Witness Statement - Planning Panel Hearings Whittlesea Planning Scheme, Amendment C241

1. Name and Address

Mr Valeri V Lenchine

c/- GHD 180 Lonsdale Street Melbourne

2. Qualifications and Experience

- PhD, Samara State Aerospace University, 1997
- MS, Samara State Aerospace University, 1993

Membership:

- Australian Acoustical Society
- Acoustical Society of America

Professional Experience

- 2018 – present: Technical Director- Noise & Vibration, GHD
- 2008-2018: Principal Noise Adviser, SA EPA
- 2006-2008: Senior Engineer (Acoustics and Vibration), VIPAC Engineers and Scientists
- 2002-2005: Senior Research Engineer (Acoustics and Vibration), Samsung Electronics
- 1991-2002: Different positions in industry and academia

3. Areas of Expertise

I specialise in noise and vibration assessments, monitoring and compliance checks. In the last 15 years, I have conducted many noise and vibration impact assessments for existing and proposed industries with the potential for off-site noise and vibration impacts. I have assisted with the development of many regulatory documents that are intended to protect sensitive land uses from noise and vibration impacts.

4. Expertise to Prepare Report

I have prepared many noise and vibration impact assessments as relevant to industrial, infrastructure, mining, and residential developments. I have applied relevant guidelines and regulatory documents to recommend relevant buffer and noise and vibration mitigation solutions. I have contributed to planning development plans and amendments as a noise and vibration specialist.

5. Instructions which defined Scope of Report

I received instructions from Harwood Andrews acting for the Victorian Planning Authority (VPA) to prepare expert evidence in relation to the upcoming panel hearing for Amendment C241, with regard to the nature of noise and vibration buffers and separation distances from the Woody Hill Quarry within the PSP area; and the Phillips Quarry adjacent to the south boundary of the precinct. I have reviewed results of noise and vibration impact predictions prepared by GHD previously (2017-2019).

The assessments were to be used by City of Whittlesea (CoW) and the VPA to inform a detailed precinct-based design that will respond to the constraints on future land use posed by the operations of the two quarries.

6. Facts, Matters, and Assumptions Relied Upon

- Review of information provided by CoW, VPA, and EPA Victoria (EPA)
- Review of documents in the brief supplied by Harwood Andrews
- My experience relevant to noise and vibration impact assessments
- My experience relevant to recommended separation distances for industrial and noise sensitive developments

7. Documents to be taken into Account

- GHD December 2017 report #51460
- GHD, April 2018 report #70468
- GHD, September 2019 report # 69174
- GHD Addendum letter October 2020 #12540645-94455-2

8. Identity of Persons Undertaking Work

- Val Lenchine and Craig McVie

9. Summary of Opinions

- The substantive portion of my statement has resulted from the three GHD reports #51460, #70468 and #69174

10. My opinions are not provisional except where specifically qualified.

11. The analysis presented in this report is within my area of expertise.

12. I declare that I have made all enquiries that I believe are desirable and appropriate, and that no matters of significance have been withheld from the Panel.

Regards

GHD

Val Lenchine
Technical Director- Noise & Vibration
28 October 2020

Attachments: GHD December 2017 report #51460

GHD, April 2018 report #70468

GHD, September 2019 report # 69174

GHD Addendum letter October 2020 #12540645-94455-2

28 October 2020

Our ref: 12540645-90721-10
Your ref:

Amendment C241wsea Whittlesea Planning Scheme - Shenstone Park PSP - Air and Noise Expert Witness
Noise and vibration buffers- Addendum Letter

1 Introduction

I was engaged by Harwood Andrews, who are acting on behalf of the Victorian Planning Authority (VPA), to provide expert opinion in relation to the Whittlesea Planning Scheme Shenstone Park Precinct Structure Plan (PSP). The upcoming panel hearing for Amendment C241wsea (the Amendment) to the Whittlesea Planning Scheme Shenstone Park Precinct Structure Plan seeks to incorporate the PSP into the Whittlesea Planning Scheme.

GHD understands that VPA has prepared a draft Precinct Structure Plan, including Buffers, Noise, Amenity, a Measurement Length Plan, and a Draft Future Urban Structure. The PSP and the Amendment were made available for public exhibition between October 2019 and November 2019. Many submissions were received from different stakeholders during the consultation period.

GHD performed buffer evaluation studies for Woody Hill Quarry operations, which are located in the Shenstone PSP zone. The VPA has engaged GHD to provide expert evidence with regard to the required buffers from the Woody Hill Quarry within the Precinct Structural Plan (PSP) area; and the adjacent Phillips Quarry to the south east boundary of the precinct.

This addendum letter covers the buffer/separation distance matter in relation to noise and vibration only and is based on the information made available to provide the expert evidence.

In relation to expert evidence, I, Valeri Lenchine, have been instructed by Harwood Andrews acting for the VPA to:

- Prepare a report in writing detailing my opinions in respect of:
  - Quarry Impact Assessment - Addendum - GHD - September 2019
  - Quarry Impact Assessment - GHD - December 2017
  - Exhibited Shenstone Park Precinct Structure Plan – October 2019
  - An assessment of noise and vibration buffers
  - The required buffer distance to meet different noise and vibration criteria
  - Analyse factors that influence buffer recommendations
  - The types of land uses that could occur within the buffers and influence the recommended separation distances
  - An opinion on the starting point for the measurement of the buffer distance

- An expert opinion of the distance(s) which the panel should recommend as the buffer distance for the Precinct
- Consideration of submissions to the amendment regarding different buffer distances

2 Review of exhibited amendment and background materials

I have reviewed the relevant exhibited amendment and background material including the following:

- Quarry Impact Assessment - Addendum – GHD, September 2019
- Shenstone Park Impact Assessment. Woody Hill Addendum – GHD, April 2018
- Quarry Impact Assessment – GHD, December 2017
- Exhibited Shenstone Park Precinct Structure Plan – October 2019
- Submissions and tabled documents available as of 20 October 2020

2.1 Impact Assessment Report for the Shenstone Park Precinct Structure Plan (GHD, December 2017)

GHD was engaged by City of Whittlesea (CoW) to prepare an Impact Assessment Report for the Shenstone Park Precinct Structure Plan (PSP) and associated investigation area to the south and east of the PSP boundary. In relation to the quarries, the assessment considered noise and vibration impacts at the following sites:

- Existing Barro Group Woody Hill Quarry (WA 492) located within the Shenstone Park PSP boundary
- Approved basalt quarry (Phillips Quarry WA 160) located immediately south of the Shenstone Park PSP boundary

The assessment was prepared to inform a detailed precinct-based design that would identify buffer requirements for future noise sensitive land uses impacted by the operations of the two quarries.

Operation of the quarries are required to meet noise criteria based on the *State environment protection policy – Control of Noise from Commerce, Industry and Trade* No. N-1 (SEPP N-1) (Victorian Government, 1989). The policy is applicable to noise sources in the Melbourne metropolitan area. Since both the quarries are allowed to perform blasting operations, there are additional blast noise and vibration criteria that are not covered by SEPP N-1. Criteria from the ANZEC *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (1990) were suggested as a reference to identify necessary separation distances from the quarries' extraction boundaries. Recommendations in relevant international standards also were utilised to assign vibration criteria from the onsite equipment operations.

GHD assessed the recommended default buffers for the quarries with the following conclusions made:

- Buffer from the Phillips Quarry extraction area to affected noise sensitive receivers should be 300 m or more to meet day time criterion in SEPP N-1.
- Current operations of the Woody Hill Quarry imply a recommended buffer of 900 m due to the elevated position of modelled noise sources.
- Blast operations require a 550 m vibration buffer to meet a long term goal Peak Particle Velocity (PPV) of 2 mm/s. This buffer is suggested on the assumption that the Maximum Instantaneous Charge (MIC) used at the Woody Hill quarry does not exceed 100 kg.
- It is difficult to suggest a buffer in terms of meeting overpressure limits from the blasting operations without further knowledge of the technical detail for blasting operations used at the site including the site constant. It was recommended to perform overpressure measurements to identify the site constant.
- All buffers were identified from the envelope of the extraction boundaries of both quarries. GHD took this envelope to be the envelope of the existing and approved extraction boundaries for the two quarries rather than the Work Authority boundary.

Buffers required to meet the vibration criteria applicable to the operation of onsite equipment and to address the fly rock issue from blasting are substantially less than the distances mentioned above. They are therefore not considered critical for establishing boundaries for future noise sensitive developments.

Meeting the operational noise criterion (day time, 48 dB(A)) is considered to be critical for the buffer requirements, since it evokes the greatest recommended buffer based on impact from the current operations in Woody Hill Quarry.

As details of blasting operations (MIC, noise and vibration site constants) are unknown, it is difficult to suggest an accurate separation distance for the blast noise and vibration. To meet the recommended 115 dB overpressure criterion for a MIC of 100 kg, the separation distance may vary from 500 m to 2.5 km depending on the site constant and a typical site exponent. A separation distance of 550 m is deemed to be sufficient to meet a strict PPV criterion (2 mm/s) for typical site vibration propagation constants, but may be greater or less depending on the actual physical properties of the site. The site constants may be confirmed by measurement of noise and vibration from the current blast operations or calibration charges.

GHD considers that the relevant buffer for the active Woody Hill Quarry area and approved quarry area with blasting should be 900 m. The sensitive developments may occur within the buffer zone if noise mitigation measures at the noise sources (quarries) are implemented, or acoustical treatments are considered for future noise sensitive developments within the buffer zone. It was also recommended to conduct further investigation of impact from blasting operations to inform more accurate assessment of the associated impacts and their influence on the buffer requirements.

Review of the GHD Impact Assessment Report (December 2017) shows that the technical findings in the assessment are still valid. Recommended buffers from the quarries are intended to prevent adverse amenity impact on community and restrict encroachment of noise sensitive land uses within these buffer areas (including land inside and outside of the PSP). Noise and vibration impact (both from typical onsite operations and blasting) may be excessive and not compatible with sensitive land uses.

2.2 Shenstone Park Impact Assessment Woody Hill Addendum (GHD, April 2018)

GHD was engaged by the CoW to predict noise and vibration impacts and provide an update on the recommended buffers for the possible expansion of the Woody Hill Quarry. The following scenarios were considered (refer to Figure 1 of the GHD Impact Assessment report, April 2018):

- An expansion to the south of the existing extraction area within the Work Authority 492 boundary
- An expansion of the Work Authority boundary and subsequently the extraction boundary to the north of the existing Work Authority boundary

The noise assessment was updated taking into account an expansion 20 m below the ground surface (as a pit). It resulted in reduced buffer requirements due to terrain effects. The separation distance required to meet the day time 48 dB(A) criterion in accordance with the SEPP N-1 noise policy was estimated at 600 m, which is 300 m less than in the previous assessment. I consider the results of this assessment remain valid for the modelled scenarios. These recommendations are consistent with findings of the most recent impact assessment (2019) discussed in the next section.

2.3 Shenstone Park Impact Assessment Woody Hill Addendum (GHD, September 2019)

The possible expansion of Woody Hill Quarry and its influence on the Shenstone Structure Plan was further investigated in 2019. GHD was engaged by the Victorian Planning Authority to update the Shenstone Park Impact Assessment Report (GHD December 2017) in accordance with new extraction boundaries. GHD was provided a revised Future Urban Structure plan, which included State Government agency feedback including the Department of Jobs, Precincts and Resources' (DJPR) (Earth Resources) comments. The revised Future Urban Structure plan incorporated an expanded resource extraction area to the east of the existing Woody Hill Quarry based on the extent of extraction area within the Northern Growth Corridor Plan.

The following scenarios were considered (refer to Figure 1 of GHD Impact Assessment report, September 2019):

1. Expansion to the south of the existing extraction area within the Work Authority 492 boundary
2. Expansion of the Work Authority boundary and subsequently the extraction boundary to the north of the existing Work Authority boundary
3. Expansion of the Work Authority boundary and subsequently the extraction boundary to the east of the existing Work Authority boundary (as identified on the Future Urban Structure plan)
4. Expansion 20 m below the ground surface

The site expansion scenarios were modelled to estimate the operational noise impact and predict its compliance with the SEPP N-1 noise limit (criterion). It was assessed that the buffer required to meet the day time noise criterion was 600 m. It should be noted that this buffer is based on the assumption that onsite operation activities that result in the greatest noise output are confined to time periods that can be classified as day time under the SEPP N-1 policy and are not elevated significantly above ground level.

An expansion of the quarry to the west was not considered due to the quarry already being constrained by existing sensitive uses, with the closest resident located approximately 300 m from the current extraction boundary. Results of the modelling show that the quarry should not expand closer to the western residences as predicted noise levels are most likely already close to the applicable limit for the worst case operational scenario.

