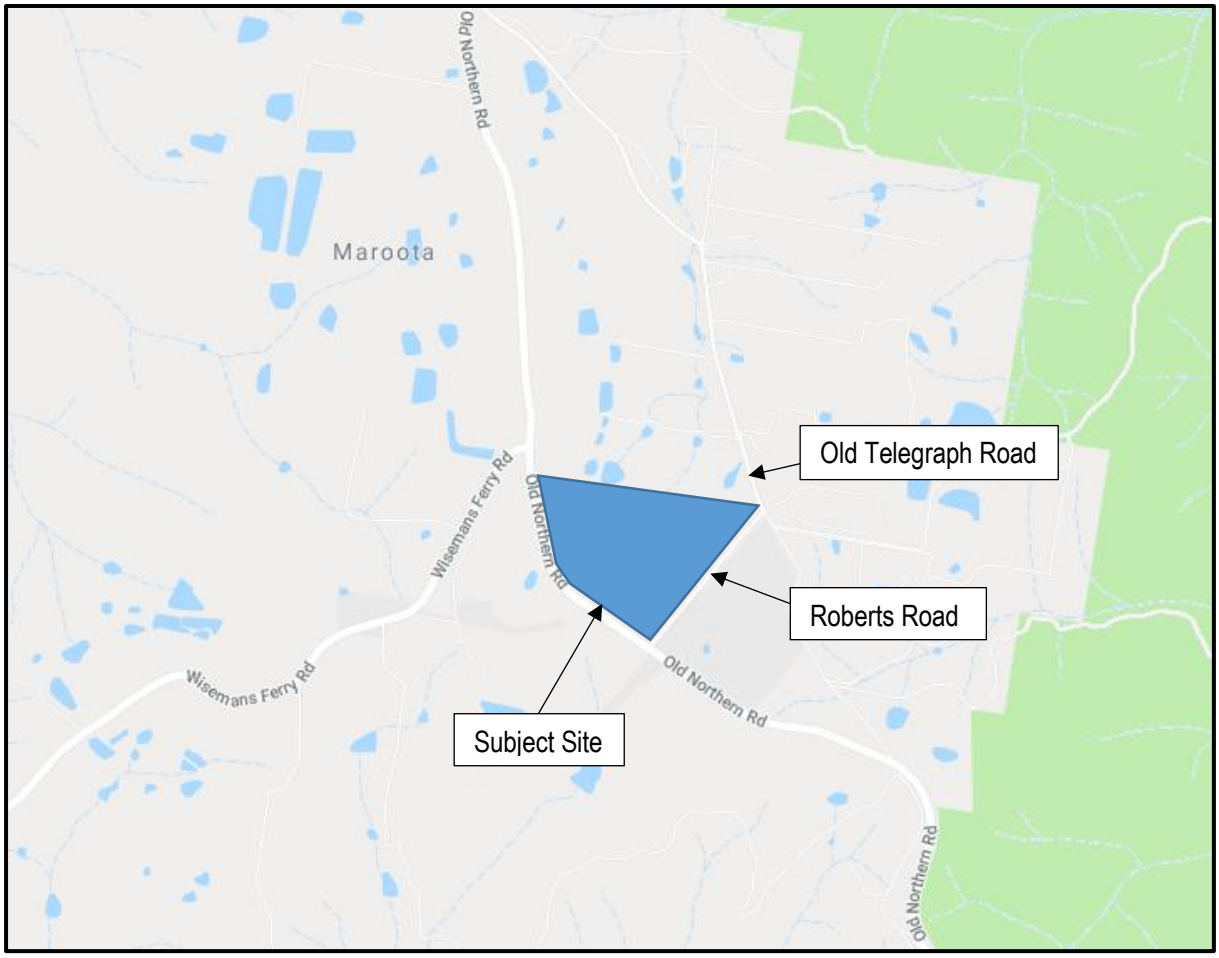


Figure 1 - Subject site in the context of the local road network

Access

There are no proposed changes to the existing access to the quarry. The site access is located on the northern side of Roberts Road, approximately 290 metres east of the intersection with Old Northern Road. Roberts Road in this location offers a straight horizontal alignment allowing for good visibility in each direction along its length. Sight distance to the right (south-west) is 290 metres with clear visibility to sight Old Northern Road as shown in Figure 2, whilst sight distance to the left (north-east) is 220 metres as shown in Figure 3.

Sight distance requirements for access driveways to commercial vehicle facilities are outlined in AS2890.2. For the speed limit of 60km/hr along Roberts Road a minimum sight distance of 83 metres is required (5 second gap), with 133 metres specified for an 8 second gap. As noted above sight distance in both directions out of the site access is well in excess of the required 83 metres and also satisfies the higher requirement. Therefore, the site access provides sight distance in accordance with AS2890.2.

Figure 2 - Visibility to the right (south-west) out of the existing site access

Figure 3 - Visibility to the left (north-east) out of the existing site access

The intersection of Old Northern Road and Roberts Road has also been assessed. Sight distance requirements at intersections are outlined in the Austroads Guide to Road Design Part 4A, with safe intersection sight distance (SISD) being the critical requirement. For the posted speed limit of 90km/hr along Old Northern Road a SISD of 214 metres is required.

Sight distances were measured on site, with visibility to the left out of Roberts Road being 300 metres, whilst visibility to the right is 278 metres. As such, the intersection satisfies Austroads requirements in regard to sight distance. The layout of this intersection also includes a channelised right turn lane for turning movements into Roberts Road, which has a storage length of approximately 35 metres with approximately 20 metres of additional storage available within the painted median. This allows storage for at least two quarry trucks with through traffic still able to pass along Old Northern Road. Given the relatively low traffic flows and minimal delays for turning movements observed during the site work this turn lane has sufficient capacity.

Traffic Flows

As part of the project work Seca Solution competed a traffic survey at the intersection of Old Northern Road and Roberts Road to determine the current peak hour traffic flows in this location. This survey was completed on the 4th December 2018 between 7am to 9am, with the peak hour determined as 7:15am to 8:15am. The distribution of traffic during the morning peak hour is shown in Figure 4 following, with the raw survey data provided in **Attachment A**.

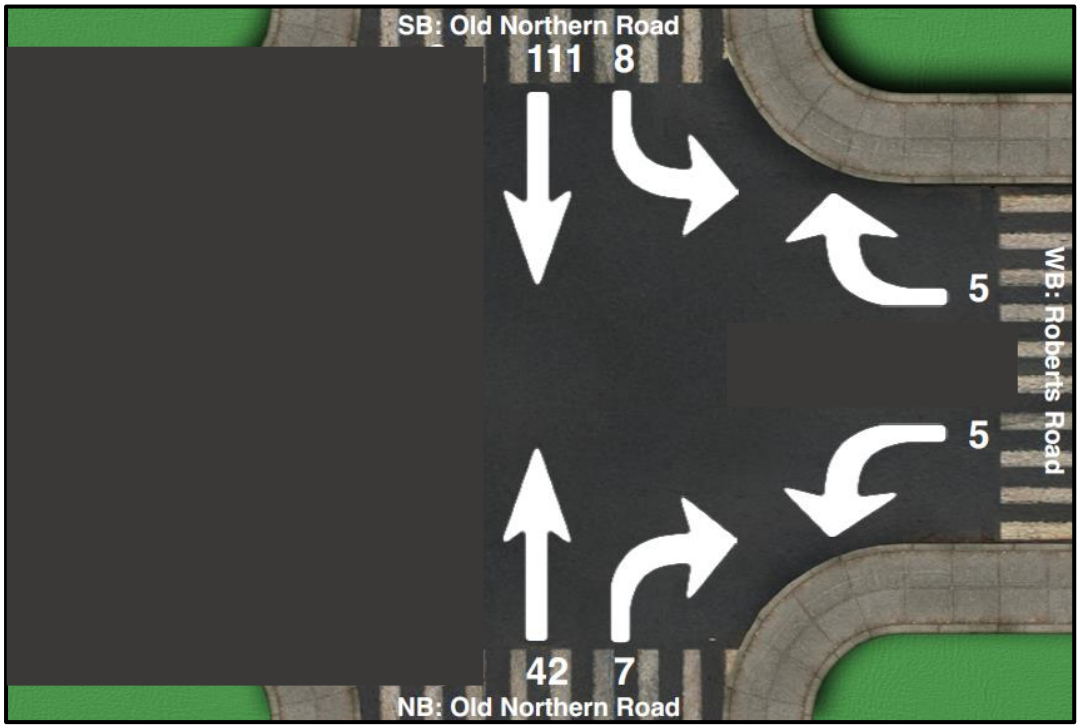


Figure 4 - Morning peak hour flows at the intersection of Old Northern Road / Roberts Road

- The two-way movements along Roberts Road during the intersection AM peak hour were 25 vehicles.
- The two-way flows along Old Northern Road (to the north of Roberts Road) were 166 vehicles.

The RMS Guide to Traffic Generating Developments states peak hourly flows typically represent 8-12% of daily flows. Based on the average of 10% the daily flows on Old Northern Road would be in the order of 1,660 vehicles per day whilst Roberts Road would be in the order of 250 vehicles per day.

Seca Solution have previously collected traffic data at the intersection of Wisemans Ferry Road and Old Northern Road on Tuesday 4th November 2018. Automatic tube counters have also been installed to determine typical daily traffic flows in May 2019 on Wisemans Ferry Road and Old Northern Road. A summary of these survey results is provided below.

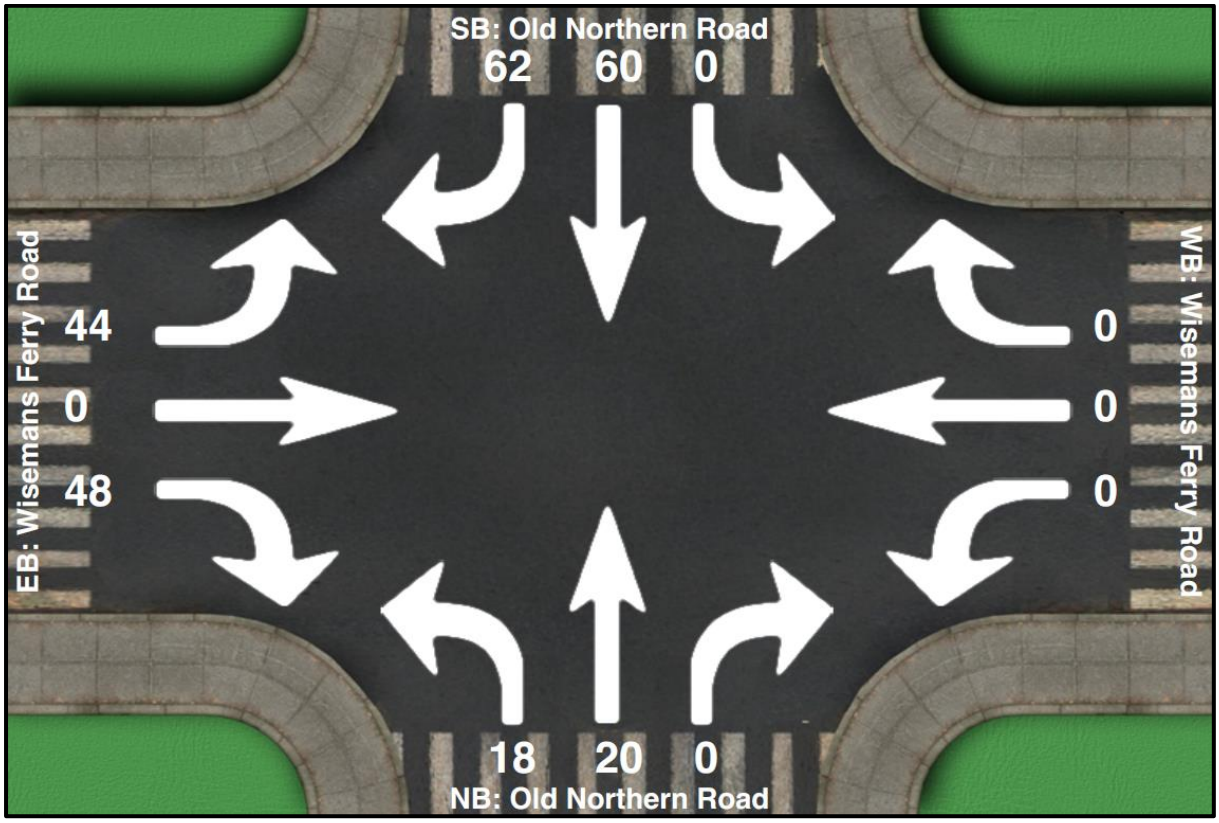


Figure 5 - Hourly traffic volumes at the intersection of Wisemans Ferry/Old Northern roads (8am to 9am).

The AM peak was surveyed as this peak is considered the critical period, as in the PM peak period the extent of truck movements associated with quarries in this location is negligible, due to the distance and time required to access the key market in Sydney.

Table 1 - Two-way Peak Hour Flows on Wisemans Ferry Road and Old Northern Road (May 2019).

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

Current Road Network Operation

Heavy vehicles represent 18% (32 vehicles) of the total flows recorded through the intersection. It is noted that the truck movements associated with the quarry operations were observed and noted as part of this survey.

The intersection of Old Northern Road and Roberts Road was modelled using Sidra Intersection 8, with the results outlined in Table 2.

Table 2 – 2018 AM Sidra results for the intersection of Old Northern Road/Roberts Road

Movement	Level of Service	Average Delay (seconds)	Back of Queue (m)
Right turn into Roberts Road	A	5.9	0.1
Left turn out of Roberts Road	A	6.2	0.4
Right turn out of Roberts Road	A	7.3	0.4
Left turn into Roberts Road	A	6.2	0.0

It can be seen from the above that the intersection currently operates well, operating at LoS A with minimal delays for all turning movements.

The operation of the intersection of Wisemans Ferry Road and Old Northern Road has also been assessed with Sidra and the results of this assessment are provided below.

Table 3 - - 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	

The above two tables clearly demonstrate that both of these intersections currently operate very well with minimal delays and no congestion.

Proposed Development

Site operations

The subject site has an approved haulage rate of 100 trucks per day (50 laden/50 unladen), which allows for inbound and outbound truck movements with the daily total two-way flows not to exceed 100 per day. The project seeks to increase the daily approval to 140 trucks per day, with no increase proposed for the existing hourly maximum of 20 trucks per hour. Instead the project shall see the additional heavy vehicle movements spread over the course of the day during periods of high demand.

All truck access will remain via the existing site access direct onto Roberts Road, with the existing distribution onto Old Northern Road to be maintained.

- 80% to/from the north, turning right onto Old Northern Road and the reverse left turn in.
- 20% to/from the south, being left turns onto Old Northern Road and right turns in.

Quarry generated truck movements for the site currently have significant hourly and day to day variation, depending on market demands. During the survey the quarry was not operating at its highest capacity of 20 vehicles per hour. To assess the operation of the Old Northern Road/Roberts Road intersection for the Quarry operating at its maximum approval (up to 20 truck movements) during the peak hour, an allowance for an additional 10 inbound and 10 outbound trucks has been made (per the distributions outlined above). This is on top of the truck flows already recorded during the traffic survey which accounted for the movements of trucks associated with the quarry operating on that day but also included other background traffic. As such this assessment provides a robust assessment of the intersection.

As the increase in daily movements does not increase the hourly trucks the above was modelled using Sidra with the results outlined below.

Table 4 – 2018 AM Sidra results for the intersection of Old Northern Road/Roberts Road with maximum quarry trucks per hour

Movement	Level of Service	Average Delay (seconds)	Back of Queue (m)
Right turn into Roberts Road	A	6.3	0.2
Left turn out of Roberts Road	A	6.6	1.2
Right turn out of Roberts Road	A	8.4	1.2
Left turn into Roberts Road	A	6.4	0.0

It can be seen from the above that the intersection will continue to operate at the highest LoS allowing for the maximum hourly truck movements for the site.

For the intersection of Old Northern Road and Wisemans Ferry Road the impact of these additional truck movements has also been assessed and the results provided below. Note that this assessment for the future impact has also allowed for the proposed modification to the consent for the Haerses Road quarry, which 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.

Table 5 – 2018 AM Intersection of Wisemans Ferry Road / Old Northern Road with Roberts Road quarry and Haerses Road quarry traffic

Approach	Movements	Level of Service	Average Delay (s)	95% Queue (m)
Old Northern Road (Northbound)	Left Turn	A	6.5	0.0
	Through	A	0.0	
Old Northern Road (Southbound)	Through	A	0.2	0.4
	Right Turn	A	6.1	
Wisemans Ferry Road (Eastbound)	Left Turn	A	7.5	0.4
	Right turn	A	8.6	

The above results confirm that the intersection of Wisemans Ferry Road and Old Northern Road will continue to operate well with minimal delays and queues, with the project traffic flows and those associated with the expansion of the Haerses Road quarry which also impacts upon this intersection.

Impact of operations to 2030

As well as the increase to daily movements, the quarry operations are seeking to operate for 5 years beyond the approval life of the existing consent, which is 2025.

To allow for assessment of the potential daily traffic flows in 2030, an annual increase of 2.0% per annum has been applied for through movements along Old Northern Road. This rate accounts for increased flows associated with the growth of other quarry operations in the area. Along Roberts Road an allowance for growth of 1% per annum has been applied to cater for other quarry operations, including the quarry located on Old Telegraph Road

off Roberts Road, which recently began operation. The above growth rates were applied to the intersection flows through to 2030 with the results outlined in Table 6.

Table 6 – 2030 AM Sidra results for the intersection of Old Northern Road/Roberts Road with maximum quarry trucks per hour

Movement	Level of Service	Average Delay (seconds)	Back of Queue (m)
Right turn into Roberts Road	A	6.4	0.3
Left turn out of Roberts Road	A	6.7	1.4
Right turn out of Roberts Road	A	9.0	1.4
Left turn into Roberts Road	A	6.4	0.0

It can be seen from the above that the intersection will continue to operate at the highest LoS allowing for the maximum hourly truck movements and background growth through to 2030.

The operation of the intersection of Old Northern Road and Wisemans Ferry Road has also been assessed, allowing for the subject site as well as the expansion of the Haerses Road quarry. The results of this assessment are provided below.

Table 7 - 2030 AM Intersection of Wisemans Ferry Road / Old Northern Road with Roberts Road quarry and Haerses Road quarry traffic

Approach	Movements	Level of Service	Average Delay (s)	95% Queue (m)
Old Northern Road (Northbound)	Left Turn	A	6.5	0.0
	Through	A	0.0	
Old Northern Road (Southbound)	Through	A	0.3	0.5
	Right Turn	A	6.2	
Wisemans Ferry Road (Eastbound)	Left Turn	A	7.6	0.6
	Right turn	A	9.3	

The above results confirm that the intersection of Old Northern Road and Wisemans Ferry Road will continue to operate to an acceptable level for the future design year of 2030.

The Sidra outputs are provided in **Attachment B**.

Impact on Daily Traffic flows

Based on the traffic survey completed, the current two-way daily traffic flows along Old Northern Road (to the north of Roberts Road) are in the order of 1,660 vpd. It is known that the quarry was operating on this day with some of these movements therefore relating to the existing quarry operations. In order to ensure a worst case assessment of the impact on daily traffic flows, an allowance for an additional 140 vpd associated with the quarry has been allowed for on top of the surveyed flows, therefore assuming the recorded flows accounted for no quarry traffic.

Based on the 80/20 (north/south) distribution of quarry traffic to the north/south there shall be:

- 112 vehicles to/from the north along Old Northern Road
- 28 vehicles to/from the south along Old Northern Road

The above shall see daily flows shall increase from 1,660 to 1,772 vpd along Old Northern Road to the north of Roberts Road. This represents an increase of 32 vpd of the current 1,740 in this direction for the existing approval of 100 trucks per day (80 vehicles northbound / 20 vehicles southbound). This increase is less than 2% and well within the capacity of the road network.

Allowing for the background growth to 2030 flows on Old Northern Road (north of Roberts Road) could be in the order of 2,200 including the quarry expansion associated with the subject site. This is still well within the capacity of the road.

Impact on Road Safety

It is noted that there is an existing school bus stop along Roberts Road. During the morning survey two buses were observed with one at approximately 7:15am and the other at 8:30am. Both turned left in and left out of the intersection of Old Northern Road and Roberts Road.

Given the low traffic flows along Roberts Road and the good visibility for Quarry trucks, it is considered the proposed increase in daily truck movements will not impact upon the operation of these buses. The hourly approval for the site will not change and as such the existing situation will remain with no identifiable safety issues for the current Roberts Road and quarry access layout. Similarly as there is no proposed change to hourly operations there shall be no impact on school bus operations.

Conclusion

The development traffic will remain consistent with its current hourly level with daily capacity increasing by an additional 40 truck movements per day.

It can thus be seen that the impact of the trucks in the future design year of 2030 is acceptable with the intersection of Roberts Road and Old Northern Road continuing to operate at a high level of service (LoS A). The intersection of Old Northern Road and Wisemans Ferry Road has also been assessed with Sidra and operates at an overall level of service of A with minimal delays and queues. The assessment at this intersection has allowed for the increased activity associated with the Haerses Road quarry expansion by Dixon Sand.

Overall it is concluded that the on-going use of the site as a quarry operation with 140 truck movements per day and 20 truck movements per hour, can continue to occur in a safe and appropriate manner with an acceptable impact upon the local road network to the future design year of 2030.

Please feel free to contact me on 4032 7979, should you have any queries.

Yours sincerely

Sean Morgan

Director

Attachment A – traffic count for Old Northern Road and Roberts Road

Turn Count Summary

Location: Old Northern Road at Roberts Road , Maroota
GPS Coordinates: Lat=-33.467309, Lon=150.999862
Date: 2018-12-04
Day of week: Tuesday
Weather:
Analyst: SL

Total vehicle traffic

Interval starts	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
06:52	2	12	0	0	0	1	0	3	0	0	0	0	18
07:00	1	21	0	2	0	2	0	6	1	0	0	0	33
07:15	0	37	0	2	0	0	0	14	1	0	0	0	54
07:30	1	23	0	3	0	1	0	9	1	0	0	0	38
07:45	3	21	0	0	0	2	0	13	2	0	0	0	41
08:00	4	30	0	0	0	2	0	6	3	0	0	0	45
08:15	4	21	0	1	0	1	0	8	0	0	0	0	35
08:30	3	26	0	5	0	4	0	6	4	0	0	0	48
08:45	1	21	0	0	0	4	0	7	1	0	0	0	34
09:00	3	24	0	3	0	1	0	10	0	0	0	0	41
09:15	0	10	0	0	0	1	0	8	0	0	0	0	19
09:30	1	17	0	0	0	1	0	16	0	0	0	0	35
09:45	2	10	0	0	0	2	0	14	6	0	0	0	34

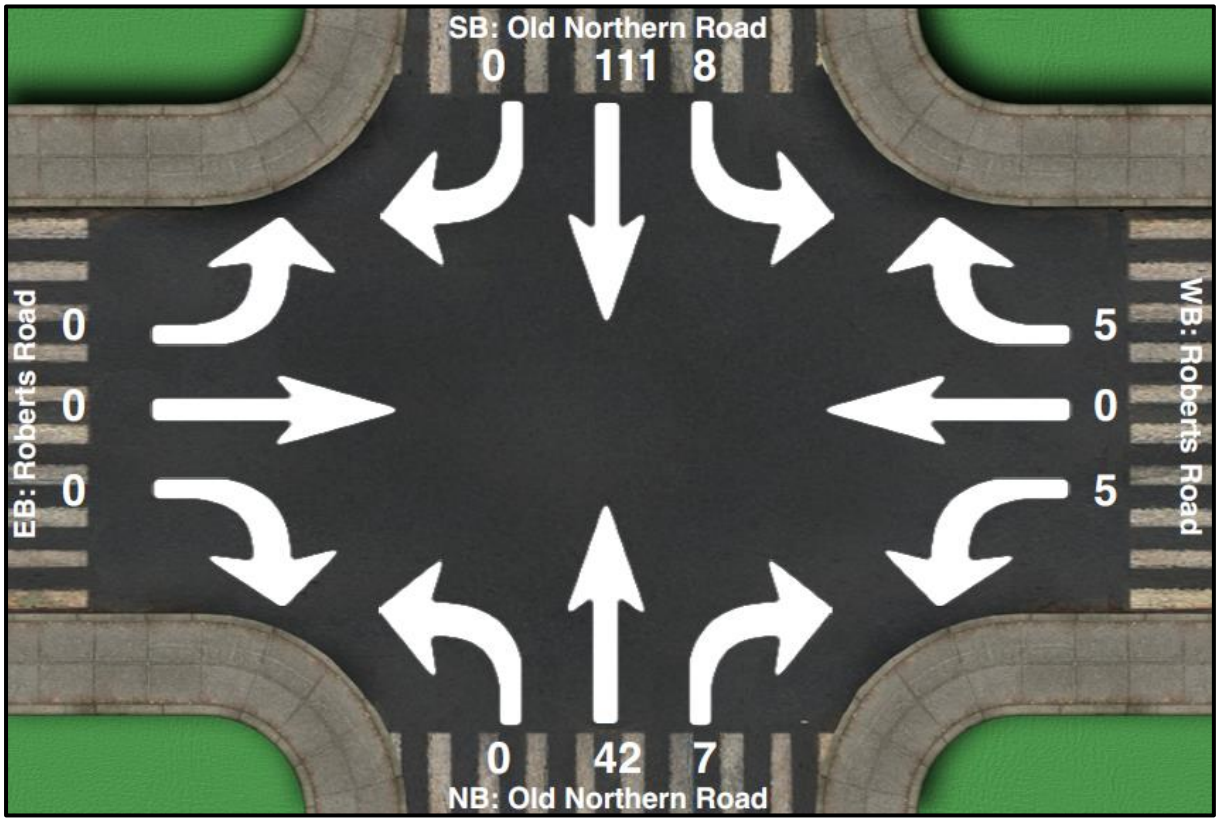
Intersection Peak Hour

07:15 - 08:15

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	8	111	0	5	0	5	0	42	7	0	0	0	178
Factor	0.50	0.75	0.00	0.42	0.00	0.62	0.00	0.75	0.58	0.00	0.00	0.00	0.82
Approach Factor	0.80			0.62			0.82			0.00			

Peak Hour Vehicle Summary

Vehicle	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Car	4	99	0	4	0	3	0	29	7	0	0	0	146
Truck	4	12	0	1	0	2	0	13	0	0	0	0	32



Attachment B - Sidra Outputs

MOVEMENT SUMMARY

Site: 101 [2018 AM Existing]

Old Northern Road / Roberts Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Old Northern Road												
2	T1	44	31.0	0.027	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
3	R2	7	0.0	0.005	5.9	LOS A	0.0	0.1	0.23	0.53	0.23	54.2
Approach		52	26.5	0.027	0.8	NA	0.0	0.1	0.03	0.08	0.03	59.3
East: Roberts Road												
4	L2	5	20.0	0.011	6.2	LOS A	0.0	0.4	0.27	0.55	0.27	53.6
6	R2	5	40.0	0.011	7.3	LOS A	0.0	0.4	0.27	0.55	0.27	51.9
Approach		11	30.0	0.011	6.7	LOS A	0.0	0.4	0.27	0.55	0.27	52.8
North: Old Northern Road												
7	L2	8	50.0	0.070	6.1	LOS A	0.0	0.0	0.00	0.04	0.00	52.2
8	T1	117	10.8	0.070	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	59.9
Approach		125	13.4	0.070	0.4	NA	0.0	0.0	0.00	0.04	0.00	59.5
All Vehicles		187	18.0	0.070	0.9	NA	0.0	0.4	0.02	0.08	0.02	59.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2018 AM Max truck movements]

Old Northern Road / Roberts Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Old Northern Road												
2	T1	44	31.0	0.027	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
3	R2	9	22.2	0.007	6.3	LOS A	0.0	0.2	0.26	0.53	0.26	51.7
Approach		54	29.4	0.027	1.1	NA	0.0	0.2	0.05	0.09	0.05	58.8
East: Roberts Road												
4	L2	7	42.9	0.028	6.6	LOS A	0.1	1.2	0.32	0.57	0.32	52.6
6	R2	14	76.9	0.028	8.4	LOS A	0.1	1.2	0.32	0.57	0.32	50.3
Approach		21	65.0	0.028	7.8	LOS A	0.1	1.2	0.32	0.57	0.32	51.1
North: Old Northern Road												
7	L2	17	75.0	0.078	6.4	LOS A	0.0	0.0	0.00	0.07	0.00	49.5
8	T1	117	10.8	0.078	0.0	LOS A	0.0	0.0	0.00	0.07	0.00	59.9
Approach		134	18.9	0.078	0.8	NA	0.0	0.0	0.00	0.07	0.00	58.9
All Vehicles		208	26.3	0.078	1.6	NA	0.1	1.2	0.04	0.13	0.04	58.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2030 AM with Max truck movements]

Old Northern Road / Roberts Road
Site Category: (None)
Giveway / Yield (Two-Way)
Design Life Analysis (Final Year): Results for 12 years

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Old Northern Road												
2	T1	55	31.0	0.034	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
3	R2	11	22.2	0.008	6.4	LOS A	0.0	0.3	0.29	0.54	0.29	51.7
Approach		65	29.5	0.034	1.0	NA	0.0	0.3	0.05	0.09	0.05	58.9
East: Roberts Road												
4	L2	8	42.9	0.033	6.7	LOS A	0.1	1.4	0.36	0.59	0.36	52.3
6	R2	15	76.9	0.033	9.0	LOS A	0.1	1.4	0.36	0.59	0.36	50.0
Approach		24	65.0	0.033	8.2	LOS A	0.1	1.4	0.36	0.59	0.36	50.9
North: Old Northern Road												
7	L2	19	75.0	0.095	6.4	LOS A	0.0	0.0	0.00	0.07	0.00	49.5
8	T1	145	10.8	0.095	0.0	LOS A	0.0	0.0	0.00	0.07	0.00	59.9
Approach		164	18.2	0.095	0.8	NA	0.0	0.0	0.00	0.07	0.00	58.9
All Vehicles		253	25.5	0.095	1.5	NA	0.1	1.4	0.05	0.12	0.05	58.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [WFR/ONR - 2018AM]

Intersection of Wisemans Ferry Road / Old Northern Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Old Northern Road												
1	L2	19	61.1	0.026	6.2	LOS A	0.0	0.0	0.00	0.27	0.00	54.1
2	T1	21	10.0	0.026	0.0	LOS A	0.0	0.0	0.00	0.27	0.00	58.5
Approach		40	34.2	0.026	3.0	NA	0.0	0.0	0.00	0.27	0.00	56.3
North: Old Northern Road												
8	T1	63	10.0	0.081	0.1	LOS A	0.4	2.9	0.13	0.29	0.13	57.2
9	R2	65	27.4	0.081	6.0	LOS A	0.4	2.9	0.13	0.29	0.13	53.3
Approach		128	18.9	0.081	3.1	NA	0.4	2.9	0.13	0.29	0.13	55.2
West: Wisemans Ferry Road												
10	L2	46	27.3	0.085	7.5	LOS A	0.3	2.7	0.08	0.62	0.08	57.4
12	R2	51	25.0	0.085	7.9	LOS A	0.3	2.7	0.08	0.62	0.08	56.8
Approach		97	26.1	0.085	7.7	LOS A	0.3	2.7	0.08	0.62	0.08	57.1
All Vehicles		265	23.8	0.085	4.8	NA	0.4	2.9	0.09	0.41	0.09	56.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [WFR/ONR - 2018AM+Haerses Rd quarry +Roberts quarry]

Intersection of Wisemans Ferry Road / Old Northern Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Old Northern Road												
1	L2	38	80.6	0.044	6.5	LOS A	0.0	0.0	0.00	0.36	0.00	53.3
2	T1	21	10.0	0.044	0.0	LOS A	0.0	0.0	0.00	0.36	0.00	58.5
Approach		59	55.4	0.044	4.2	NA	0.0	0.0	0.00	0.36	0.00	55.0
North: Old Northern Road												
8	T1	63	10.0	0.082	0.2	LOS A	0.4	3.0	0.17	0.29	0.17	57.0
9	R2	65	27.4	0.082	6.1	LOS A	0.4	3.0	0.17	0.29	0.17	53.2
Approach		128	18.9	0.082	3.2	NA	0.4	3.0	0.17	0.29	0.17	55.0
West: Wisemans Ferry Road												
10	L2	46	27.3	0.114	7.5	LOS A	0.4	3.9	0.10	0.63	0.10	57.2
12	R2	69	45.5	0.114	8.6	LOS A	0.4	3.9	0.10	0.63	0.10	55.6
Approach		116	38.2	0.114	8.2	LOS A	0.4	3.9	0.10	0.63	0.10	56.2
All Vehicles		303	33.3	0.114	5.3	NA	0.4	3.9	0.11	0.43	0.11	55.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [WFR/ONR - 2030AM plus Haerses Rd quarry Roberts quarry]

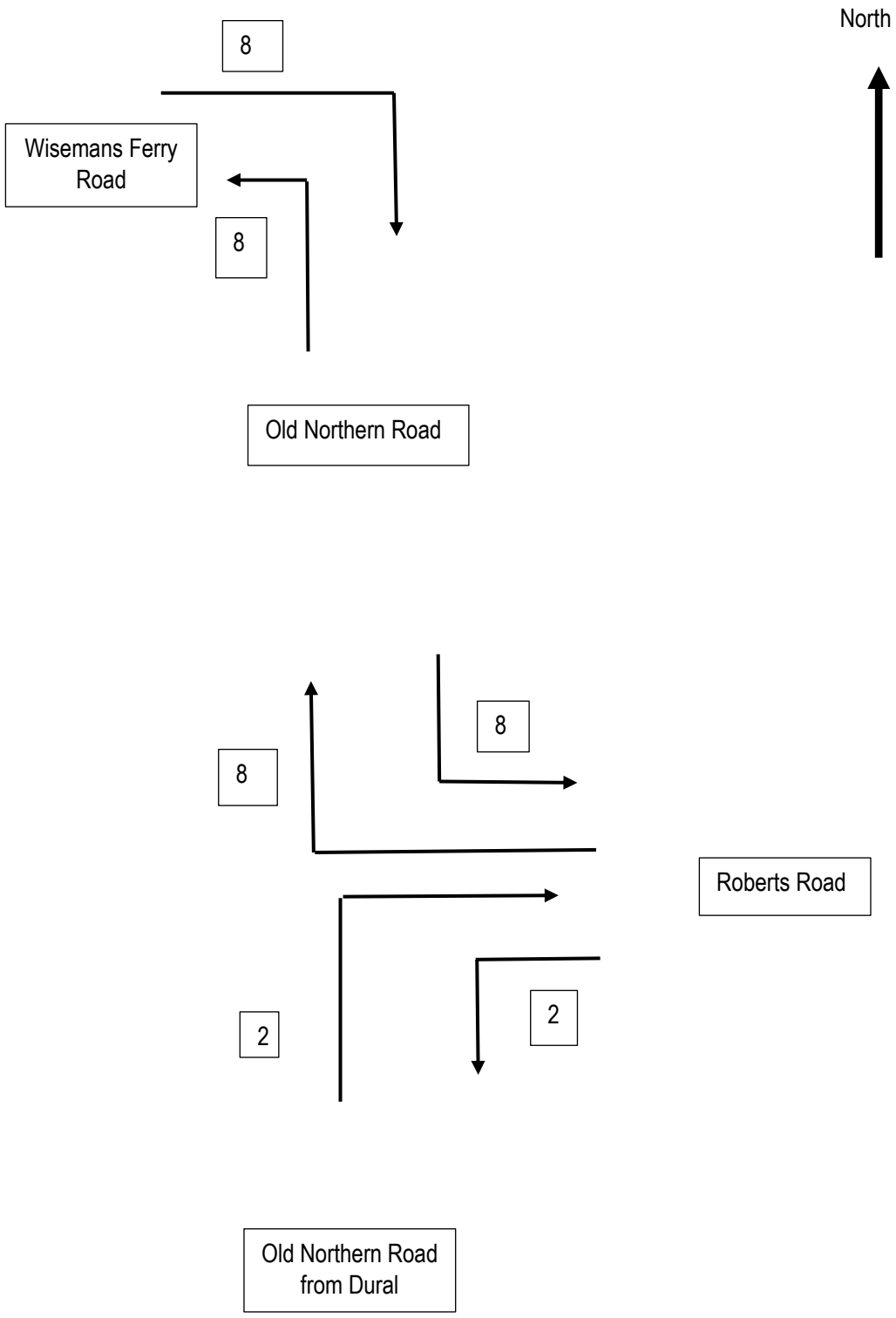
Intersection of Wisemans Ferry Road / Old Northern Road
Site Category: (None)
Giveway / Yield (Two-Way)

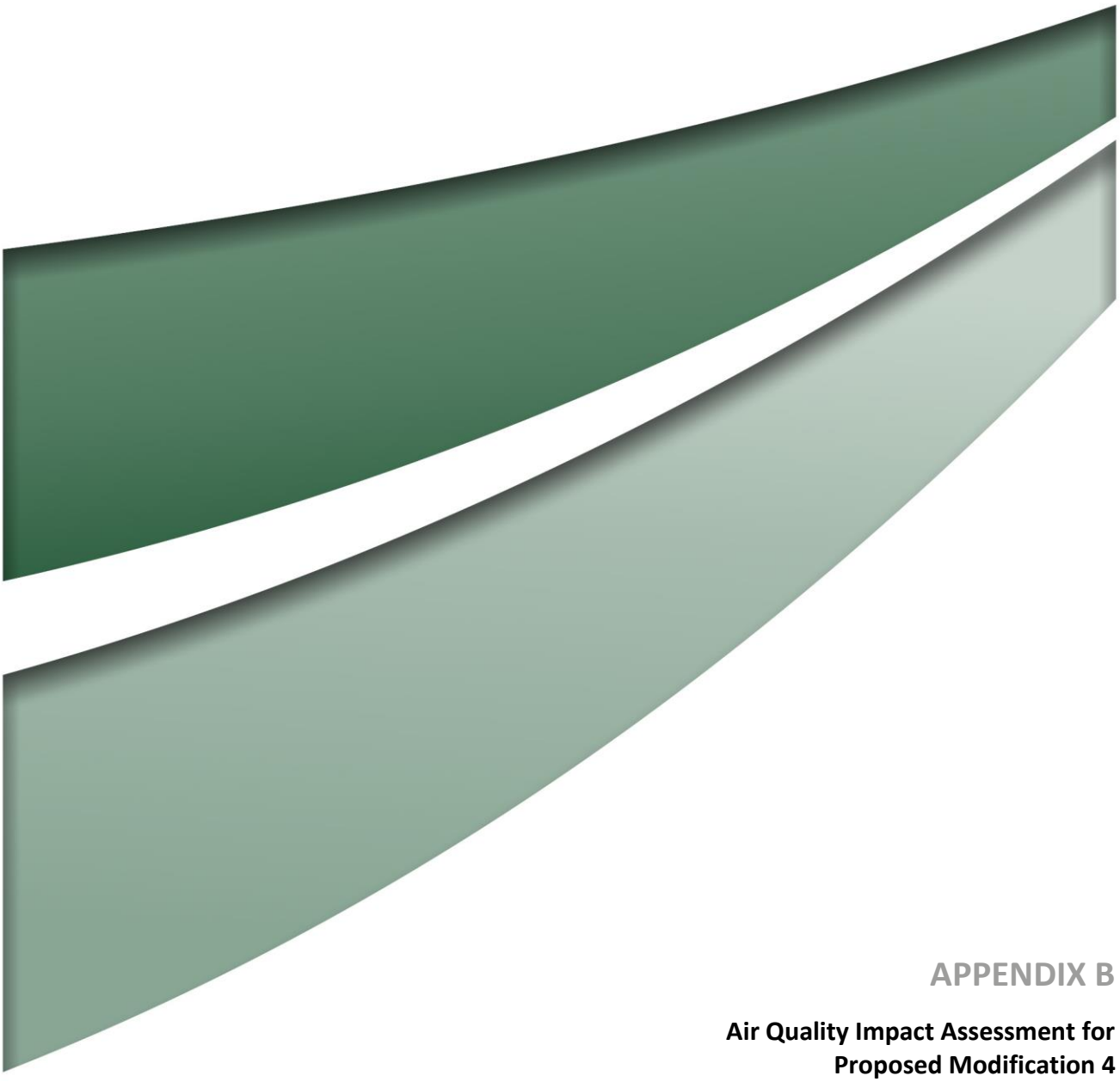
Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Old Northern Road												
1	L2	53	80.6	0.061	6.5	LOS A	0.0	0.0	0.00	0.36	0.00	53.3
2	T1	29	10.0	0.061	0.0	LOS A	0.0	0.0	0.00	0.36	0.00	58.5
Approach		83	55.4	0.061	4.2	NA	0.0	0.0	0.00	0.36	0.00	55.0
North: Old Northern Road												
8	T1	88	10.0	0.117	0.3	LOS A	0.5	4.4	0.21	0.29	0.21	56.9
9	R2	91	27.4	0.117	6.2	LOS A	0.5	4.4	0.21	0.29	0.21	53.1
Approach		180	18.9	0.117	3.3	NA	0.5	4.4	0.21	0.29	0.21	54.9
West: Wisemans Ferry Road												
10	L2	65	27.3	0.170	7.6	LOS A	0.6	6.0	0.13	0.63	0.13	56.8
12	R2	97	45.5	0.170	9.3	LOS A	0.6	6.0	0.13	0.63	0.13	55.2
Approach		162	38.2	0.170	8.6	LOS A	0.6	6.0	0.13	0.63	0.13	55.9
All Vehicles		424	33.3	0.170	5.5	NA	0.6	6.0	0.14	0.43	0.14	55.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Attachment C – Traffic distribution for Roberts Road quarry





APPENDIX B

Air Quality Impact Assessment for Proposed Modification 4

Roberts Road Quarry

Umwelt Australia Pty Ltd

Air Quality Impact Assessment for Proposed Modification 4

F0 | v2

18 March 2020

Roberts Road Quarry

Project No:	IA206300
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Document No.:	F0
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Client Name:	Umwelt Australia Pty Ltd
Project Manager:	Luke Spencer
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Document history and status

Revision	Date	Description	By	Review	Approved
D0v0	31/05/2019	Initial draft for internal technical review	LS	SL	SL
D0v1	03/06/2019	Second draft following initial client review	LS	SL	SL
F0v0	04/06/2019	Final	LS	SL	SL
F0v1	17/03/2020	Final v1 addressing additional information following exhibition for internal review	LS	SL	SL
F0v2	18/03/2020	Final v2	LS	SL	SL

Contents

List of tables

List of figures

Executive Summary

This report provides an assessment of the air quality impacts of the proposed modification to allow VENM/ENM importation at Roberts Road Quarry. The air quality impact assessment has been carried out in accordance with the EPA's "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW" (EPA, 2016).