The 600 m buffer from new extraction boundary was suggested to prevent excessive noise impact from the Woody Hill Quarry. Other buffers are estimated to be smaller than 600 m. It should be noted that details of blast operations, blast noise and vibration propagation constants are unknown. The blast separation distances were determined for average site conditions. Therefore, comments relevant to the blasting operations in the 2017 GHD report (section 2.1 of this evidence) are also applicable to the latest impact assessment (2019). GHD considers findings in the assessment dated September 2019 remain valid unless assumptions in the report are reconsidered in view of additional information or site investigations.

2.4 Exhibited Shenstone Park Precinct Structure Plan – September 2019

GHD has analysed the Shenstone Park Precinct Structure Plan (PSP) dated September 2019. The document suggests amenity buffers (including noise) in section 3.8.4 in the PSP. The buffers in Plan 15 of the PSP are given from the approved extraction boundaries, the possible expansion of operations boundary (Woody Hill Quarry), and the proposed operation area (Phillips Quarry, Water Treatment Plant). They are broadly consistent with the results of the latest GHD Impact Assessment (2019) and the initial impact assessment (2017).

A conservative 600 m noise buffer for future expansion of the Woody Hill Quarry defines the zone outside of which sensitive developments are possible. It is consistent with the 900 m buffer taken from the boundary of current extraction zone of Woody Hill Quarry in the eastern zone of the PSP.

It is understood that a 550 m sensitive use buffer has been derided taking into account few environmental impact factors. This buffer appears to be greater than the 600 m in some parts of Plan 15. Perhaps the sensitive use buffer was defined from different boundaries and takes into account many impact assessment factors. I would recommend that the individual buffers relating to the separate impacts such as blast vibration, noise and air quality be represented in the plan.

The sensitive use buffer 550 m for the Philips Quarry is drawn from the outer boundary of the quarry area and may reflect recommendations for blast generated vibration, however factors taken into account to derive the sensitive use buffer for the quarry are not clearly outlined in the PSP. It should be noted that GHD Impact Assessment (2017) recommended buffers from the approved extraction zone rather than from the outer boundaries of the quarry area. This comment is also relevant to other blast, noise and vibration buffers. As such, buffers in Plan 15 of the PSP represent precautionary approach by widening the buffer zones around the quarry.

It is understood that noise from the proposed water treatment plant is not expected to be significant and it was not assessed. Noise buffers for the plant were not included in the PSP.

I would recommend that clarification be given with respect to “sensitive use” buffers for the quarries. Individual buffers relating to the separate impacts as per the GHD December 2017 and September 2019 reports may be included to provide a conservative envelope for sensitive land uses based on a number of environmental factors to represent the greatest distance recommended by assessment of impact from noise, vibration or air quality.

2.5 Submissions and tabled documents available as of October 2020

Many submissions were available for review as relevant to the Planning Scheme Amendment C241wsea. Due to the large number of submissions, GHD has provided relevant comments regarding the EPA and City of Whittlesea submissions and have responded to the broad themes identified by other submissions.

EPA Submission

VIC EPA is generally supportive of Amendment C241 and the approach taken in determining the appropriate separation distances from existing and proposed industry, and the land uses permitted within these areas. It is understood that the EPA provided its response based on results of GHD's Impact Assessment 2017. The EPA submission is dated by 23 July 2019 and information in the latest GHD report (September 2019) was not available that time.

It is understood that the EPA supports a precautionary method of consolidating both the recommended separation distances established in the assessments by adopting the largest of each suggested buffers.

Consistent with EPA Publication 1518, EPA supports sensitive uses being prohibited in the applied Industrial 1 and 3 Zones, which prohibit certain sensitive land uses including accommodation, child care centres, education centres (other than business college, employment training centre or tertiary institution) or hotels within the Quarry Sensitive Use Buffers.

The EPA recommends that "any development that will accommodate residential or other noise-sensitive uses in the Precinct must be designed and constructed to include noise attenuation measures. These noise attenuation measures must ensure that industrial noise received at new residential or other noise-sensitive uses complies with the requirements of *State Environment Protection Policy (Control of Noise from Industry, Commerce and Trade) No. N-1."* The recommendations deemed to be related to any noise sensitive development within the PSP zone. Operational noise impacts at separation distances above the noise buffers are expected to meet relevant noise criteria and additional noise attenuation measures may not be required.

The EPA also notes that "Plan 15 – *Buffers, Noise Amenity Area & Measurement Length* does not display a noise amenity buffer for the Phillips Quarry, despite one being referenced in the UGZ7. As discussed with Council, EPA recommends removing reference to Phillips Quarry from the noise assessment section of the UGZ7." The latest PSP (September 2019) shows conservative noise buffers from the quarry area boundary, therefore this comment can be considered as resolved. The buffer should form a part of the PSP to indicate a zone of potential high noise impact where additional acoustic treatment for noise sensitive developments may be required.

It should be noted that the EPA submission does not refer to potential noise and vibration impacts from blast operations; however blast impacts may be critical to defining buffers for encroachment of noise sensitive developments to the quarries' boundaries.

City of Whittlesea submission- Planning Scheme Amendment C241wsea

The City of Whittlesea Council notes that erection of new buildings within a 200 m buffer is prohibited and a noise assessment is required for developments within the existing noise buffer around the Woody Hill Quarry. This is a reasonable approach in view that details of blasting operations were not provided. As it was noted in the GHD Impact Assessment (2017), noise sensitive developments within 900 m buffer are possible if noise mitigation measures for the onsite sources are implemented or acoustic treatment is considered for sensitive land uses encroaching upon the quarry boundaries. The same comment is relevant for the 600 m operational noise buffer identified for possible expansion scenarios for the quarry.

2.5.1 Tabled documents

GHD has reviewed the available tabled documents. Ponte lawyers acting on behalf of Barro Group have provided maps showing the current and proposed zoning for the Woody Hill Quarry site. Information in their response is relevant to quarry buffers (Directions 6 and 7).

From review of the provided materials, it appears that the current Works Approval WA 492 area is zoned SUZ4 while WA 6437 to the north is currently zoned FZ with the proposed zoning to be SUZ4.

Woody Hill Quarry

The documents provided show the following:

- WA 492 was approved in March 2003 with the resource being predominantly mudstone
- Work Plan variation of WA 492 was statutorily endorsed on February 3, 2020, for the extension of the extraction area to the south of the existing extraction area of WA 492, with the resource being primarily mudstone
- Work Plan for WA 6437 was statutorily endorsed on August 16, 2019 for the extraction area north and east of the existing extraction area of WA 492 with the resource being primarily basalt, underlain by mudstone
- WA 6437 will be part of an expanded integrated operation of WA 492 and will not operate on a standalone basis
- The resource extracted from WA 6437 boundaries will be processed in the existing area of WA 492
- A concrete batching plant obtained a planning permit in January 2009 and is located at the northern end of WA 492
- In terms of extraction process and processing methods for WA 492 and WA 6437 are confirmed to be:
  - Soil stripped and either hauled directly to rehabilitation areas or stockpiled for later use. Soil and overburden striping involves an excavator loading haul trucks but can also include dozers, scraper and wheel loaders
  - The fresher material will be extracted by conventional drilling and blasting techniques using a tracked hydraulic percussion drill rig and non-electric blast initiation
  - The broken material loaded into dump trucks and taken to a crushing and processing plant
  - All material for crushing and screening to be processed through existing fixed and mobile facilities

Phillips Quarry

The documents provided include the following:

- Planning permit 704901 amended June 20, 2014, was extended and Development must commence by July 8, 2024
- There are no endorsed plans for the permit
- WA 160 previously applied to the site
- WA 6852 was allocated to the Phillips Quarry on September 25, 2018
- WA 6852 covers the whole of the Phillips Quarry property with the resource comprising primarily of basalt
- Phillips Quarry will have its own fixed processing plant

c) Copies of relevant material that would assist the Panel to understanding the existing and proposed extraction limits.

Annexure 6 (b) (vii) A Figure 1, Date 24 September 2018 shows the WA boundaries for WA 492, WA 6437 and WA 6852 along with the extraction area boundaries.

d) Anticipated lifespan of each quarry:

The following was provided:

- The potential extraction life of WA 492 is expected to be more than 30 years
- The potential extraction life of WA 6437 is expected to be more than 25 years
- The potential extraction life of WA 6852 is expected to be more than 50 years

e) Staging and timing of proposed expansions.

With regards to staging, it appears that Barro have commenced WA 492 and expect to commence WA 6437 as soon as the relevant approvals are obtained. The northern portion is intended to be extracted first.

WA 6852 is also expected to commence as soon as the relevant approvals are obtained. The northeastern portion is currently intended to be fully extracted first, while the northwestern portion will initially be extracted to a level suitable to allow placement of a fixed processing plant.

f) Information on the arrangements with Donnybrook JV about access to the Phillips Quarry.

As relevant to buffers (vi) states that residential and associated development will not occur on the Barro Group and Donnybrook JV Pty Ltd (DBJV) land within 500 m of WA 492, WA 6437 and WA 6852. Barro has stated that they intend to extract the northeastern area of WA 6852 in a southerly direction as soon as practicable so that DBJV can develop the area indicated as a future residential area in the Future Urban Structure Plan as the extraction area within 500 m.

2.5.2 Influence on GHD buffer estimates

While direct comparison of extraction boundaries in the work approvals with information in the Ponte lawyers report is difficult, discrepancy between the boundaries can have some effects on the recommended buffers.

Woody Hill Quarry

- The existing operational impact with regards to noise and vibration buffers from the Woody Hill Quarry WA 492 presented in GHD December 2017 is unchanged. All buffers scribed from the envelope of potential sources are given from the existing extraction boundaries. GHD took this envelope to be the envelope of the existing extraction boundary rather than the Work Authority boundary.
- Noise and vibration buffers from the Work Plan variation of WA 492 endorsed on February 3, 2020 for the extension of the extraction area to the south of the existing extraction area of WA 492 are unchanged from that presented in GHD Impact Assessment (April 2018). The largest 600 m buffer is intended to provide compliance with the operational noise limits and is given from the expanded extraction area.

Boundaries of extraction areas in accordance with WA 492 or WA 6437 are slightly different from that presented in GHD Impact Assessment (September 2019). The 600 m noise buffer from the extraction area still applies, with a slight difference at the southeast corner where the assumed extraction area is deemed to be less than that assumed in the GHD assessment, therefore noise and vibration buffers may be less to the southeast.

Phillips Quarry

Noise and vibration buffers for operations in the quarry were given for extraction boundaries assumed in the GHD Impact Assessment 2017. The recommended buffers may need to be in accordance with the change in extraction area, which has increased to the north, northwest and west, as this will result in a greater buffer to land located to the north, northwest and west of Phillips Quarry.

2.5.3 Influence on buffers in the PSP

The main implication to the PSP from the provided information regarding the quarry operations are the boundaries of the possible extraction areas. The Woody Hill possible extraction expansion is not expected to extend as far east but may extend further to the north compared to what is indicated in the Plan 15. Variations in the changed extraction boundary may result in shorter buffers towards the southeast and a greater extension to the north than presented in the plan. The effect of mismatching boundaries is expected to be minor and should not affect the proposed sensitive uses as per the PSP.

The PSP adopted a conservative approach to specify buffers for the Phillips Quarry. Noise and vibration buffers in the Plan 15 are given from outer boundaries of the entire area designated for the quarry. Extraction boundaries are expected to be within these zones. The recommended buffers in the PSP are greater than suggested in the GHD Impact Assessment 2017 and discrepancies in the extraction boundaries do not influence buffers in the PSP.

3 Noise and Vibration Buffer Advice

Victorian regulatory documents do not provide recommendations on buffers from a noise and vibration perspective. Noise buffers should be sufficient to secure compliance with noise limits in the *State environment protection policy – Control of Noise from Commerce, Industry and Trade* No. N-1. The policy does not specify vibration limits. Vibration limits were recommended by GHD based on criteria in relevant guidelines and standards.

3.1 An assessment of different types of buffers

Noise buffers can be segregated into two main categories:

- Operational noise buffer
- Blast noise buffer

Relevant noise limits for operational noise are derived in accordance with noise policy SEPP N-1 and must be satisfied at the affected noise sensitive receptors. Blast noise is recommended to meet human perception criteria in ANZEC Guidelines that are consistent with requirements in the *Ground vibration and airblast limits for mines and quarries (VicResources)*.

Vibration buffers should be sufficient to meet:

- Human perception limits for operational vibration
- Human perception limits for blast vibration

It should be noted that human perception vibration criteria are stricter than structural integrity limits, therefore vibration limits for structures are not considered here.

Fly rock buffers from blasting operations are expected to be relatively small based on experience with quarry operations and are not critical to the PSP, however they are included in the Plan 15.

3.2 The required buffer distance for each type

The recommended buffers were identified in the GHD Impact Assessments. They are intended to provide a level of safety so that noise and vibration impacts remain below applicable criteria.