Identification of key risks

The primary air quality issue associated with the proposal was identified to be dust (that is, particulate matter in the form of TSP, deposited dust, PM_{10} or $PM_{2.5}$) from continued quarrying operations, as well as planned VENM/ENM importation activities.

Existing environment

A detailed review of the existing environment was carried out to understand key features of the existing environment. Aerial imagery was reviewed to identify sensitive receivers around the Quarry. Meteorological observations from the on-site automatic weather station were analysed to identify a suitable meteorological year for the assessment. Air quality monitoring data collected from dust deposition gauges and a High-Volume Air Sampler at the Quarry were reviewed, as well as data from a nearby monitor operated at the Maroota Public School by Dixon Sands. These data were used to establish background conditions around the Quarry, identify any current air quality related issues and establish values to be applied as part of the assessment.

Assessment of impacts

The computer-based dispersion model known as CALPUFF was used to predict the potential air quality impacts of the proposed modification. The dispersion modelling accounted for meteorological conditions, land use and terrain information and used dust emission estimates to predict the off-site air quality impacts. The focus of the assessment was on the potential change in air quality, noting that the Quarry already contributes to existing air quality.

The main conclusions of the assessment for each key pollutant and assessable averaging time were:

- Annual average TSP, annual average PM_{10}, and annual average deposited dust: Changes in air quality as a result of the proposed modification would not lead to exceedances of the EPA's relevant impact assessment criteria at any of the nearest sensitive receivers.
- 24-hour average PM_{10} and $PM_{2.5}$: No additional days were predicted where the EPA's impact assessment criteria would be exceeded at the identified surrounding sensitive receivers.
- Annual average $PM_{2.5}$: Background concentrations already exceed the EPA's 8 µg/m^3 criterion, with increases of up to 0.2 µg/m^3 (i.e. around 1.5 percent) predicted at the most-affected sensitive receivers as a result of the proposal.

Recommended safeguards

Measures consistent with best-practice were recommended to control emissions to air including the use of watering during material hauling, loading and unloading and screening, as well as on exposed surface and stockpiles, and during screening and crushing activities as identified as being required.

Safeguard measures have been recommended to proactively identify meteorological conditions that could lead to elevated background concentrations, to assist with operations planning and management. Further visual verifications were recommended should conditions arise during operations, such that the level of activity, location and controls would need to be reviewed. Review of the siting of the on-site meteorological station was also recommended, to improve the usefulness of data collected.

With respect to Voluntary Land Acquisition and Mitigation Policy (VLAMP), which is applicable to the Quarry as a State Significant Development, the conservative, potential predictions of the assessment indicate that the

provisions of this guideline could apply. To ascertain whether operations present an actual rather than potential risk, it was recommended that fit-for-purpose monitoring be considered with the EPA.

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to quantify the potential air quality impacts of the proposed VENM/ENM importation modification at Roberts Road Quarry in accordance with the scope of services set out in the contract between Jacobs and Umwelt Australia Pty Ltd (Umwelt). That scope of services, as described in this report, was developed with Umwelt.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by Umwelt and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from information sourced from Umwelt (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context.

This report has been prepared on behalf of, and for the exclusive use of, Umwelt, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the Client. Umwelt accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

1. Introduction

Roberts Road Quarry (the Quarry) is operated by Hodgson Quarries and Plant Pty Ltd (Hodgson Quarries) on Lots 1 and 2, DP 228308; and Lot 2, DP 312327, within the Hills Shire Council Local Government Area (LGA) (see to **Figure 1-1** below). The Quarry operates in accordance with Development Consent DA 267-11-99 which permits the extraction and on-site processing of sand, clay and pebble. DA 267-11-99 has been modified three times, with the most recent update allowing an amendment to the dam construction process from stages two and three, modification to the sequence and process of extraction, and extension of the approved life until 2026, granted 18 March 2016.

Hodgson Quarries is proposing a fourth modification to DA 267-11-99 to allow the importation of clean fill material generated from Sydney construction projects, increase the number of truck movements generated by the Quarry, and extend the life of the Quarry (beyond 2026). Umwelt (Australia) Pty Ltd (Umwelt) is assisting Hodgson Quarries with the environmental approval process for this modification and has engaged Jacobs Group Australia Pty Ltd (Jacobs) to prepare an Air Quality Impact Assessment (AQIA) to assess the potential for air quality impacts as a result of the proposed modification. A Preliminary Environmental Assessment (PEA) prepared by Umwelt to support an application for Environmental Assessment Requirements from the Department of Planning & Environment (DPE) (Umwelt, 2019) identified the need for

> *"further review of potential sources of dust emissions will be undertaken and dispersion modelling undertaken to demonstrate that the minor modifications to operations will not result in exceedance of the nominated air quality criteria".*

Additionally, the NSW Environment Protection Authority (NSW EPA) requested an air quality assessment be completed for the modification. Their requirements and where they are addressed in this report as listed in **Table 1-1**.

Table 1-1 NSW EPA air quality assessment requirements for the modification

Environmental aspect	Requirement	Where addressed in this report
Air quality	The additional processing of some VENM and ENM materials, increase in daily truck movements and additional area exposure has the potential to increase the generation of dust (PM_{10} and $PM_{2.5}$) 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:	This report
	- a description of the existing air quality and meteorology using existing information and site representative ambient monitoring data;	**Section 5**
	- an outline of the point and fugitive sources of all pollutant emissions and the resulting ground level concentrations of all pollutants at all sensitive receivers;	**Section 6** and **Section 7**
	- 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	**Section 8**
	- details of the mitigation measures proposed in managing the any additional impacts of air emission from the proposed modification.	**Section 9**

In achieving the assessment objectives identified in the PEA and assessment requirements of the NSW EPA, the objectives of this report were to:

- Outline existing and proposed Quarry operations, and the wider local setting (**Section 2**);
- Identify key air quality risks associated with the proposed modifications (**Section 3**);
- Establish suitable assessment criteria (**Section 4**);

- Describe existing local meteorological and background air quality conditions (**Section 5**);
- Estimate changes in emissions to air as a result of the proposed modification (**Section 6**);
- Explain the methods used to predict potential air quality impacts (**Section 7**);
- Present potential air quality impacts, as determined by the comparison of results from dispersion modelling with criteria, and results for existing operations (**Section 8**); and
- Recommend suitable mitigation, management and monitoring measures to address any predicted increases in impacts (**Section 9**).

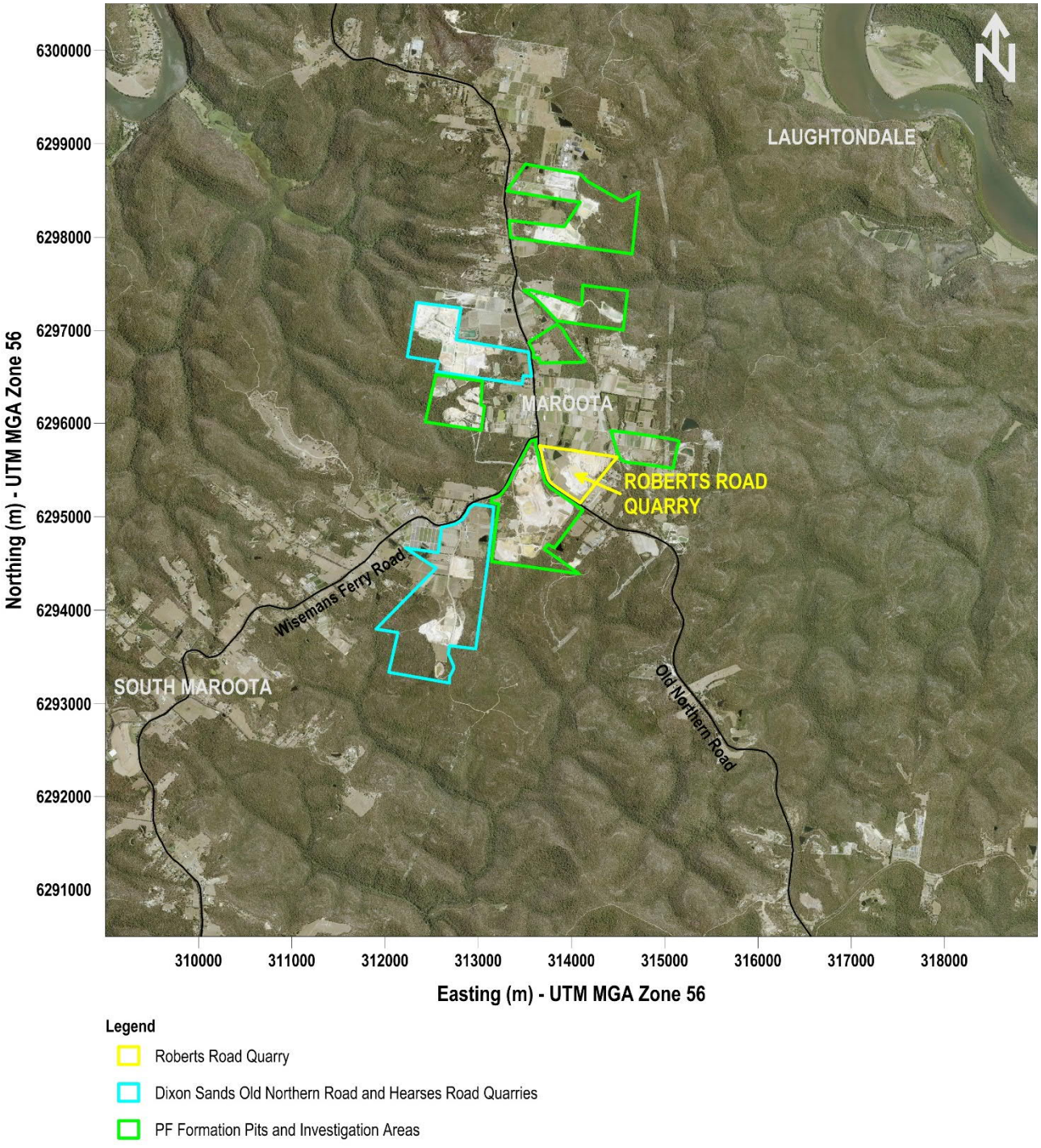


Figure 1-1 Location of Roberts Road Quarry

2. Project description

The Quarry is currently approved to produce a range of coarse, fine and ultra-fine sand, clay and pebble products. Although DA 267-11-99 does not include a limit on annual extraction, production is limited by the number of truck movements allowed from the Quarry. This limit is presently 50 laden trucks (i.e. 100 movements) per day and a maximum of 20 movements per hour; equating to a theoretical maximum of around 480,000 tonnes per annum (tpa). Extraction and processing of these products are undertaken at the Quarry, with most products transported to Sydney construction projects. The proposed modification seeks to change operations at the Quarry in the following ways:

- Up to 300,000 t of Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM) would be imported to the Quarry annually.
- The VENM and ENM would be primarily used to backfill the completed sections of the extraction area and recreate a final landform which more closely reflects the pre-Quarry topography. A portion of the imported VENM and ENM, containing sufficiently high proportion of sandstone or sand, would be blended with existing resources at the Quarry to extend its operational life. Based on an analysis of the remaining resources of the Quarry and selective blending with the imported VENM/ENM, a further increase in the life of the Quarry of around 5 years to 2030 is proposed.
- To accommodate the importation of VENM and ENM, the number of daily truck movements to and from the Quarry would need to increase from 100 to 140 movements per day.
- To accommodate the additional activities associated with the importation, placement and profiling of the VENM and ENM, Condition 29 (c) of DA 267-11-99 which restricts the extent of the 'exposed and active' working areas to 3 hectares would also need to be amended.

Figure 2-1 below shows the approximate boundary of the Quarry, and the nearest surrounding sensitive receiver locations. It is noted that the Quarry boundary would not change as a result of the proposed modification. As **Figure 2-1** displays, the nearest residential receivers are located to the east of the site off Roberts Road, to the south and west off the Old Northern Road and northwest off Old Telegraph Road.

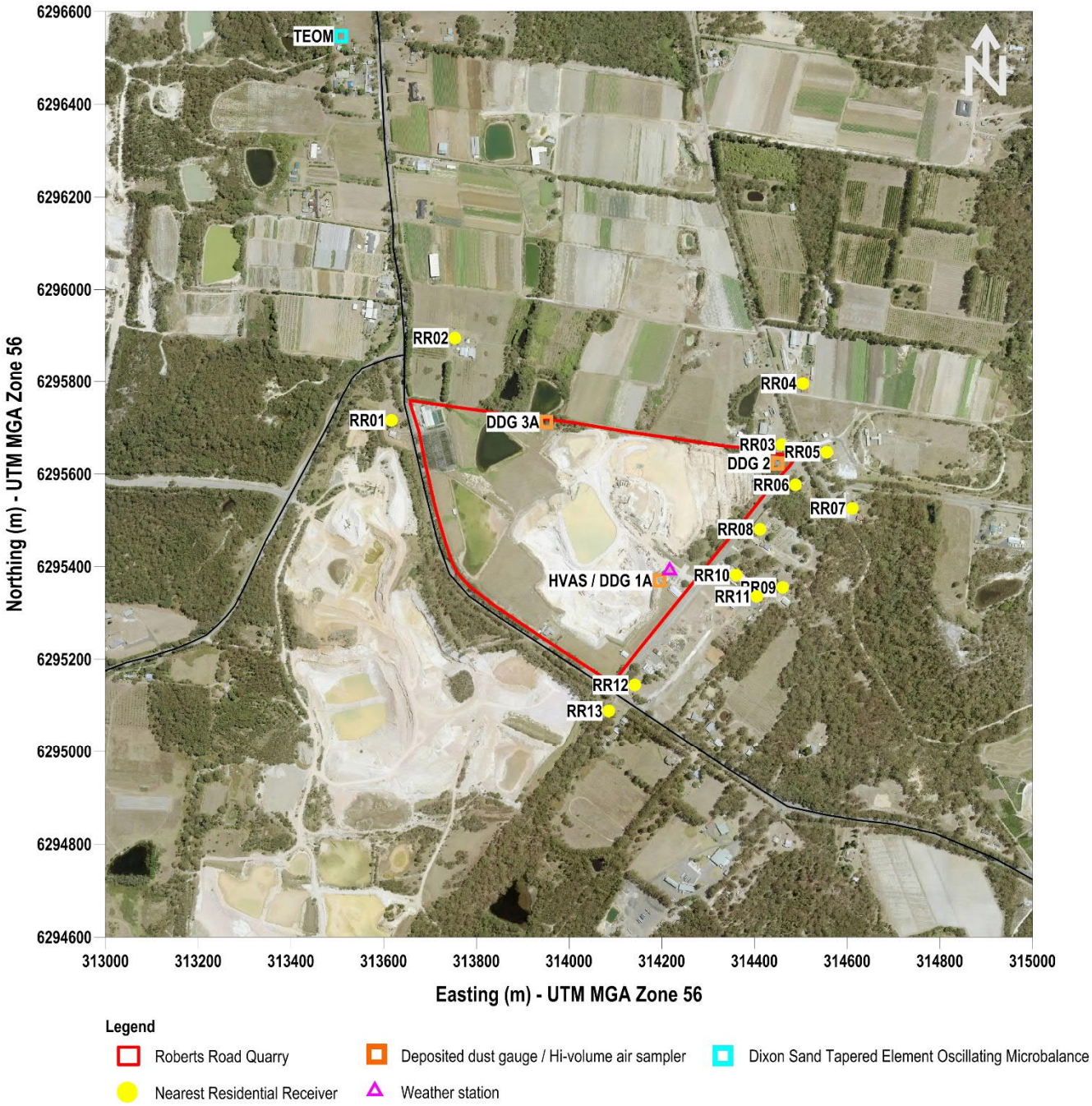


Figure 2-1 Roberts Road Quarry and surrounding residential receivers and monitoring stations

3. Air quality risks

Air quality issues can arise when emissions from an industry or activity lead to a deterioration in the ambient air quality. Potential air quality issues have been identified from a review of the proposed modification and its associated activities. This identification process has considered the types of emissions to air and proximity of these emission sources to sensitive receptors.

Emissions to air will occur from a variety of activities including material extraction, material handling, material transport, processing, and wind erosion of stored materials and exposed surfaces. These emissions would mainly comprise of particulate matter in the form of total suspended particulates (TSP), particulate matter with equivalent aerodynamic diameter of 10 microns or less (PM_{10}) and particulate matter with equivalent aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$). There would also be relatively minor emissions from machinery exhausts such as carbon monoxide (CO), oxides of nitrogen (NO_x) and particulate matter.

The primary air quality issue associated with the proposed modification was identified to be dust (that is, particulate matter in the form of TSP, deposited dust, PM_{10} or $PM_{2.5}$) from existing quarrying and planned VENM/ENM importation activities. The focus of this assessment was to predict how concentrations of dust generated by the modified operations at surrounding residential receivers would compare against existing (unmodified) operations and assessment criteria from applicable guidelines (refer to **Section 4** below).

4. Policy setting and assessment criteria

Typically, air quality is quantified by the concentrations of air pollutants in the ambient air. Air pollution occurs when the concentration (or some other measure of intensity) of substances known to cause health, nuisance and/or environmental effects, exceeds a certain level. With regard to human health and nuisance effects, the air pollutants most relevant to the Quarry are particulate matter emissions from, excavation works and material handling, transport and processing activities; as well as from wind erosion of stored materials and exposed surfaces (see **Section 3**).

There are various classifications of particulate matter and the EPA has developed assessment criteria for:

- TSP, to protect against nuisance amenity impacts;
- PM_{10}, to protect against health impacts;
- $PM_{2.5}$, to protect against health impacts; and
- Deposited dust, to protect against nuisance amenity impacts.

Most of the EPA criteria are drawn from national standards for air quality set by the National Environmental Protection Council of Australia (NEPC) as part of the National Environment Protection Measures (NEPM). To measure compliance with ambient air quality criteria, the Office of Environment and Heritage (OEH) has established a network of monitoring stations across the State and up-to-date records are published on the OEH website.

Air quality impacts from a project are determined by the level of compliance with the air quality criteria set by the EPA as part of their 'Approved Methods for the Modelling and Assessment of Air Pollutants in NSW' (Approved Methods), (EPA, 2016). These criteria are outlined in **Table 4-1** and apply to existing and potential sensitive receptors such as such as residences, schools and hospitals.

Table 4-1 EPA Impact assessment criteria

Substance	Averaging time	Criterion	Source
Particulate matter (PM_{10})	24-hour	50 µg/m^3	EPA (2016) / DoE (2016)
	Annual	25 µg/m^3	EPA (2016) / DoE (2016)
Particulate matter ($PM_{2.5}$)	24-hour	25 µg/m^3	EPA (2016) / DoE (2016)
	Annual	8 µg/m^3	EPA (2016) / DoE (2016)
Particulate matter (TSP)	Annual	90 µg/m^3	EPA (2016) / NHMRC (1996)
Deposited dust	Annual (maximum increase)	2 g/m^2/month	EPA (2016) / NERDDC (1998)
	Annual (maximum total)	4 g/m^2/month	EPA (2016) / NERDDC (1998)

The EPA air quality assessment criteria relate to the total concentration of air pollutant in the air (that is, cumulative) and not just the contribution from project-specific sources. Therefore, some consideration of background levels needs to be made when using these criteria to assess the potential impacts. Further discussion of background levels around the proposal is provided in **Section 5**.

In situations where background levels are elevated, the proponent must "demonstrate that no additional exceedances of the impact assessment criteria will occur as a result of the proposed activity and that best management practices will be implemented to minimise emissions of air pollutants as far as is practical" (EPA, 2016).

The NSW Voluntary Land Acquisition and Mitigation Policy (VLAMP) (2018) includes the NSW Government's policy for voluntary mitigation and land acquisition to address dust (particulate matter) impacts from state significant mining, petroleum and extractive industry developments. The VLAMP (2018) brings the air quality criteria in line with the NEPM standards and EPA criteria. From this Policy, voluntary mitigation or acquisition

rights may apply where, even with best practice management, the development contributes to exceedances of the criteria specified in VLAMP 2018. The applicability of the VLAMP has been reviewed in the context of the certainty of potential air quality risks of the proposed modification.

5. Existing environment

5.1 Meteorology

Meteorological conditions are important for determining the direction and rate at which emissions from a source will disperse. The key meteorological requirements of air dispersion models are, typically, hourly records of wind speed, wind direction, temperature, and atmospheric stability. For air quality assessments, a minimum one year of hourly data is usually required, which means that almost all possible meteorological conditions, including seasonal variations, are considered in the model simulations.

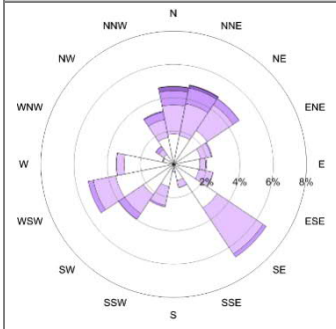
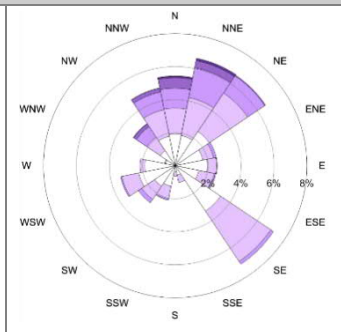
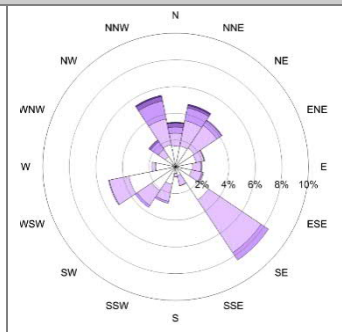
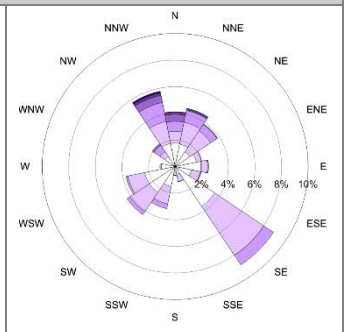
Hodgson Quarries operates a meteorological station on-site at Roberts Road Quarry. As **Figure 2-1** shows, the meteorological station is located near the southwestern boundary of the site, adjacent to the main site access point off Roberts Road. Data from the station for the period from 28 December 2013 to 7 February 2019 were provided by VGT Environmental Compliance Solutions who provide environmental monitoring and management services to the Quarry.

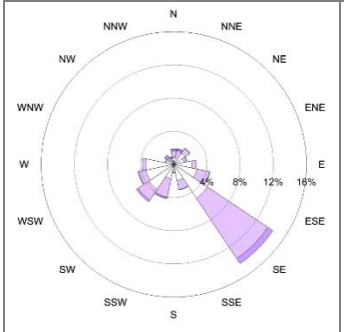
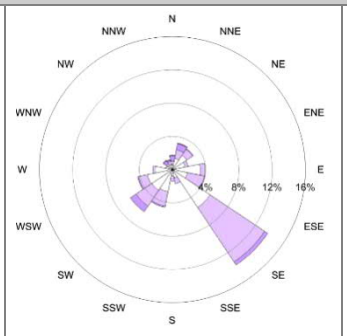
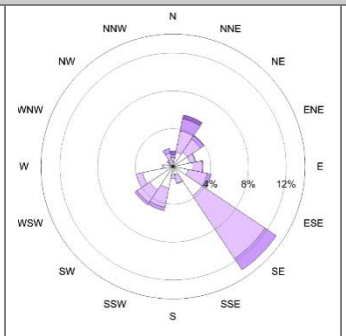
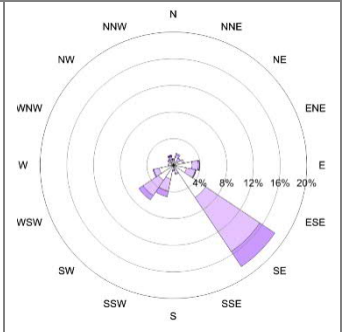
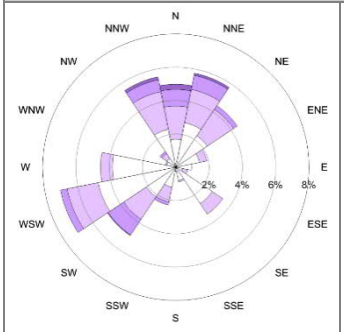
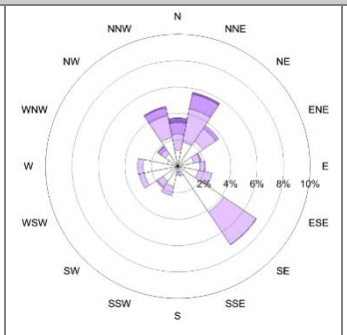
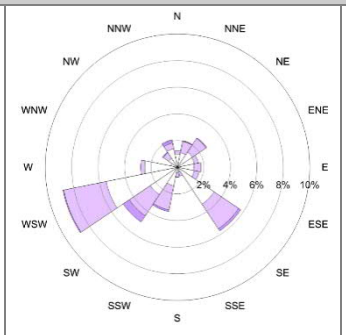
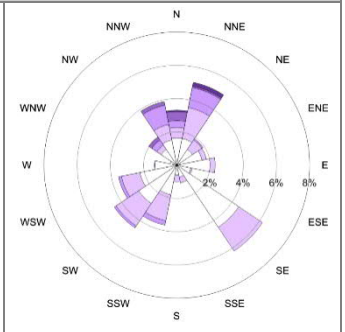
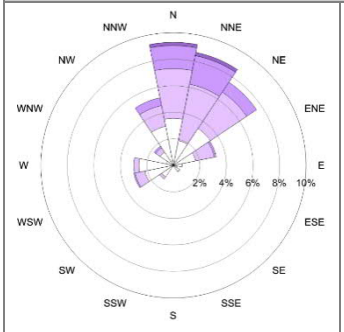
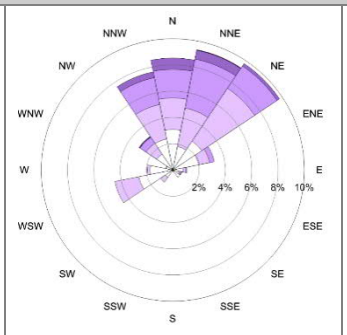
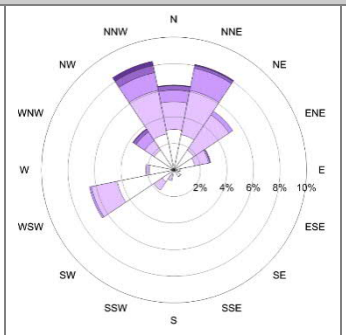
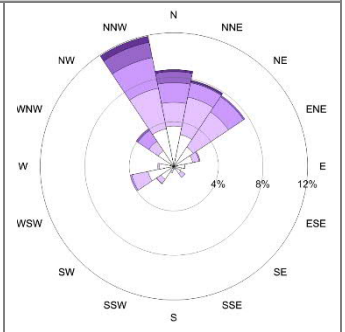
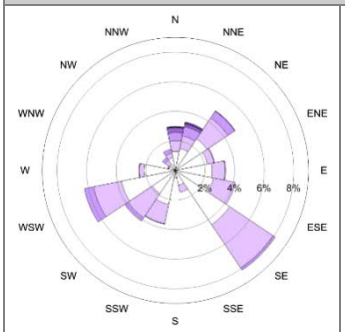
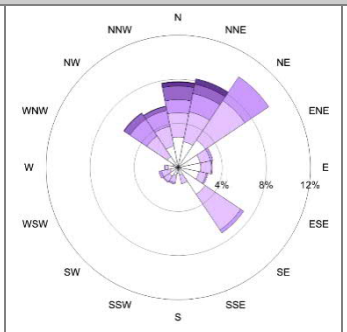
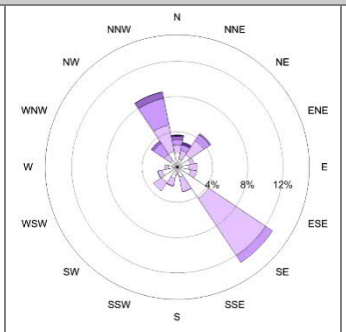
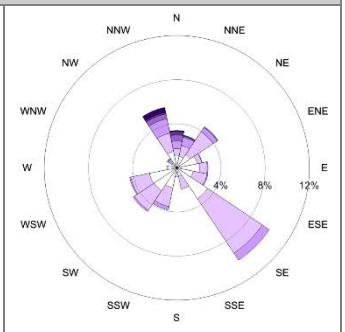
As outlined above, a minimum of one year of data is generally required for dispersion modelling assessments, and so data from the years' 2014 to 2018 were reviewed to determine a suitable year for the assessment. **Table 5-1** shows the statistics reviewed as part of this analysis.

Table 5-1 Annual statistics from meteorological data collected at Roberts Road Quarry meteorological station (2014 to 2018)

Statistic	2014	2015	2016	2017	2018
Percent complete (%)	85.1	97.6	99.9	91.6	99.9
Mean wind speed (m/s)	1.0	0.9	1.1	1.0	1.1
99th percentile wind speed (m/s)	4.9	4.0	5.4	4.9	5.8
Percentage of calms (%)	46.0	49.7	46.0	49.2	49.9
Percentage of winds >6 m/s (%)	0.3	0.1	0.3	0.3	0.6

As displayed in **Table 5-1**, mean wind speeds were generally of the order of 1.0 m/s. 99th percentile wind speeds (i.e. wind speeds only exceeded one percent of the time) were also consistent, ranging between 4.0 and 5.8 m/s. The percentage occurrence of calm conditions (i.e. when wind speeds were recorded less than 0.5 m/s) was also consistent, ranging from 46 to 50 percent. The EPA requires that, for "Level 2" assessments based on site-specific information, the meteorological data should be derived from a site-specific source and at least 90 percent complete. The 2015, 2016, 2017 and 2018 datasets meet the EPA's site-specific data capture rate requirements. With 2014 excluded owing to insufficient dataset completion; meteorological conditions in 2015, 2016, 2017 and 2018 were further analysed to identify representative year for modelling. Annual and seasonal wind roses were developed for these years. These are displayed below in **Figure 5-1**.

2015	2016	2017	2018
Annual			
 Calms: 49.7%	 Calms: 46.0%	 Calms: 49.2%	 Calms: 49.7%

2015	2016	2017	2018
Summer			
 Calms: 45.2%	 Calms: 44.5%	 Calms: 44.9%	 Calms: 48.4%
Autumn			
 Calms: 50.5%	 Calms: 54.3%	 Calms: 57.9%	 Calms: 56.9%
Winter			
 Calms: 54.7%	 Calms: 47.6%	 Calms: 52.2%	 Calms: 45.9%
Spring			
 Calms: 48.8%	 Calms: 37.5%	 Calms: 44.1%	 Calms: 47.6%
Legend			

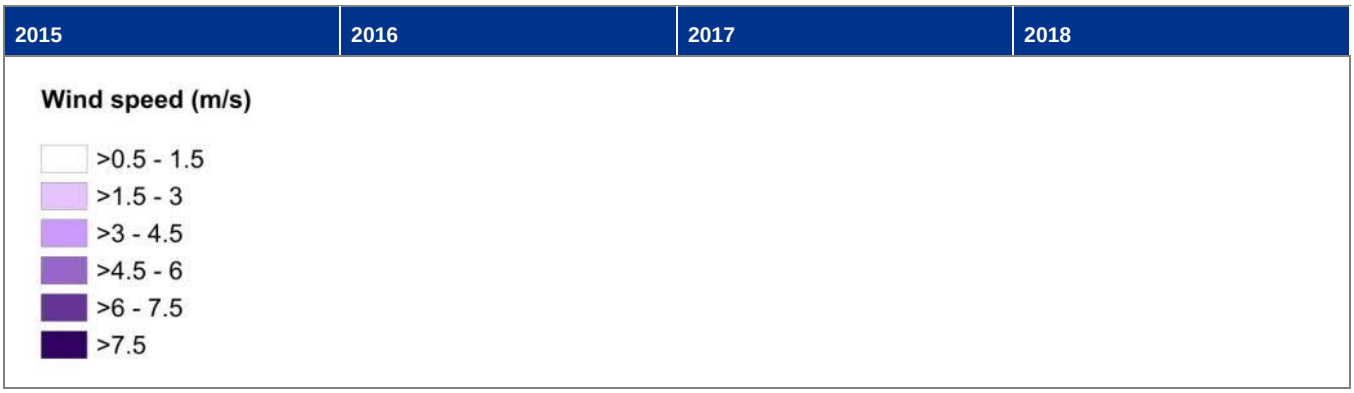


Figure 5-1 Annual and seasonal wind roses 2015 to 2018

The 2018 calendar year was selected selected as the meteorological modelling year. The reasoning for this selection was as follows:

- 2018 had a higher data capture rate compared with 2017, 2016 and 2015.
- A higher frequency of calm conditions was recorded in 2018. Calm conditions typically lead to higher predictions of ground-level concentrations as these conditions are often associated with poor dispersion whereby any dust emissions disperse more slowly and allow higher concentrations to exist for extended periods of time.
- Contemporaneous background data is available for 2018, to allow a more detailed review of changes in the number of exceedances. Further detail of this is provided below in **Section 5.2**.