3.2.1 Noise buffers

The GHD Impact Assessment reports show that operational noise is the limiting factor that controls the proximity of noise sensitive uses to the quarries. The operational noise buffer is the largest for existing and future quarry operations. The estimates show that a 900 m buffer from the current extraction boundary of the Woody Hill Quarry is required to meet SEPP N-1 criteria. This buffer may be reduced to 600 m for future operations. Operations in Phillips Quarry area require 300 m operational noise buffer.

It should be noted that details of blasting operations within the quarry boundaries are not provided as well as the blast propagation constants. Therefore, it is difficult to provide accurate estimates of buffers for blast noise. The blast noise impact on sensitive uses may be controlled by limiting charges and using special noise mitigation techniques.

3.2.2 Vibration buffers

Operational vibration from onsite equipment is typically unperceivable at distances of 100 m or more, which was confirmed by the GHD noise and vibration impact assessments.

Vibration impacts from blast operations are expected to be greater than from operation of typical equipment. GHD suggested a conservative approach based on a long term PPV goal of 2 mm/s. A buffer of 550 m is predicted to be sufficient for average site vibration propagation constants and a MIC not exceeding 100 kg.

3.3 The type of factors which influence buffer distances

3.3.1 Noise impact

As it was noted earlier, there are no widely used recommendations on buffer distances for noise. The buffers should be chosen to meet the requirements of the SEPP N-1 noise policy. Applicable noise criteria are derived based on a comparison of planning zone criteria and background noise at sensitive receptors.

The operational noise buffer is predicted based on the most conservative operation scenario, which assumes that the noisiest onsite activities are confined to the day time period. Results of predictions are affected by assumed environmental conditions, terrain, acoustic characteristics of the noise sources, and the operational scenario. Minor variations in positions of stationary and mobile noise sources (haul routes) may have a minor influence on the suggested buffers as their size is already substantial (900 m for existing Woody Hill Quarry operations and 600 m for future expansion).

If land sensitive uses are approved in the areas close to the quarries, buffers to the quarries may need individual verification based on individual zoning and background information. The criteria should be compared with predicted operational noise impact to identify the sufficiency of the buffer.

Details of blasting operations within the extraction boundaries are not known and blast overpressure estimates depend on unknown blast propagation constants. It is difficult to provide recommendations on buffers for blast noise. The blast noise impact on sensitive uses may be controlled by using special noise mitigation techniques and limiting charges if necessary.

3.3.2 Vibration impact

There are no clear recommendations in Victorian regulatory documents on vibration buffers. There are some recommendations on safe separation distances from construction equipment in some guidelines and standards. There is no relevant information on a recommended buffer distance for blast works.

As details of blast operations and noise and vibration propagation constants are unknown, certain assumptions about charge size and site propagation constants were made to provide recommendations on vibration buffers. Variations in position of onsite equipment and their vibration output are not expected to be critical for defining buffers for sensitive land uses.

Predicted blast vibration levels show that a 550 m buffer is expected to be sufficient for a MIC of 100 kg and below. If site conditions happen to be more favourable for blast vibration propagation, the suggested buffer distance is still expected to be sufficient to meet a greater criterion of 5 mm/s PPV suggested in Victorian *Ground vibration and airblast limits for mines and quarries (VicResources).* The GHD Impact Assessments recommended a more conservative approach based on the long-term regulatory goal of 2 mm/s in the ANZEC Guidelines. Therefore, the suggested vibration buffer is expected to be acceptable to accommodate a possible variation in the vibration site constant to meet the VicResources' vibration limit for quarry blast works.

3.4 The types of land uses / buildings that could occur within buffers

The noise policy SEPP N1, which was used to identify operational noise buffers around the quarries, states noise criteria to be applicable to beneficial land uses including normal domestic activities, recreation and sleep. Commercial, industrial and other uses that are not classified as "noise sensitive" and can be allowed within the operational noise buffers.

Potentially commercial, industrial and other business activities can be allowed within blast noise and vibration buffers. Noise and vibration impacts should be assessed for them and compared with less stringent blast noise and vibration criteria in accordance with relevant standards and guidelines.

3.5 An opinion on the starting point for the measurement of the buffer distance

As the SEPP N-1 does not give guidance on the noise buffers, separation distances should be taken from noise generating activities to the noise sensitive land uses such as those recommended distances from the current or future extraction zones suggested in the GHD Impact Assessments. This approach is justified since theoretically noise generating equipment may be positioned anywhere within the approved extraction zones.

Plan 15 in the PSP shows a 900 m operational noise buffer from the existing extraction zone of the Woody Hill Quarry and a 600 m noise buffer for future expansion, which is taken from the envelope of the quarry area. This is considered to represent a conservative approach to identify zones for noise sensitive land uses. As the grounds for the 550 m "sensitive use" buffer is not clearly outlined in the PSP, it is assumed that recommendation of a 550 m blast vibration buffer are taken into account to identify the buffer. This should be taken from an envelope of the area where blast works may occur including the site expansion.

Noise and vibration buffers for Phillips Quarry in the PSP are given from the boundary of the quarry area. This is acceptable as a precautionary approach, since these boundaries include any possible extraction zone within the quarry area. Similar to the Woody Hill Quarry, grounds for the 550 m "sensitive use" buffer around the Phillips Quarry is not clarified in the PSP. If this buffer replicates or includes the recommended 550 m blast vibration buffer, it should have been taken from an envelope of the blasting zones.

3.6 An expert opinion of the distances which the panel should recommend as the buffer distances for the PSP

GHD recommendations for noise and vibration buffers are based on the results of the GHD Impact Assessment 2017 for the current Woody Hill Quarry operations and the GHD 2019 assessment for the expanded quarry area. The separation distances are to be applied to the quarries to protect the amenity of any future sensitive uses within the PSP. The noise and blast buffers would apply to the Woody Hill Quarry:

- Greater of 900 m from extraction boundary of the quarry or 600 m from the envelope of the quarry area including expansion zones (operational noise buffer). This is designed to be a buffer from noise sensitive land uses without the need for noise mitigation measures to be implemented
- “No development” zone of 200 m taken from the envelope of the quarry area including expansion zones (fly rock blast buffer)

It should be noted that envelopes of the Woody Hill Quarry expansion in the work approvals and PSP require alignment. The recommendations above do not include the 550 m blast vibration buffer taken from the boundary of possible blast works, which is less than the expanded quarry area because of the blast restricted zone at the southern boundary of the site. This vibration buffer is contained within the operational noise buffers.

Blast operation buffers around Phillips Quarry are critical for future sensitive and non-sensitive developments:

- 550 m from the envelope of the quarry area for sensitive land uses (blast vibration buffer)
- “No development” zone of 200 m taken from the envelope of the quarry area including expansion zones (fly rock blast buffer)

The current precautionary approach in the PSP states buffers specified for the Phillips Quarry from the quarry boundaries, it eliminates the importance of extraction zones and their exact location, as these will be contained within the quarry boundaries.

Details of blast operations, blast noise and vibration constants should be confirmed for both quarries to verify that the blast buffers are sufficient to secure that blast overpressure and vibration are below the recommended limits. If necessary, operational controls should be imposed on the quarries to ensure that the environmental impact is acceptable.

3.7 Consideration of submissions to the amendment regarding different buffer distances

GHD can provide opinion on submissions concerning different buffer sizes provided by third parties when they are made available to GHD.

4 Limitations

This report has been prepared by GHD Pty Ltd (GHD) for the Victorian Planning Authority and may only be used and relied on by the Victorian Planning Authority for the purpose agreed between GHD and the Victorian Planning Authority as set out in section 1 of this report.

GHD otherwise disclaims responsibility to any person other than the Victorian Planning Authority arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

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

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

This letter report must be read in conjunction with the previous GHD assessments namely:

- Impact Assessment Report for the Shenstone Park Precinct Structure Plan (GHD, December 2017)
- Shenstone Park Impact Assessment Woody Hill Addendum (GHD, April 2018)
- Shenstone Park Impact Assessment Woody Hill Addendum (GHD, September 2019)

Yours sincerely
GHD

Val Lenchine
Technical Director - Noise & Vibration
+61 3 86878710

Appendices

- Appendix A - Shenstone Park Impact Assessment Woody Hill Addendum (GHD, April 2018)

Appendix A Shenstone Park Impact Assessment Woody Hill Addendum (GHD, April 2018)

City Of Whittlesea Council

Shenstone Park Impact Assessment
Woody Hill Addendum

April 2018

Executive summary

GHD Pty Ltd (GHD) has been engaged by the City of Whittlesea (CoW) to prepare an air quality (including dust and odour), noise and vibration impact assessment report for the Shenstone Park Precinct Structure Plan (PSP) and the associated investigation area to the south and east of the PSP boundary. The impact assessment considered the following:

1. Existing mudstone quarrying operations at the Barro Group Woody Hill Quarry, which is located within the Shenstone Park PSP boundary
2. Approved basalt quarry (Phillips Quarry) located immediately south of the PSP
3. Proposed Yarra Valley Water (YVW) Wollert sewerage treatment plant (STP) also located immediately south of the PSP

The objective of this commission is to conduct additional air, noise and vibration technical investigations for the possible expansion of the Woody Hill Quarry.

The following scenarios have been considered in this report:

1. Expansion to the south of the existing extraction area within the Work Authority 492 boundary
2. Expansion of the Work Authority boundary and subsequently the extraction boundary to the north of the existing Work Authority boundary
3. Expansion 20 m below the ground surface

The focus of this study is in three parts:

- Review of available environmental, planning, quarry operations information in consultation with stakeholders
- Technical dust, noise, vibration and blasting assessments of current and approved quarry operations to identify site-specific offsite impacts in the Shenstone Park PSP area
- Provide recommendations for management and/or mitigation of environmental risks on land uses in a planning context

Default buffers

In the case of existing industries and uses, the EPA recommends separation distances that should be considered when preparing a planning scheme, planning scheme amendment or planning permit application.

A buffer (separation) distance is a planning instrument used to provide separation of sensitive land uses (i.e. residential, schools, hospitals and recreation reserves) from existing industrial premises with the potential for offsite emissions (odour or dust) that can cause disamenity in the event of an upset/malfunction. Note that the buffers are for upset[1] operational conditions only routine emissions must meet EPA SEPP (Air Quality Management) guidelines and have no impact offsite.

GHD has assessed and mapped the recommended default buffers for the identified possible expansion scenarios for the Woody Hill Quarry. This default buffer analysis shows that a portion of the PSP will be within the recommended default buffers from each scenario.

[1] Upset conditions refer to unintended emissions which do not occur under routine operations. Upsets may occur due to extreme weather conditions, mechanical breakdowns/malfunctions or operational failures.

Site specific variation to default buffer

Two criteria that allow for site specific variations which would have significant impact in varying the default buffers are considered to be the size of the facility (de-rating a default buffer) and local meteorology (directional buffer). GHD considers that the relevant buffer for the active quarry area with blasting should be the default 500 m buffer irrespective of the throughput of the quarry.

However, GHD considers that the directional buffer would apply to the default 500 m buffer given that the default buffer accounts for possible transport of dust particles, which would be subject to meteorological influences. The local meteorology would only apply during daytime hours for the quarry as blasting and excavation and transport of material would only occur during the daytime (6 am to 6 pm).

DEDJTR advice[2] indicates that a 200 m radial buffer distance from the extraction boundary of the extraction area is sufficient to mitigate against safety issues from flyrock during blasting, with which GHD agrees. This buffer is to be radial, as the flyrock component will be independent of wind speed and direction, as the projectile speed of flyrock is much larger than the wind speed.

The directional buffer assessment shows that the default buffer can be retracted and extended in the directions of good and poor dispersion. A large extension of the default buffer occurs to the east and northeast into the PSP area, while the default buffer is retracted in the west due to anticipated meteorological conditions.

Quantitative dust impact assessment

Dust dispersion modelling was undertaken for dust impacts from the two expansion scenarios using a number of conservative assumptions. The criterion for PM_{10} extends into the PSP area for both scenarios. However, the criterion was predicted to be met at all existing sensitive receptors and contained within the default and directional separation distances for each quarry.

Noise and vibration impact assessment

It is understood that the Woody Hill Quarry operates during the EPA defined night-time period between the hours of 6:00 am and 7:00 am Monday to Friday and also during the EPA defined evening period on Saturday afternoons after 1:00 pm. Therefore noise from this quarry must be assessed across all three time periods (Day, Evening, Night), refer to Table 7.

It is expected that the daytime noise levels generated from the Woody Hill Quarry for both expansion scenarios will require a buffer of up to approximately 600 m from the northern and southern extraction areas at the Woody Hill Quarry to meet the daytime criteria of 48 dB(A), prior to any noise mitigation measures being implemented.

Modelling of the existing approved extraction area for the Woody Hill Quarry was also undertaken in the GHD report entitled *'City Of Whittlesea Council Impact Assessment Report for the Shenstone Park Precinct Structure Plan – December 2017[3]'*. In that report a buffer of 900 m was recommended, which is 300 m greater that that assessed in this report due to the elevated location of existing noise sources combined with the concrete batching plant. However, as the northern and southern extraction scenarios will be at a much lower elevation, this has enabled greater attenuation of the noise impact from each of these two scenarios reducing the buffer size by one third down to 600 m.