5.2 Air quality conditions

The EPA air quality criteria refer to levels of substances which generally include the contribution from the project of interest as well as the contribution from existing sources. To fully assess impacts against all the relevant air quality criteria (see **Section 4**) it is necessary to have information or estimates of the existing air quality conditions. This section provides a description of the existing air quality.

Air quality around Roberts Road Quarry is monitored by VGT Environmental Compliance Solutions (VGT). This monitoring includes the measurement of:

- Total suspended particulates (TSP);
- Particulate matter (as PM_{10} and $PM_{2.5}$); and
- Dust deposition.

As displayed above in **Figure 2-1**, deposited dust is measured at three deposited dust gauges (DDGs) 1A, 2 and 3A located towards the eastern, north-eastern and northern boundaries of the site respectively. As shown, a high-volume air sampler (HVAS) measuring TSP, PM_{10} and $PM_{2.5}$ is also located near the eastern boundary adjacent to DDG 1A. Data collected from these locations from 15 January 2016 to 7 March 2019 reported on Hodgson Quarries website were reviewed to identify existing conditions around the Quarry.

As displayed in **Figure 1-1** there are several other quarries and extractive operations located near Roberts Road Quarry. Dixon Sand Penrith Pty Ltd (Dixon Sand) conduct quarrying operations at the Old Northern Road (one kilometre to the northwest of the Roberts Road Quarry) and Haerses Road (around one and a half kilometres to the southwest). Dixon Sand operate a tapered element oscillating microbalance (TEOM) at the Maroota Public School just to the southeast of their operations at the Old Northern Road Quarry. The indicative location of the TEOM in relation to Roberts Road Quarry is displayed above in **Figure 2-1**. Daily PM_{10} concentrations are measured at the TEOM, with data available on the website for 2017 and 2018 calendar years.

5.2.1 Total suspended particulates (TSP)

TSP data are collected every six days from the HVAS near DDG 1A. TSP concentration measurements were available from 18 August 2016 to 16 April 2018. The daily concentrations measured are summarised below in **Figure 5-2**.

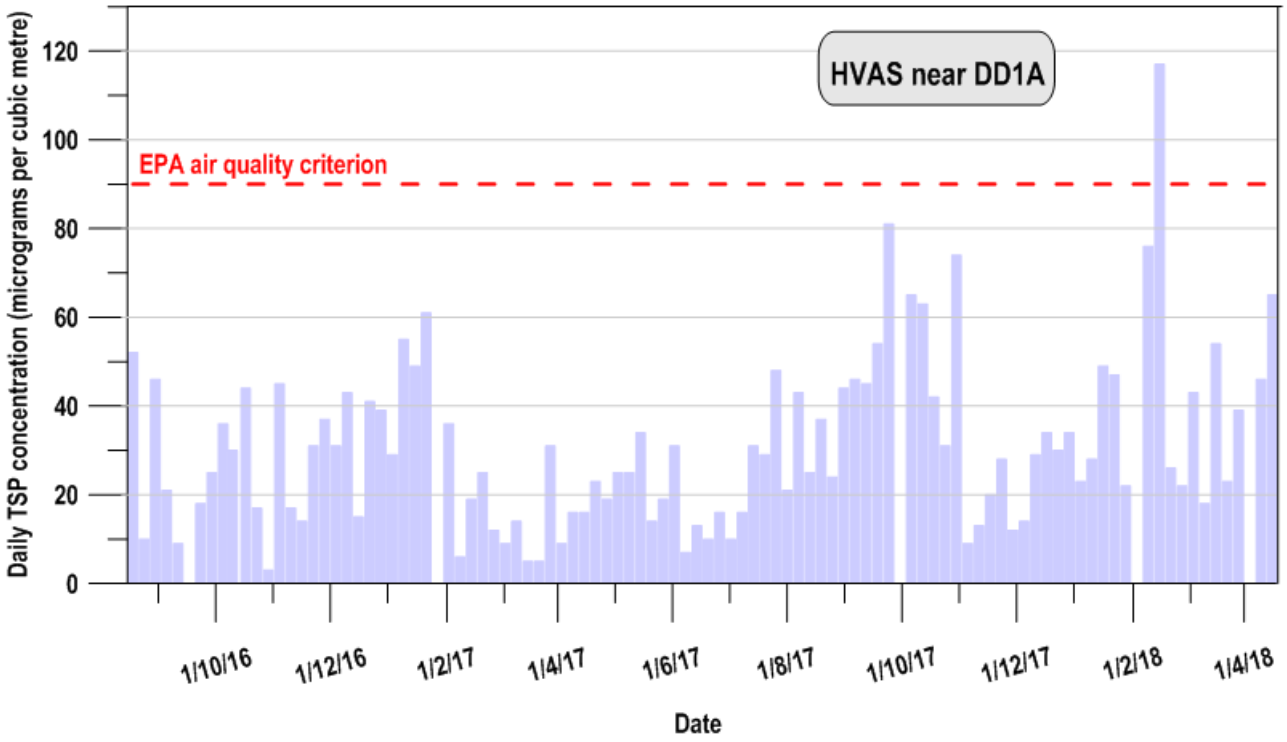


Figure 5-2 Measured 24-hour averaged TSP concentrations measured at Roberts Road Quarry HVAS

As displayed, annual TSP concentrations from this monitor were only able to be estimated from these data from one calendar year (2017), noting that the data for 2016 and 2018 were incomplete. For 2017, an annual TSP average of 29 µg/m^3 was measured, well below the EPA's 90 µg/m^3 assessment criteria.

5.2.2 Particulate matter (PM_{10})

Roberts Road Quarry HVAS

PM_{10} concentrations were also collected every 6 days from the Roberts Road Quarry HVAS. The data collected are displayed below in **Figure 5-3**.

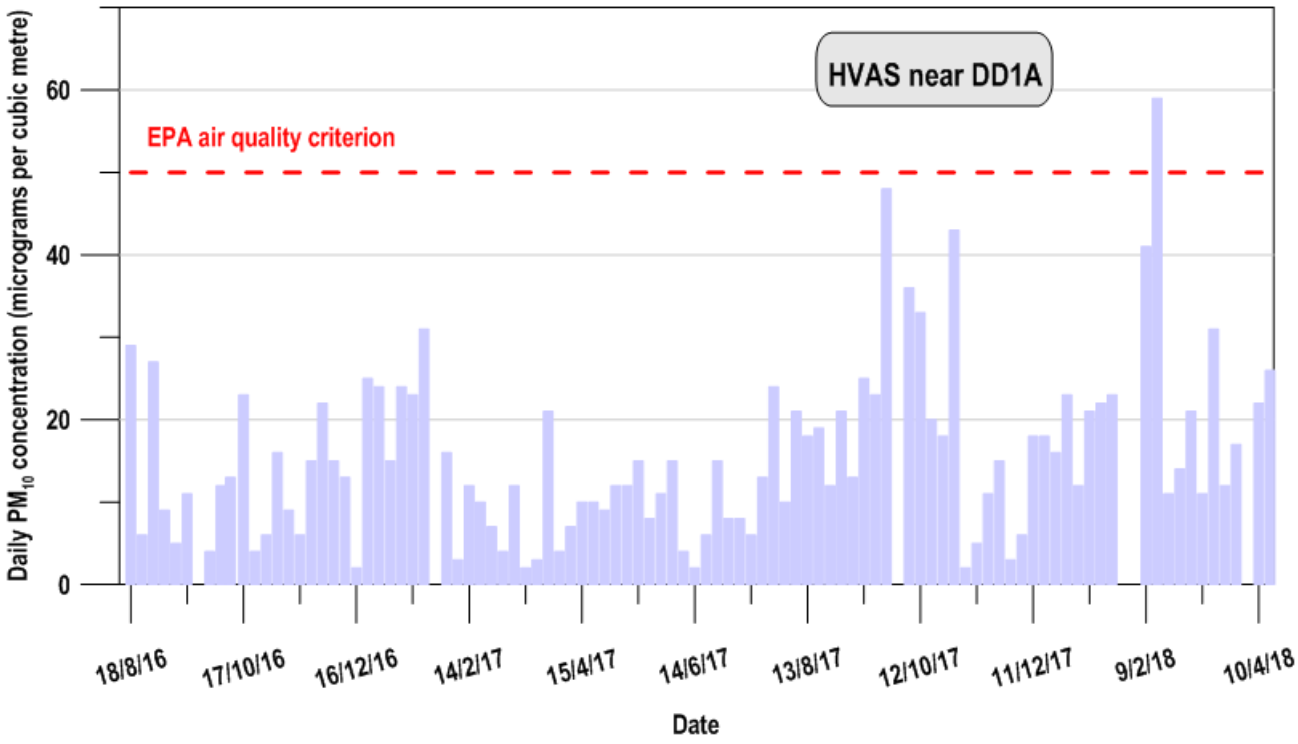


Figure 5-3 Measured 24-hour averaged PM_{10} concentrations measured at Roberts Road Quarry HVAS

Over the approximately 20 months of measurements between August 2016 and April 2018 the EPA's 24-hour averaged assessment criteria of 50 µg/m^3 was recorded to have been exceeded once. There may have been further exceedances over the period of available data, noting the six-day sampling frequency of the HVAS. For the only full calendar year (2017), the maximum recorded 24-hour average was 48 µg/m^3, with the maximum value over the 20-month period being 59 µg/m^3. The annually averaged PM_{10} concentration in 2017 was 15 µg/m^3, 10 µg/m^3 below the EPA's 25 µg/m^3 annual PM_{10} impact assessment criteria.

Dixon Sand TEOM

Daily measurements of PM_{10} are collected at the TEOM run by Dixon Sand near their Old Northern Road quarrying operations. These data are displayed below in **Figure 5-4**.

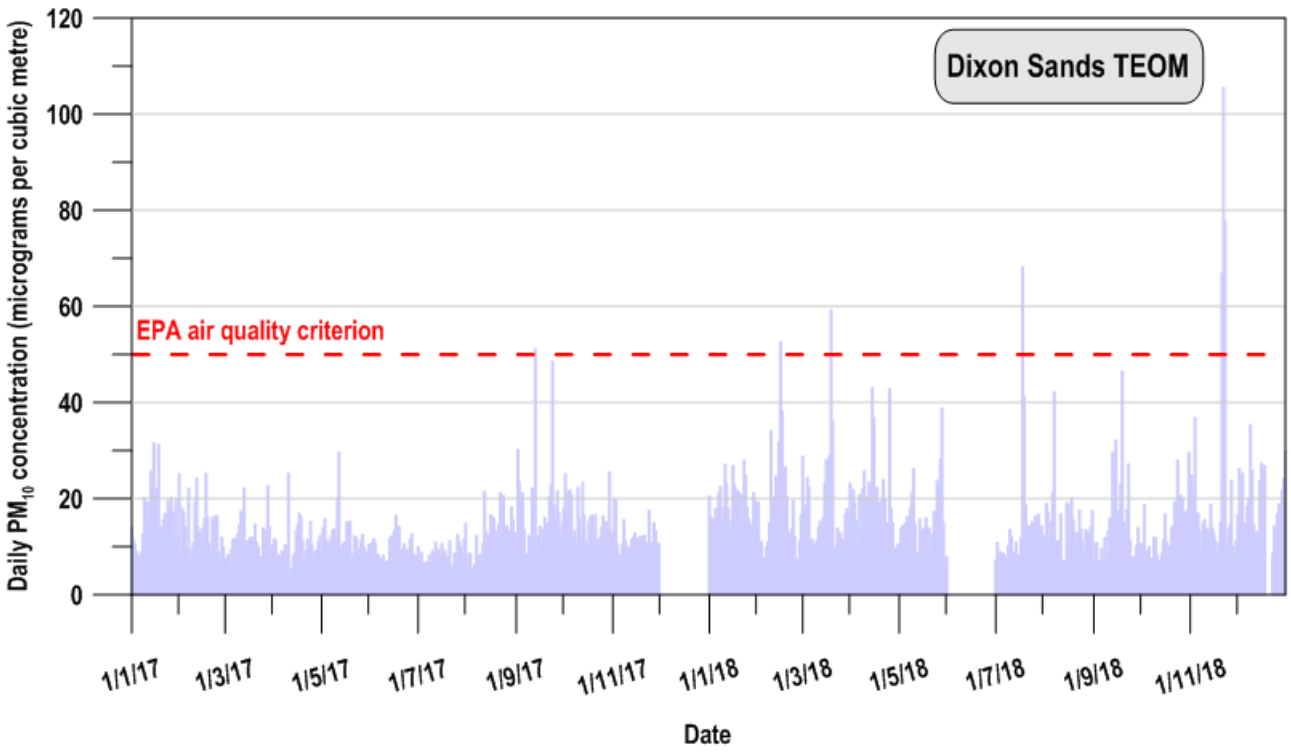


Figure 5-4 Measured 24-hour averaged PM_{10} concentrations measured at Dixon Sand Quarry TEOM

For the 2017 and 2018 period reviewed there were seven instances when 24-hour-averaged PM_{10} exceeded 50 µg/m^3. Each instance was investigated in their monitoring log, with six of the seven instances of exceedances having been in some way attributed to Dixon Sand's operations. Noting the data gaps in December 2017, June 2018 and 19 to 22 December 2018, annually averaged PM_{10} concentrations of 13 µg/m^3 and 17 µg/m^3 were measured in 2017 and 2018 respectively.

5.2.3 Particulate matter ($PM_{2.5}$)

The Roberts Road Quarry HVAS also measured $PM_{2.5}$ on a six-day cycle between August 2016 and April 2018. **Figure 5-5** below shows the 24-hour averaged $PM_{2.5}$ monitoring values.

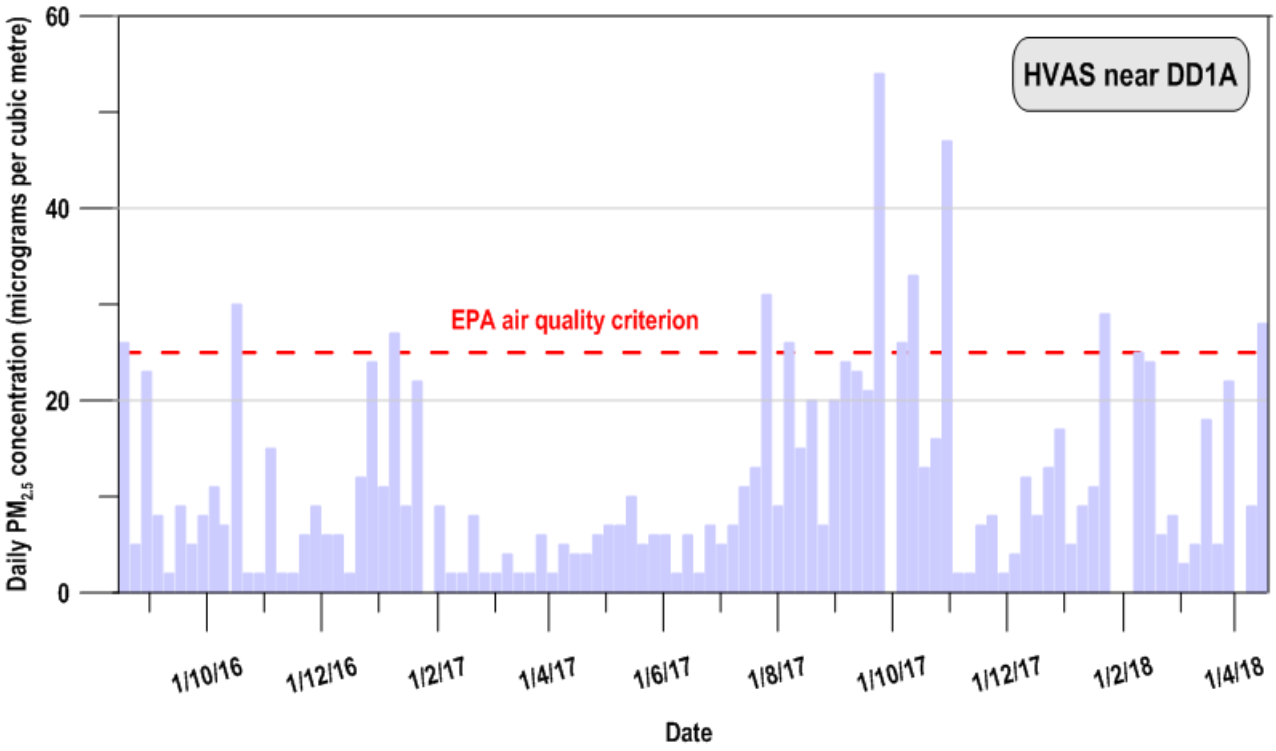


Figure 5-5 Measured 24-hour averaged $PM_{2.5}$ concentrations measured at Roberts Road Quarry HVAS

As displayed, there were 11 instances where the EPA's 24-hour averaged $PM_{2.5}$ assessment criteria of 25 µg/m^3 was exceeded, with seven of these instances recorded during the 2017 calendar year. There may have been further exceedances over the period of available data, noting the six-day sampling frequency of the HVAS.

For the 2017 calendar year, the maximum 24-hour averaged $PM_{2.5}$ concentration was 54 µg/m^3; that is, above the EPA's 25 µg/m^3 assessment criteria from the Approved Methods. The annual average in 2017 was 11.6 µg/m^3, 3.6 µg/m^3 above the 8 µg/m^3 EPA assessment criteria. It is noted that these values are high compared with the measured PM_{10} concentrations. It is generally common that $PM_{2.5}$ concentrations are around 50% or less than PM_{10}, although at the Quarry's HVAS they have been reported as being around 77%. The measured annual average of 11.6 µg/m^3 at the Quarry is also well above the values measured over the last five calendar years (2014 to 2018 inclusive) at the nearest air quality monitoring station operated by the Office of Environment and Heritage (OEH) at Richmond. Over these five years' annual averages of 6.7, 7.7, 7.9, 7.0, and 8.1 µg/m^3 were measured.

5.2.4 Deposited dust

Table 5-2 shows the annual average deposited dust levels for each gauge from data collected between 2016 and 2017.

Table 5-2 Summary of measured deposited dust levels near Roberts Road Quarry

Year	Annual average expressed as g/m^2/month			
	DDG 1A	DDG 2	DDG 3A	EPA criteria
2016	1.9	1.2	1.3	4
2017	1.9	1.8	1.9	

As displayed, deposited dust levels remained less than 50% of the EPA's 4 g/m^2/month at all three deposited dust gauges over 2016 and 2017.

5.3 Adopted background levels

One of the objectives for reviewing the air quality monitoring data was to determine appropriate background levels to be added to model predictions for the assessment of potential cumulative impacts, that is, Project contribution plus other sources. The establishment of background levels also needs to consider that there is an existing Quarry that is likely to contribute to measured levels. The estimated background levels that apply at sensitive receptors are shown below in **Table 5-3**.

Table 5-3 Assumed background levels that apply at sensitive receptors

Substance	Averaging time	Assumed background level that applies at sensitive receptors	Notes
Particulate matter (PM_{10})	24-hour	Daily PM_{10} measured values from Dixon Sand TEOM	Time-varying data collected at Dixon Sand TEOM for year of modelling (2018)
	Annual	17 µg/m^3	Annual average of data collected at Dixon Sand TEOM for year of modelling (2018)
Particulate matter ($PM_{2.5}$)	24-hour	Daily values based on measurements from Dixon Sand TEOM	Time-varying data collected at Dixon Sand TEOM for year of modelling (2018) with scaling applied based on the ratio of PM_{10} to $PM_{2.5}$ measured at Roberts Road HVAS. This ratio was 0.73.
	Annual	13 µg/m^3	Annual average of data collected at Dixon Sand TEOM for year of modelling (2018) with scaling applied based on the ratio of PM_{10} to $PM_{2.5}$ measured at Roberts Road HVAS. The measured on-site annual average in 2017 was 12 µg/m^3, so the value adopted is considered to be conservative.
Particulate matter (TSP)	Annual	32 µg/m^3	Annual average of data collected at Dixon Sand TEOM for year of modelling (2018) with scaling applied based on the ratio of PM_{10} to TSP measured at Roberts Road HVAS. It should be noted that the assumed level of 32 µg/m^3 is higher than the on-site measurement of 29 µg/m^3. This is a conservative approach.
Deposited dust	Annual	1.9 g/m^2/month	Highest value measured at DDG 1A, DDG 2 and DDG 3A for available 2016 and 2017 monitoring data

6. Emissions to air

6.1 Emissions inventory – Roberts Road Quarry

The most significant emission to air from the Quarry will be dust (particulate matter) due to material handling, material transport, processing, and wind erosion of stored and exposed surfaces. Estimates of these emissions are required by the dispersion model. Total dust emissions have been estimated by analysing the material handling schedule, equipment listing and Quarry plans and identifying the location and intensity of dust generating activities. Operations have been combined with emissions factors developed both locally and by the US EPA.

The emission factors used for this assessment have been drawn largely from the following sources:

- *Emission Estimation Technique Manual for Mining* (NPI, 2012); and
- AP 42 (US EPA, 1985 and updates).

Dust emission inventories have been developed for each of the modelled scenarios, namely:

- Existing operations, at the approved extraction rate, for comparison with future operations;
- Proposed Modification with VENM/ENM filling at northeast corner of the Quarry; and
- Proposed Modification with VENM/ENM filling at southeast corner of the Quarry.

The inventories applied in the assessment for each of these scenarios are summarised below in **Table 6-1** (existing), **Table 6-2** (proposed modification with VENM/ENM filling in the north) and **Table 6-3** (proposed modification with VENM/ENM filling in the south). The key change in these inventories between the assessment scenarios for the two modification options and existing operations are additional emissions associated with the hauling, unloading, and placement of VENM/ENM materials. Full details of how these inventories were developed is provided in **Appendix A**. It is noted that these inventories, including the variables and assumptions applied were reviewed and updated following the EPA's review of the initial (F0v0) version of this assessment. Further details are provided in **Appendix A**.

Table 6-1 Estimated TSP emissions from the Quarry

Activity	Estimated annual emissions (kg/y)		
	Existing	Proposed Modification, North	Proposed Modification, South
Dozers ripping materials	476	1,855	1,855
Excavators loading raw product to trucks	131	131	131
Hauling raw product to Screening 1	5874	2,937	2,937
Unloading raw product to Screens 1	1,440	1,440	1,440
Screening 1	3,000	3,000	3,000
Loading product stockpiles	11	11	11
Excavators loading screened product to trucks	22	22	22
Hauling raw product to Screening 2	3,525	3,525	3,525
Unloading raw product to Screens 2	1,440	1,440	1,440
Screening 2	3,000	3,000	3,000
Loading product stockpiles	22	22	22
Excavators loading screened product to trucks	44	44	44
Hauling product off-site	3,165	3,165	3,165
Wind erosion from exposed areas, inactive	662	662	662

Activity	Estimated annual emissions (kg/y)		
	Existing	Proposed Modification, North	Proposed Modification, South
Wind erosion from exposed areas, active	842	842	842
Wind erosion from rehabilitation area (VENM/ENM placement), inactive in existing and active in proposed options	758	541	541
Wind erosion from product stockpiles	662	662	662
Hauling VENM/ENM to site	0	3,515	4,017
Unloading VENM/ENM	0	1,920	1,920
Dozers placing materials	0	1,855	1,855
Crushing (primary) 1	0	120	120
Crushing (primary) 2	0	120	120
Total	**25,073**	**30,828**	**31,330**

Table 6-2 Estimated PM_{10} emissions from the Quarry

Activity	Estimated annual emissions (kg/y)		
	Existing	Proposed Modification, North	Proposed Modification, South
Dozers ripping materials	101	393	393
Excavators loading raw product to trucks	62	62	62
Hauling raw product to Screening 1	1,497	749	749
Unloading raw product to Screens 1	516	516	516
Screening 1	1,032	1,032	1032
Loading product stockpiles	5	5	5
Excavators loading screened product to trucks	10	10	10
Hauling raw product to Screening 2	898	898	898
Unloading raw product to Screens 2	516	516	516
Screening 2	1,032	1,032	1032
Loading product stockpiles	10	10	10
Excavators loading screened product to trucks	21	21	21
Hauling product off-site	807	807	807
Wind erosion from exposed areas, inactive	331	331	331
Wind erosion from exposed areas, active	421	421	421
Wind erosion from rehabilitation area (VENM/ENM placement), inactive in existing and active in proposed options	379	271	271
Wind erosion from product stockpiles	331	331	331
Hauling VENM/ENM to site	0	896	1024
Unloading VENM/ENM	0	688	688
Dozers placing materials	0	393	393
Crushing (primary) 1	0	48	48
Crushing (primary) 2	0	48	48

Activity	Estimated annual emissions (kg/y)		
	Existing	Proposed Modification, North	Proposed Modification, South
Total	**7,969**	**9,477**	**9,509**

Table 6-3 Estimated $PM_{2.5}$ emissions from the Quarry

Activity	Estimated annual emissions (kg/y)		
	Existing	Proposed Modification, North	Proposed Modification, South
Dozers ripping materials	24	93	93
Excavators loading raw product to trucks	7	7	7
Hauling raw product to Screening 1	176	88	88
Unloading raw product to Screens 1	72	72	72
Screening 1	150	150	150
Loading product stockpiles	1	1	1
Excavators loading screened product to trucks	1	1	1
Hauling raw product to Screening 2	106	106	106
Unloading raw product to Screens 2	72	72	72
Screening 2	150	150	150
Loading product stockpiles	1	1	1
Excavators loading screened product to trucks	2	2	2
Hauling product off-site	95	95	95
Wind erosion from exposed areas, inactive	33	33	33
Wind erosion from exposed areas, active	42	42	42
Wind erosion from rehabilitation area (VENM/ENM placement), inactive in existing and active in proposed options	38	27	27
Wind erosion from product stockpiles	33	33	33
Hauling VENM/ENM to site	0	105	121
Unloading VENM/ENM	0	96	96
Dozers placing materials	0	93	93
Crushing (primary) 1	0	6	6
Crushing (primary) 2	0	6	6
Total	**1,002**	**1,279**	**1,282**

It should be noted that the main intent of the inventories is to capture the most significant emission sources that may affect off-site air quality. Not every source will be captured, however, the contribution of emissions from sources not identified will be captured in the assumed background levels and these data have been added to the predicted Project contributions.

6.2 Emissions controls – Roberts Road Quarry

In consultation with Hodgson Quarries, the controls listed in **Table 6-4** were applied in the existing and proposed emissions inventories. Control efficiency values were applied consistent with guidance presented in Table 4 of NPI, 2012.

Table 6-4 Emission control measures

Source/activity	Control measure	Control efficiency (%)	Reference
Existing operations:			
Hauling raw product to Screening 1	Watering of internal haul route	50	(NPI, 2012), Table 4
Unloading raw product to Screens 1	Water sprays	50	(NPI, 2012), Table 4
Loading product stockpiles	Water sprays	50	(NPI, 2012), Table 4
Hauling raw product to Screening 2	Watering of internal haul route	50	(NPI, 2012), Table 4
Unloading raw product to Screens 2	Water sprays	50	(NPI, 2012), Table 4
Loading product stockpiles	Water sprays	50	(NPI, 2012), Table 4
Hauling product off-site	Level 2 watering of primary haul route	75	(NPI, 2012), Table 4
Wind erosion from exposed areas, inactive	Watering	50	(NPI, 2012), Table 4
Wind erosion from exposed areas, active	Watering	50	(NPI, 2012), Table 4
Wind erosion from rehabilitation area, inactive	Partial rehabilitation	30	(NPI, 2012), Table 4
Proposed operations:			
Hauling raw product to Screening 1	Watering of internal haul route	50	(NPI, 2012), Table 4
Unloading raw product to Screens 1	Water sprays	50	(NPI, 2012), Table 4
Loading product stockpiles	Water sprays	50	(NPI, 2012), Table 4
Hauling raw product to Screening 2	Watering of internal haul route	50	(NPI, 2012), Table 4
Unloading raw product to Screens 2	Water sprays	50	(NPI, 2012), Table 4
Loading product stockpiles	Water sprays	50	(NPI, 2012), Table 4
Hauling product off-site	Level 2 watering of primary haul route	75	(NPI, 2012), Table 4
Wind erosion from exposed areas, inactive	Watering	50	(NPI, 2012), Table 4
Wind erosion from exposed areas, active	Watering	50	(NPI, 2012), Table 4
Wind erosion from rehabilitation area (VENM/ENM), active	Watering	50	(NPI, 2012), Table 4
Hauling ENM/VENM to site	Level 2 watering of primary haul route	75	(NPI, 2012), Table 4
Unloading ENM/VENM	Water sprays	50	(NPI, 2012), Table 4

6.3 Other local sources

As identified above in **Figure 1-1**, several other quarries are located in close proximity to the Quarry. It is expected that the same types of activities are taking place at these locations and that these operations would also contribute to local particulate matter air quality conditions.

7. Approach to assessment

7.1 Overview

This assessment has followed the EPA's Approved Methods which specifies how assessments based on the use of air dispersion models should be undertaken. The Approved Methods include guidelines for the preparation of meteorological data, reporting requirements and air quality assessment criteria to assess the significance of dispersion model predictions.

The CALPUFF computer-based air dispersion model has been used to predict ground-level concentrations and deposition levels due to the identified emission sources, and the model predictions have been compared with relevant air quality criteria. The choice of model has considered the expected transport distances for the emissions, as well as the potential for temporally and spatially varying flow fields due to influences of the locally complex terrain, non-uniform land use, and potential for stagnation conditions characterised by calm or very low wind speeds with variable wind directions.

The CALPUFF model, through the CALMET meteorological pre-processor, simulates complex meteorological patterns that exist in a particular region. The effects of local topography and changes in land surface characteristics are accounted for by this model. The model comprises meteorological modelling as well as dispersion modelling, both of which are described below.

7.2 Meteorological modelling

The air dispersion model used for this assessment, CALPUFF, requires information on the meteorological conditions in the modelled region. This information is typically generated by the meteorological pre-processor, CALMET, using surface observation data from local weather stations and upper air data from radio-sondes or numerical models, such as the CSIRO's prognostic model known as TAPM (The Air Pollution Model). CALMET also requires information on the local land-use and terrain. The result of a CALMET simulation is a year-long, three-dimensional output of meteorological conditions that can be used as input to the CALPUFF air dispersion model.

There are no known meteorological stations in the Roberts Road Quarry area that collect suitable surface or upper air data for CALMET. The closest station with suitable data is operated by the Bureau of Meteorology at Richmond, approximately 30 km to the southwest. The necessary surface and upper air data were therefore generated by TAPM, using influence from the surface observations at the Roberts Road Quarry meteorological station. Key setup details for TAPM are listed in **Table 7-1**.

Table 7-1 TAPM setup details

Parameter	Value(s)
Model version	4.0.5
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Number of grids point	35 x 35 x 25
Year(s) of analysis	2018, with one “spin-up” day.
Centre of analysis	Roberts Road Quarry (33°27.5’ S, 151°0’ E)
Terrain data source	Shuttle Research Topography Mission (SRTM), 30 m resolution
Land use data source	Default
Meteorological data assimilation	Roberts Road Quarry meteorological station. Radius of influence = 10 km. Number of vertical levels for assimilation = 4. Quality factor = 0.1. This quality factor value was adopted so that the observation data were considered in the meteorological assimilation in TAPM, with appropriate adjustments made for potential uncertainties around these data.

CALTAPM was used to process the outputs from TAPM into a suitable format for CALMET. Meteorological modelling in CALMET was completed in ‘no observations’ mode. This setting was applied rather than ‘observations’ mode using the surface observation data from the monitoring station at Roberts Road Quarry as there was some uncertainty of observations from the privately-operated station. This was primarily due to the frequency of calm conditions measured (refer to Table 5-1) being higher than might be expected for this location. This might suggest some localised screening around the station. The approach adopted allowed these data to be considered, with weighting also given to synoptic data from TAPM. **Table 7-2** lists the key settings that were applied in CALMET.

Table 7-2 CALMET setup details

Parameter	Value(s)
Model version	6.334
Run mode	No-observations mode
Terrain data source(s)	NASA SRTM1 30 metre resolution dataset
Land-use data source(s)	Digitized from aerial imagery and classified as ‘forest’, ‘water’, ‘barren’ or ‘agricultural’ categories specified in “CALPUFF Modeling System Version 6 User Instructions”, (TRC, 2011). This is displayed below in **Figure 7-1**.
Meteorological grid domain	10 kilometres x 10 kilometres x 0 to 3 kilometres depth spread over 11 vertical layers
Meteorological grid resolution	0.1 km
Meteorological grid dimensions	100 x 100 x 11
Meteorological grid origin	309000 mE, 6290500 mN. MGA Zone 56
Surface meteorological inputs	Wind speed, wind direction, ceiling height, cloud cover, temperature, relative humidity and air pressure for the site location from TAPM.
Upper air meteorological inputs	Wind speed, wind direction, ceiling height, cloud cover, temperature, relative humidity and air pressure for the site location from TAPM.
Simulation length	8760 hours (1 Jan 2018 to 31 Dec 2018)

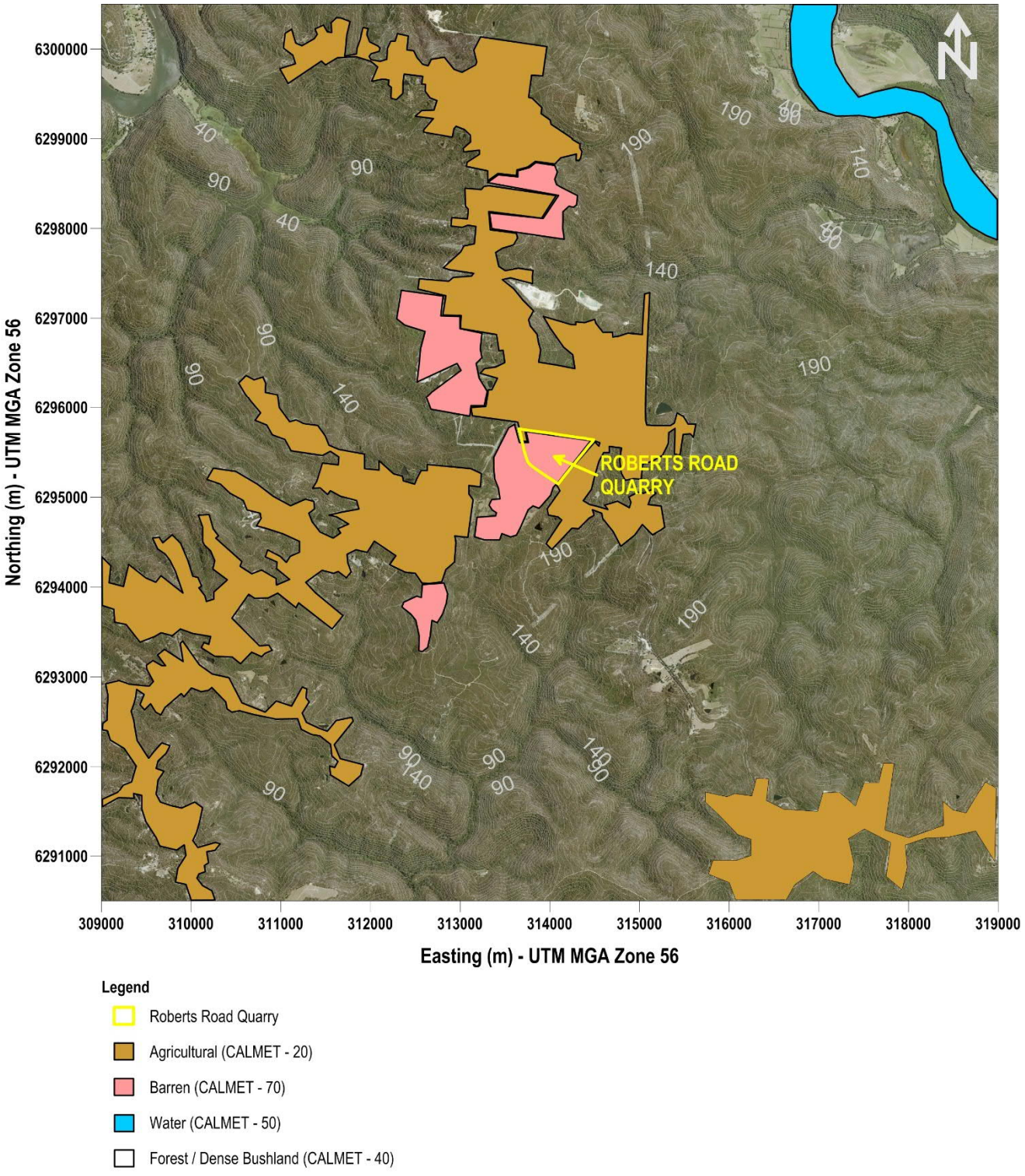


Figure 7-1 CALMET land use classifications

7.3 Dispersion modelling

Ground-level concentration and deposition levels due to the identified emission sources have been predicted using the air dispersion model known as CALPUFF (Version 6.42). CALPUFF is a Lagrangian dispersion model that simulates the dispersion of pollutants within a turbulent atmosphere by representing emissions as a series of puffs emitted sequentially. Provided the rate at which the puffs are emitted is sufficiently rapid, the puffs overlap, and the serial release is representative of a continuous release.