[2] Meeting with DEDJTR on 17 October 2017

[3] GHD Report #51460

Blast generated noise is very dependent on site specific constants and can vary significantly based on the blast methodology being used. Onsite measurements would be required prior to any future development to understand the air blast overpressure from each quarry's operation and what restrictions this would have on future development.

It is expected that any vibrational impact from blasting at the Woody Hill Quarry would require a distance of approximately 550 m from the extraction boundary to provide sufficient attenuation for a blast with an MIC of approximately 100 kg.

The existing quarry will likely remain throughout the PSP development and the quarry asset owner will remain obligated to comply with the SEPP N-1 noise policy. However, it is expected any sensitive receivers proposing to build within the PSP in the future, will be required to design and build future structures in a manner so as to minimise any existing noise impacts on persons utilising the proposed building.

Development may still be able to occur within the 600 m buffer following appropriate mitigation either at the quarry or via building acoustic treatments at the sensitive receiver location.

Discussion with the asset owner may need to be undertaken to provide effective as well as agreed noise mitigation measures for the quarry, as necessary.

Should a control at source noise mitigation strategy not be possible or practicable, it is common that the indoor amenity of sensitive receivers subject to operational noise be acoustically treated using a control at receiver strategy, via building acoustic treatment. However, the limitation of this strategy is that it would not preserve the outdoor amenity of the receiver unless a combination of controls such as noise controls at the source of transmission be implemented.

Mitigation Measures

Noise mitigation strategies can generally be divided into four different areas from the most to the least preferred (NSW INP, 2000):

1. *Land-use Controls* (separating the location of noise-producing activities from sensitive areas)
2. *Control at Source* (reduce the noise output of the source to provide protection surrounding environment)
3. *Control in Transmission* (reduce noise levels at the receiver but not necessarily the environment surrounding the source, e.g. noise barrier, etc.)
4. *Receiver Control* (localised acoustic treatment at sensitive receiver)

Recommended Buffers

From the assessment, the following is recommended (refer to Figure 17) to provide a visual display of the impact assessments undertaken as part of this report):

- 500 m dust directional buffers from the extraction area boundaries for the two expansion scenarios.
- Operational noise buffer for the Woody Hill Quarry of 600 m from the extraction area boundaries for the two expansion scenarios (north and south), prior to any operational noise mitigation being implemented. Should further work be undertaken to determine the noise controls and operations in place at the quarry, it may be possible to reduce the extent of the noise buffer. It is expected operational noise from the operation of a basalt winning pit would generate less noise beyond the boundary due to the shielding effect of the pit walls, if the crushing and screening also occurred in the pit.

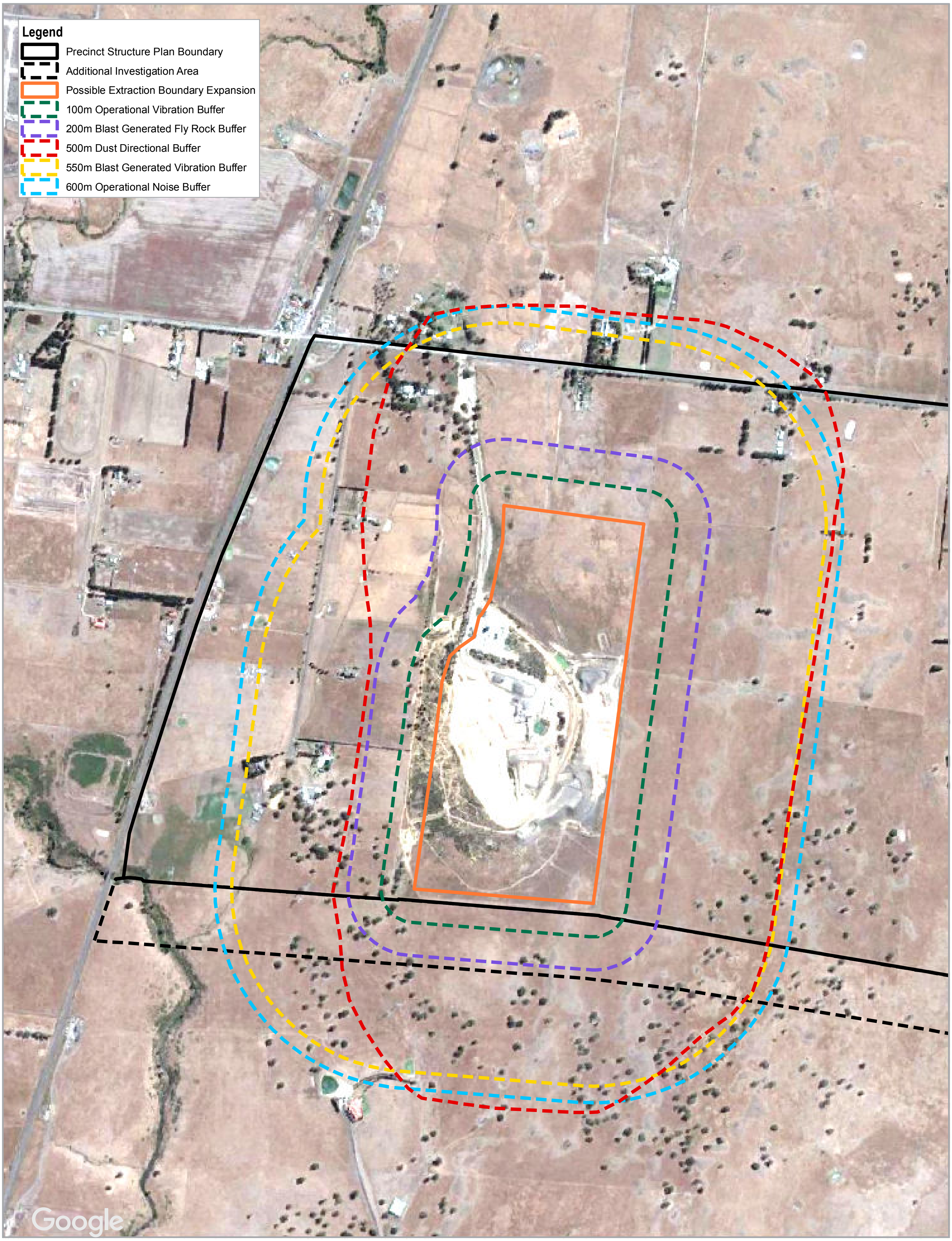
- 100 m operational vibration buffer from the approved extraction area boundaries for the two expansion scenarios (north and south).
- Blast generated flyrock buffer of 200 m from the approved extraction area boundaries for the two expansion scenarios (north and south).
- Blast generated noise would require empirical measurements prior to any proposed development to assess the site specific conditions experienced during a blast event. Any proposed development would be limited by the requirement to achieve 115 dB (linear) at the proposed development location.
- Blast generated vibration buffer of 550 m for the Woody Hill Quarry, from the approved extraction area boundaries for the two expansion scenarios (north and south) for an MIC of approximately 100 kg to meet the 2 mm/s (PPV) long-term regulatory goal for human comfort.

The intent of the buffers from the quarry would be to restrict additional sensitive land use intensification in these buffer areas (including land inside and outside of the PSP), due to the risk from, dust, operational noise and vibration, blast noise, blast vibration, and blast generated flyrock.

The inclusion of buffer controls within the PSP should achieve separation of non-compatible uses and delineate land available for urban development.

The PSP planning process must protect significant assets, whilst enabling sustainable development to occur. Inappropriate planning may adversely impact the operations and viability of the quarry into the future and, in turn, impact the amenity and health of the community.

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.3 and the assumptions and qualifications contained throughout the report.



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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City of Whittlesea
Shenstone Park PSP - Impact Assessment

Possible Buffer Areas - Woody Hill Expansions

Project No. 31-35311
Revision No. -
Date 12 Dec 2017

FIGURE 17

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Data source: Data Source: Image © 2016 Google, DigitalGlobe dated 2017/07/10 and VicMap, DELWP (2017).. Created by: lrsmith

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1. Introduction

1.1 Study objective

GHD Pty Ltd (GHD) has been engaged by the City of Whittlesea (CoW) to prepare an air quality (including dust and odour), noise and vibration impact assessment report for the Shenstone Park Precinct Structure Plan (PSP) and the associated investigation area to the south and east of the PSP boundary. The impact assessment considered the following:

1. Existing mudstone quarrying operations at the Barro Group Woody Hill Quarry, which is located within the Shenstone Park PSP boundary
2. Approved basalt quarry (Phillips Quarry) located immediately south of the PSP
3. Proposed Yarra Valley Water (YVW) Wollert sewerage treatment plant (STP) also located immediately south of the PSP

The findings of this assessment can be found in GHD Report #51460 and which will be used to assess those areas that are or will be subject to impact from the different quarry operations and the STP, and to inform future land use planning associated with development of the PSP. The PSP planning process is designed to protect significant earth resources and state significant infrastructure, whilst enabling sustainable urban development as established in Plan Melbourne and the North Growth Corridor Plan.

1.2 Scope of assessment

The objective of this project is to conduct additional air, noise and vibration technical assessments for the possible expansion of the Woody Hill Quarry and their potential impact on the Shenstone Park PSP.

This report should be read in conjunction with GHD Report #51460.

1.3 Limitations and assumptions

This report has been prepared by GHD for the City of Whittlesea and may only be used and relied on by the City of Whittlesea. GHD otherwise disclaims responsibility to any person other than the City of Whittlesea arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in section 1.2 and throughout the report.

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

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

GHD has prepared this report on the basis of information provided by the City of Whittlesea and project stakeholders, which GHD has not independently verified or checked. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information. GHD disclaims liability for the identification of all relevant industries and any subsequent industries that may have been overlooked.

The opinions, conclusions and any recommendations in this report are based on information obtained from site inspection undertaken at or in connection with, specific areas. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, existing surrounding industries, services and vegetation, etc. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions may change after the date of this report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

The assessment in this report was based on onsite inspections undertaken by GHD on 4 August 2017 and onsite monitoring between 25 August 2017 and 6 September 2017. It is the nature of environmental assessment that all variation in environmental conditions as well as the existing Woody Hill Quarry operating conditions cannot be assessed and all uncertainty concerning the conditions of the ambient air and noise environment cannot be eliminated. In addition, it is not the intention of this assessment to cover every element of the air and noise environment but rather to conduct the assessment with consideration to the prescribed work scope. Professional judgement must be expected in the investigation and interpretation of observations.

The Department of Economic Development, Jobs. Transport and Resources (DEDJTR) was contacted during preparation of this assessment for specific information pertaining to the two quarries, however DEDJTR were not able to provide this without the approval of the work authority holder and referred GHD to the Work Plan for Woody Hill.

Input relating to operational details for the quarries were sought from stakeholders, including a site visit. As no information was provided, GHD has made a number of assumptions for the impact assessments.

Therefore, the assessment findings and recommendations, in the absence of information, are estimates only. Council should endeavour to source the relevant information from the quarry operator/s and revise/update this assessment once the information becomes available.

2. Woody Hill Quarry expansions

Specific information regarding the possible expansions and existing operations of Woody Hill Quarry were not available nor provided by stakeholders at the time this report was prepared. However, a preliminary description is provided, based on:

1. The existing Work Plan for Woody Hill Quarry
2. Information supplied by CoW
3. The perimeter site visits conducted by GHD on 25 August 2017 and 6 September 2017, and from aerial photographs

DEDJTR was contacted during preparation of this assessment for specific information pertaining to the quarry, however DEDJTR were not able to provide this without the approval of the work authority holder and referred GHD to the Work Plan.

All relevant stakeholders were contacted during the preparation of this assessment to provide inputs pertaining to operations. Where there was no provision of information, GHD has made a number of assumptions for the impact assessments.

A copy of the Work Plan[4] was provided to GHD. The existing quarrying operations include extraction of mudstone rock and is subject to Work Authority 492. A planning permit is not required for the site, as it is operating under an existing use right. The site consists of several quartz veins interspersing Silurian sediments, predominantly consisting of silt shales. Basalt underlies the shale and other sedimentary rocks. The estimated volume of material within the proposed extraction area was 2.7 million cubic meters in-situ back in 2003. Current extraction is 150,000 tonnes per year for low- grade crushed rocks and sub base type material primarily for road construction. This would give a working life of approximately 30 years from 2003.

The existing stone extraction area is smaller than the current Work Authority boundary, however from the information provided to GHD, it may be possible that the quarry may expand in the future. The following scenarios have been considered in this report:

1. Expansion to the south of the existing extraction area within the Work Authority 492 boundary
2. Expansion of the Work Authority boundary and subsequently the extraction boundary to the north of the existing Work Authority boundary
3. Expansion 20 m below the ground surface

Figure 1 shows the investigation area and location of the possible expansions of the quarry.

The existing extraction techniques are a combination of soft rock and conventional drill and blast. The material is then ripped and pushed with a dozer and scraper. Drill and blasting[5] is used for the harder material. It is expected that at the end of extraction, the entire hill will be removed leaving a flat topography.

Mobile plant used for extracting and processing rock comprises of dozers, excavators, off-road haul trucks, wheel loaders, mobile screening units and road registered tipping trucks. A grader is used at times during rehabilitation works and maintenance of the access road. A water cart is also used to control dust. Road registered tip trucks are used to transport material from the site.

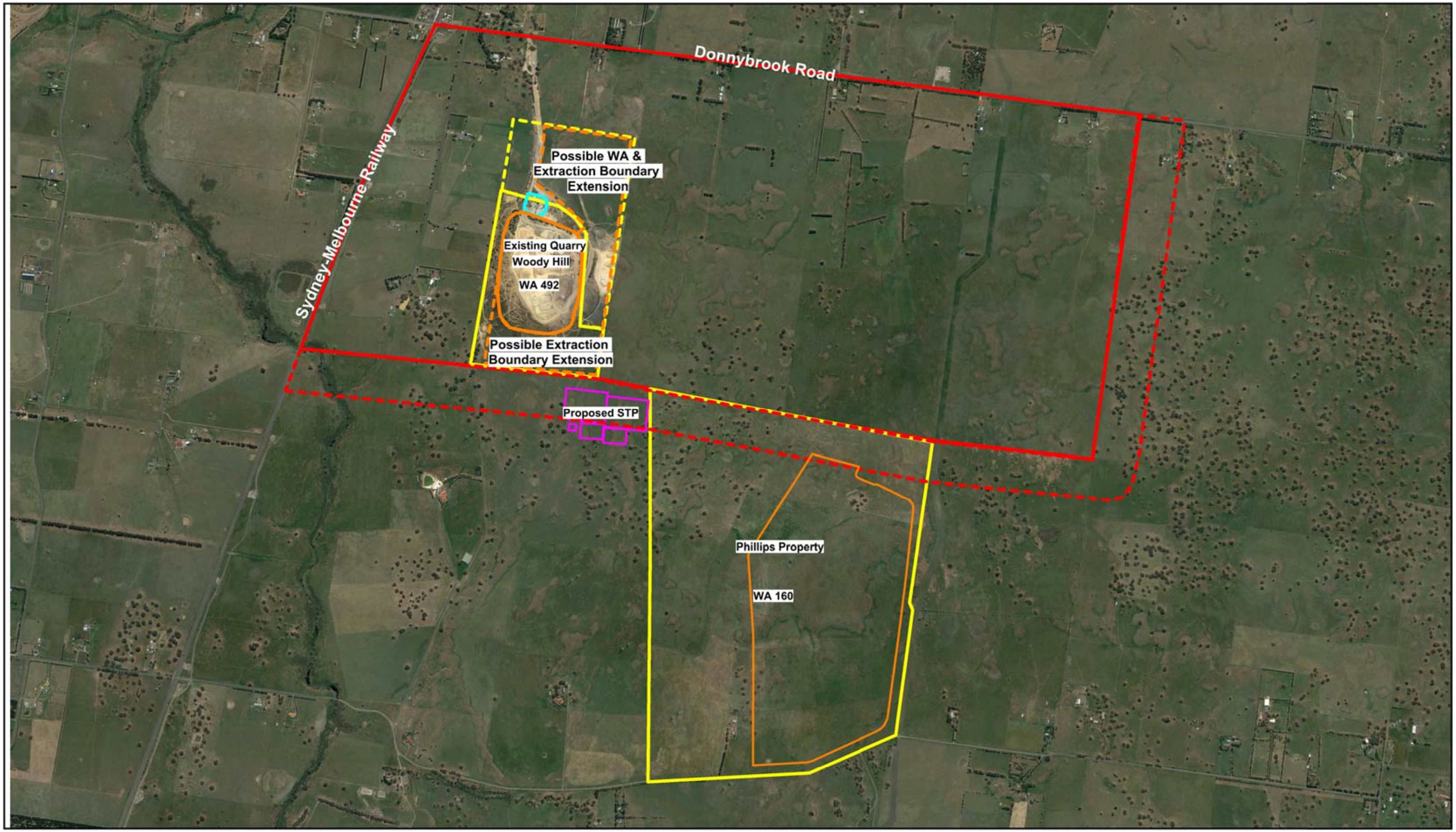
[4] Bell Cochrane and Associates, Work Plan for mudstone extraction, Extractive Industries Work Authority 492 prepared for Mitchell Sand and Gravel Pty Ltd, 12 February 2003
[5] DEDJTR email dated 20 July 2017, confirming blasting does occur at WA 492

The Work Plan states that there is no fixed plant on site. The processing and crushing plant is portable/relocatable and brought to the site as required. The plant would consist of a primary and secondary crusher, and a series of control and product screens.

The process of extraction within WA 492 is assumed to be typical of a Stone Processing Plant as described in Chapter 11 of AP-42 (USEPA, 2004). It is assumed the operator proposes to supply only the coarser grades of aggregate, and neither a tertiary nor a fines crusher would be used for quarry operations. Instead, processed rock would pass through a screen to separate aggregate into the sizes.

The hours of operation are from 6.00 am to 6.00 pm Monday to Saturday.

An active quarry normally generates dust from blasting, rock breaking, loading, haul road traffic and wind erosion over the quarry site.



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metres (at A4)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 55

N W E S

LEGEND

- PSP Boundary
- Additional Investigation Area
- Work Authority Boundary
- Approved Extraction Boundary
- Possible Work Authority Boundary Expansion
- Possible Extraction Boundary Expansion
- Concrete Batching Plant
- Proposed STP

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City of Whittlesea
Shenstone Park PSP-Impact Assessment

Investigation Area and Possible Expansions *of Woody Hill Quarry*

Job Number	3135311
Revision	A
Date	12/12/2017

Figure 1

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Google Earth Imagery 2017. Created by: M.A

3. Existing environment

The existing environment including an overview of the local meteorology, background air quality and background noise monitoring are presented in the GHD Report #51460. Please refer to this report for the existing environment findings.

4. Buffer assessment

This section applies the generic separation distances for quarries as specified in EPA Publication 1518. The separation distances are based on EPA experience, as to the range at which complaints are received in the event of an upset, the separation distance would decrease to a minimum. The generic separation distance does not take account of the specific operations of the quarry. These are addressed for dust, noise and vibration blasting impacts in sections 5, 6, 7, 9 and 10 respectively.

Note these latter assessments are to quantify the impact of routine quarry operations, whereas the buffer assessment gives the required separation under upset/malfunction conditions, in order to minimise impact at sensitive land uses. The criteria to be met for routine emissions are more stringent than that provided by a separation distance because the likelihood of exposure to an upset/malfunction is very much lower than routine emissions.

While the quantitative assessments are specific to the Woody Hill Quarry operation, the results can't be translated to a process-specific separation distance without also characterising: (i) the factor of increase of the emission above routine levels during the upset, (ii) the likely duration of the upset, and (iii) the upset event 'return interval'.

4.1 Default separation distances

The EPA Victoria (EPA) recommended separation distance guidelines that apply to existing industries in the vicinity of the subject site are the relevant current guidelines to inform planning for land uses within the PSP.

EPA has published[6] recommended separation distances for selected industry categories (EPA Guidelines) that replace the earlier buffer guideline. Separation distances can be used to define zones of land offsite from the industry premises, which are constrained from development for sensitive land uses.

GHD has applied the EPA separation distances to the possible expansions of the Woody Hill Quarry for the purposes of defining the appropriate required separation distances.

4.1.1 Active quarry with blasting

From the EPA guideline, an active quarry with blasting has a recommended buffer of 500 m, while an active quarry without blasting would have a separation distance of 250 m. Though not specified in the guideline, the 250 m increase in separation distance for blasting and auxiliary activities, has been interpreted to account for dust particles associated with the blast being transported further distances and is not related to flyrock, refer to section 4.2[7].

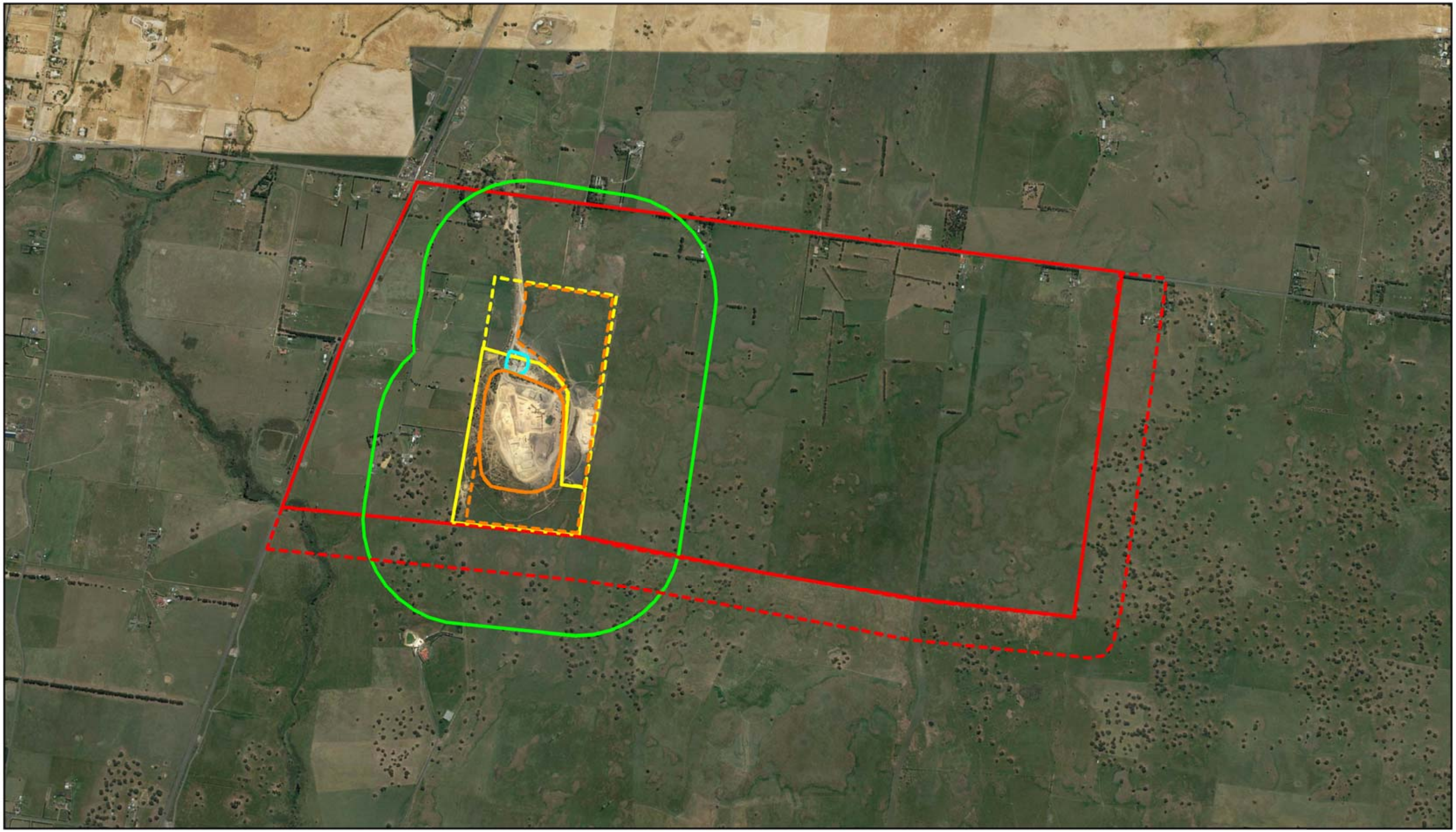
Note that the buffer as per Method 1 in the EPA guideline requires it to be drawn from the envelope of potential sources. GHD has taken this envelope to be the envelope of the possible extraction boundaries rather than the Work Authority boundary.

Further information on blast related impacts from quarry operations are discussed in sections 8, 9, and 10 in this report.

Figure 2 shows the 500 m buffer applied to two additional scenarios namely; (i) possible extraction boundary extension to the south of existing Work Authority boundary, and (ii) possible extraction boundary extension to the north of the existing Work Authority boundary.

The figures show that the possible expansion to the south and north extends the 500 m buffer further east and north within the PSP and south outside the PSP.