The CALPUFF model differs from traditional Gaussian plume models (such as AUSPLUME and ISCST3) in that it can model spatially varying wind and turbulence fields that are important in complex terrain, long-range transport and near calm conditions. It is the preferred model of the United States Environmental Protection Agency for the long-range transport of pollutants and for complex terrain (TRC, 2007). CALPUFF has the ability to model the effect of emissions entrained into the thermal internal boundary layer that forms over land, both through fumigation and plume trapping. CALPUFF is an air dispersion model which has been approved by the EPA for these types of assessments (EPA, 2016).

The modelling was performed using the emission estimates from **Section 6** and using the meteorological information provided by the CALMET model, described in **Section 7.2**. Predictions were made at 481 discrete receptors (including the 13 nearby sensitive receptors shown in **Figure 2-1**) to allow for contouring of results. The locations of the model receptors are shown in **Figure 7-2**.

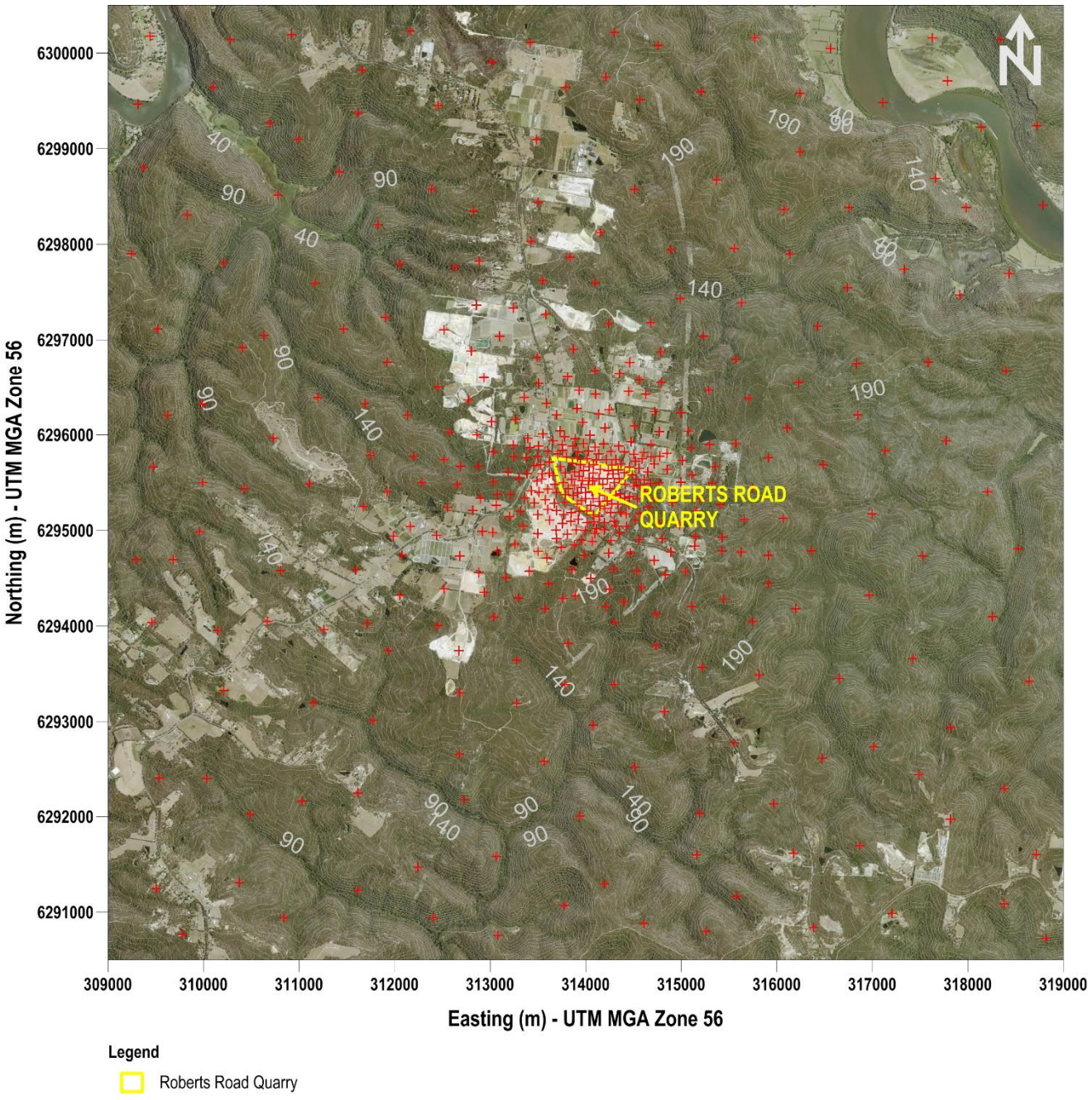


Figure 7-2 CALPUFF discrete receiver locations

Quarry operations were represented by a series of volume sources located according to the location of activities for each modelled scenario. TSP, PM_{10} and $PM_{2.5}$ emissions for existing operations listed in **Table 6-1**, **Table 6-2** and **Table 6-3** were applied as displayed **Figure 7-3**. For the proposed modification with VENM/ENM placement in the north of the Quarry, emissions outlined in these tables were modelled as shown in **Figure 7-4**. Finally, for the modification option where VENM/ENM filling would take place in the south of the site, the location where different dust generating sources were modelled is shown in **Figure 7-5**.

Dust emissions for all modelled Quarry-related sources have been considered to fit in one of three categories, as follows:

- Wind insensitive sources, where emissions are relatively insensitive to wind speed (for example, dozers).
- Wind sensitive sources, where emissions vary with the hourly wind speed, raised to the power of 1.3, a generic relationship published by the US EPA (1987). This relationship has been applied to sources such as loading and unloading of materials to/from trucks and results in increased emissions with increased wind speed.
- Wind sensitive sources, where emissions also vary with the hourly wind speed, but raised to the power of 3, a generic relationship published by Skidmore (1998). This relationship has been applied to sources including wind erosion from stockpiles, exposed areas or active pits, and results in increased emissions with increased wind speed.

Emissions from each volume source were developed on an hourly time step, taking into account the level of activity at that location and, in some cases, the hourly wind speed. This approach ensured that light winds corresponded with lower dust generation and higher winds, with higher dust generation.

All site activities have been modelled for the hours of day proposed under the proposed modification, for every day of the year. Further, the model considers these activities occurring at all locations displayed in **Figure 7-3**, **Figure 7-4** and **Figure 7-5** which is not likely to be the case for extraction, loading and VENM/ENM placement activities. Also, the model assumes the maximum rate of activity which in practice is not expected to be achieved. These assumptions were necessary to ensure that all source and meteorological interactions are considered although these aspects of the model result in predictions were the quarries likely contribution to local air quality is over-estimated.

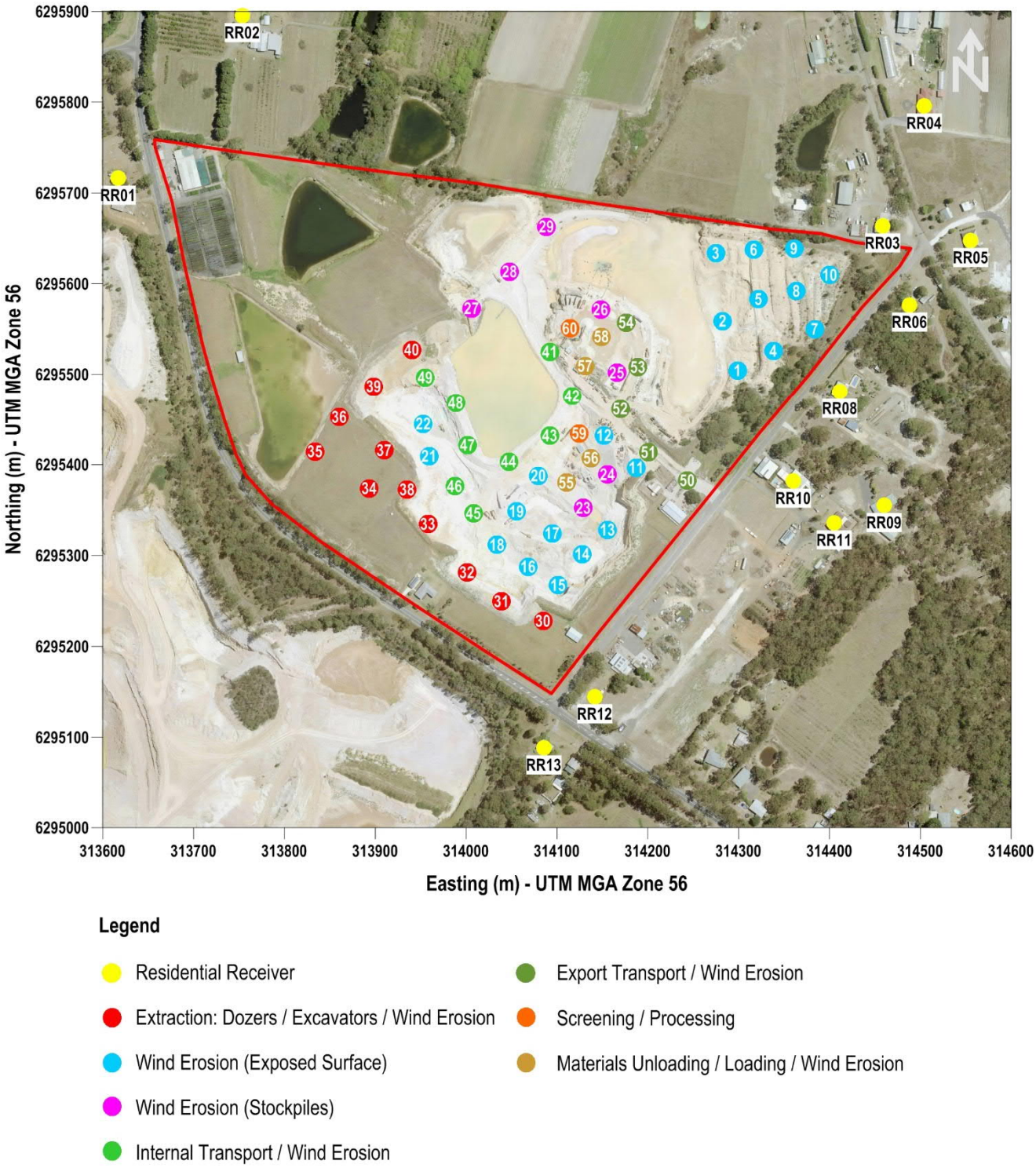


Figure 7-3 Location of modelled sources – Existing operations (no VENM/ENM placement)

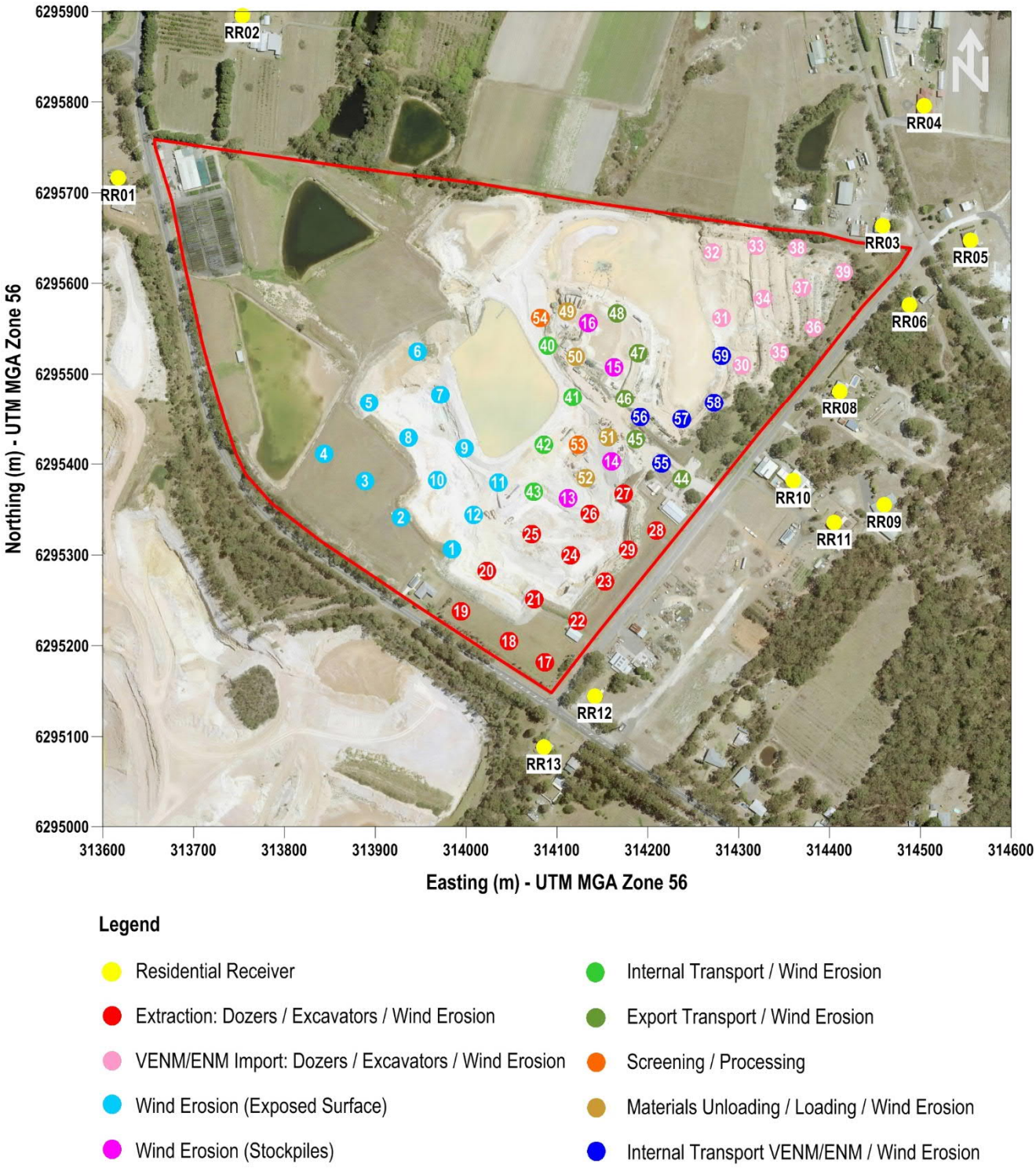


Figure 7-4 Location of modelled sources – Proposed operations, VENM/ENM placement at northeast of the Quarry

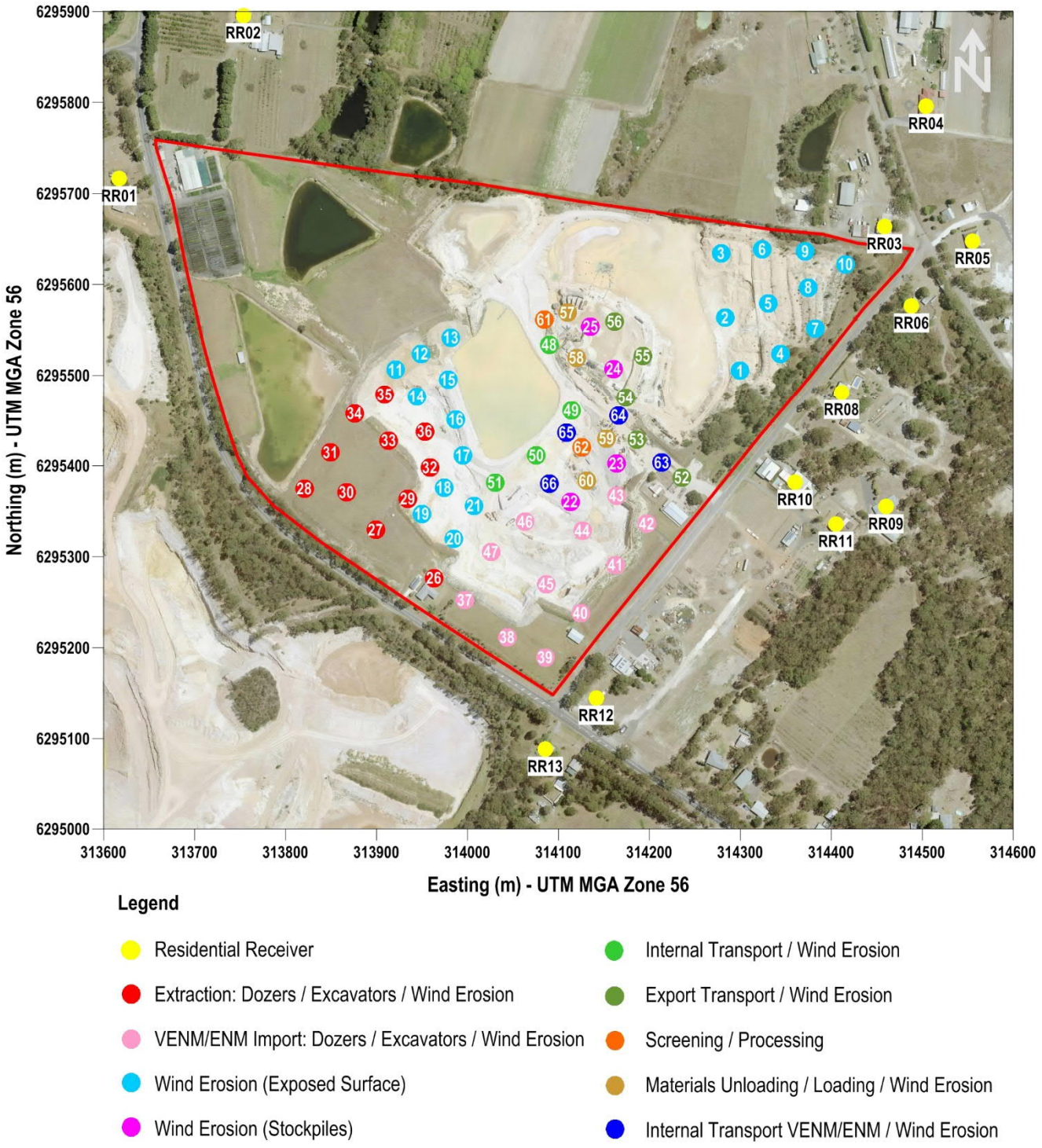


Figure 7-5 Location of modelled sources – Proposed operations, VENM/ENM placement at southeast of the Quarry

8. Assessment of impacts

This section provides an assessment of the key air quality issues associated with the proposed modification, primarily based on model predictions and comparisons to air quality criteria. One objective of this study was to predict the extent of air quality impacts due to the proposed modification, and to identify the potential changes in air quality over existing levels, recognising that the Quarry currently exists and that the proposed modification represents the continuation of quarrying activities up to the same maximum approved rate of extraction, albeit with an increase in activity arising from the importation of VENM/ENM products. For this objective, examination of the predicted incremental change from existing to proposed operations is useful. Therefore "Cumulative" has been defined as the "Project" (as modelled) minus "Existing" (as modelled) plus "Background". This approach also addressed potential cumulative impacts with neighbouring quarries as the contributions from these quarries will be contained in the assumed background levels.

Results are presented and discussed by pollutant in the sub-sections below.

8.1 Total suspended particulates (TSP)

Table 8-1 summarises the predicted annually averaged TSP concentrations (incremental and cumulative) at the nearest sensitive receiver locations (refer to **Figure 2-1**) from existing and proposed operations (north and south). Compliance with the EPA's assessment criterion for annual average TSP (90 µg/m^3) is predicted at all locations.

Table 8-1 Predicted annual average TSP concentrations (µg/m^3)

ID	Due to Quarry			Background	Cumulative		Criteria
	Existing	Proposed Modification (North)	Proposed Modification (South)		Proposed Modification (North)	Proposed Modification (South)	
1	1	1	1	32	32	32	90
2	1	1	1	32	32	32	90
3	3	7	3	32	36	32	90
4	2	3	2	32	33	32	90
5	2	3	2	32	33	32	90
6	3	6	3	32	35	32	90
7	2	2	2	32	32	32	90
8	4	9	5	32	37	33	90
9	2	4	3	32	34	33	90
10	4	8	6	32	36	34	90
11	3	5	4	32	34	33	90
12	4	6	7	32	34	35	90
13	3	4	5	32	33	34	90

Results are also displayed as contour plots in **Appendix B**.

8.2 Particulate matter (PM_{10})

Table 8-2 shows the predicted annually averaged PM_{10} concentrations (incremental and cumulative) at the nearest sensitive receiver locations (refer to **Figure 2-1**) from existing and proposed operations (north and south), in tabular form. As listed, compliance with the EPA's assessment criterion for annual average PM_{10} (25 µg/m^3) was predicted at all locations.

Table 8-2 Predicted annual average PM_{10} concentrations (µg/m^3)

ID	Due to Quarry			Background	Cumulative		Criteria
	Existing	Proposed Modification (North)	Proposed Modification (South)		Proposed Modification (North)	Proposed Modification (South)	
1	1	1	1	17	17	17	25
2	1	1	1	17	17	17	25
3	2	3	2	17	18	17	25
4	1	1	1	17	17	17	25
5	1	2	1	17	18	17	25
6	2	3	2	17	18	17	25
7	1	1	1	17	17	17	25
8	2	4	2	17	19	17	25
9	1	2	1	17	18	17	25
10	2	3	3	17	18	18	25
11	1	2	2	17	18	18	25
12	2	2	3	17	17	18	25
13	1	2	2	17	18	18	25

Regarding 24-hour averaged PM_{10}, the 2018 (modelled simulation year) background air quality data from Dixon Sand's TEOM presented above in **Section 5.2.2** shows how daily background PM_{10} concentrations already exceeded the EPA's 50 µg/m^3 assessment criteria on up to six days per year. Consistent with guidance presented in the Approved Methods it was reviewed whether the proposal would cause additional days of exceedance at surrounding sensitive receivers. Predicted maximum 24-hour PM_{10} contributions from existing and proposed operations at sensitive receivers were reviewed in terms of the the number of exceedances per year. Results are presented below in **Table 8-3**.

Table 8-3 Review of change in the number of days with PM_{10} concentrations exceeding 50 µg/m^3

Receiver	Maximum 24-hour contribution due to existing quarry operations (µg/m^3)	Number of exceedances per year (existing)	Maximum 24-hour contribution due to proposed quarry operations (µg/m^3)		Number of exceedances per year (Proposed)		Change in number of exceedances per year	
			North	South	North	South	North	South
R01	7	6	7	8	6	6	0	0
R02	8	6	7	8	6	6	0	0
R03	24	6	29	18	6	6	0	0
R04	17	6	19	14	6	6	0	0
R05	18	6	17	13	6	6	0	0
R05	27	6	24	18	6	6	0	0
R06	11	6	12	10	6	6	0	0
R07	18	6	23	19	6	6	0	0
R08	16	6	19	17	6	6	0	0
R09	21	6	25	24	6	6	0	0
R10	18	6	21	21	6	6	0	0
R11	17	6	20	24	6	6	0	0

Receiver	Maximum 24-hour contribution due to existing quarry operations (µg/m³)	Number of exceedances per year (existing)	Maximum 24-hour contribution due to proposed quarry operations (µg/m³)		Number of exceedances per year (Proposed)		Change in number of exceedances per year	
			North	South	North	South	North	South
R12	13	6	17	19	6	6	0	0
R13	7	6	7	8	6	6	0	0

As listed, it was predicted that the proposed modification would not result in any additional days where PM_{10} concentrations were above 50 µg/m³ at the identified surrounding sensitive receivers.

Maximum 24-hour and annual average PM_{10} contributions from existing and proposed operations are presented as contour plots in **Appendix B**. Cumulative 24-hour average PM_{10} concentrations are also presented as time-series graphs in **Appendix C**.

8.3 Particulate matter ($PM_{2.5}$)

Table 8-4 lists the predicted annually averaged $PM_{2.5}$ concentrations (incremental and cumulative) at the nearby sensitive receiver locations displayed in **Figure 2-1** from existing and proposed operations (north and south). As shown, annually the averaged $PM_{2.5}$ background concentration in 2018 (13.5 µg/m³ inferred from PM_{10} measurements at Dixon Sand's TEOM and the relationship between PM_{10} and $PM_{2.5}$ at the HVAS located at Roberts Road Quarry)) already exceeded the 8 µg/m³ assessment criteria in the Approved Methods. Increases of up to 0.2 µg/m³ (i.e. around 1.5 percent) were predicted for the proposed modification. It can also be seen from **Table 8-4** that the contribution of the existing Quarry to $PM_{2.5}$ concentrations is less than 1 µg/m³ at all nearest receivers. This means that the existing (and proposed) Quarry operation is not likely to be the cause of background annual average $PM_{2.5}$ concentrations which exceed the 8 µg/m³ criterion. The assumed background level of 13.5 µg/m³ is taken to be conservatively high.

Table 8-4 Predicted annual average $PM_{2.5}$ concentrations (µg/m³)

ID	Due to Quarry			Background	Cumulative		Criteria
	Existing	Proposed Modification (North)	Proposed Modification (South)		Proposed Modification (North)	Proposed Modification (South)	
1	0.1	0.1	0.1	13.5	13.5	13.5	8
2	0.1	0.1	0.1	13.5	13.5	13.5	8
3	0.2	0.4	0.2	13.5	13.7	13.5	8
4	0.1	0.2	0.1	13.5	13.6	13.5	8
5	0.1	0.2	0.1	13.5	13.6	13.5	8
6	0.2	0.4	0.2	13.5	13.7	13.5	8
7	0.1	0.2	0.1	13.5	13.6	13.5	8
8	0.3	0.5	0.3	13.5	13.7	13.5	8
9	0.2	0.2	0.2	13.5	13.5	13.5	8
10	0.3	0.4	0.3	13.5	13.6	13.5	8
11	0.2	0.3	0.2	13.5	13.6	13.5	8
12	0.2	0.3	0.4	13.5	13.6	13.7	8
13	0.2	0.2	0.3	13.5	13.5	13.6	8

As for PM_{10}, daily background $PM_{2.5}$ concentrations in 2018 were also measured to occasionally exceed the 25 µg/m³ impact assessment criteria. The same assessment approach was applied, with the average ratio of PM_{10} to $PM_{2.5}$ measured at the Roberts Road HVAS used to scale the daily PM_{10} to estimate daily $PM_{2.5}$ at Dixon Sand's TEOM. Since $PM_{2.5}$ data from the HVAS were only available to April 2018, the June and December 2018

gaps in the Dixon Sand TEOM dataset were filled using the annually averaged $PM_{2.5}$ concentration (13 µg/m^3). Consistent with the Approved Methods, it was reviewed whether the proposal would cause additional days of exceedance at surrounding sensitive receivers. This review including maximum 24-hour $PM_{2.5}$ contributions from existing and proposed operations at sensitive receivers, and whether the number of exceedances per year would change is presented below in **Table 8-3**.

Table 8-5 Review of change in the number of days with $PM_{2.5}$ concentrations exceeding 25 µg/m^3

Receiver	Maximum 24-hour contribution due to existing quarry operations (µg/m^3)	Number of exceedances per year (existing)	Maximum 24-hour contribution due to proposed quarry operations (µg/m^3)		Number of exceedances per year (Proposed)		Change in number of exceedances per year	
			North	South	North	South	North	South
R01	1	17	1	1	17	17	0	0
R02	1	17	1	1	17	17	0	0
R03	3	17	3	2	17	17	0	0
R04	2	17	2	2	17	17	0	0
R05	2	17	2	1	17	17	0	0
R05	3	17	3	2	17	17	0	0
R06	1	17	2	1	17	17	0	0
R07	2	17	3	3	17	17	0	0
R08	2	17	3	2	17	17	0	0
R09	3	17	3	3	17	17	0	0
R10	2	17	3	3	17	17	0	0
R11	2	17	3	3	17	17	0	0
R12	2	17	2	3	17	17	0	0
R13	1	17	1	1	17	17	0	0

As listed, it was predicted that the proposal would not result in any additional days where $PM_{2.5}$ concentrations were above 25 µg/m^3 at the identified surrounding sensitive receivers.

Maximum 24-hour and annual average $PM_{2.5}$ contributions from existing and proposed operations are presented as contour plots in **Appendix B**. Cumulative 24-hour average $PM_{2.5}$ concentrations are also presented as time-series graphs in **Appendix C**.

8.4 Deposited dust

Table 8-6 shows the predicted deposited dust levels (incremental and cumulative) at the nearest sensitive receiver locations (refer to **Figure 2-1**) from existing and proposed operations (north and south), in tabular form. Compliance with the EPA's assessment criterion for annual average criterion of 4 g/m^2/month was predicted at all locations.

Table 8-6 Predicted dust deposition (g/m^2/month)

ID	Due to Quarry			Background	Cumulative		Criteria
	Existing	Proposed Modification (North)	Proposed Modification (South)		Proposed Modification (North)	Proposed Modification (South)	
1	0.1	0.1	0.1	1.9	1.9	1.9	4

ID	Due to Quarry			Background	Cumulative		Criteria
	Existing	Proposed Modification (North)	Proposed Modification (South)		Proposed Modification (North)	Proposed Modification (South)	
2	0.1	0.1	0.1	1.9	1.9	1.9	4
3	0.4	0.8	0.4	1.9	2.3	1.9	4
4	0.2	0.3	0.2	1.9	2	1.9	4
5	0.2	0.4	0.3	1.9	2.1	2	4
6	0.3	0.6	0.4	1.9	2.2	2	4
7	0.2	0.3	0.2	1.9	2	1.9	4
8	0.5	0.9	0.6	1.9	2.3	2	4
9	0.3	0.4	0.4	1.9	2	2	4
10	0.5	0.9	0.7	1.9	2.3	2.1	4
11	0.3	0.5	0.5	1.9	2.1	2.1	4
12	0.4	0.5	0.7	1.9	2	2.2	4
13	0.3	0.4	0.5	1.9	2	2.1	4

Results are also displayed as contour plots in **Appendix B**.

8.5 Summary

In summary, the following changes in local air quality as a result of the proposed modification were predicted:

- Annual average TSP, annual average PM_{10}, and annual average deposited dust: Changes in air quality as a result of the proposed modification would not lead to exceedances of the EPA's relevant impact assessment criteria at any of the nearest sensitive receivers.
- 24-hour average PM_{10} and $PM_{2.5}$: No additional days were predicted where the EPA's impact assessment criteria would be exceeded at the identified surrounding sensitive receivers.
- Annual averaged$PM_{2.5}$: Background concentrations already exceed the EPA's 8 µg/m^3 criterion, with increases of up to 0.2 µg/m^3 (i.e. around 1.5 percent) predicted at the most-affected sensitive receivers as a result of the proposal.

9. Safeguards and monitoring

As presented in **Section 8** the assessment found that the EPA's impact assessment criteria for annually averaged TSP, PM_{10} and deposited dust would continue to be met. Negligible (less than 1%) increases in annually averaged $PM_{2.5}$ were predicted at surrounding sensitive receivers, with background concentrations noted to already exceed criteria. No additional days where PM_{10} and $PM_{2.5}$ concentrations exceeded the EPA's impact assessment criterion were predicted.

Consistent with Section 5.1.3 of the Approved Methods, for environments were background air quality conditions are already elevated and where it has been demonstrated that there would be no attributable additional exceedances of the EPA's impact assessment criteria, best practice management practices are to be implemented to "minimise emissions of air pollutants as far as practical". As identified in **Table 6-4** above in **Section 6.2**, a variety of measures are committed to control emissions to air associated with the proposal. These have been reproduced below in **Table 9-1**.

Table 9-1 Dust management measures

Source/activity	Recommended and committed control measure	Timing	Responsibility
Hauling of materials in trucks (internal roads)	Watering of haul route	Regularly when in-use	Site operator
Hauling of materials in trucks (primary internal roads)	Watering of haul route	Regularly when in-use	Site operator
Loading and unloading of materials	Water sprays	During loading and unloading activities	Site operator
Wind erosion from exposed surfaces and stockpiled materials	Watering	Regular watering during operations	Site operator

Where visible dust is observed to be emanating from screening or crushing activities at the site boundary, watering would also be applied to these activities.

Additionally, to proactively identify and appropriately plan for unfavourable conditions before they occur, local meteorological forecasts should be reviewed regularly. Where unfavourable meteorological conditions are forecast, the intensity (including number of trucks), types and location of activities and the controls to be implemented should be reviewed and adjusted.

A second trigger involving visual inspections should also be implemented. This would involve routine inspections to review whether the planned intensity, types, location and level of activities and the levels of controls in place remain adequate, or whether operations need to be scaled back or temporarily suspended. Metrics for making this determination would include whether:

- Dust is emanating from Quarry operations;
- The efficacy of control measures is observable as being impaired; and
- Meteorological conditions have changed so that wind is blowing dust in the direction from the site to the nearest surrounding receivers.

To improve the level of understanding of meteorological conditions at the Quarry, the location of the on-site meteorological station should be reviewed against the siting requirements detailed in Section 2.6.1 of Australian/New Zealand Standard AS/NZS 3580.14:2014 Methods for sampling and analysis of ambient air - Part 14: Meteorological monitoring for ambient air quality monitoring applications. $PM_{2.5}$ measurement at the on-site HVAS should also be reviewed, noting the potential issues outlined above in **Section 5.2.3**.

In respect of the VLAMP, the conservative, potential predictions of the assessment indicate that the provisions of this guideline could apply. To ascertain whether operations present an actual rather than potential risk, fit-for-purpose monitoring should be considered as appropriate, in consultation with the EPA.

10. Conclusion

This report has assessed the potential for adverse changes in local air quality from a proposed modification to operations at Roberts Road Quarry. The proposed modification would involve the importation and placement of VENM/ENM at the Quarry, an increase in the number of daily truck movements and removal of a restrictive condition associated with the area of 'active and exposed' areas at the Quarry.

The primary air quality issue associated with the proposed modification was identified to be dust (that is, particulate matter in the form of TSP, deposited dust, PM_{10} or $PM_{2.5}$) from existing Quarrying and planned VENM/ENM importation activities.

Statutes, policies and guidelines were reviewed to identify a suitable approach and criteria for assessing potential impacts from the modification. From the EPA's Approved Methods and consistent with the EPA's specific assessment requirements for the proposal it was confirmed that impacts were to be assessed quantitatively, and suitable criteria were established.

The assessment required an understanding of key features of the existing environment including the presence and location of sensitive receivers; local meteorological conditions; and existing background pollutant concentrations. Nearby sensitive receivers around the site were identified by reviewing aerial imagery.

Consistent with EPA guidance, the last 5 calendar years of meteorological data collected at the Roberts Road Quarry automatic weather station were reviewed to identify a representative year for the purpose of the assessment. Based on this review, 2018 was confirmed as a suitable year for the purpose of the assessment. For 2018, as for the other years reviewed, winds were measured predominantly blowing from the southeast annually, with winds from the north-northwest also common.

The EPA's impact assessment criteria are based on the total concentration of these pollutants, that is the existing background concentrations as well as any changes as a result of the modification. Data collected from the on-site dust deposition gauges and a High-Volume Air Sampler at the Quarry were reviewed, as well as data from a nearby TEOM operated by Dixon Sands at the Maroota Public School to establish background conditions around the Quarry.

The computer-based dispersion model known as CALPUFF was used to predict the potential air quality impacts of the existing and proposed modified Quarry operations. The dispersion modelling accounted for meteorological conditions, land use and terrain information and used dust emission estimates to predict the off-site air quality impacts. The focus of the assessment was on the potential change in air quality, noting that the Quarry already contributes to existing air quality.

The main conclusions of the assessment for each key pollutant and assessable averaging time were:

- Annual average TSP, annual average PM_{10}, and annual average deposited dust: Changes in air quality as a result of the proposed modification would not lead to exceedances of the EPA's relevant impact assessment criteria at any of the nearest sensitive receivers.
- 24-hour average PM_{10} and $PM_{2.5}$: No additional days were predicted where the EPA's impact assessment criteria would be exceeded at the identified surrounding sensitive receivers.
- Annual average$PM_{2.5}$: Background concentrations already exceed the EPA's 8 µg/m^3 criterion, with increases of up to 0.2 µg/m^3 (i.e. around 1.5 percent) predicted at the most-affected sensitive receivers as a result of the proposal.

Measures consistent with best-practice were recommended to control emissions to air including the use of watering during material hauling, loading and unloading and screening, as well as on exposed surface and stockpiles, and during screening and crushing activities as identified as being required.

Safeguard measures to proactively identify meteorological conditions that could lead to elevated background concentrations so that they could be planned for and effectively managed were recommended. Further visual verifications were recommended should conditions arise during operations, such that the level of activity,

location and controls would need to be reviewed. Review of the siting of the on-site meteorological station and $PM_{2.5}$ monitoring at the HVAS was also recommended, to improve the usefulness of data collected.

Regarding the VLAMP, the conservative, potential predictions of the assessment indicate that the provisions of this guideline could apply. To ascertain whether operations present an actual rather than potential risk, it was recommended that fit-for-purpose monitoring be considered with the EPA.