[6] EPAV 2013 "Recommended separation distances for industrial residual air emissions" Pubn. 1518, March 2013
[7] EPA email advice dated 02/11/2017 from Paul Torre - Senior Applied Scientist - Air & Odour / Principal Expert - Air



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Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 55

N W E S

LEGEND

- PSP Boundary
- Additional Investigation Area
- Work Authority Boundary
- Approved Extraction Boundary
- Possible Extraction Boundary
- Possible Work Authority Boundary
- Default 500 m Buffer
- Concrete Batching Plant

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City of Whittlesea
Shenstone Park PSP-
Impact Assessment

Job Number | 3135311
Revision | A
Date | 12/12/2017

Woody Hill
active quarry buffers
Possible Expansions

Figure 2

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4.2 Site specific variation to default buffer

Two criteria that allow for site specific variations which would have a significant impact on varying the default buffers, are considered to be the size of facility (de-rating a default buffer) and the local meteorology (directional buffer). GHD considers that the relevant buffer for the possible expansion to the quarry area with blasting, should be the default 500 m buffer irrespective of the throughput of the quarry.

However, GHD considers that the directional buffer would apply to the default 500 m buffer given that the default buffer accounts for possible transport of dust particles, which would be subject to meteorological influences. The local meteorology would only apply during daytime hours for the quarry, as blasting would only occur during the daytime.

DEDJTR advice[8] indicates that a 200 m radial buffer distance from the boundary of the extraction area, is sufficient to mitigate against safety issues from flyrock during blasting, with which GHD agrees. This buffer would be radial, as the flyrock component will be independent of wind speed and direction, as the projectile speed of flyrock is much larger than the influence of wind speed.

The daytime directional buffer that provides the same enclosed area as a 500 m radius circle (i.e. 785,398 m^2) is presented in Table 1. Table 1 shows the extent of the directional contour is greater than the all-direction mean of 500 m towards the south, extending to 640 m. Similarly, the extent of the contour to the west is significantly less than 500 m, reduced to 219 m (west southwest). The contour shows the departure from the fixed 500 m radius that would be required, if an equal exposure to disamenity was to be given in the event of an upset/malfunction at the quarry when blasting occurs during the day.

Table 1 Directional variation in 500 m default buffer in response to local meteorology – Melbourne Airport (daytime hours)

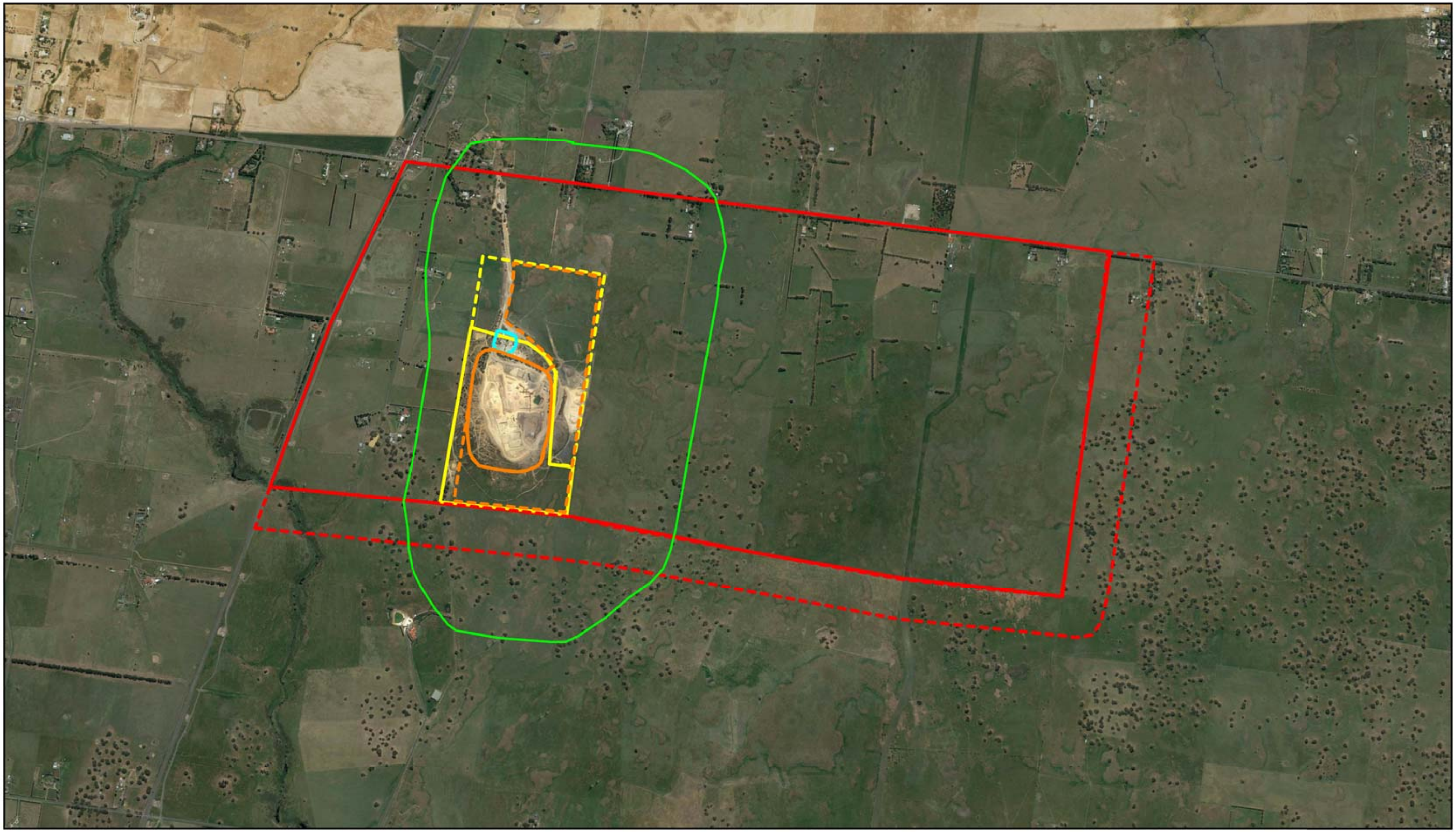
Direction Sector	Degrees	Range (m)	% of mean range	Direction Sector	Degrees	Range (m)	% of mean range
N	0	612	122	S	180	640	128
	15	625	125		195	524	105
	30	625	125		210	407	81
NE	45	625	125	SW	225	293	59
	60	625	125		240	245	49
	75	600	120		255	219	44
E	90	555	111	W	270	231	46
	105	522	104		285	242	48
	120	487	97		300	327	65
SE	135	475	95	NW	315	479	96
	150	490	98		330	565	113
	165	546	109		345	608	122

[8] Meeting with DEDJTR on 17 October 2017

Directional buffer constraints

Figure 3 shows that the directional buffers for the possible expansions at the Woody Hill Quarry. Figure 3 shows that the directional buffers, which extend further than the default buffers to the east and northeast, encompassing additional land within the PSP compared to the default radial buffers. A significant reduction to the west is shown for each of the three quarrying areas.

A large extension of the default buffer is shown to the east and northeast into the PSP, while the default buffer was retracted in the west due to anticipated meteorological conditions.



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Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 55

N W E S

LEGEND

- PSP Boundary
- Additional Investigation Area
- Work Authority Boundary
- Approved Extraction Boundary
- Possible Extraction Boundary
- Possible Works Authority Boundary
- Directional Buffer
- Concrete Batching Plant

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City of Whittlesea
Shenstone Park PSP-
Impact Assessment

Job Number	3135311
Revision	A
Date	12/12/2017

Directional Buffer for Woody Hill Possible Expansions

Figure 3

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Google Earth Imagery 2017. Created by: M.A

5. Dust impact assessment

5.1 Regulatory requirements

The Environment Protection Act 1970 (EP Act) is the primary legislative document that governs the protection of the environment in Victoria. Pursuant to the EP Act, the air quality environment is protected by the following policies:

- State Environment Protection Policy (Ambient Air Quality), February 1999 (SEPP (AAQ))
- State Environment Protection Policy (Ambient Air Management), December 2001 (SEPP (AQM))

In addition to the SEPP (AQM), the Protocol for Environmental Management: Mining and Extractive Industries (PEM 2007) was developed to set out the requirements for emissions to air from mining and extractive operations.

5.2 Victorian dust criteria

The SEPP-AQM provides dust concentration design criteria for $PM_{2.5}$, PM_{10} and total suspended particulate (TSP). The PM_{10} criterion of 80 µg/m^3, 1 -hour average, 99.9th percentile is considered to be the most stringent. TSP has a criterion of 330 µg/m^3 for a 3-minute average and 99.9th percentile.

Air-shed air quality goals relating to dust are also specified in SEPP – Ambient Air Quality (AAQ). The current 24-hour average for PM_{10} is 50 µg/m^3. There are also advisory reporting standards for $PM_{2.5}$, which are 25 µg/m^3 (24-hours average) and 8 µg/m^3 as a one-year average.

The relevant dust criteria for non-point sources of dust are specified in the Mining and Extractive Industries Protocol for Environmental Management (PEM) are:

- PM_{10} at 60 µg/m^3, 24 hour average
- $PM_{2.5}$ at 36 µg/m3, 24 hour average
- Nuisance deposited dust, 4 g/m^2/month (including background)

Basalt contains approximately 45-55% silica content, however due to the physiochemical properties of basalt, the silica is bound in a manner in which minimises the opportunity for creation of cleaved silica so that there is not expected to be offsite exposure to respirable crystalline silica (RCS) from the quarry operations. A series of occupational surveys (i.e. onsite exposure) conducted in the 1990s at Boral quarries by Kilpatrick and Associates, gave a direct measure of the likely percentage crystalline silica in $PM_{2.5}$ dust emissions from their basalt quarry sites. The surveys were conducted to gauge the potential exposure of quarry workers in different activities. The percentage of RCS in the $PM_{2.5}$ samples taken from the breathing zone of the workers was found to be approximately ~ 1%.

Given PM_{10} is the lead indicator (i.e. critical constraint) for quarry impacts, GHD has conducted dispersion modelling for this constituent only.

5.2.1 Scenarios

GHD has had to make a number of assumptions regarding the operations of the Woody Hill Quarry based on similar quarry operations.

Three scenarios for Woody Hill Quarry were agreed upon in consultation with CoW namely:

- Scenario 1: Woody Hill proposed expansion to the south
- Scenario 2: Woody Hill proposed expansion to the north
- Scenario 3: Woody Hill expansion 20 m below the ground surface

5.2.2 Emissions inventory

Emissions rates for the fine fraction (PM_{10}) of dust emissions were developed from a number of published references, including:

- National Pollutant Inventory (NPI) Emissions Estimation Technique Manual for Mining and Processing of Non-Metallic Minerals, Version 2.0
- USEPA AP-42 Chapter 11.19.2 – Crushed Stone Processing and Pulverized Mineral Processing, version 8/04
- Air Pollution Engineering Manual (Buonicore & Davis, 1992)

Where emission factor data was not available in the NPI, then GHD sourced emission factors from AP42 and Buonicore & Davis.

Process emission rates are expressed as kg per tonne processed for static sources such as crushing, screening, conveyor transfer, dumping and loading. For mobile sources such as haul trucks, emission rates are expressed as kg per vehicle kilometre travelled (VKT), and for dozers emissions are expressed as kg per hour of operation.

These references account for various levels of dust control. Where water spray bars are installed at crushers, screens or conveyor transfer points, a reduction factor of between 70% and 90% can be applied to the uncontrolled emissions rate (Davis, 1992). Given GHD was not provided any specific operational detail, we have assumed dust controls at the crushers, screens or conveyor points are absent.

A list of source emission rate data for PM_{10} is provided in Appendix A.

The mean PM_{10} emissions rates for all identified process and erosion sources relevant to the maximum operational scenario (assumed to be 200 tph based on similar quarries) are summarised into the relevant process categories in Table 3. The mean PM_{10} emission rates have been presented as the published upper limit maximum emission factors without controls applied.

5.2.3 Excavation of rock

The quarry Work Plan states that mudstone is extracted from the quarry by ripping of soft rock, and for isolated hard pockets, by more conventional drill and blasting. The material would be ripped and pushed with a dozer and scraper and then loaded onto haul trucks by excavators. It has been assumed that water spraying is undertaken to reduce the dust emissions from these sources. Extracted rock is transported to the crushing and screening plant described below. The operation of each mobile plant generates dust, as does the transportation of the rock along haul roads. Emission rates from these sources were obtained from the NPI (Environment Australia, 2000) and are listed in Appendix A.

Wheel generated dust from trucks entering and leaving the site and haul trucks moving between the pits and the crushing plant, overburden stockpiles and bunding areas have been included in the model. Line volume sources have been used to model the estimated truck routes onsite. The estimated distance travelled has been based on the extraction rate, size of haul trucks and average number of trucks entering and leaving the site.

A grader has also been included to maintain the haul roads.

It has also been assumed that water is applied to unpaved roads, resulting in dust control equivalent to Level 1 watering as defined in the NPI Emission EET for Mining (>1 litres/m^2/hr).

The following mobile equipment has been assumed:

- Hyundai 770-7A wheel loaders (bucket size 5 m^3) x 5
- Hitachi EX800 excavator (bucket size 5.5 m^3) x 2
- Mine haul truck (Volvo A40) dump truck (30 m^3 capacity) x 1
- Quad dogs with 35 tonne payload x 1.5/hr
- Grader x 1

Blasting can also create airborne dust and has been included in the dispersion modelling for PM_{10}. GHD has assumed blasting occurs once per month at 12 pm.

5.2.4 Processing of rock

The site currently uses mobile equipment for all crushing and screening. A primary crusher (jaw) accepts all extracted stone and removes scalps. Stone is then gradually sized and screened out through the primary crusher, secondary crusher and screen deck to different aggregate sizes and fines.

Within the rock processing, sources of dust are:

- From the screens (including fine screens)
- Conveyor transfer points
- Operating crushers (jaw and impact)
- Loading to the crushers
- Loading of the stockpiles
- Loading aggregate from stockpiles for transport offsite

Inputs described in Table 2 were combined to define the overall emission rate for crushing in Table 3.

Table 2 Crushing throughputs assumed for modelling

Dust Source	Max throughput (tph)
Primary Crusher	200
Secondary Crusher	160

Processing of stone assumed the following equipment:

- Primary Crusher
- Secondary Crusher
- Screening
- Fines Screening

5.2.5 Other dust sources

Wind generated dust is also produced from stockpiles and barren land. The amount of dust generated is dependent on wind speed, moisture content and erodability.

For modelling of exposed (non- vegetated) areas, wind generated dust was assessed using the standard emission factor from NPI of 0.2 kg/ha/hr.

Each transfer point of rock would also be a source of emissions. This occurs when rock is transferred from excavators to dump trucks, from trucks to mobile plant, and when it is loaded and unloaded from haul trucks. Five transfer points were used in the modelling to represent these interactions between various fixed and mobile plant. Whilst this number may vary depending on operations, as shown in Table 3, it provides a comparatively low percentage of overall dust emissions, at just 0.1 g/s per transfer point.

Dry depletion has not been accounted for in the model. Previous assessments conducted by GHD (refer to the New Chiltern Quarry Air Quality Assessment, GHD, 2009) have shown that accounting for dry depletion when assessing PM_{10} for a rock quarry marginally reduces the impacts from the quarry dust plume. By not including dry depletion the level of conservatism in the model increases.

Table 3 Summary of dust emission rates for proposed maximum operation scenario (at 200 tph)

Activity		Typical Operating Hours	Mean Emission Rate during operation, without controls (g/s)	% of Total Emissions
Rock Winning	Dumping	6 am – 6 pm	0.24	66%
	Excavator	6 am – 6 pm	2.33	
	Loading	6 am – 6 pm	0.09	
	Blasting[1]	Once per month for 1 hr	0.86	
	Haul Roads	6 am – 6 pm	0.26	
	Grader	6 am – 6 pm	0.06	
Plant	Primary Crushing	6 am – 6 pm	0.07	34%
	Secondary Crushing	6 am – 6 pm	0.05	
	Screening	6 am – 6 pm	0.24	
	Fines Screening	6 am – 6 pm	1.60	
Transfer Points (x 5)		6 am – 6 pm	0.01	0.1%
Wind Erosion (product stockpile area and haul roads)[1]		24 hours	0.2	3%
		TOTAL	**5.81 g/s**	
Notes [1] Based on an open area of 36,000 m^2				

5.2.6 PM2.5

The emission rates of PM_{10} from the sources modelled can be factored to give the $PM_{2.5}$ (respirable fraction of fine dust) emission rates by reference to a background document cited in the USEPA AP-42 Chapter 11.19.2 – *Crushed Stone Processing and Pulverised Mineral Processing*. In this, dust emission rates are given as a function of particle size, in micron, for the controlled operations of; screening, tertiary crushing, fines crushing and conveyor transfer points.

The corresponding $PM_{2.5}$/PM_{10} emission rate ratios were 0.13, 0.25, 0.125 and 0.33 respectively. Proportioning these ratios to the calculated PM_{10} emission rates for each category of operation (as given in Table 3) gives a site mean $PM_{2.5}$/PM_{10} emission ratio of 0.18. This ratio could be used to proportion the PM_{10} modelling results so that predicted $PM_{2.5}$ levels could be presented.

However, given PM_{10} is the most critical constituent for quarry assessments, only PM_{10} impacts have been presented for the scenarios.

5.2.7 Respirable crystalline silica (RCS)

There is a minimal amount silica in mudstone and as previously stated the physiochemical properties of basalt result in minimal opportunity for creation of cleaved silica, therefore minimal offsite exposure to RCS from the quarry operations. Previous assessments by GHD for rock/stone quarries have analysed the mean percentage of RCS as around 1% of $PM_{2.5}$ (refer to Leongatha South Quarry Air Quality assessment, GHD, 2010).

5.2.8 Model set up

The EPA Victoria approved dispersion model AERMOD was used to predict offsite dust levels of PM_{10} associated with the above scenarios. Contour plots of predicted peak levels of PM_{10} resulting from the quarry emissions including background PM_{10} levels were assessed by applying a representative 70th percentile background concentration and adding that value to the quarry 'signal' contours.

The AERMOD simulations were run with model settings outlined in Table 4. The model was set up using emissions from Table 3. This represents the maximum expected throughput of 200 tph operating at all hours within the production times of 6 am to 6 pm. Actual operations would be at significantly lower average throughputs, with expected maximum daily throughputs of around 500 tonnes, which equates to an average hourly throughput of around 50 tph. As such, predicted maximum concentrations are highly conservative and are based on the coincidence of worst-case dispersion conditions coinciding with maximum quarry operations. Sources are listed in Table 3 with their locations as shown in Figure 4. These locations provide an indicative estimate of source locations, however the actual locations will vary around the site but are not expected to significantly alter the patterns of dispersion presented.

Table 4 AERMOD settings

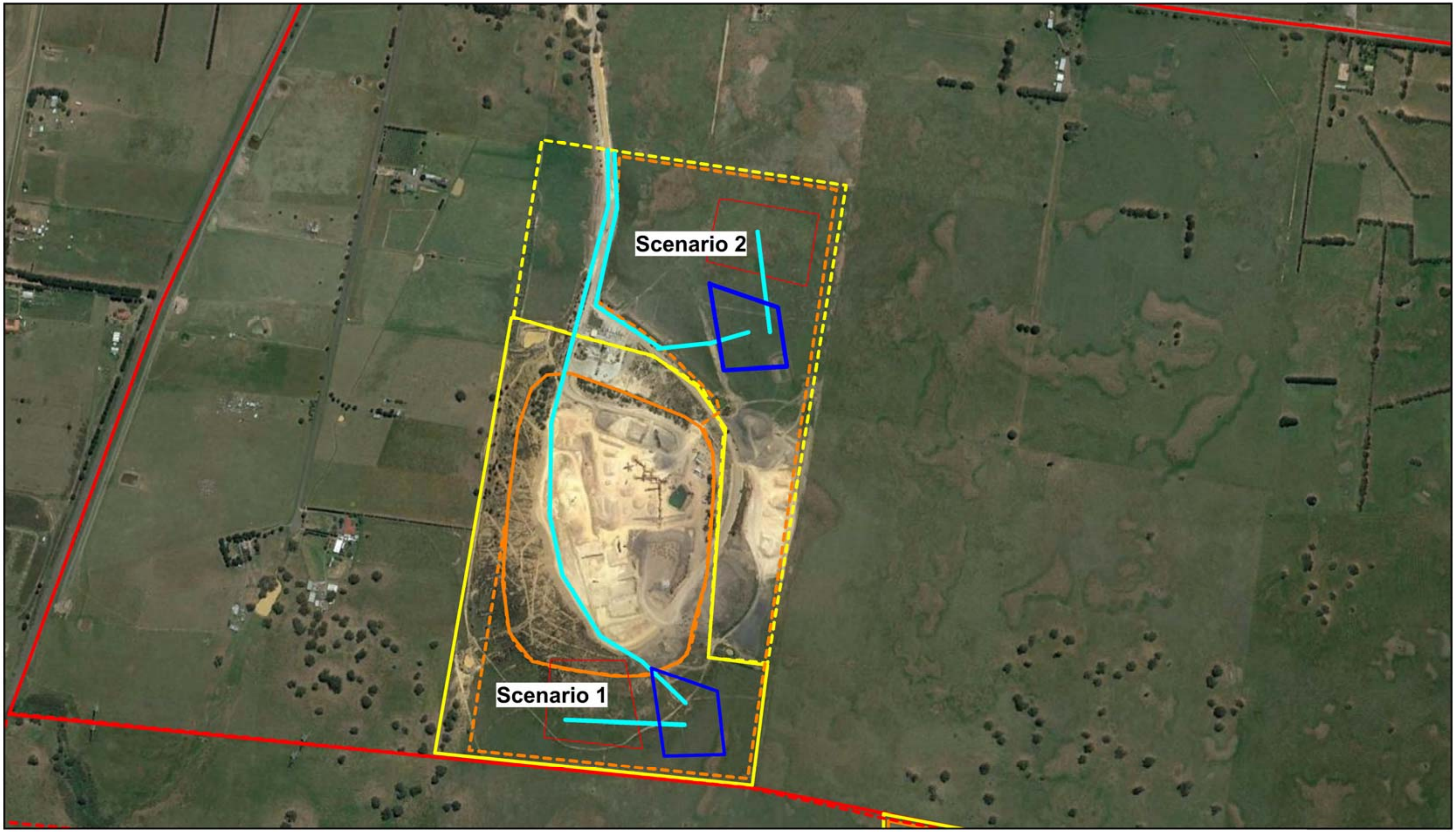
Parameter
Five 12 month meteorological datasets for the site for the years 2012, 2013, 2014, 2015 and 2016 were used from Melbourne Airport:
A 5 km x 5 km square receptor grid, centred over the each of the seven sites, using a grid resolution of 50 metres.
An averaging period of 24 hours.
Given that the topography of the broader region surrounding the site is relatively flat and the model domain of interest is confined to the near-field (e.g. site boundary and nearest receptors), the effects of terrain on dispersion were considered negligible and therefore not included in this assessment.
Rural dispersion coefficients.
Low wind adjustment factor, LOWWIND3, applied, as per latest USEPA guidance.
A surface roughness height of 0.1 metres was used, flat rural area.

Sources were defined in AERMOD according to the specifications outlined in Table 5. All volume sources were placed within the appropriate stage boundaries and were input as variable emissions sources dependent on the hour of day, whereby emissions were only applied between the hours of 6 am and 6 pm. The unsealed roads consisting of haul roads and the access road were input as line volume sources according to USEPA regulatory standards.

Table 5 AERMOD source characteristics

Source of Emissions	Source Type	Source Properties			
Excavator, Dumping, Grader, Loading, Transfer Points	Volume	2 m release height	4 m side length	1 m Initial lateral dispersion	1 m initial vertical dispersion
Primary Crusher, Secondary Crusher	Volume	3 m release height	20 m side length	5 m initial lateral dispersion	1.5 m initial vertical dispersion
Screening and Fines Screening	Volume	1 m release height	2 m side length	0.5 m initial lateral dispersion	0.5 m initial vertical dispersion
Haul Roads	Line Volume	Separated 2W configuration*	3 m vehicle width	4 m vehicle height	Factor of 1.7*
Blasting	Volume	2 m release height	4 m side length	1 m Initial lateral dispersion	7 m initial vertical dispersion
Wind Erosion	Area	Ground level release			
Notes * US EPA regulatory standard configuration					

Further details about the model configuration are given in the AERMOD input text file shown in Appendix B.