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Appendix A. Emissions Calculations

Emission estimates, controls factors, emission factors and input variables

JACOBS

Emission calculations																							
Roberts Road Quarry Existing																							
	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables										
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	(ws/2.2)^1.3	Moisture (%)	t/truck	km/trip	Silt (%)	Reference					
Dozers ripping materials	476	101	24	0	80	h/y	5.94462	kg/h/v	1.25893	kg/h/v	0.29723	kg/h/v		3.4	-	-	7.5	EETM Mining (2012), Section 1.1.5					
Excavators loading raw product to trucks	131	62	7	0	480000	t/y	0.00027	kg/t	0.00013	kg/t	0.000	kg/t	0.48	3.4	-	-	-	EETM Mining (2012), Section 1.1.2					
Hauling raw product to Screening 1	5874	1497	176	50	4364	VKT/y	2.69236	kg/VKT	0.68618	kg/VKT	0.081	kg/VKT	-	-	55	0.5	4.8	EETM Mining (2012), Section 1.1.11, AP42-13.2.2-1					
Unloading raw product to Screens 1	1440	516	72	50	240000	t/y	0.01200	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	EETM Mining (2012), Section 1.1.6					
Screening 1	3000	1032	150	0	240000	t/y	0.0125	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	EETM Mining (2012), Section 5.2.2, AP42-11.19.2-1					
Loading product stockpiles	11	5	1	50	240000	t/y	0.00009	kg/t	4.3E-05	kg/t	0.000	kg/t	0.48	7.4	-	-	-	EETM Mining (2012), Section 1.1.2					
Excavators loading screened product to trucks	22	10	1	0	240000	t/y	0.00009	kg/t	4.3E-05	kg/t	0.000	kg/t	0.48	7.4	-	-	-	EETM Mining (2012), Section 1.1.2					
Hauling raw product to Screening 2	3525	898	106	50	2618	VKT/y	2.69236	kg/VKT	0.68618	kg/VKT	0.081	kg/VKT	-	-	55	0.3	4.8	EETM Mining (2012), Section 1.1.11, AP42-13.2.2-1					
Unloading raw product to Screens 2	1440	516	72	50	240000	t/y	0.01200	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	EETM Mining (2012), Section 1.1.6					
Screening 2	3000	1032	150	0	240000	t/y	0.0125	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	EETM Mining (2012), Section 5.2.2, AP42-11.19.2-1					
Loading product stockpiles	22	10	1	50	480000	t/y	0.00009	kg/t	4.3E-05	kg/t	0.000	kg/t	0.48	7.4	-	-	-	EETM Mining (2012), Section 1.1.2					
Excavators loading screened product to trucks	44	21	2	0	480000	t/y	0.00009	kg/t	4.3E-05	kg/t	0.000	kg/t	0.48	7.4	-	-	-	EETM Mining (2012), Section 1.1.2					
Hauling product off-site	3165	807	95	75	5000	VKT/y	2.53238	kg/VKT	0.64541	kg/VKT	0.076	kg/VKT	-	-	48	0.5	4.8	EETM Mining (2012), Section 1.1.11, AP42-13.2.2-1					
Wind erosion from exposed areas, inactive	662	331	33	50	2.2	ha	601.6	kg/ha/y	300.8	kg/ha/y	30.1	kg/ha/y	-	-	-	-	-	EETM Mining (2012), Section 1.1.18					
Wind erosion from exposed areas, active	842	421	42	50	2.8	ha	601.6	kg/ha/y	300.8	kg/ha/y	30.1	kg/ha/y	-	-	-	-	-	EETM Mining (2012), Section 1.1.18					
Wind erosion from rehabilitation area, inactive	758	379	38	30	1.8	ha	601.6	kg/ha/y	300.8	kg/ha/y	30.1	kg/ha/y	-	-	-	-	-	EETM Mining (2012), Section 1.1.18					
Wind erosion from product stockpiles	662	331	33	0	1.1	ha	601.6	kg/ha/y	300.8	kg/ha/y	30.1	kg/ha/y	-	-	-	-	-	EETM Mining (2012), Section 1.1.18					
kg/yr	**25073**	**7969**	**1002**																				

Where:

Moisture (%) overburden, sand values were adopted from AP-42, Chapter 13.2.4, Table 4-1

T/truck for internal and outbound truck values were adopted from the previous assessment (Wilkinson Murray, 2015)

Km/trip values were based on internal round-trip haul distances

Silt content (%) for overburden ripping and internal haul routes were adopted from AP-42, Chapter 13.2.4, Table 4-1 and AP-42, Chapter 13.2.2, Table 2-1 respectively

A value of 60 was adopted for typical number of days with >0.25 mm of rainfall based on historical records collected BoM's Richmond AWS and 2% for the frequency of wind speeds above 5.4 m/s using data collected from the on-site meteorological station.

Control factors were applied as outlined above in Section 6.2

Emission estimation techniques were applied as listed in the 'reference' column, with further details of these equations listed below.

Emission calculations																						
Roberts Road Quarry Proposed, VENM/ENM filling North																						
	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables									
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	(ws/2.2)^1.3	Moisture (%)	t/truck	km/trip	Silt (%)					
Dozers ripping materials	1855	393	93	0	312	h/y	5.94462	kg/h/v	1.25893	kg/h/v	0.29723	kg/h/v		3.4	-	-	7.5	EETM Mining (2012), Section 1.1.5				
Excavators loading raw product to trucks	131	62	7	0	480000	t/y	0.00027	kg/t	0.00013	kg/t	0.000	kg/t	0.48	3.4	-	-	-	EETM Mining (2012), Section 1.1.2				
Hauling raw product to Screening 1	2937	749	88	50	2182	VKT/y	2.69236	kg/VKT	0.68618	kg/VKT	0.081	kg/VKT	-	-	55	0.25	4.8	EETM Mining (2012), Section 1.1.11, AP42-13.2.2-1				
Unloading raw product to Screens 1	1440	516	72	50	240000	t/y	0.01200	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	EETM Mining (2012), Section 1.1.6				
Screening 1	3000	1032	150	0	240000	t/y	0.0125	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	EETM Mining (2012), Section 5.2.2, AP42-11.19.2-1				
Loading product stockpiles	11	5	1	50	240000	t/y	0.00009	kg/t	4.3E-05	kg/t	0.000	kg/t	0.48	7.4	-	-	-	EETM Mining (2012), Section 1.1.2, AP42-13.2.4				
Excavators loading screened product to trucks	22	10	1	0	240000	t/y	0.00009	kg/t	4.3E-05	kg/t	0.000	kg/t	0.48	7.4	-	-	-	EETM Mining (2012), Section 1.1.2, AP42-13.2.4				
Hauling raw product to Screening 2	3525	898	106	50	2618	VKT/y	2.69236	kg/VKT	0.68618	kg/VKT	0.081	kg/VKT	-	-	55	0.3	4.8	EETM Mining (2012), Section 1.1.11, AP42-13.2.2-1				
Unloading raw product to Screens 2	1440	516	72	50	240000	t/y	0.01200	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	EETM Mining (2012), Section 1.1.6				
Screening 2	3000	1032	150	0	240000	t/y	0.0125	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	EETM Mining (2012), Section 5.2.2, AP42-11.19.2-1				
Loading product stockpiles	22	10	1	50	480000	t/y	0.00009	kg/t	4.3E-05	kg/t	0.000	kg/t	0.48	7.4	-	-	-	EETM Mining (2012), Section 1.1.2, AP42-13.2.4				
Excavators loading screened product to trucks	44	21	2	0	480000	t/y	0.00009	kg/t	4.3E-05	kg/t	0.000	kg/t	0.48	7.4	-	-	-	EETM Mining (2012), Section 1.1.2, AP42-13.2.4				
Hauling product off-site	3165	807	95	75	5000	VKT/y	2.53238	kg/VKT	0.64541	kg/VKT	0.076	kg/VKT	-	-	48	0.5	4.8	EETM Mining (2012), Section 1.1.11, AP42-13.2.2-1				
Wind erosion from exposed areas, inactive	662	331	33	50	2.2	ha	601.6	kg/ha/y	300.8	kg/ha/y	30.1	kg/ha/y	-	-	-	-	-	EETM Mining (2012), Section 1.1.18				
Wind erosion from exposed areas, active	842	421	42	50	2.8	ha	601.6	kg/ha/y	300.8	kg/ha/y	30.1	kg/ha/y	-	-	-	-	-	EETM Mining (2012), Section 1.1.18				
Wind erosion from rehabilitation area (VENM/ENM), active	541	271	27	50	1.8	ha	601.6	kg/ha/y	300.8	kg/ha/y	30.1	kg/ha/y	-	-	-	-	-	EETM Mining (2012), Section 1.1.18				
Wind erosion from product stockpiles	662	331	33	0	1.1	ha	601.6	kg/ha/y	300.8	kg/ha/y	30.1	kg/ha/y	-	-	-	-	-	EETM Mining (2012), Section 1.1.18				
Hauling ENM/VENM to site	3515	896	105	75	6400	VKT/y	2.19685	kg/VKT	0.5599	kg/VKT	0.066	kg/VKT	-	-	35	0.7	4.8	EETM Mining (2012), Section 1.1.11, AP42-13.2.2-1				
Unloading ENM/VENM	1920	688	96	50	320000	t/y	0.01200	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	EETM Mining (2012), Section 1.1.6				
Dozers placing materials	1855	393	93	0	312	h/y	5.94462	kg/h/v	1.25893	kg/h/v	0.29723	kg/h/v		3.4	-	-	7.5	EETM Mining (2012), Section 1.1.5				
Crushing (primary) 1	120	48	6	0	12000	t/y	0.01	kg/t	0.004	kg/t	0.001	kg/t	-	-	-	-	-	EETM Mining (2012), Section 5.2.2				
Crushing (primary) 2	120	48	6	0	12000	t/y	0.01	kg/t	0.004	kg/t	0.001	kg/t	-	-	-	-	-	EETM Mining (2012), Section 5.2.2				
kg/yr	**30828**	**9477**	**1279**																			

Where:

Moisture (%) overburden, sand values were adopted from AP-42, Chapter 13.2.4, Table 4-1

T/truck for internal and outbound truck values were adopted from the previous assessment (Wilkinson Murray, 2015)

Km/trip values were based on internal round-trip haul distances

Silt content (%) for overburden ripping and internal haul routes were adopted from AP-42, Chapter 13.2.4, Table 4-1 and AP-42, Chapter 13.2.2, Table 2-1 respectively

A value of 60 was adopted for typical number of days with >0.25 mm of rainfall based on historical records collected BoM's Richmond AWS and 2% for the frequency of wind speeds above 5.4 m/s using data collected from the on-site meteorological station.

Control factors were applied as outlined above in Section 6.2

Emission estimation techniques were applied as listed in the 'reference' column, with further details of these equations listed below.

Emission calculations																					
Roberts Road Quarry, Proposed South																					
	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	(ws/2.2)^1.3	Moisture (%)	t/truck	km/trip	Silt (%)				
Dozers ripping materials	1855	393	93	0	312	h/y	5.94462	kg/h/v	1.25893	kg/h/v	0.29723	kg/h/v		3.4	-	-	7.5	EETM Mining (2012), Section 1.1.5			
Excavators loading raw product to trucks	131	62	7	0	480000	t/y	0.00027	kg/t	0.00013	kg/t	0.000	kg/t	0.48	3.4	-	-	-	EETM Mining (2012), Section 1.1.2			
Hauling raw product to Screening 1	2937	749	88	50	2182	VKT/y	2.69236	kg/VKT	0.68618	kg/VKT	0.081	kg/VKT	-	-	55	0.25	4.8	EETM Mining (2012), Section 1.1.11, AP42-			
Unloading raw product to Screens 1	1440	516	72	50	240000	t/y	0.01200	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	EETM Mining (2012), Section 1.1.6			
Screening 1	3000	1032	150	0	240000	t/y	0.0125	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	EETM Mining (2012), Section 5.2.2, AP42-1			
Loading product stockpiles	11	5	1	50	240000	t/y	0.00009	kg/t	4.3E-05	kg/t	0.000	kg/t	0.48	7.4	-	-	-	EETM Mining (2012), Section 1.1.2, AP42-1			
Excavators loading screened product to trucks	22	10	1	0	240000	t/y	0.00009	kg/t	4.3E-05	kg/t	0.000	kg/t	0.48	7.4	-	-	-	EETM Mining (2012), Section 1.1.2, AP42-1			
Hauling raw product to Screening 2	3525	898	106	50	2618	VKT/y	2.69236	kg/VKT	0.68618	kg/VKT	0.081	kg/VKT	-	-	55	0.3	4.8	EETM Mining (2012), Section 1.1.11, AP42-			
Unloading raw product to Screens 2	1440	516	72	50	240000	t/y	0.01200	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	EETM Mining (2012), Section 1.1.6			
Screening 2	3000	1032	150	0	240000	t/y	0.0125	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	EETM Mining (2012), Section 5.2.2, AP42-1			
Loading product stockpiles	22	10	1	50	480000	t/y	0.00009	kg/t	4.3E-05	kg/t	0.000	kg/t	0.48	7.4	-	-	-	EETM Mining (2012), Section 1.1.2, AP42-1			
Excavators loading screened product to trucks	44	21	2	0	480000	t/y	0.00009	kg/t	4.3E-05	kg/t	0.000	kg/t	0.48	7.4	-	-	-	EETM Mining (2012), Section 1.1.2, AP42-1			
Hauling product off-site	3165	807	95	75	5000	VKT/y	2.53238	kg/VKT	0.64541	kg/VKT	0.076	kg/VKT	-	-	48	0.5	4.8	EETM Mining (2012), Section 1.1.11, AP42-			
Wind erosion from exposed areas, inactive	662	331	33	50	2.2	ha	601.6	kg/ha/y	300.8	kg/ha/y	30.1	kg/ha/y	-	-	-	-	-	EETM Mining (2012), Section 1.1.18			
Wind erosion from exposed areas, active	842	421	42	50	2.8	ha	601.6	kg/ha/y	300.8	kg/ha/y	30.1	kg/ha/y	-	-	-	-	-	EETM Mining (2012), Section 1.1.18			
Wind erosion from rehabilitation area	541	271	27	50	1.8	ha	601.6	kg/ha/y	300.8	kg/ha/y	30.1	kg/ha/y	-	-	-	-	-	EETM Mining (2012), Section 1.1.18			
Wind erosion from product stockpiles	662	331	33	0	1.1	ha	601.6	kg/ha/y	300.8	kg/ha/y	30.1	kg/ha/y	-	-	-	-	-	EETM Mining (2012), Section 1.1.18			
Hauling ENM/VENM to site	4017	1024	121	75	7314	VKT/y	2.19685	kg/VKT	0.5599	kg/VKT	0.066	kg/VKT	-	-	35	0.8	4.8	EETM Mining (2012), Section 1.1.11, AP42-			
Unloading ENM/VENM	1920	688	96	50	320000	t/y	0.01200	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	EETM Mining (2012), Section 1.1.6			
Dozers placing materials	1855	393	93	0	312	h/y	5.94462	kg/h/v	1.25893	kg/h/v	0.29723	kg/h/v		3.4	-	-	7.5	EETM Mining (2012), Section 1.1.5			
Crushing (primary) 1	120	48	6	0	12000	t/y	0.01	kg/t	0.004	kg/t	0.001	kg/t	-	-	-	-	-	EETM Mining (2012), Section 5.2.2			
Crushing (primary) 2	120	48	6	0	12000	t/y	0.01	kg/t	0.004	kg/t	0.001	kg/t	-	-	-	-	-	EETM Mining (2012), Section 5.2.2			
kg/yr	**31330**	**9509**	**1282**																		

Where:

Moisture (%) overburden, sand values were adopted from AP-42, Chapter 13.2.4, Table 4-1

T/truck for internal and outbound truck values were adopted from the previous assessment (Wilkinson Murray, 2015)

Km/trip values were based on internal round-trip haul distances

Silt content (%) for overburden ripping and internal haul routes were adopted from AP-42, Chapter 13.2.4, Table 4-1 and AP-42, Chapter 13.2.2, Table 2-1 respectively

A value of 60 was adopted for typical number of days with >0.25 mm of rainfall based on historical records collected BoM's Richmond AWS and 2% for the frequency of wind speeds above 5.4 m/s using data collected from the on-site meteorological station.

Control factors were applied as outlined above in Section 6.2

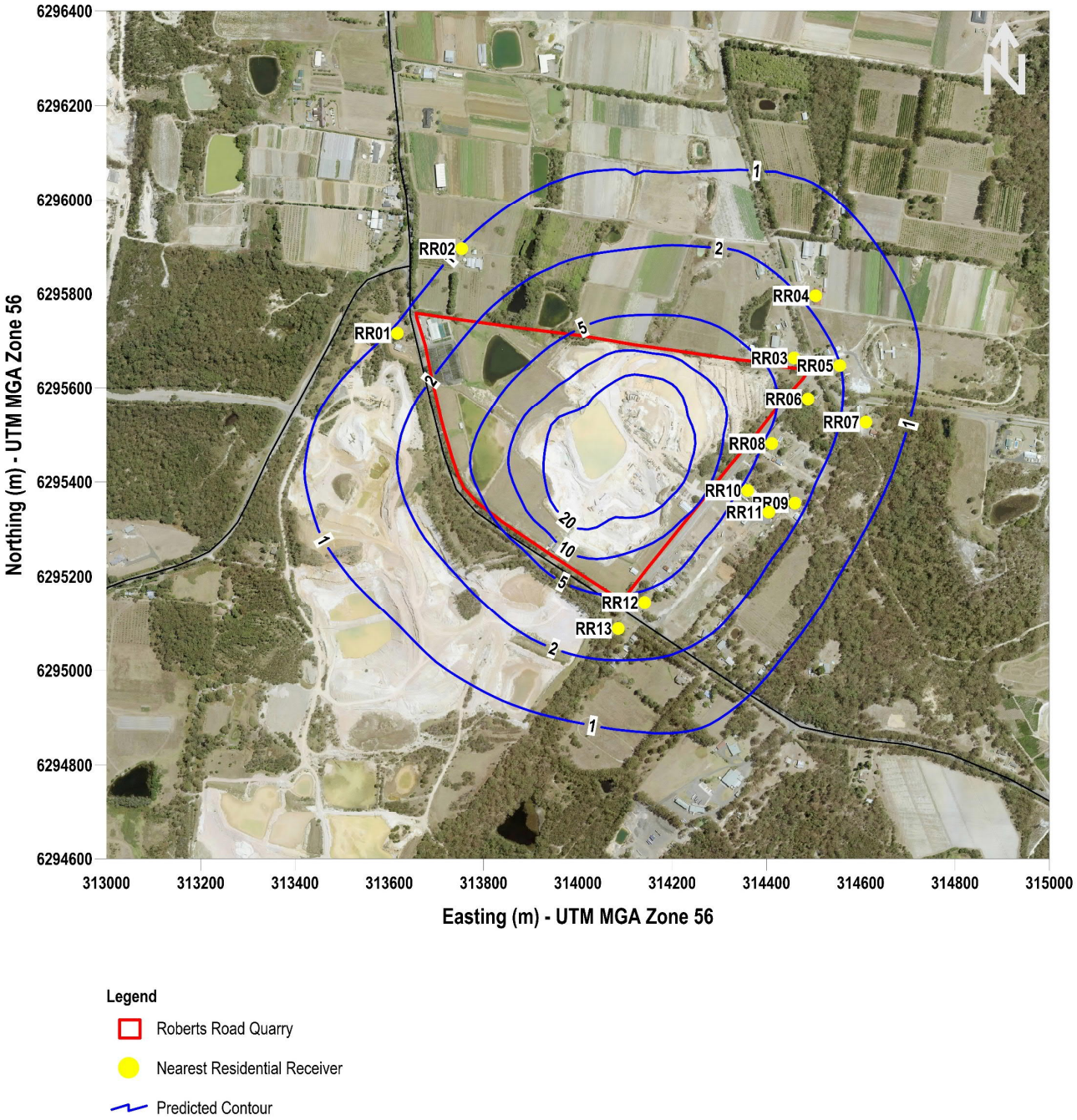
Emission estimation techniques were applied as listed in the 'reference' column, with further details of these equations listed below.

Activity	Emission factor			Units	Source
	TSP	PM_{10}	$PM_{2.5}$		
Dozers ripping materials	$E_{TSP} = 2.6*(S^{1.2})/(M^{1.3})$	$E_{PM10} = 0.34*(S^{1.5})/(M^{1.4})$	$E_{PM2.5} = E_{TSP} * 0.05$	kg/h	NPI, 2012 Section 1.1.5
Excavators loading/unloading materials	$E_{TSP} = 0.74*0.0016*((U/2.2)^{1.3})/((m/2)1.4)$	$E_{PM10} = 0.35*0.0016*((U/2.2)^{1.3})/((m/2)1.4)$	$E_{PM2.5} = E_{TSP} * 0.05$	kg/t	NPI, 2012 Section 1.1.2
Material haulage	$E_{TSP} = (0.4536/1.6093)*4.9*((S/12)^{0.7})*((W/3)^{0.45})$	$E_{PM10} = (0.4536/1.6093)*1.5*((S/12)^{0.9})*((W/3)^{0.45})$	$E_{PM2.5} = E_{TSP} * 0.03$	kg/vkt	NPI, 2012 Section 1.1.11, AP-42, Chapter 13.2
Unloading raw product	$E_{TSP} = 0.012$	$E_{PM10} = 0.0043$	$E_{PM2.5} = E_{TSP} * 0.05$	Kg/t	NPI, 2012 Section 1.1.6
Wind erosion from exposed areas, stockpiles	$E_{TSP} = 1.9*(S/1.5)*365*((365-p)/235)*(f/15)$	$E_{PM10} = E_{TSP}*0.5$	$E_{PM2.5} = E_{TSP} *0.05$	kg/t	NPI, 2012 Section 1.1.18,
Screening	$E_{TSP} = 0.0125$	$E_{PM10} = 0.0043$	$E_{PM2.5} = E_{TSP} * 0.05$	kg/t	AP-42 Chapter 11.9.2 Table 2-1
Crushing	$E_{TSP} = 0.1$	$E_{PM10} = 0.004$	$E_{PM2.5} = 0.001$	kg/t	NPI, 2012 Section 5.2.2

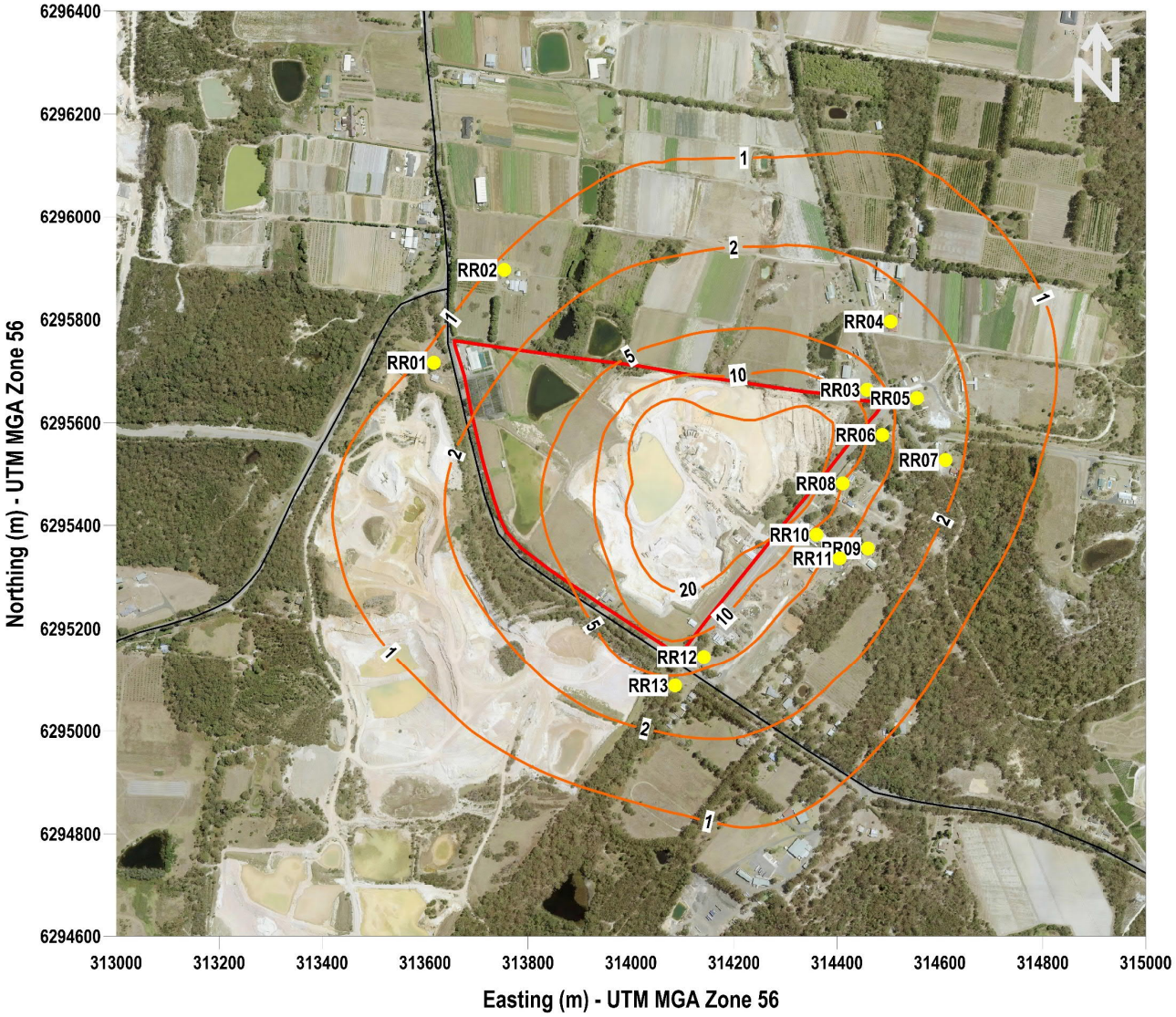
Appendix B. Contour plots

B.1 Total suspended particulates (TSP)

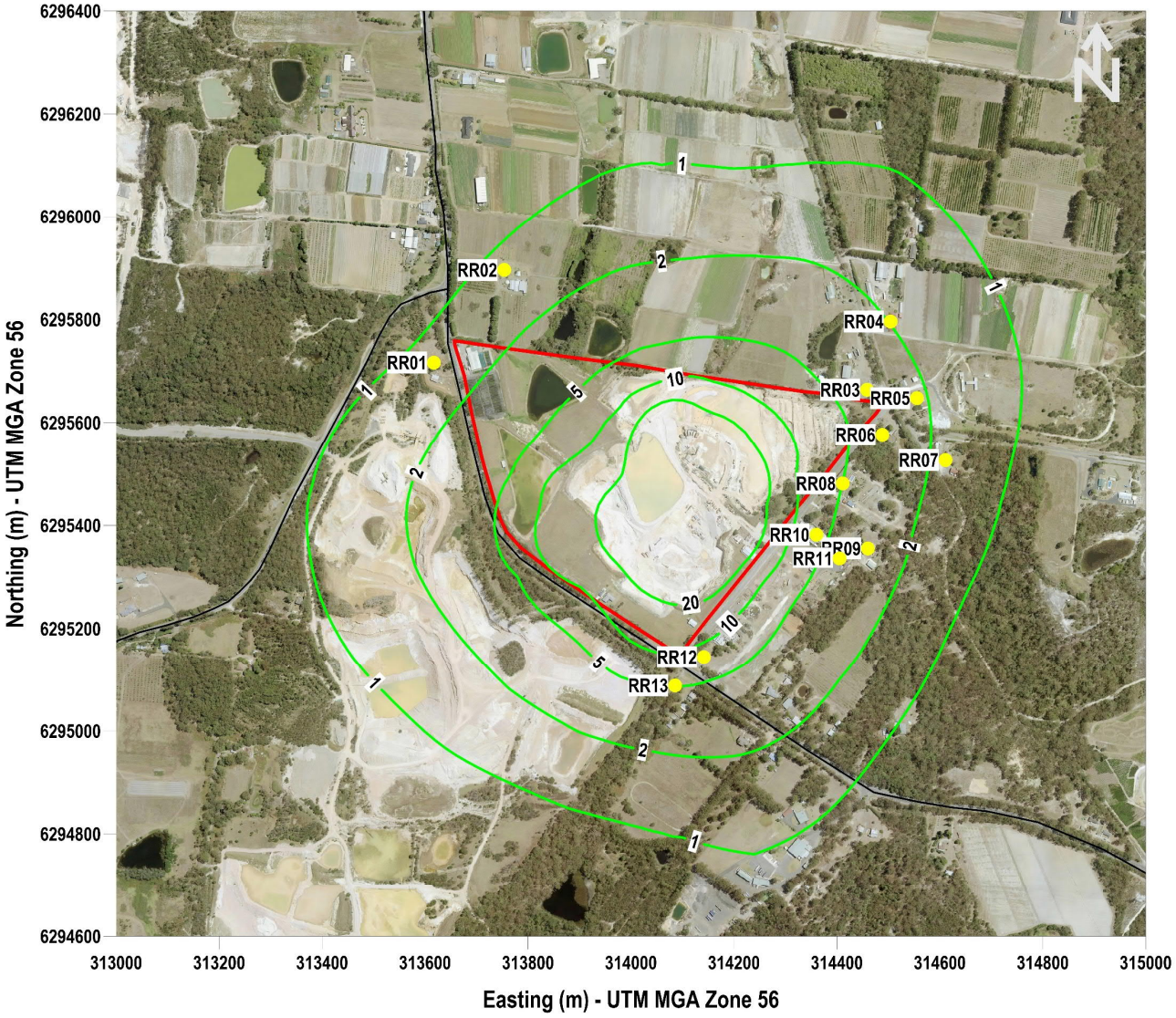
Annually averaged TSP, µg/m^3, site contribution only (existing)



Annually averaged TSP, µg/m^3, site contribution only (proposed, north)

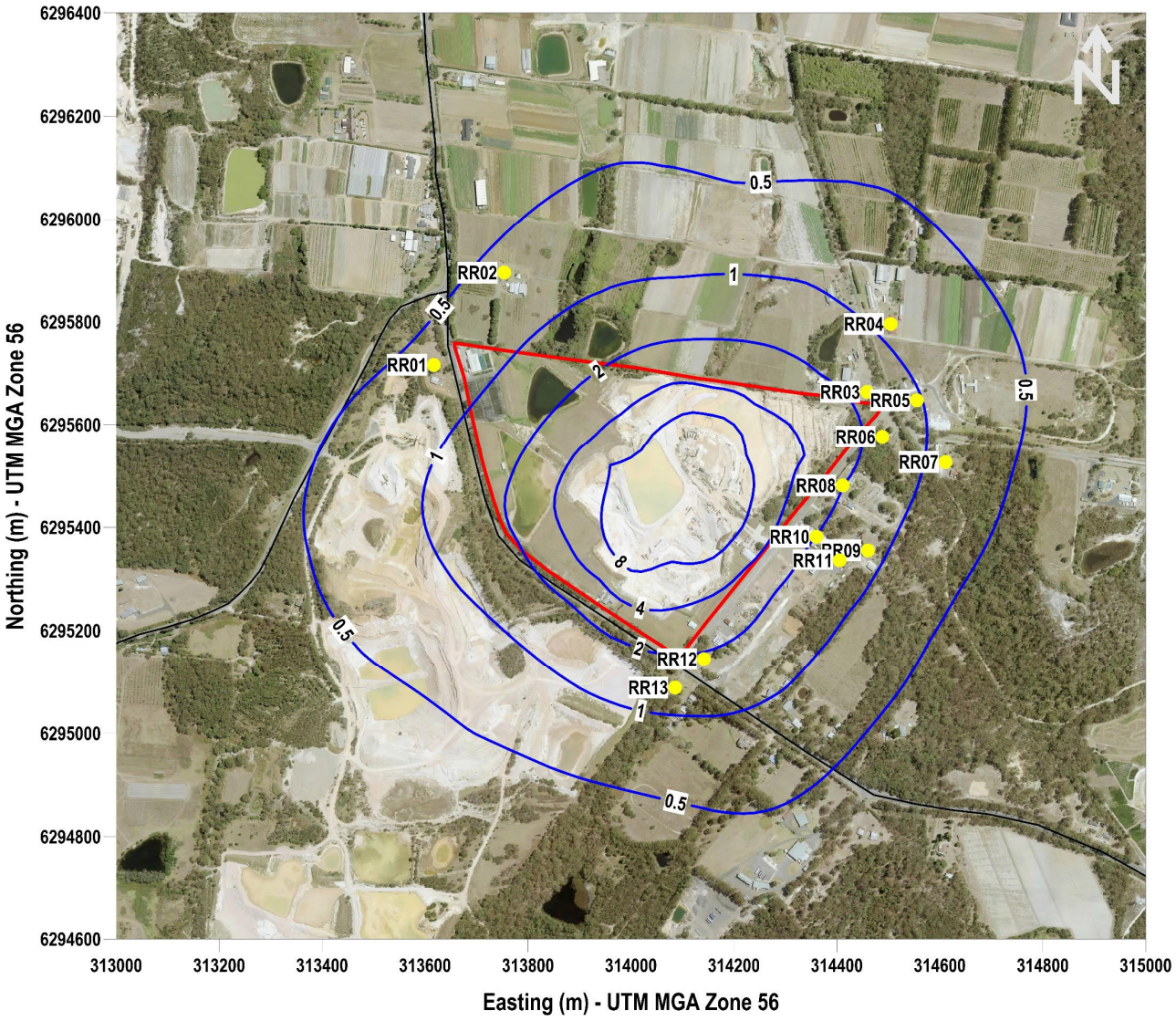


Annually averaged TSP, µg/m^3, site contribution only (proposed, south)

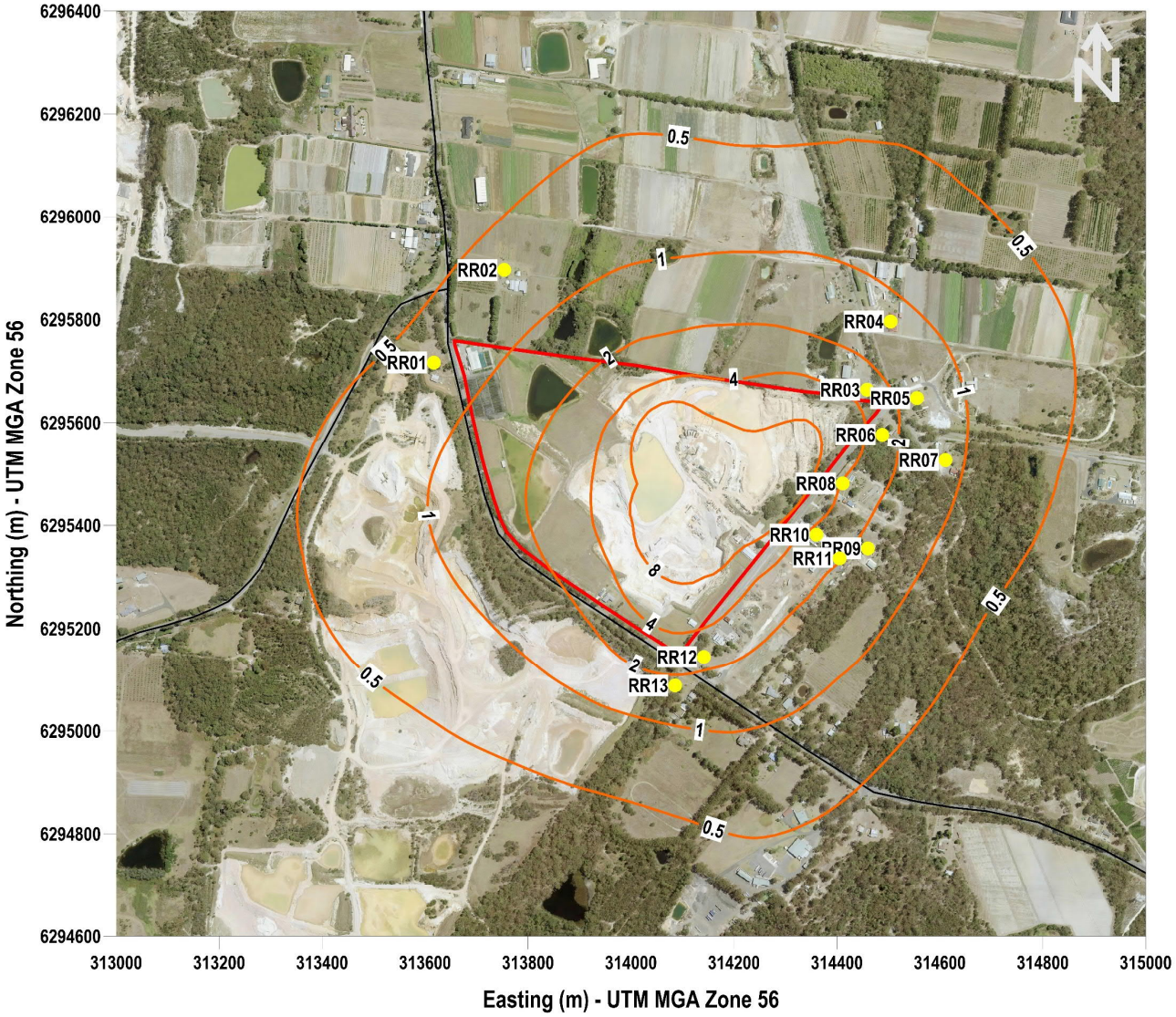


B.2 Particulate matter (PM_{10})

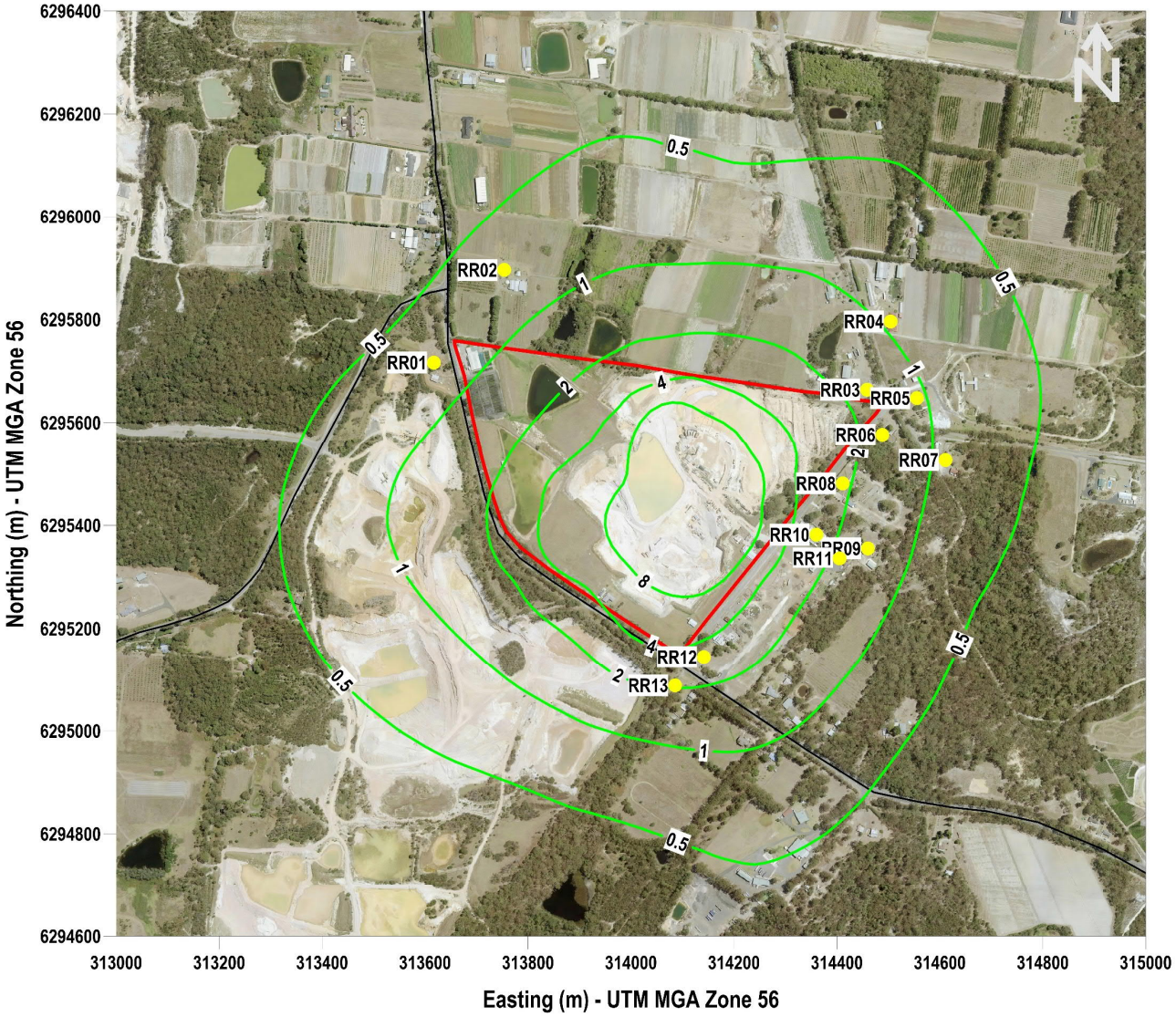
Annually averaged PM_{10}, µg/m^3, site contribution only (existing)



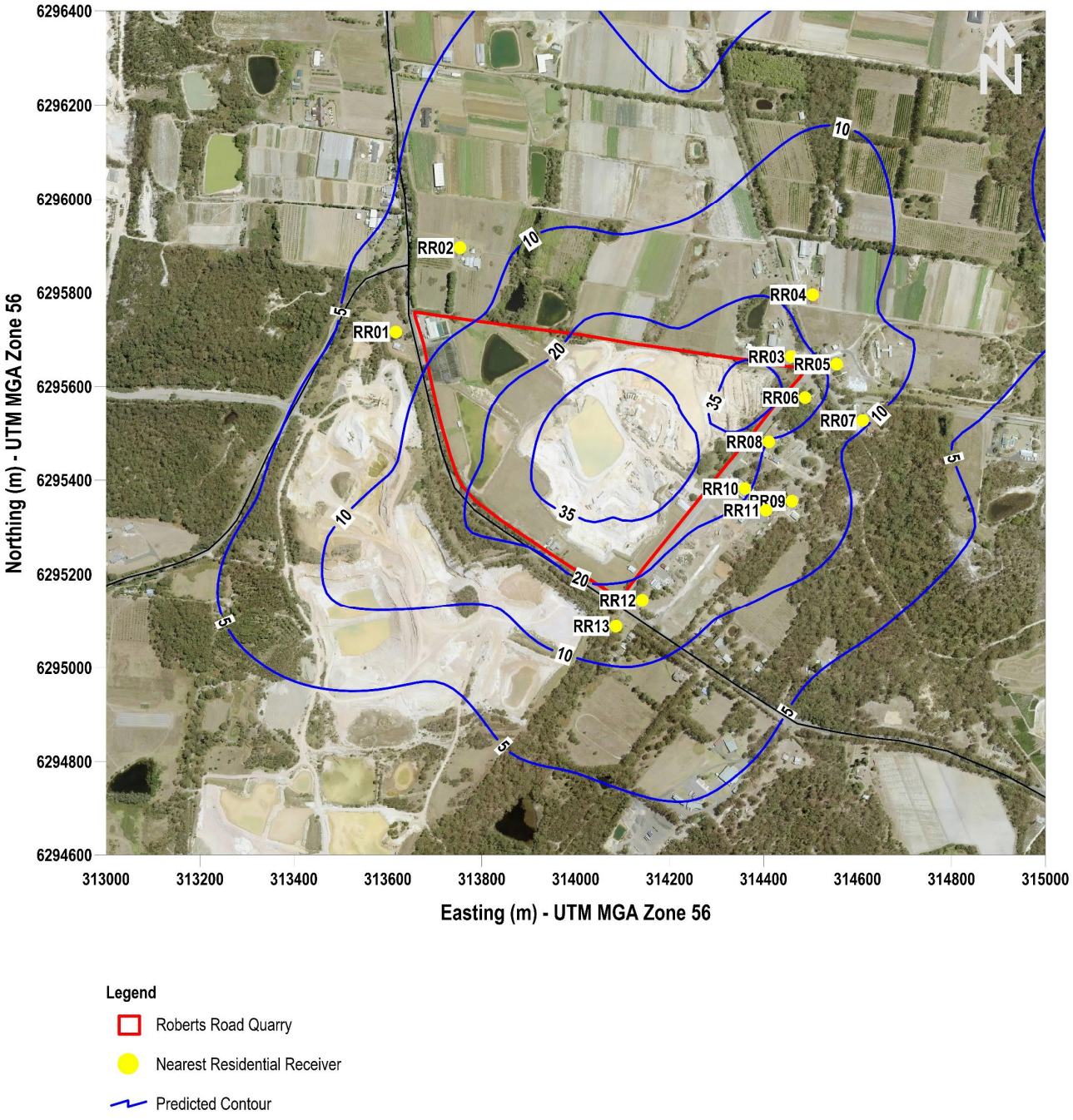
Annually averaged PM_{10}, µg/m^3, site contribution only (proposed, north)



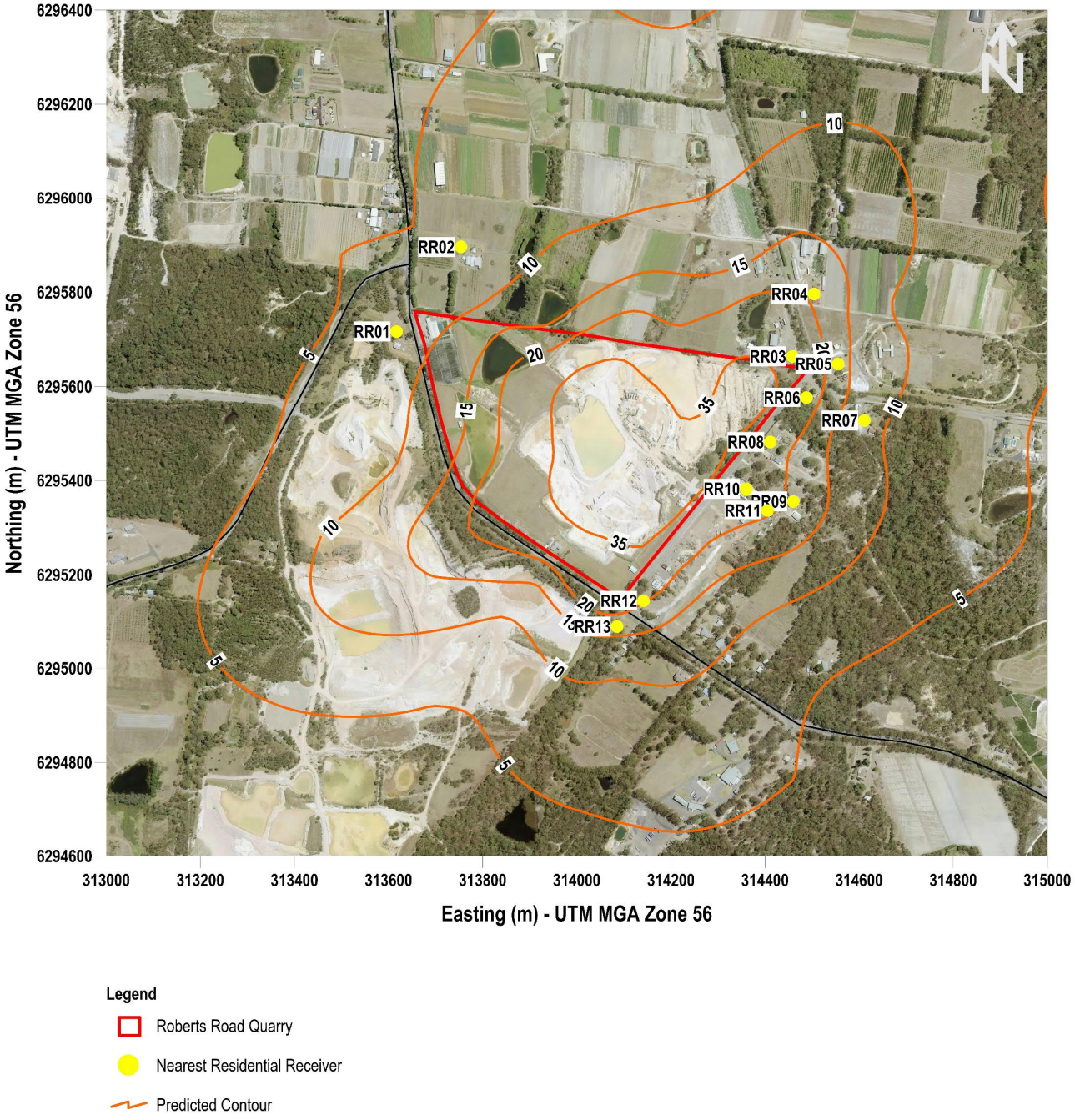
Annually averaged PM_{10}, µg/m^3, site contribution only (proposed, south)



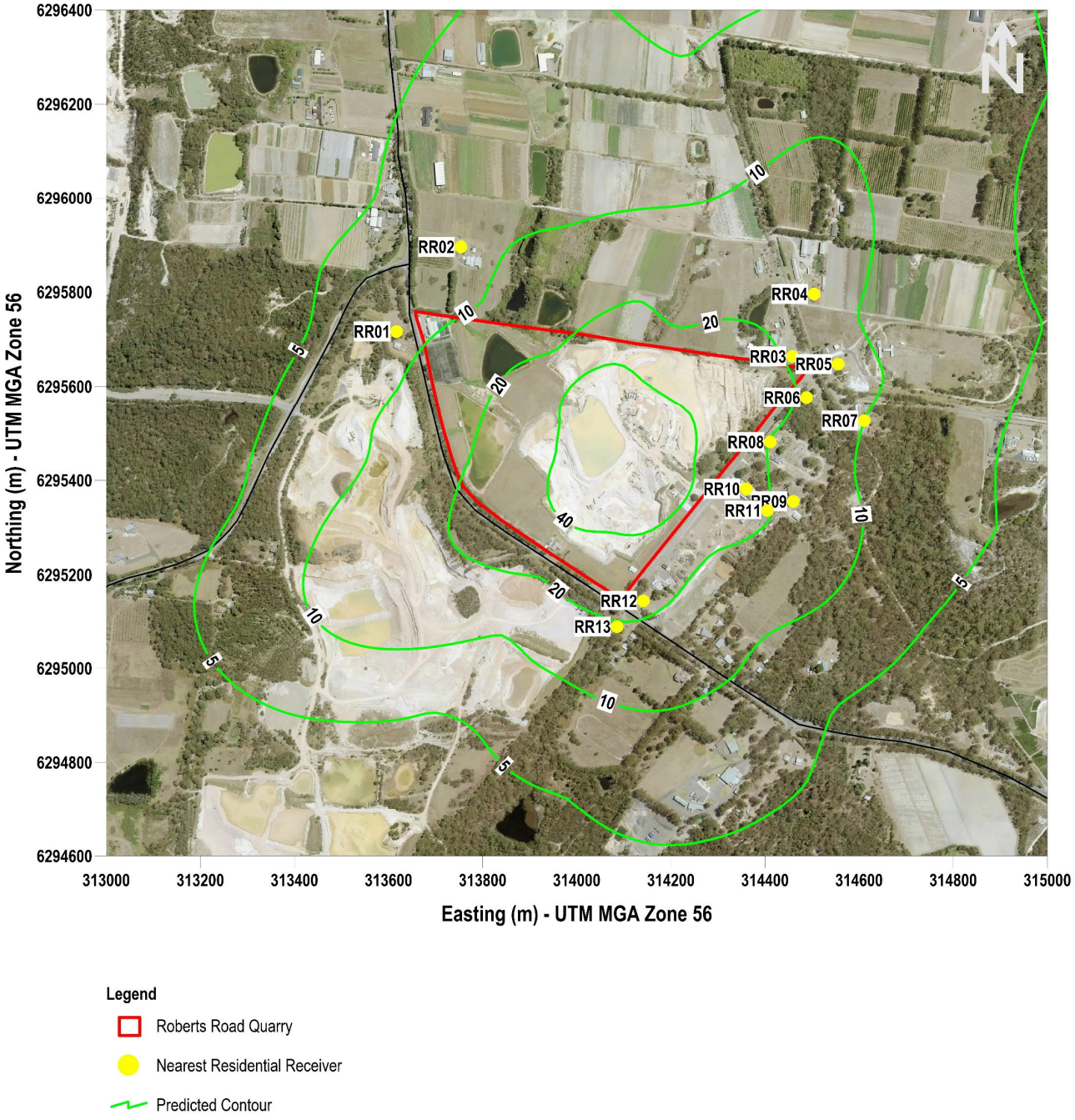
Maximum 24-hour averaged PM_{10}, µg/m^3, site contribution only (existing)



Maximum 24-hour averaged PM_{10}, µg/m^3, site contribution only (proposed, north)

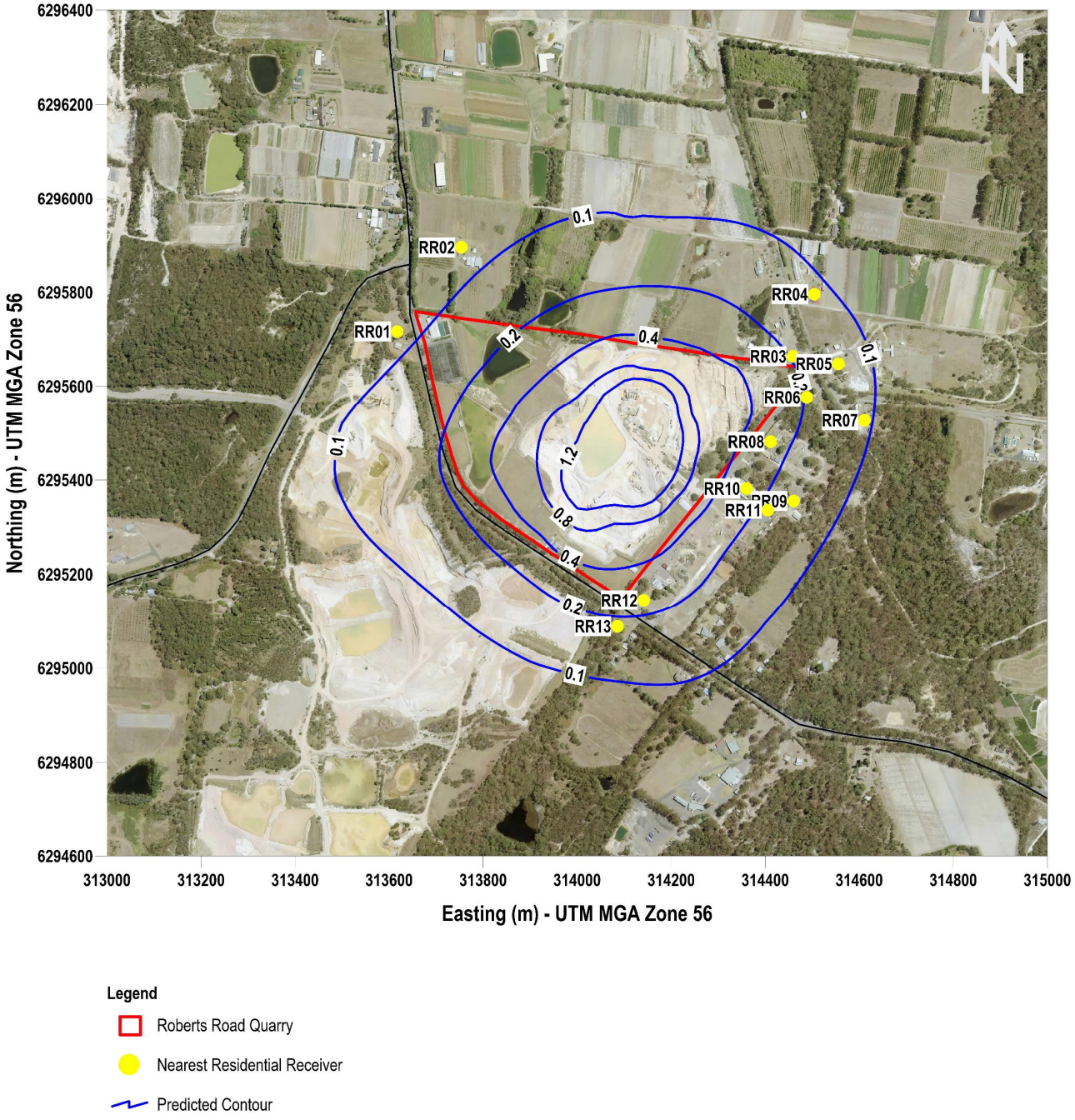


Maximum 24-hour averaged PM_{10}, µg/m^3, site contribution only (proposed, south)

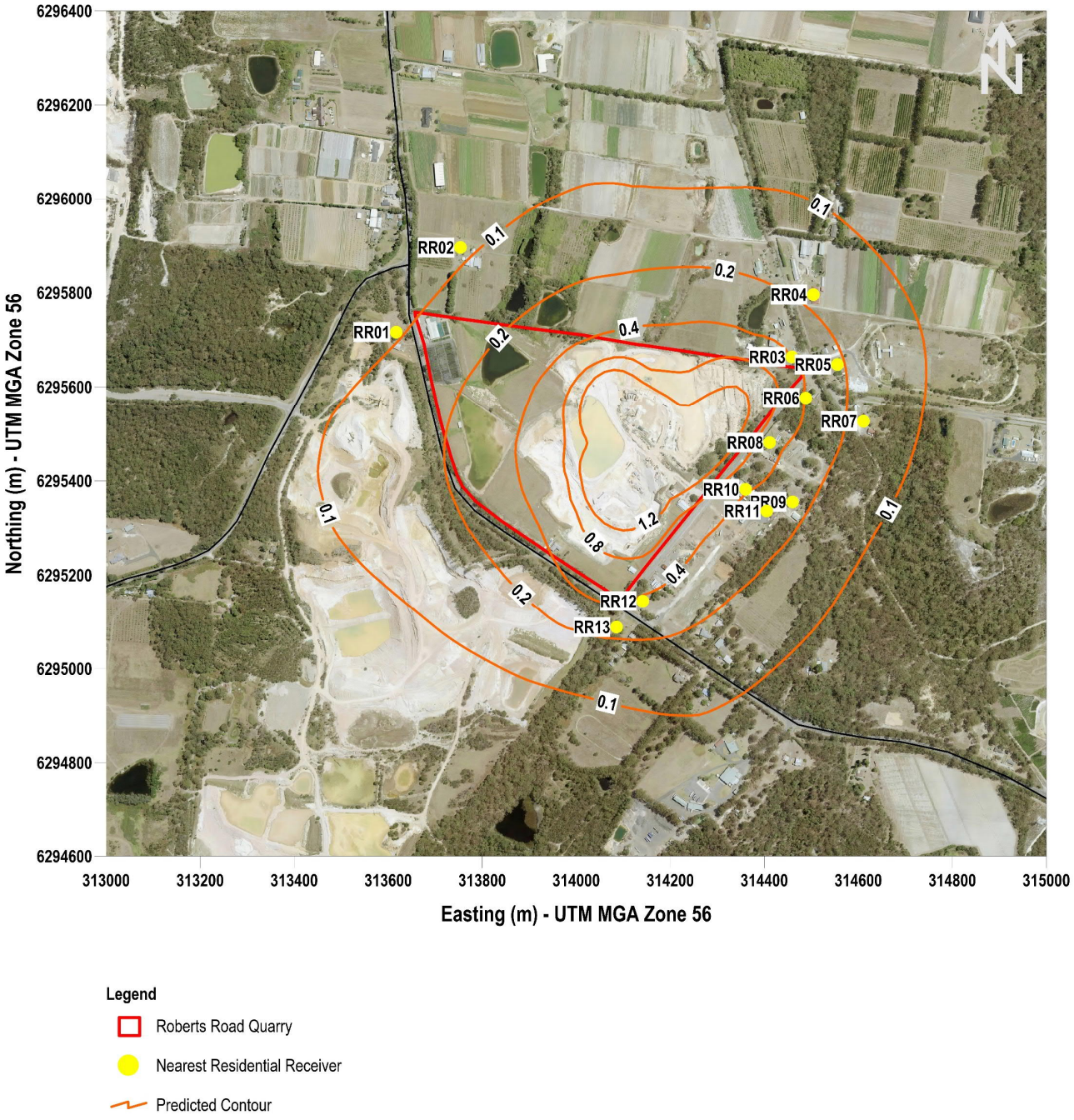


B.3 Particulate matter ($PM_{2.5}$)

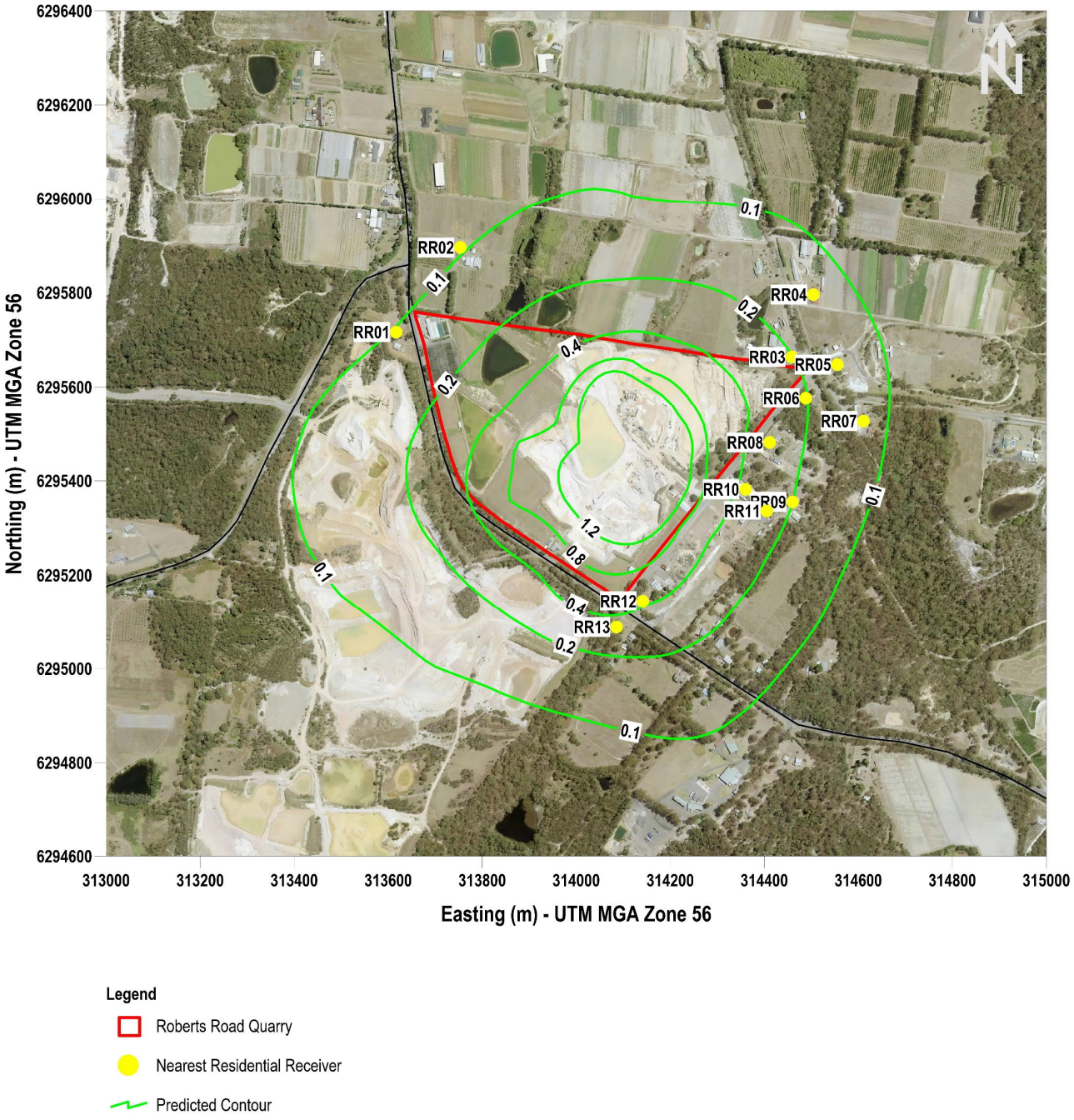
Annually averaged $PM_{2.5}$, µg/m^3, site contribution only (existing)



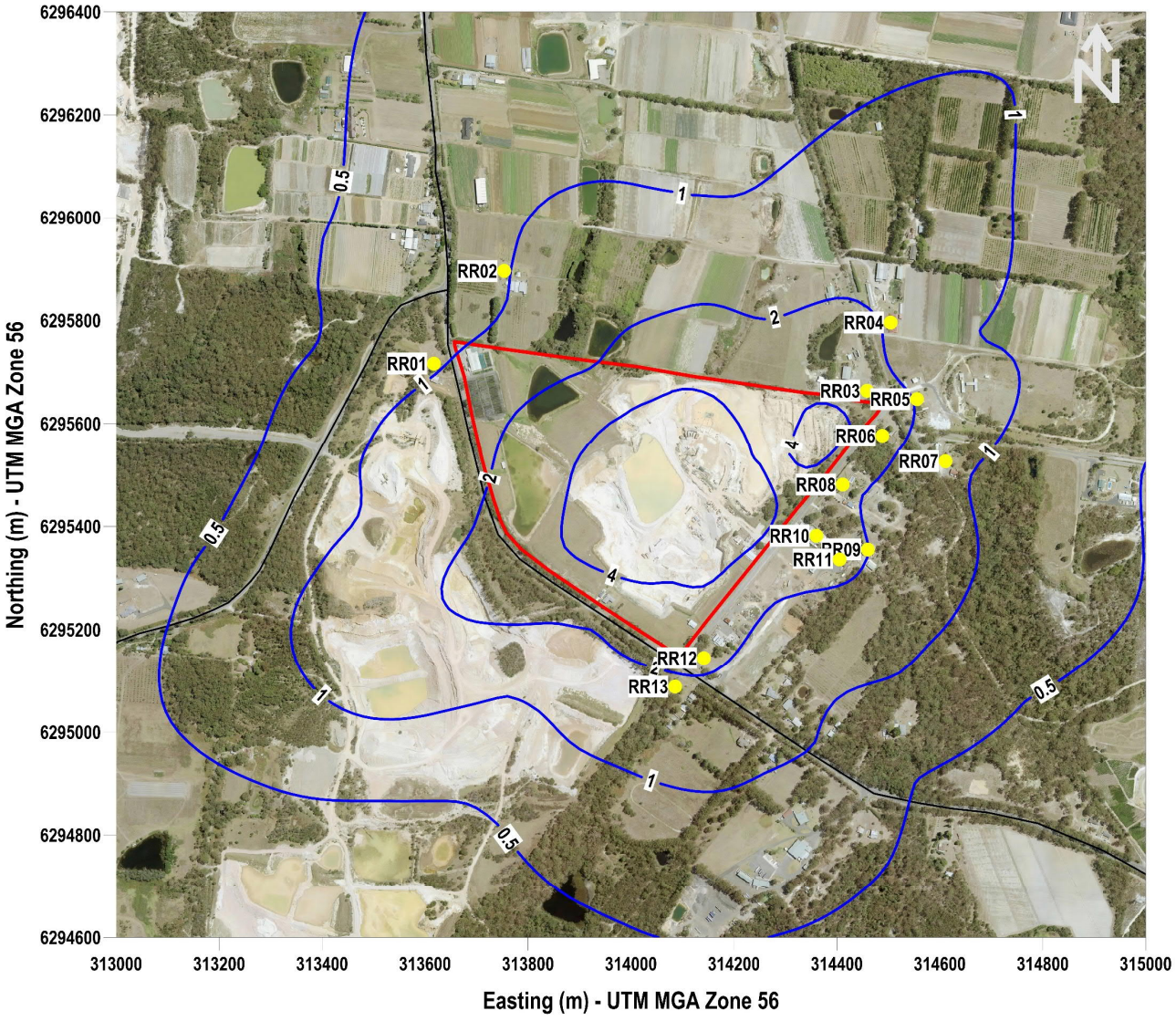
Annually averaged $PM_{2.5}$, µg/m^3, site contribution only (proposed, north)



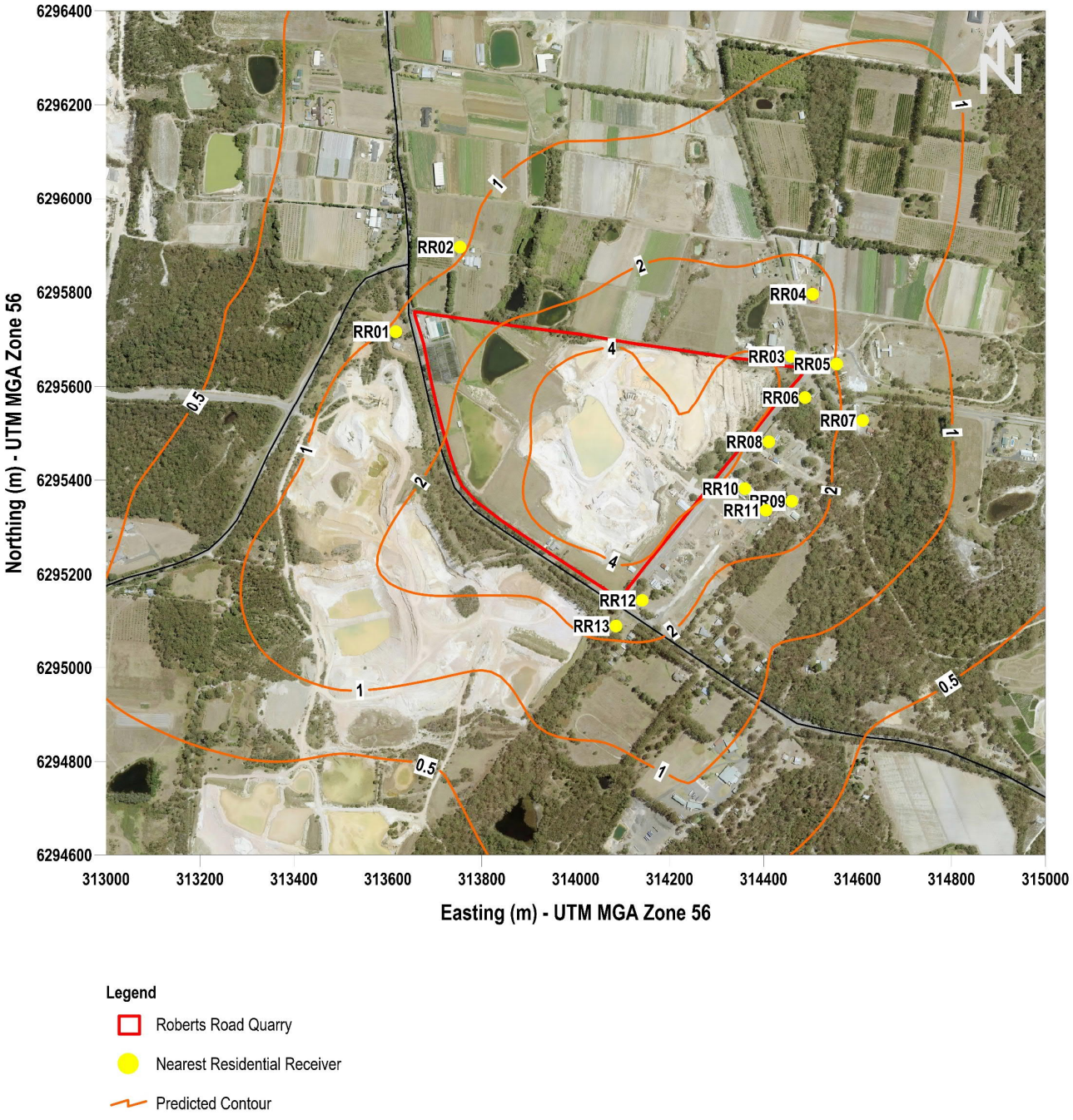
Annually averaged $PM_{2.5}$, µg/m^3, site contribution only (proposed, south)



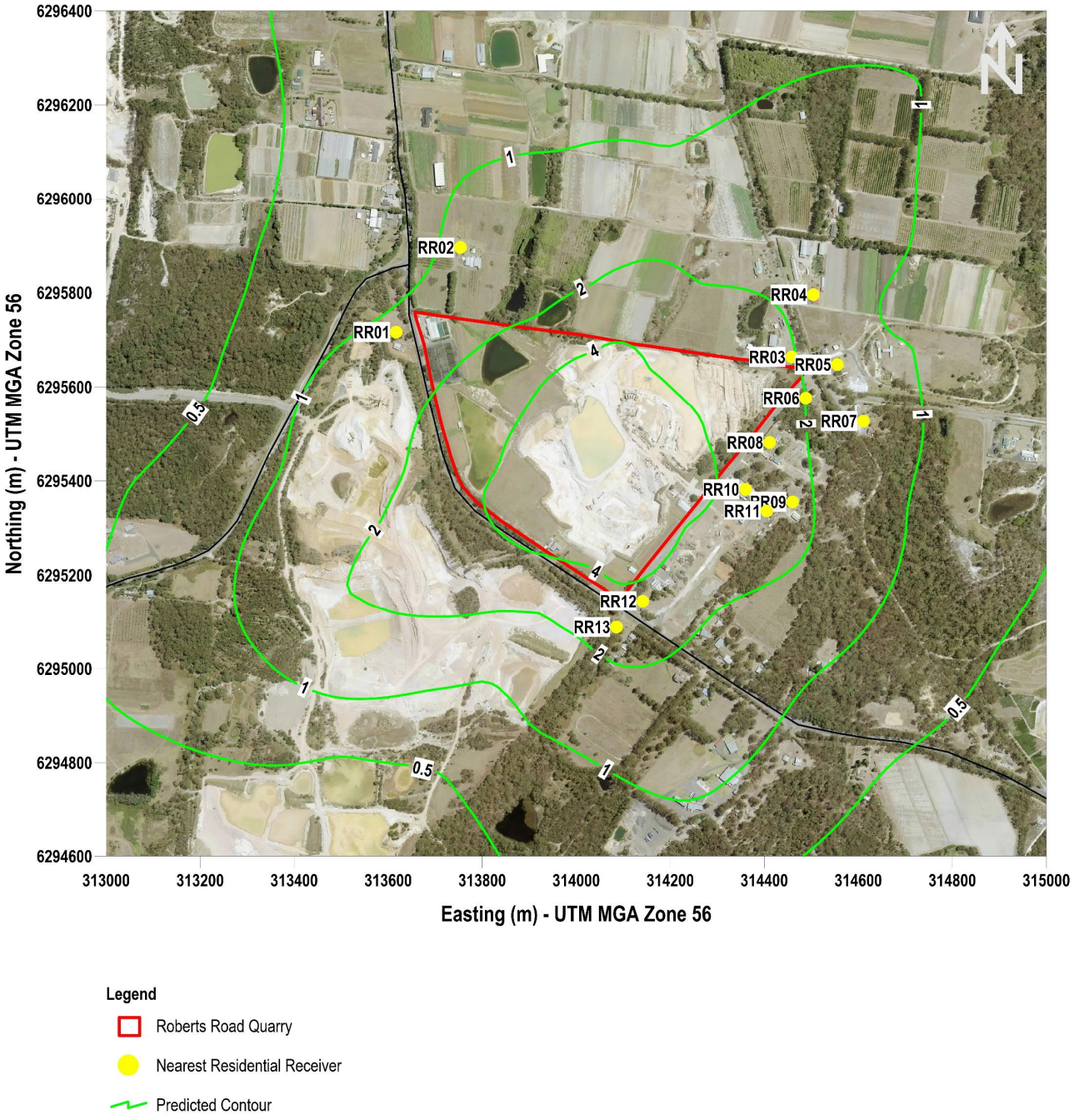
Maximum 24-hour averaged $PM_{2.5}$, µg/m^3, site contribution only (existing)



Maximum 24-hour averaged $PM_{2.5}$, µg/m^3, site contribution only (proposed, north)

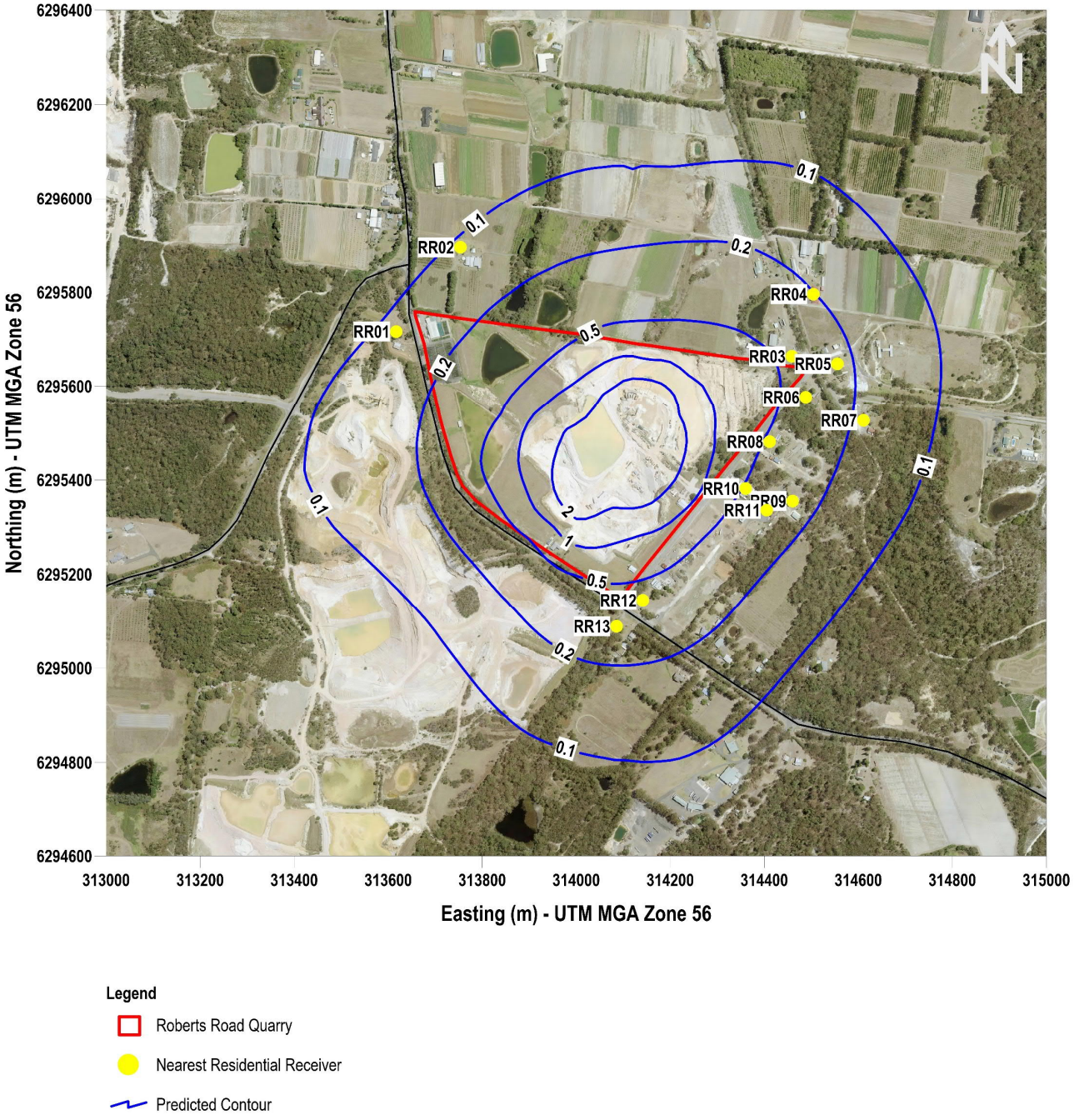


Maximum 24-hour averaged $PM_{2.5}$, µg/m^3, site contribution only (proposed, south)

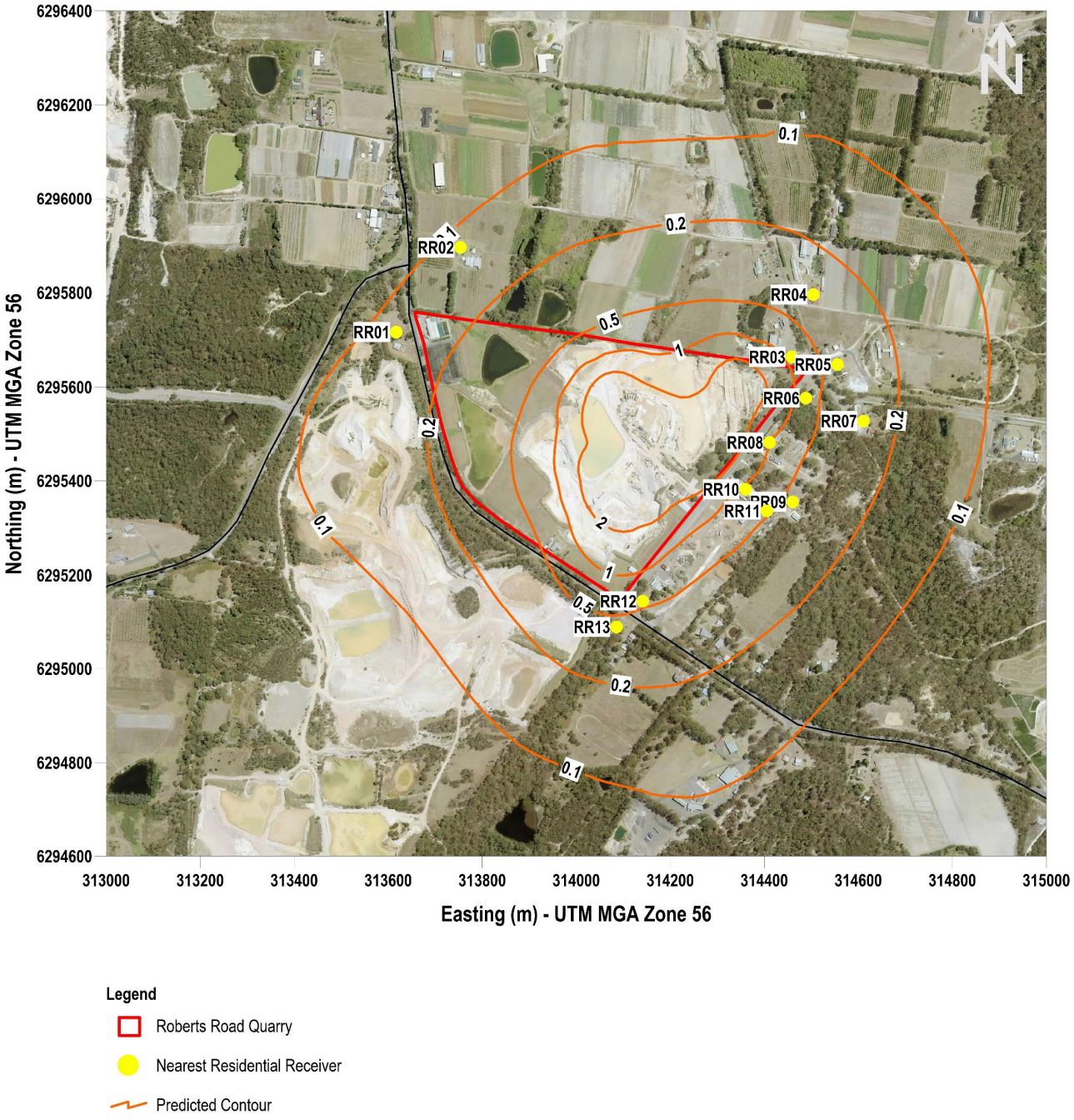


B.4 Deposited dust

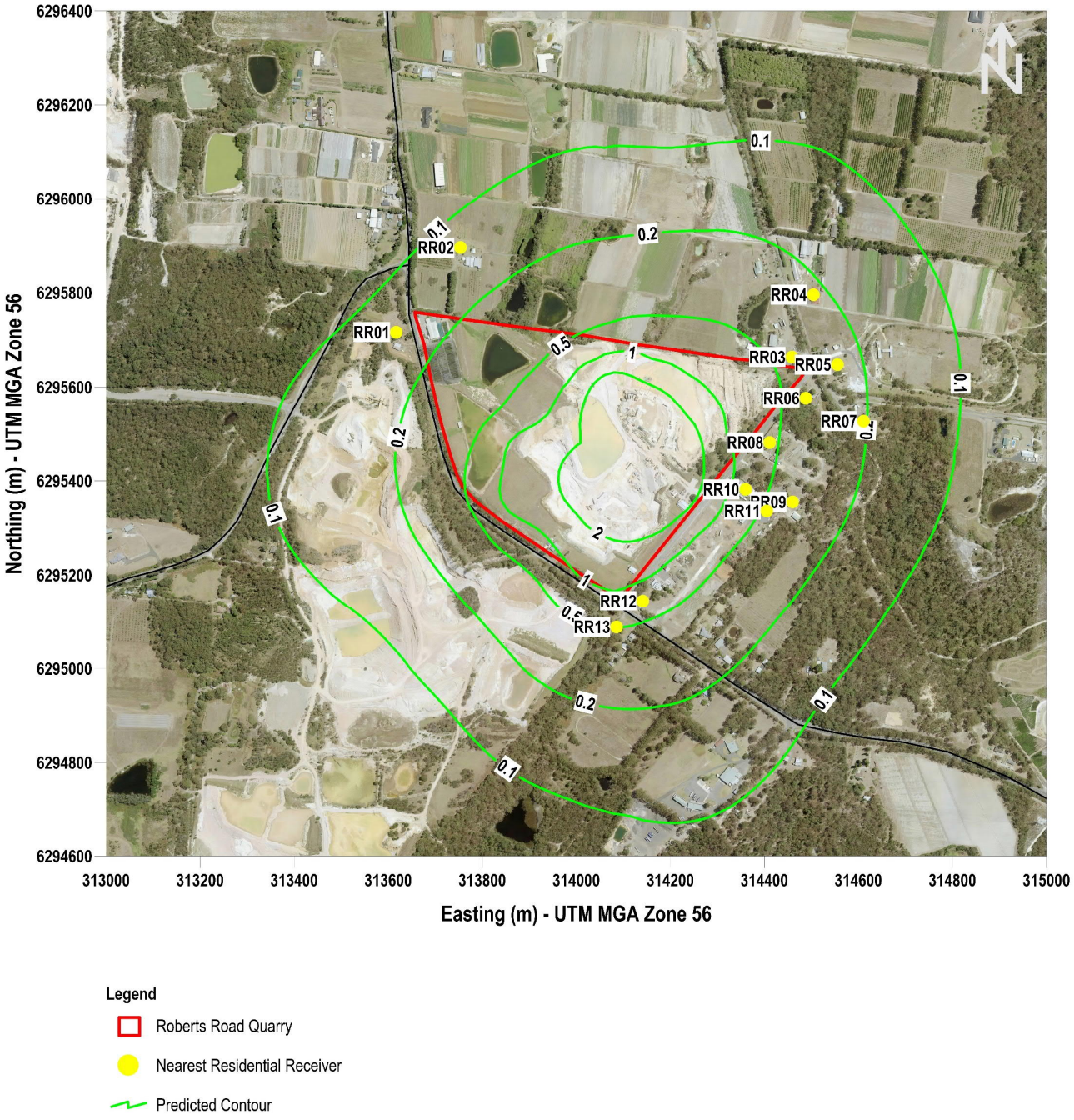
Annually averaged maximum deposited dust (g/m²/month), site contribution only (existing)



Annually averaged maximum deposited dust (g/m^2/month), site contribution only (proposed, north)

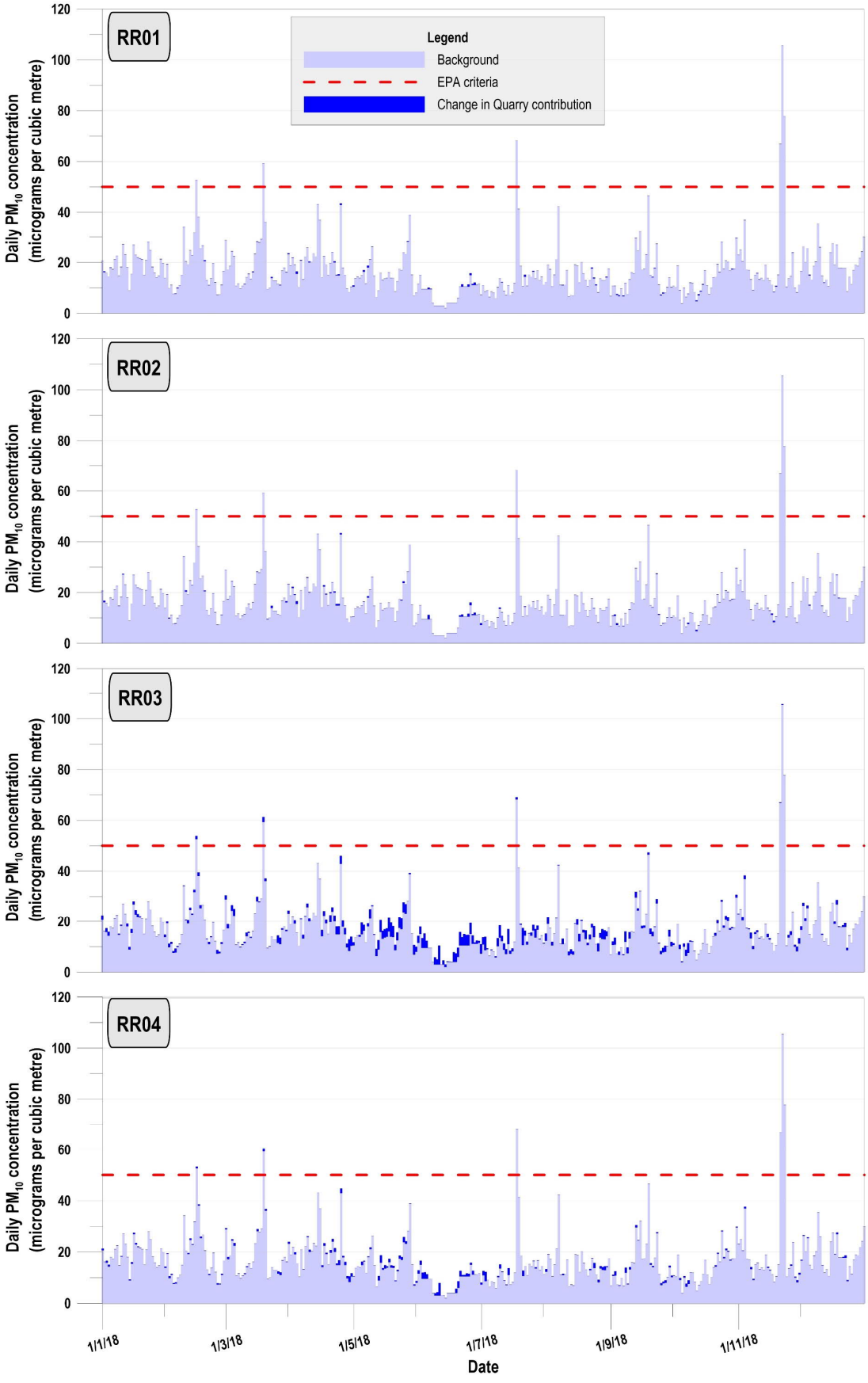


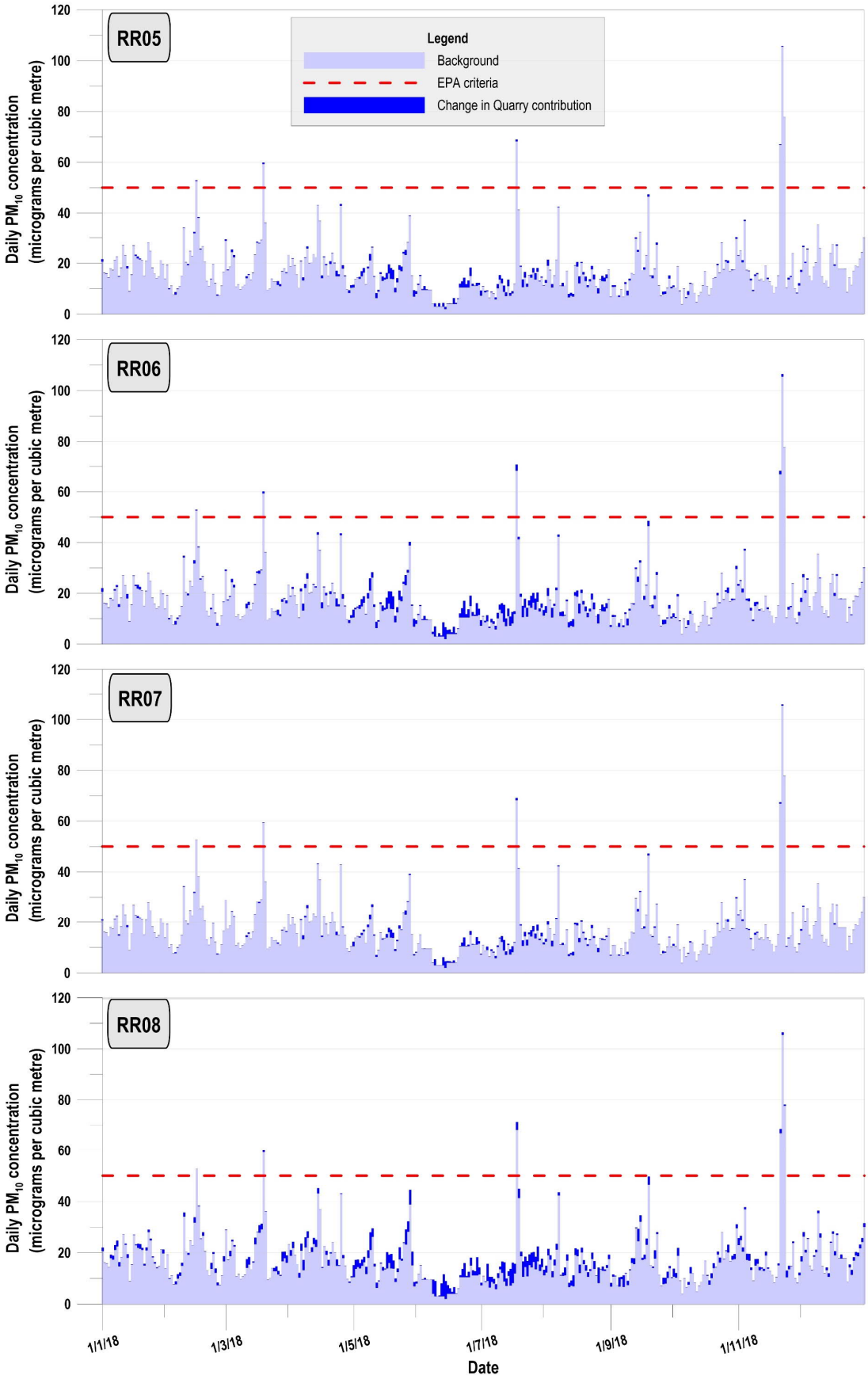
Annually averaged maximum deposited dust (g/m²/month), site contribution only (proposed, south)



Appendix C. Time-series plots, daily PM_{10} and $PM_{2.5}$

24-hour averaged PM_{10}, $\mu g/m^3$, proposed (north)




RR05
RR06
RR07
RR08
Legend
Background
EPA criteria
Change in Quarry contribution
Daily PM10 concentration (micrograms per cubic metre)
0
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1/5/18
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1/11/18
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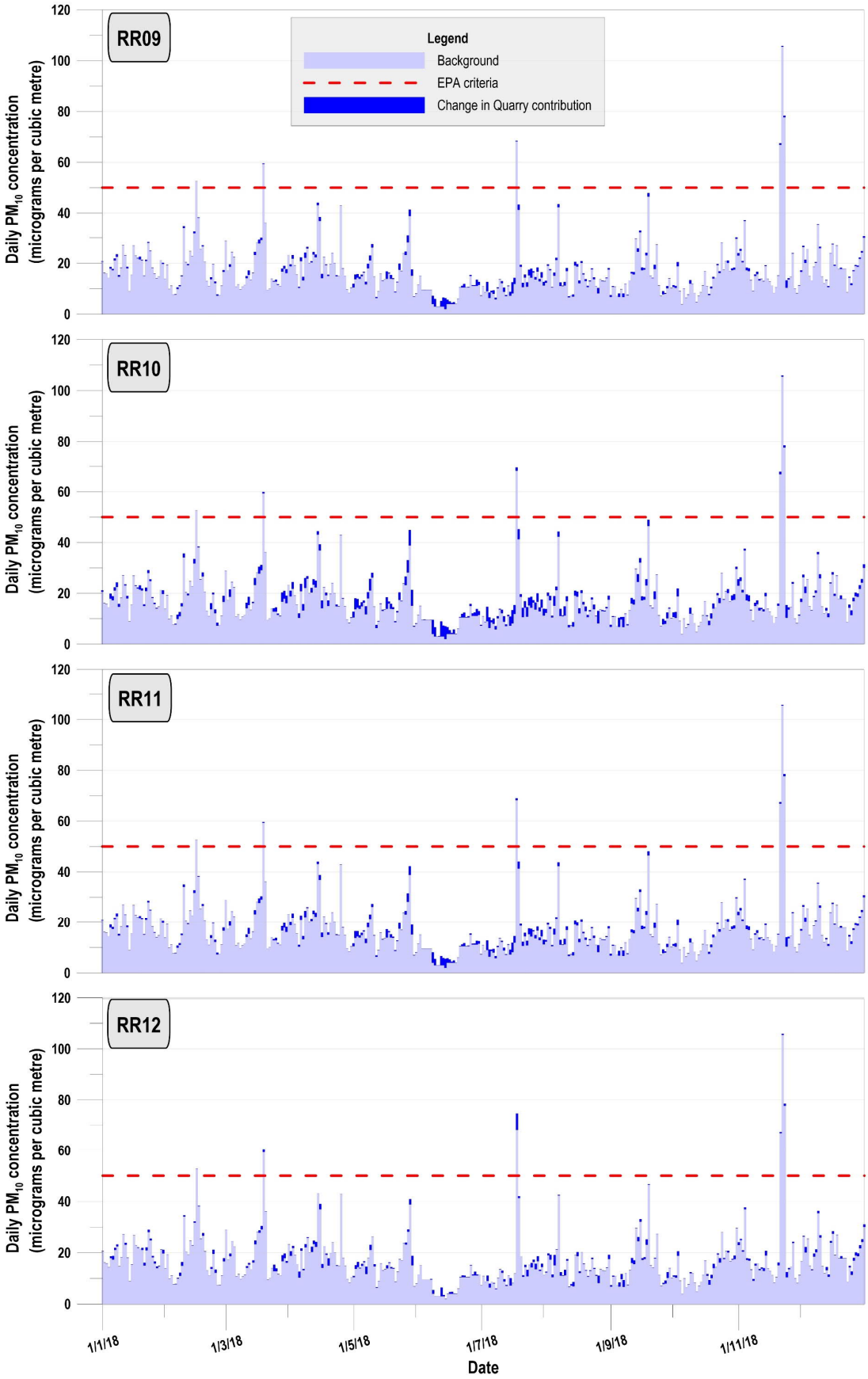
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EPA criteria
Change in Quarry contribution
Daily PM10 concentration (micrograms per cubic metre)
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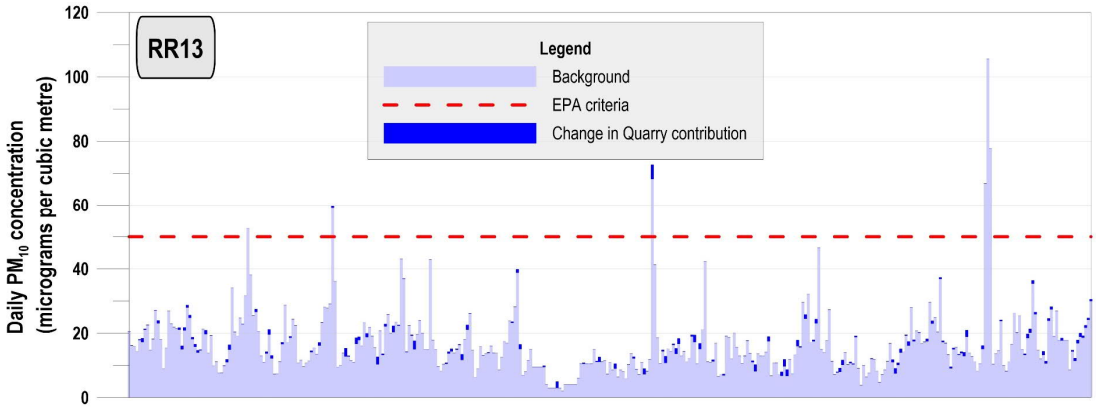
RR13
Legend
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EPA criteria
Change in Quarry contribution
Daily PM10 concentration (micrograms per cubic metre)
120
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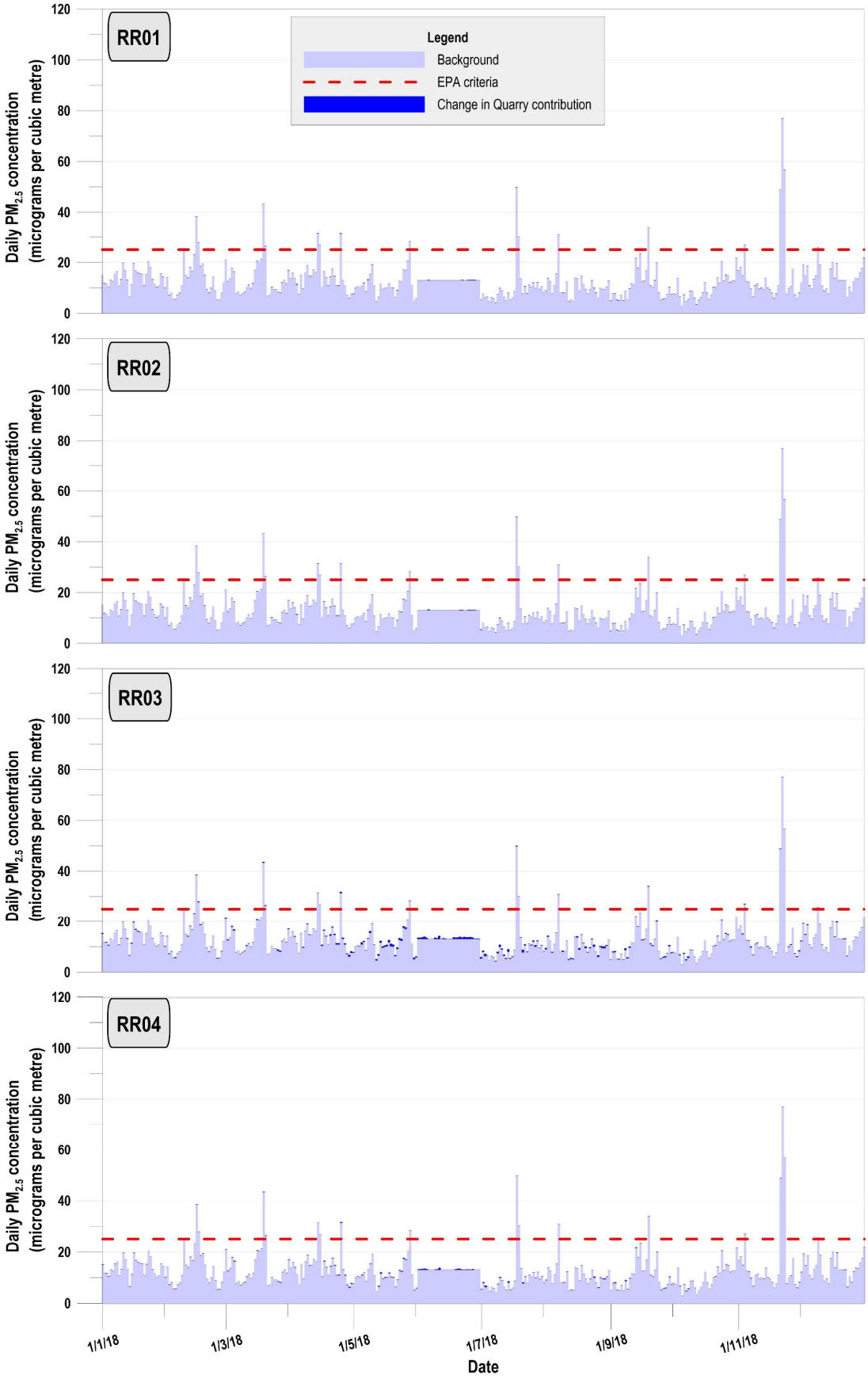
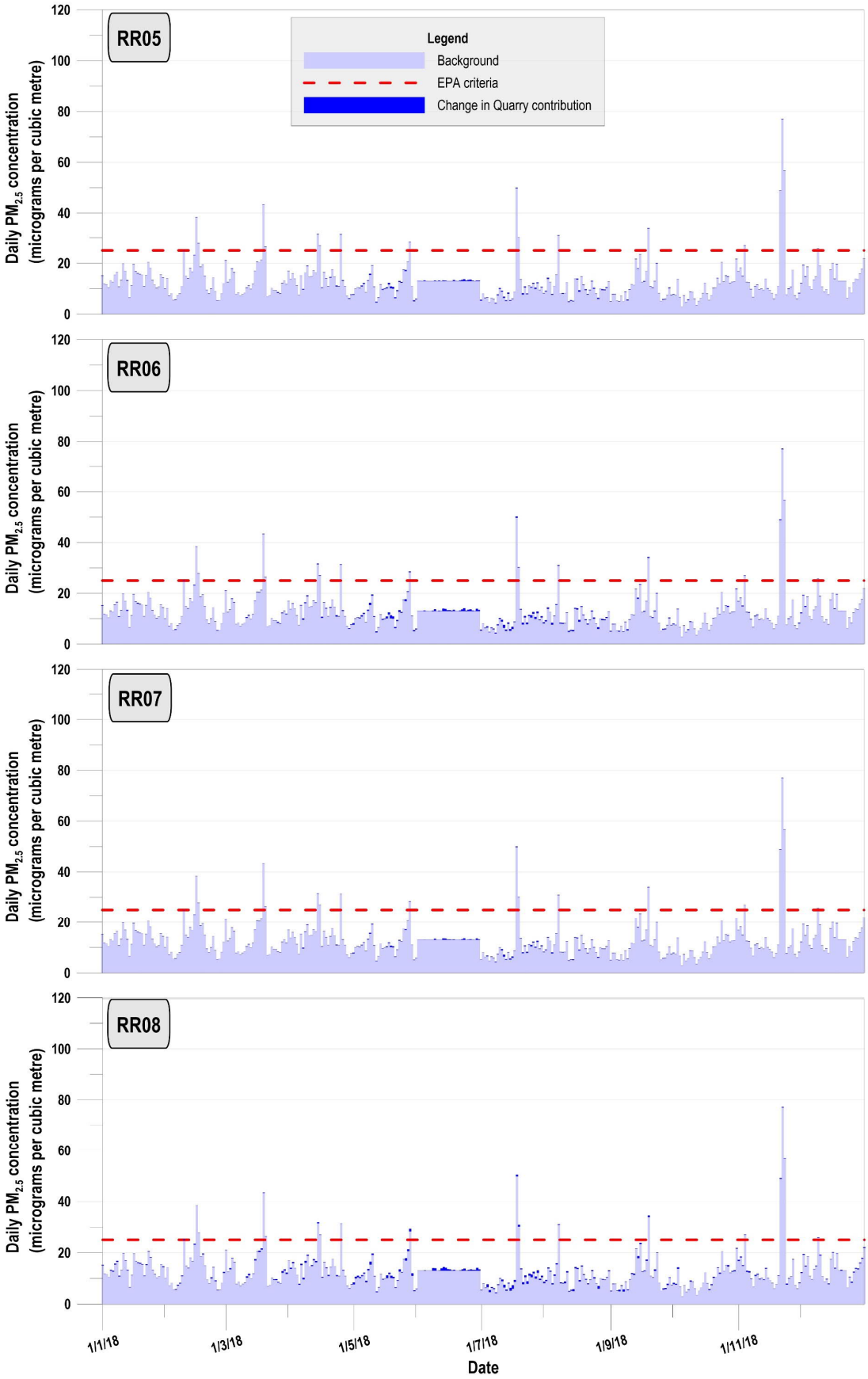
24-hour averaged $PM_{2.5}$, $\mu g/m^3$, proposed (north)

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Change in Quarry contribution
Daily PM2.5 concentration (micrograms per cubic metre)
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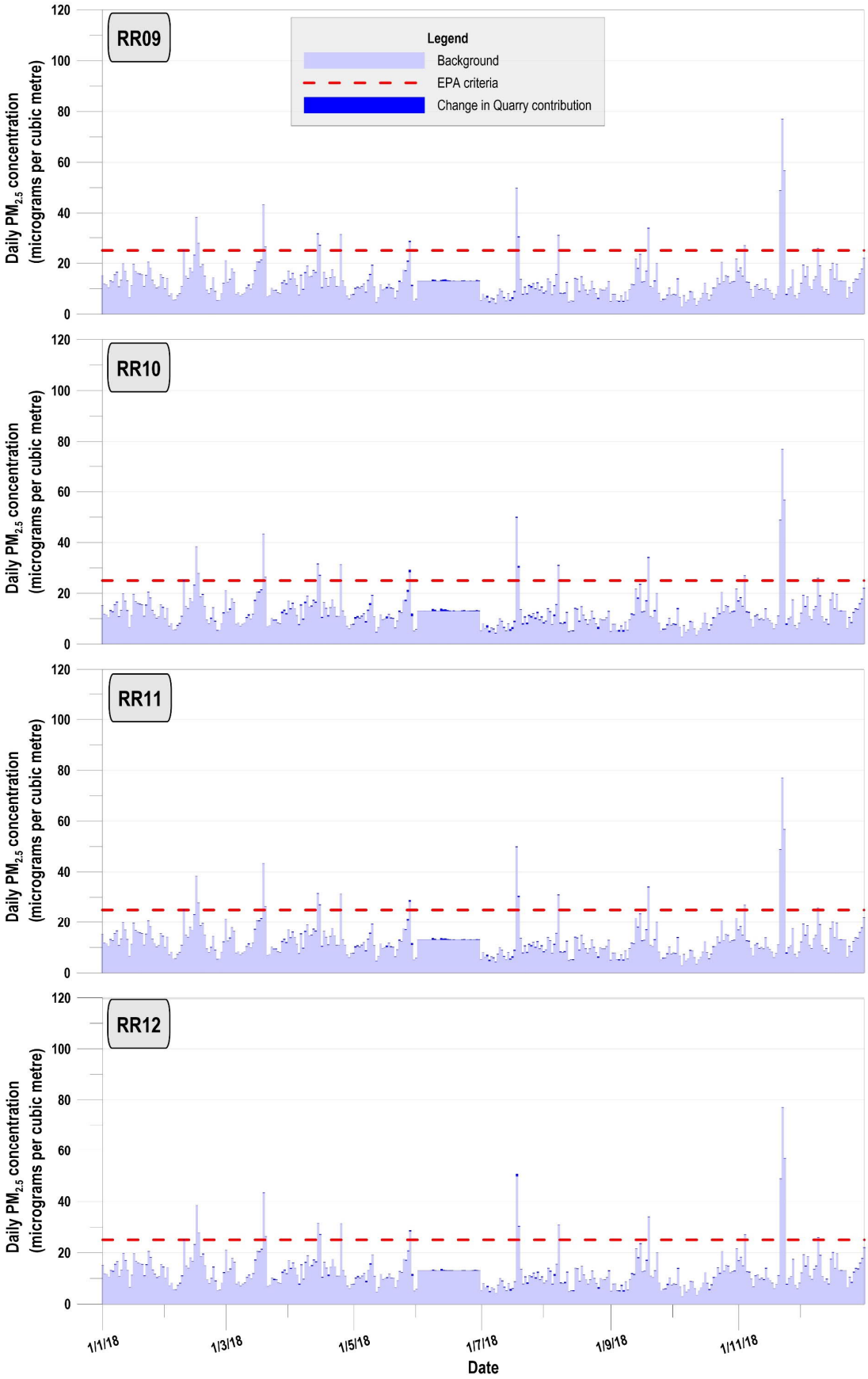
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EPA criteria
Change in Quarry contribution
Daily PM2.5 concentration (micrograms per cubic metre)
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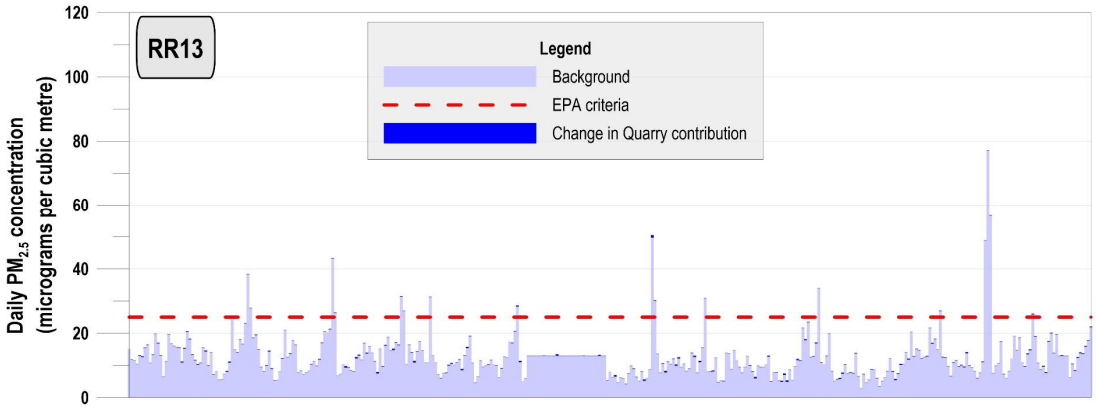
RR13
Legend
Background
EPA criteria
Change in Quarry contribution
Daily $PM_{2.5}$ concentration (micrograms per cubic metre)
120
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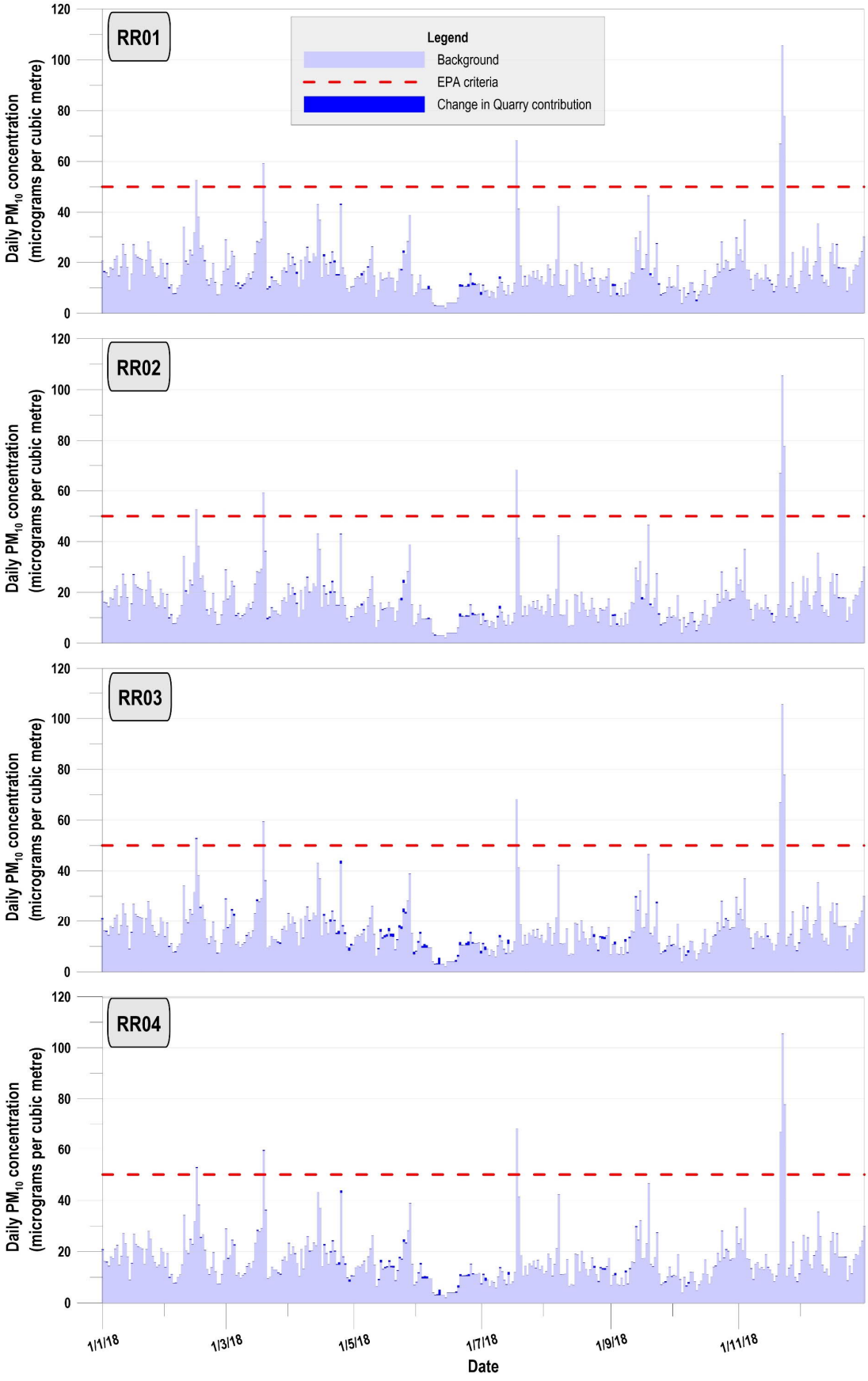
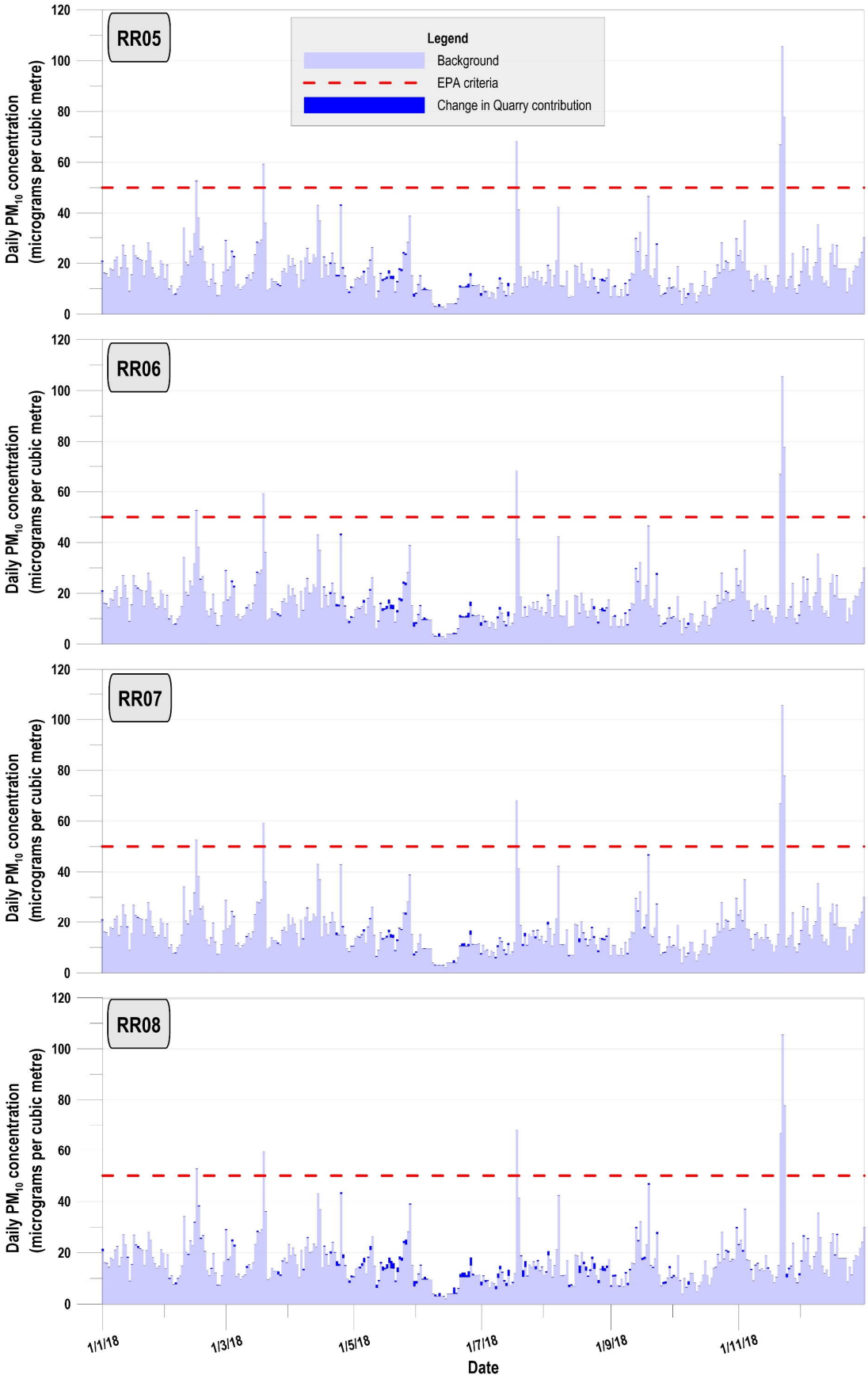
24-hour averaged PM_{10}, $\mu g/m^3$, proposed (south)

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Legend
Background
EPA criteria
Change in Quarry contribution
Daily PM10 concentration (micrograms per cubic metre)
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1/5/18
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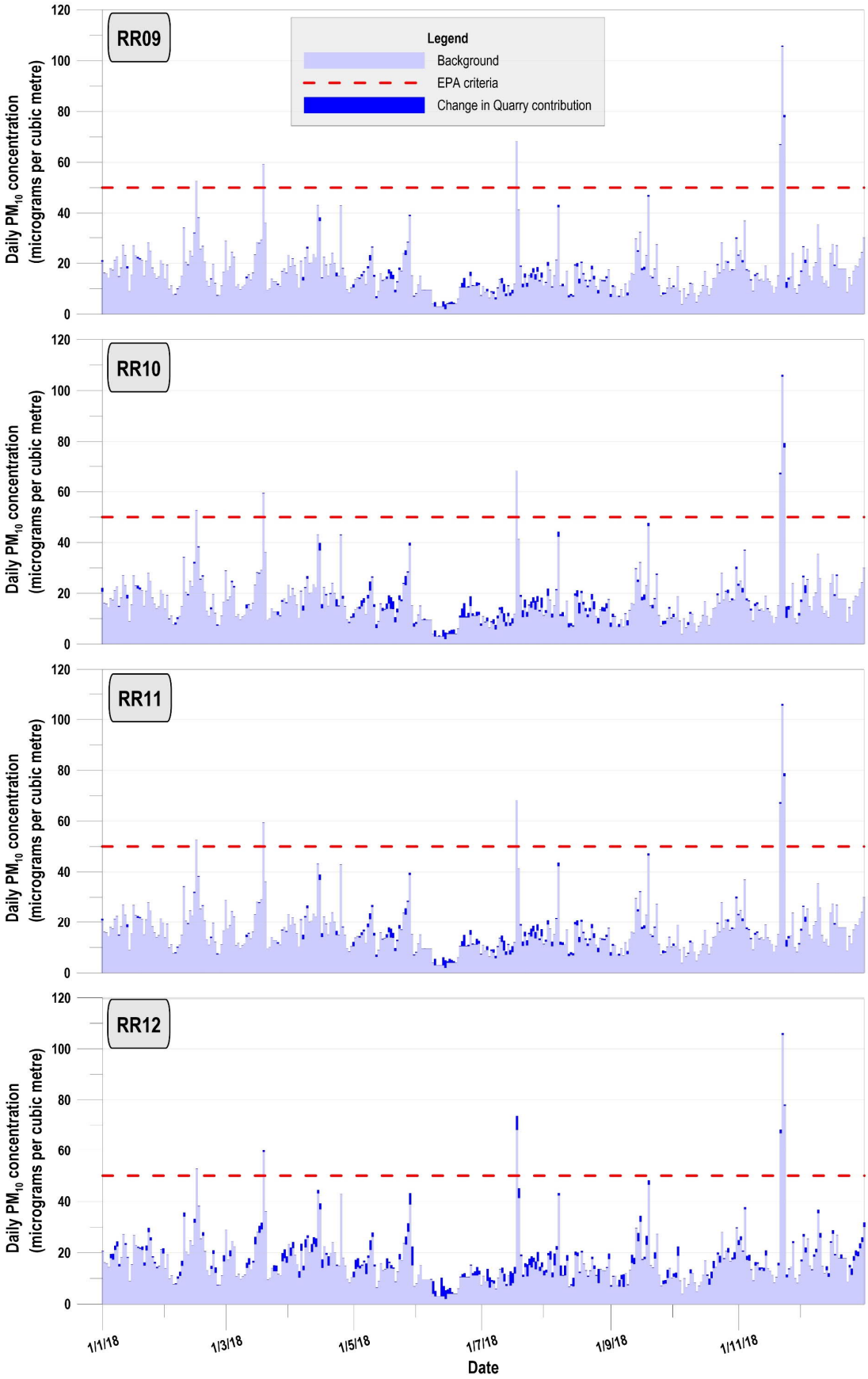
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Legend
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EPA criteria
Change in Quarry contribution
Daily PM10 concentration (micrograms per cubic metre)
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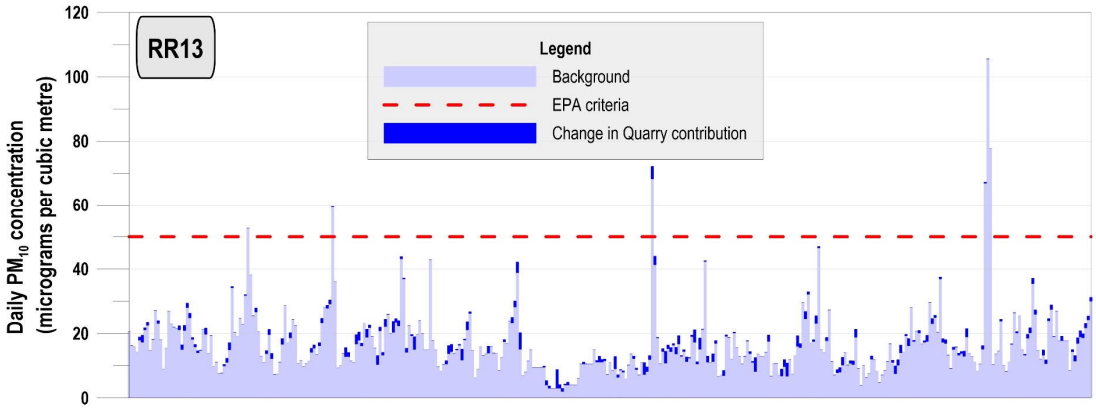
RR13
Legend
Background
EPA criteria
Change in Quarry contribution
Daily PM10 concentration (micrograms per cubic metre)
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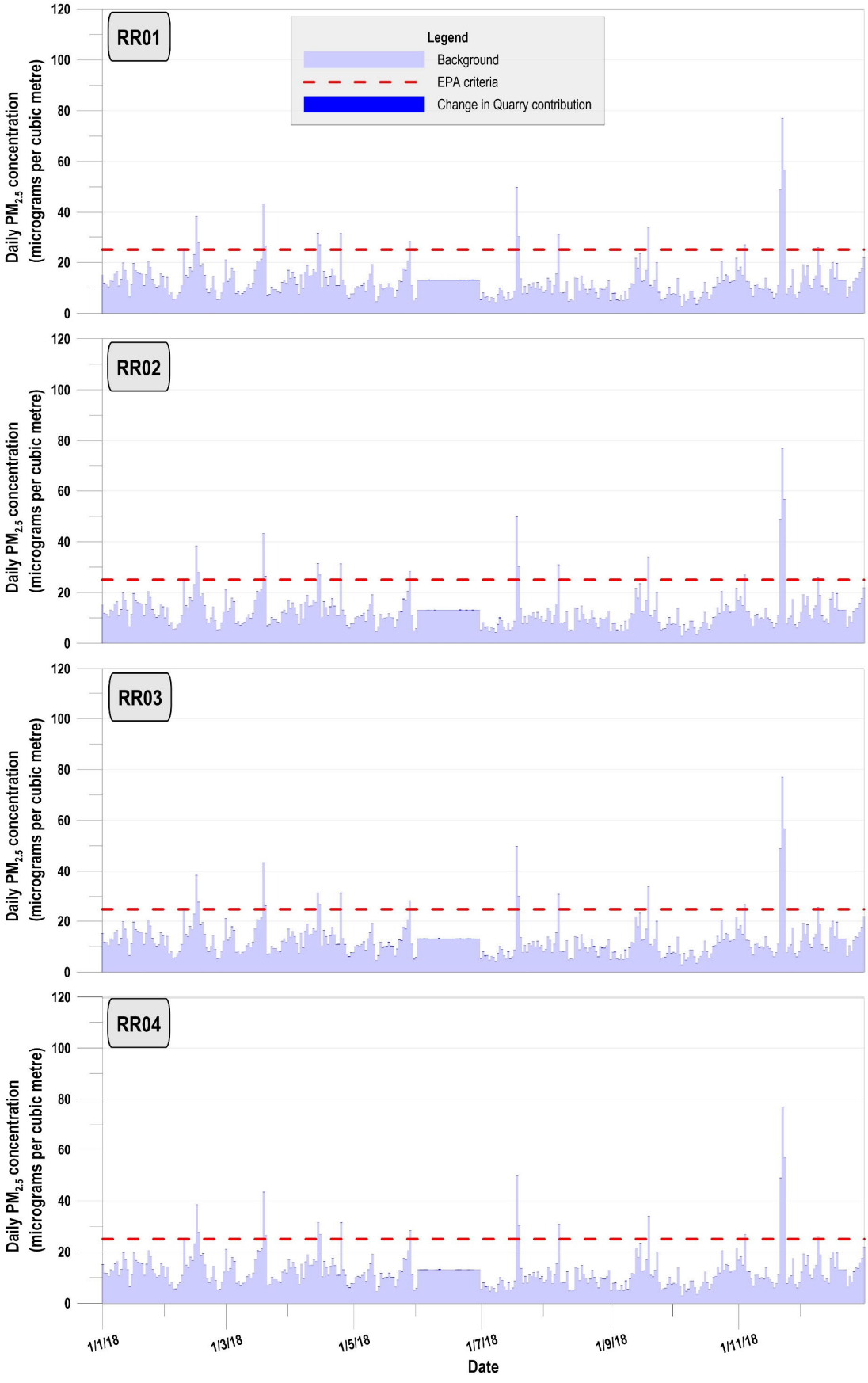
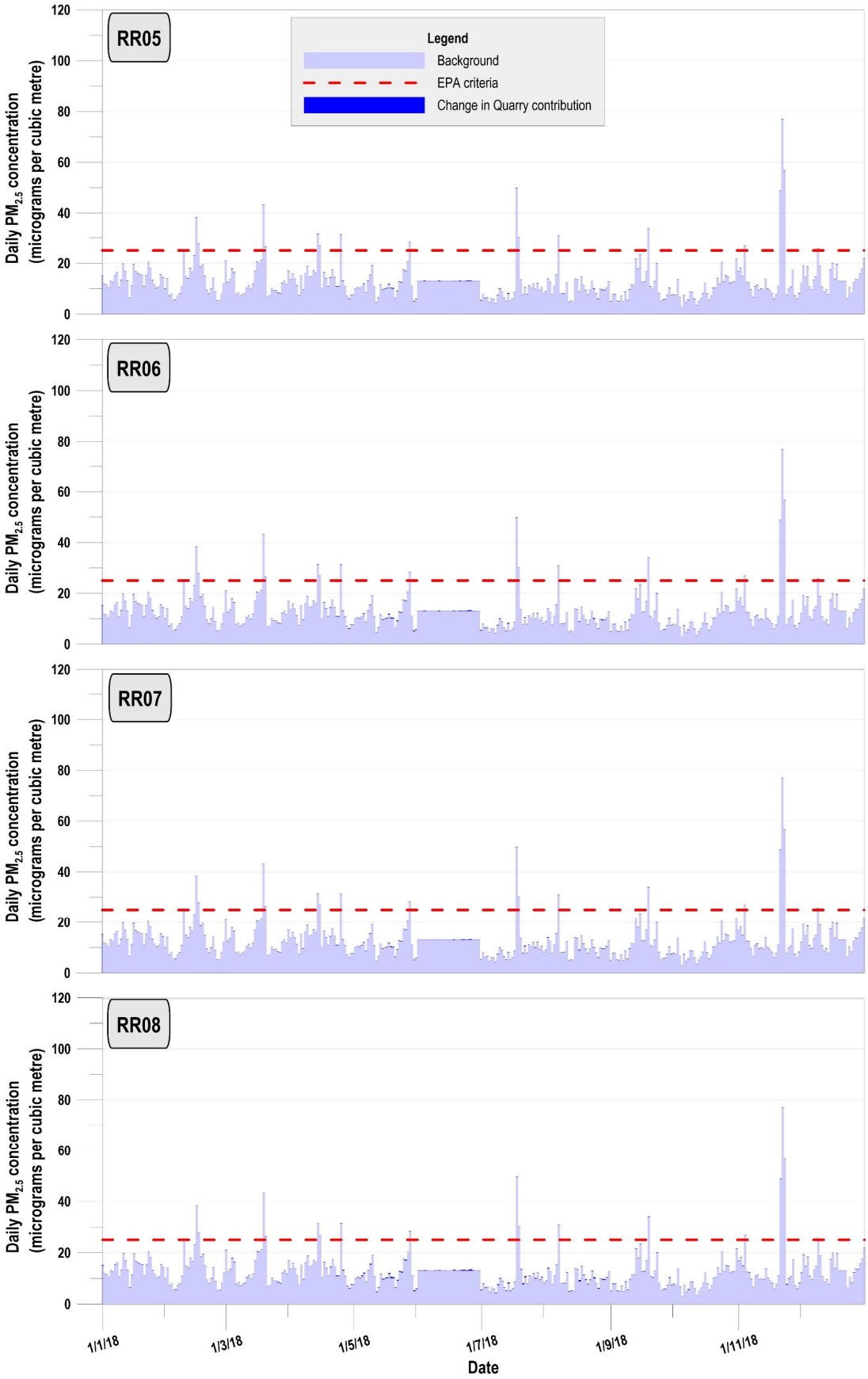
24-hour averaged $PM_{2.5}$, $\mu g/m^3$, proposed (south)

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EPA criteria
Change in Quarry contribution
Daily PM2.5 concentration (micrograms per cubic metre)
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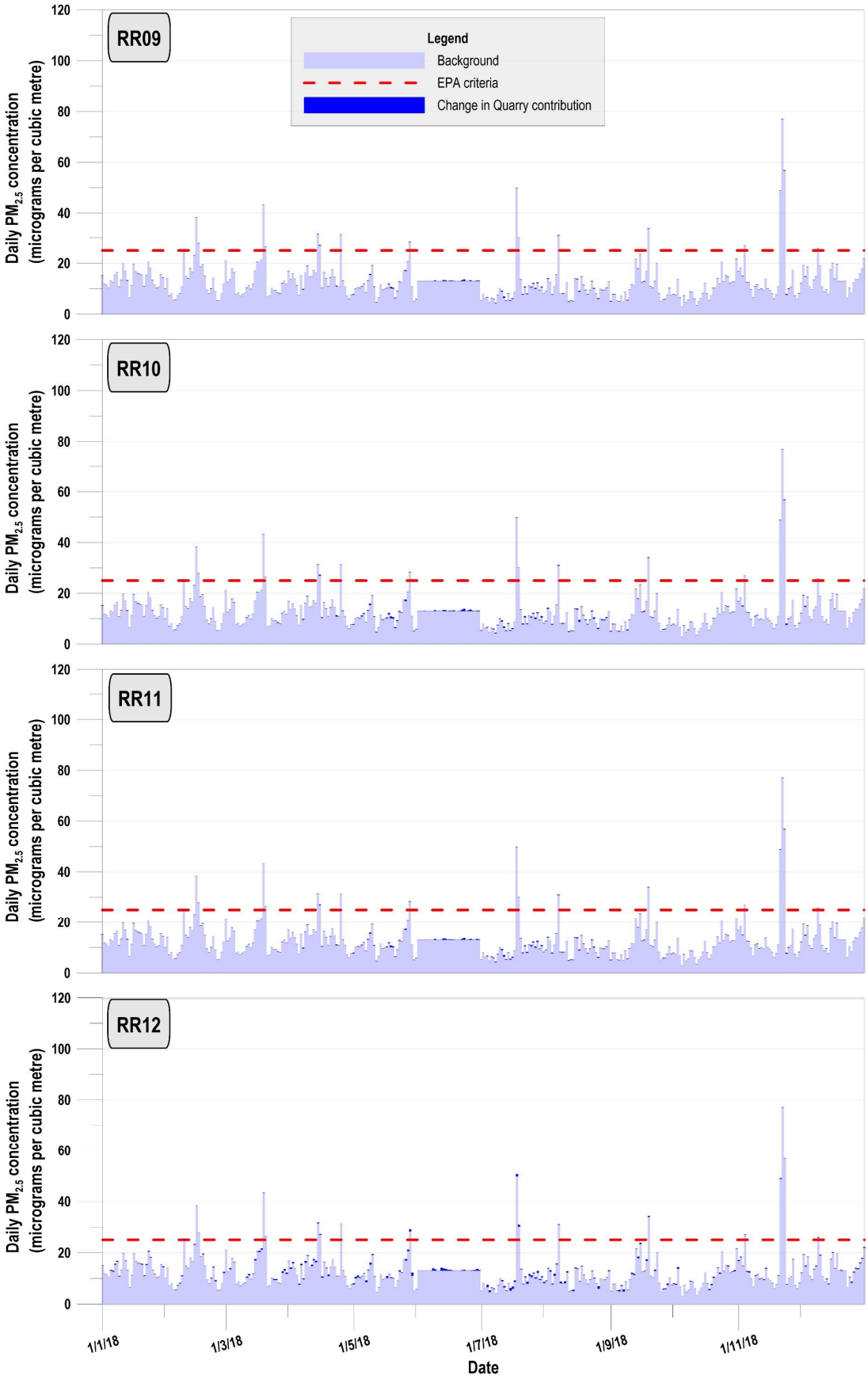
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EPA criteria
Change in Quarry contribution
Daily PM2.5 concentration (micrograms per cubic metre)
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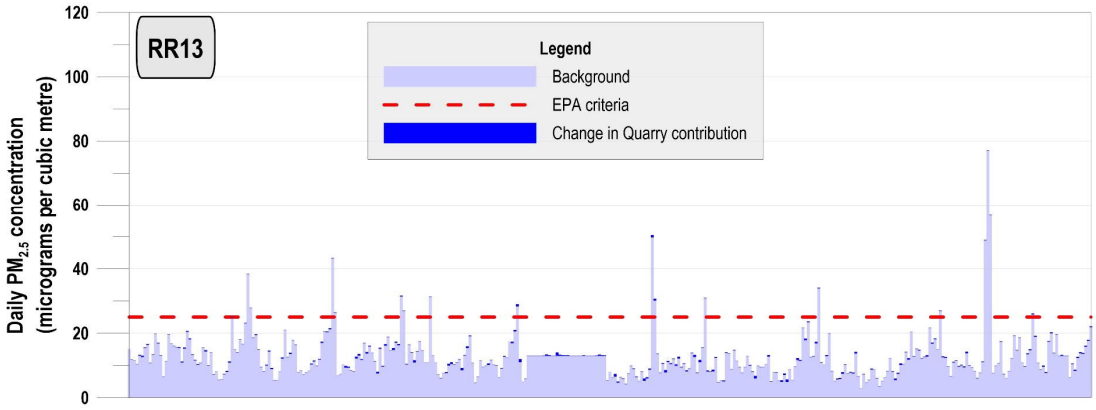
Date


RR13
Legend
Background
EPA criteria
Change in Quarry contribution
Daily $PM_{2.5}$ concentration (micrograms per cubic metre)
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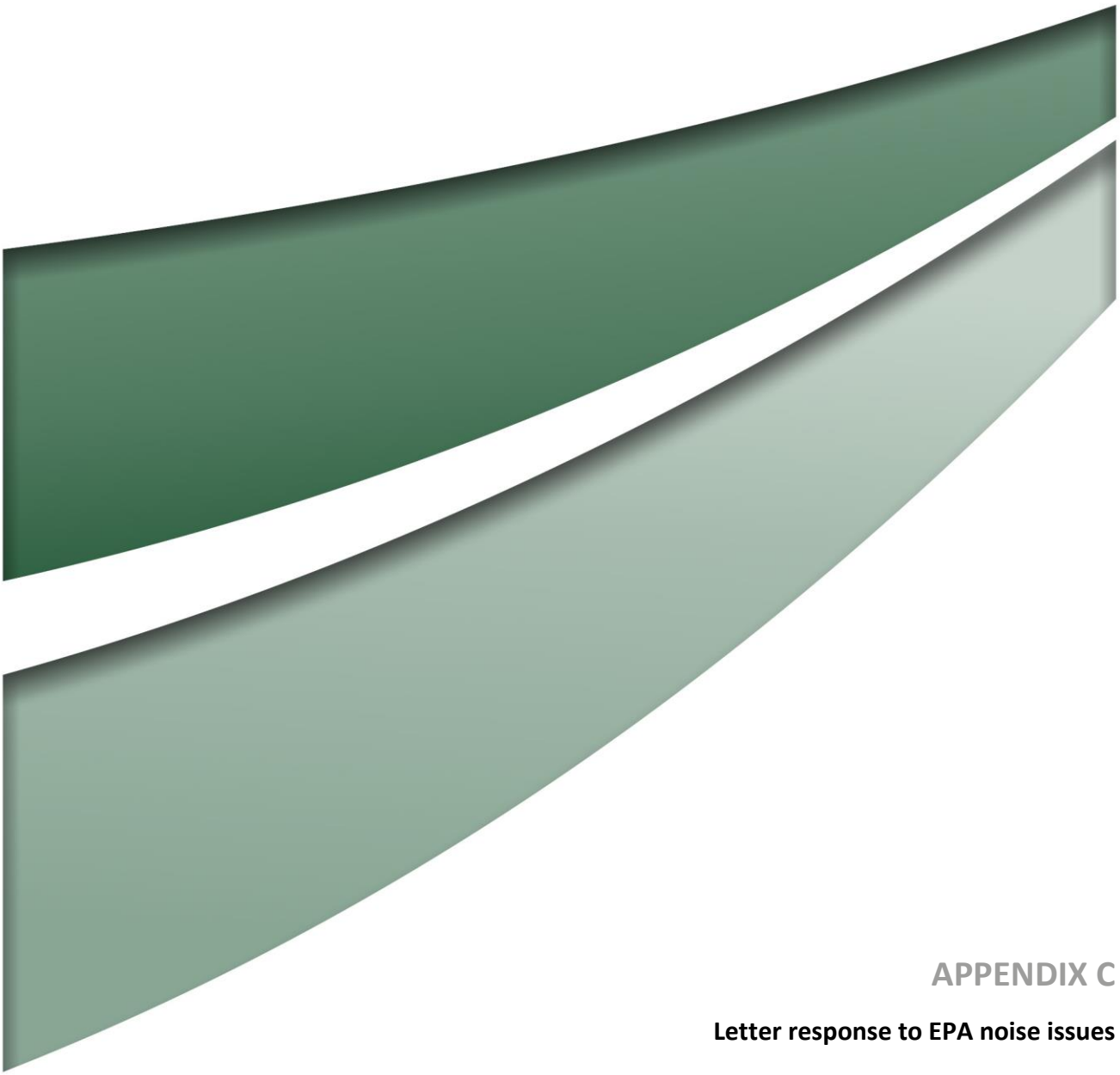

APPENDIX C

Letter response to EPA noise issues

Inspired People
Dedicated Team
Quality Outcomes

Our Ref: 4465_RTS_Noise response_20200319a_ltr

19 March 2020

Mr Caleb Ferry
Department of Planning, Industry and Environment

E| caleb.ferry@planning.nsw.gov.au

Dear Caleb

Re: EPA Response to Roberts Road Quarry Modification 4 (DA267-11-99-Mod-4)

We refer to the letter from the EPA to DPIE dated 3 February 2020 (Ref: DOC20/6390, Your Ref. DA267-11-99-Mod-4). Our responses to the EPA's comments are provided in **Table 1** below.

We also refer to the letter from the EPA to Umwelt dated 24 April 2019 (Ref: DOC19/313616-1) (copy attached).

Roberts Road Quarry MOD2 was assessed in 2016 in accordance with the Industrial Noise Policy (EPA, 2000) and approved on 18 March 2016 (DA267-11-99). The applicable noise limits for the Project were given in Development Consent Condition 47. The Environment Protection Licence (EPL) 6535 was not updated at that time.

The Noise Impact Assessment (NIA) completed by Umwelt for MOD4 has demonstrated that the quarry can continue to comply with the noise limits specified in DA267-11-99. The noise modelling undertaken for the NIA predicted the activities associated with MOD4 could result in a minor exceedance of 1 dB(A) of the existing noise limits at one residence under worst-case conditions if appropriate noise controls are not implemented .

The Proponent understands the implication of the noise modelling results and proposes to operate the facility, including MOD 4, within the noise limits currently imposed in DA267-11-99. This will be achieved through adherence to the noise control strategies outlined in the Quarry's Operational and Road Noise Management Plan, which will be updated as necessary.

Accordingly, the Proponent requests that the EPL be updated to reflect the noise limits specified in DA267-11-99.

We trust this information meets with your current requirements. Please do not hesitate to contact the undersigned on 1300 793 267 should you require clarification or further information.

Yours sincerely

Dave Davis
Principal Acoustician

Newcastle | Orange | Sydney | Canberra | Brisbane | Perth

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E| info@umwelt.com.au

www.umwelt.com.au

Umwelt (Australia) Pty Limited
ABN 18 059 519 041

Table 1 Responses to EPA comments, letter 3 February 2020

Issues Identified	Response
The Wilkinson Murray noise monitoring was based on short term attended monitoring only. An analysis of the data presented within the report shows that the quarry operation at the time of the monitoring significantly increased the background noise level in the area by 5 - 10 dBA. Providing licence limits for the current modification application will need to be based on up to date noise levels that are obtained as per the most recent EPA noise policy documentation, namely the Noise Policy for Industry (NPfI) (EPA, 2017). The Umwelt Report has been not based on the NPfI. It is possible that there would be significant changes in the Project Trigger Noise Levels (PNTLs) derived under NPfI assessment.	The Project noise limits are specified in the Development Consent Conditions. It is not necessary to derive Project Trigger Noise Levels in accordance with the Noise Policy for Industry if the proposed modification can achieve the currently approved noise limits.
The Wilkinson Murray report recommended changing the licence conditions from the outdated L10 metric to an LAeq level. However, this was not adopted at the time. As outlined within the NPfI transition policy, the NPfI should be applied to this application. The relevant section of the transition policy is presented below: *4. The Noise Policy for Industry (2017) will be used to assess and develop requirements for existing industrial developments/activities under the circumstances and through the processes described in points 5 and 6 below.* *5. Modification to a planning approval: a. where the planning authority requires a noise impact assessment to support the modification;* As per the above, we would expect that Umwelt undertake an assessment as per the NPfI for this development, including derivation of Project Noise Trigger Levels in LAeq	The noise limits in the Development Consent Conditions are given in terms of the contemporary noise level descriptor LAeq(15 minute). The EPL, if updated to reflect the current Development Consent Conditions, will also present the noise limits in terms of the current noise level descriptor.
All of the recommendations contained within the Wilkinson Murray report were to enable compliance with their assessment under the Industrial Noise Policy (INP, EPA, 2000). As an assessment under the NPfI may lead to different/lower PNTLs, Umwelt's assumption of existing compliance may not be valid because the existing noise levels from the site may be over the targets that would be derived from the NPfI.	The PNTLs are not relevant to the current MOD4 as the Project noise limits are specified in the Development Consent Conditions.
The modelled noise levels in the Wilkinson Murray report have been used as a basis for the Umwelt NIA assessment. We also note that the Umwelt NIA has used the "typical" noise level assessment from the Wilkinson Murray report, rather than the worst case scenario. Umwelt have not addressed the frequency or impact of the worst-case noise levels presented within Table 5.5 of the Wilkinson Murray report. The proposed additional operations, in conjunction with the worst case noise levels may lead to significant increases over the NPfI PNTLs.	Acknowledged Incorrect. The WM report presented the 'typical' *worst-case* noise levels when the combination of noise sources in alternative locations resulted in the highest total noise levels at receivers, and Umwelt has adopted those predictions as the basis for the MOD4 NIA (Section 4.1.2, paragraph 2) The noise sources considered in the WM report in the rightmost two columns in Table 5-5 (the dozer and the excavator) are the same items of plant that have been modelled in different locations for the current proposed MOD4 NIA. Since these noise sources cannot be in both places at the same time, Umwelt's noise modelling has correctly combined the 'typical worst-case' noise levels from the WM modelling with noise from the proposed new locations of the dozer and the excavator. The predicted combined noise levels in the Umwelt report Table 5.1 are substantially less than the noise levels in the rightmost two columns of the WM report Table 5-5, which were predicted with the same noise sources in different locations.
Neither of the assessments consider adverse meteorological conditions. Assessment of all meteorological conditions is important as they can affect the noise levels at the receivers (by increasing them). Due to the distances between the development and the receivers, this may impact some residents more than others. However, this has not been assessed within either report.	The WM report Section 5.1 provided justification for predicting noise levels under neutral meteorological conditions only, based on analysis of weather data collected near the site (Maroota). The Proponent is not seeking to modify the project noise limits or the specified meteorological conditions under which the noise compliance measurements are considered to be valid.

umwelt
Environmental & Social Consultants

Newcastle | Perth | Canberra | Brisbane | Sydney | Orange

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