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0 100 200 300
metres (at A4)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 55

N W E S

LEGEND
Processing Plant
Wind Erosion
Haul/ Access Roads

GHD
CLIENTS | PEOPLE | PERFORMANCE

City of Whittlesea
Shenstone Park PSP-
Impact Assessment

Job Number | 3135311
Revision | A
Date | 12/12/2017

Location of modelled sources -
Woody Hill Expansions

Figure 4

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8/180 Lonsdale St Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com.au W www.ghd.com.au

Google Earth Imagery 2017. Created by: M.A

5.2.9 Dispersion modelling results

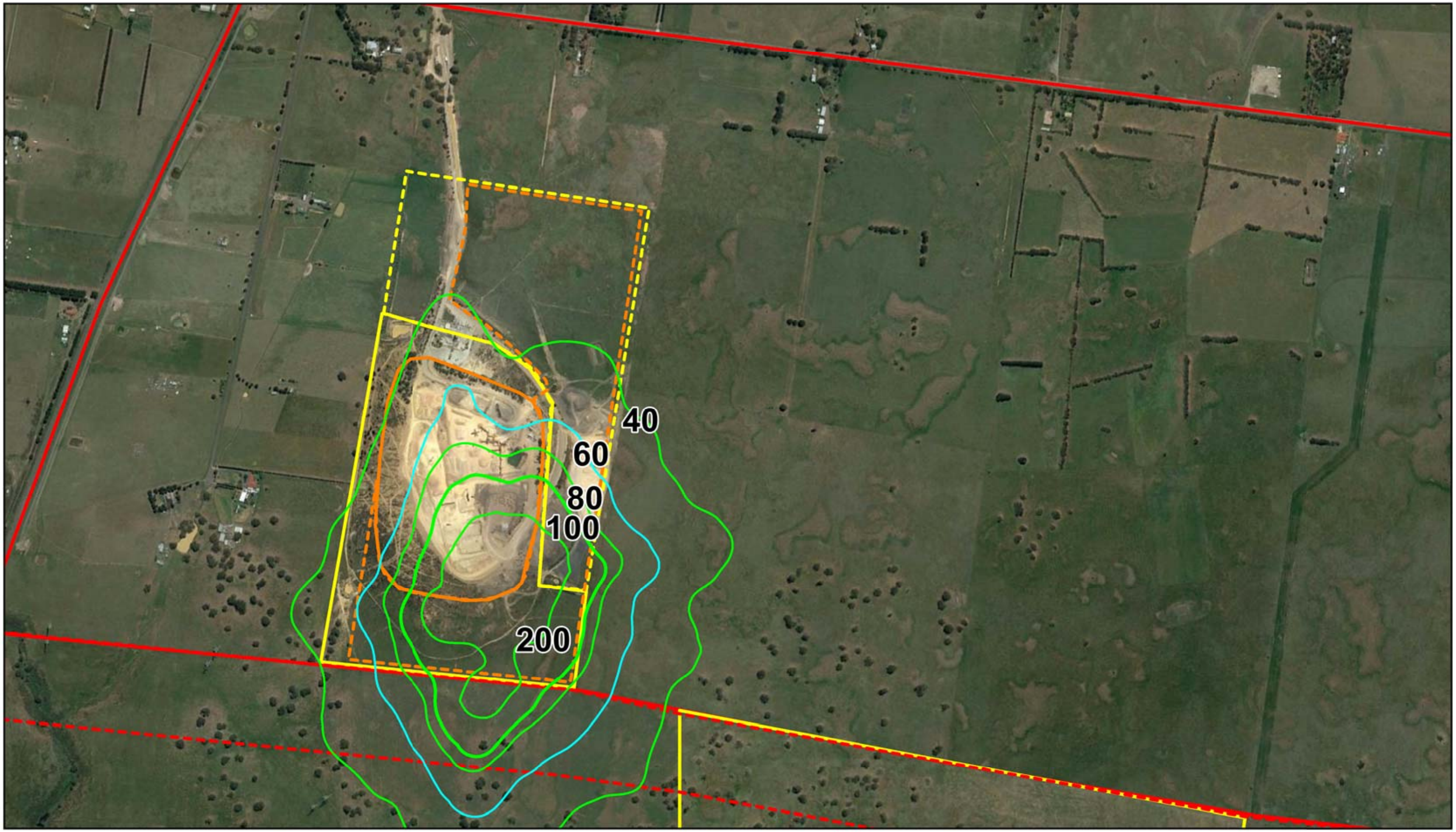
Assuming equivalent operations and the same peak 200 tph in the final stages of the quarry life, and with the finished quarry areas rehabilitated, it could be reasonably expected that the quarry would produce similar dust emissions over its operational life time.

As such, to simulate the predicted maximum concentrations of PM_{10} for possible expansions of the quarry, the source array for existing operations has been translated to the southern and northern boundaries of the quarry – so as to demonstrate the likely extent of dust impacts at later stages of the quarry life. Note that operations can/will change over this period of time and that the resultant patterns of offsite impact are indicative only.

Figure 5 shows the predicted theoretical maximum 24-hour concentration of PM_{10} for Scenario 1 (expansion to the south) based on a throughput of 200 tph and assuming a conservative background 70%ile level of 14.8 µg/m3. The criterion for PM_{10} (60 µg/m3) extends approximately 150 m to the east onto the PSP area. Even with moving all dust sources to the south of the quarry, the PM_{10} 24 hour criterion is met at all existing sensitive receptors. The 60 µg/m^3 criterion is also well contained within the default separation distance for the quarry.

Figure 6 shows the predicted theoretical maximum 24-hour concentration of PM_{10} for Scenario 2 (expansion to the north) based on a throughput of 200 tph and assuming a conservative background 70%ile level of 14.8 µg/m3. The criterion for PM_{10} (60 µg/m3) extends approximately 230 m to the east and 270 m north into PSP area. With the moving of all dust sources to the northeast of the quarry, the PM_{10} 24 hour criterion is met at all existing sensitive receptors. Again, the 60 µg/m^3 criterion is well contained within the default separation distance for the quarry.

Scenario 3 for an expansion of 20 m below the ground surface would have very similar impacts to Scenario 1 (the current existing operations of the Woody Hill Quarry) presented in the earlier GHD Report #51460, albeit a slight 5% reduction for pit emission retention. Refer to the existing operational impact assessment presented in the earlier GHD Report #51460.



0 125 250 375
metres (at A4)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 55

N W E S

LEGEND

- PSP Boundary
- Additional Investigation Area
- Work Authority Boundary
- Proposed Work Authority Boundary
- Extraction Boundary
- Proposed Extraction Boundary
- Peak Predicted PM10 Concentration ug/m3
- PM10 criterion - 60 ug/m3

CLIENTS | PEOPLE | PERFORMANCE

City of Whittlesea
Shenstone Park PSP-
Impact Assessment

Woody Hill Scenario 1-
PM10 predicted peak off-site impact

Job Number | 3135311
Revision | A
Date | 22/09/2017

Figure 5

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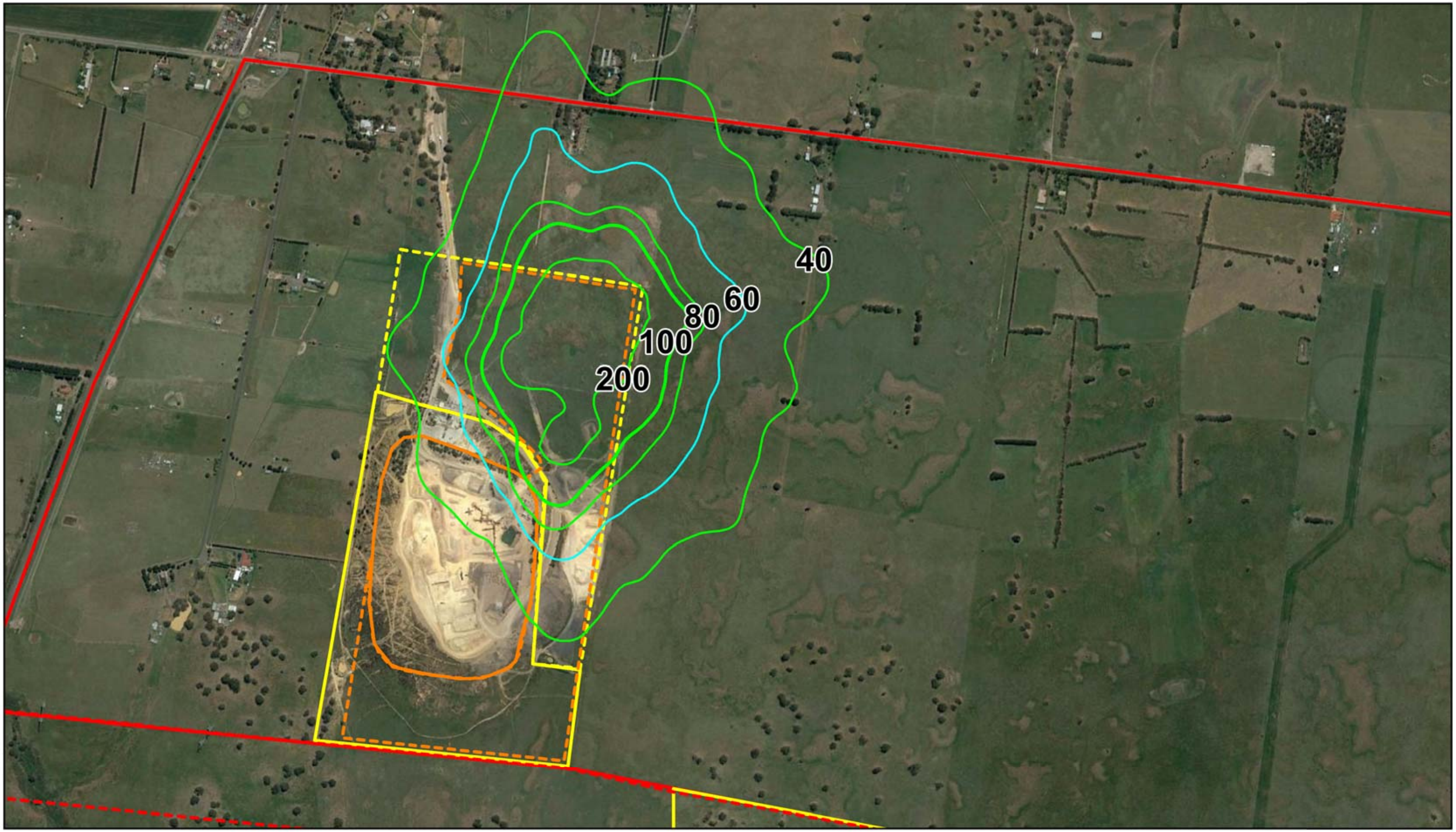

0 125 250 375		
metres (at A4)		

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 55

N W E S

LEGEND

- PSP Boundary
- Additional Investigation Area
- Work Authority Boundary
- Proposed Work Authority Boundary
- Extraction Boundary
- Proposed Extraction Boundary
- Peak Predicted PM10 Concentration ug/m3
- PM10 criterion - 60 ug/m3

GHD CLIENTS | PEOPLE | PERFORMANCE

City of Whittlesea
Shenstone Park PSP-
Impact Assessment

Woody Hill Scenario 2-
PM10 predicted peak off-site impact

Job Number | 3135311
Revision | A
Date | 22/09/2017

Figure 6

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5.2.10 Potential for further dust emission reductions and mitigation

A number of conservative assumptions have been used in the prediction of maximum dust impacts from the quarry. These include:

- Assuming full quarry operations every day of the year, instead of Monday to Saturday
- Using a maximum assumed throughput of 200 tph for peak quarry operations, when the average throughput is more likely to be around 50 tph
- Not accounting for dry depletion, whereby larger particle sizes within the PM_{10} range would settle faster and result in marginally lower concentrations of PM_{10}

In addition to this, modelling of PM_{10} has assumed that no controls have been placed on sources of dust emissions at the quarry to estimate the maximum dust impacts, with the exception of haul road watering. It is likely that the operator of the Woody Hill Quarry would implement dust management practices for product handling and storage in accordance with BPEM (Best Practice Environmental Management) measures for to mitigate dust onsite. This includes water sprays and a water cart in and around the plant and stockpile areas. According to the NPI, this would result in further reductions of 50% for loading and unloading stockpiles, wind erosion from stockpiles and hauling, and up to 70% reductions for unloading operations.

6. Noise impact assessment (non-blasting)

The operation of the Woody Hill Quarry would have the potential to generate environmental noise impacts at the Shenstone Park PSP site.

The purpose of this noise assessment is to assess the likelihood of impact from the possible expansions.

6.1 Legislation, policy and guidelines

The Victorian Government provides guidance on operational noise levels for industry in Victoria, with one mandatory policy for metropolitan areas and one guideline for regional areas as follows:

- *State Environment Protection Policy – Control of Noise from Commerce, Industry and Trade No. N-1* (SEPP N-1) (Victorian Government, 1989) for metropolitan areas throughout Victoria
- *Noise from Industry in Regional Victoria (NIRV): Recommended Maximum Noise Levels From Commerce, Industry and Trade Premises in Regional Victoria* (EPA publication 1411) (EPA Victoria, 2011)

The SEPP N-1 policy is applicable for industry located in a Major Urban Area (MUA), with the potential to impact nearby sensitive receivers. A '*Major Urban Area*' is defined as:

- *The part of Melbourne that is within the SEPP N-1 boundary (refer to Figure 7), or*
- *The part of Melbourne that extends beyond the SEPP N-1 boundary, but is within the Planning Urban Growth Boundary (UGB) (refer to Figure 7)*

The areas outside the MUA boundaries are managed by the NIRV guideline. The NIRV guideline is applicable for industry located in a *Rural Area*, with the potential to create noise impacts at nearby sensitive receiver locations. A *'Rural Area'* is defined as:

- *Land that is not within a 'Major Urban Area', including land in cities or towns with a population below 7,000 and rural locations outside 'Major Urban Areas.'*

In addition, NIRV makes provision for land located outside the SEPP N-1 boundary that has a population greater than 7,000 to be assessed against the SEPP N-1 methodology.

For this assessment, the PSP site and the assessed quarries are all located within Urban Growth and SEPP N-1 boundaries (refer to Figure 7).

Hence, the surrounding industrial noise has been assessed in accordance with the SEPP N-1 policy.

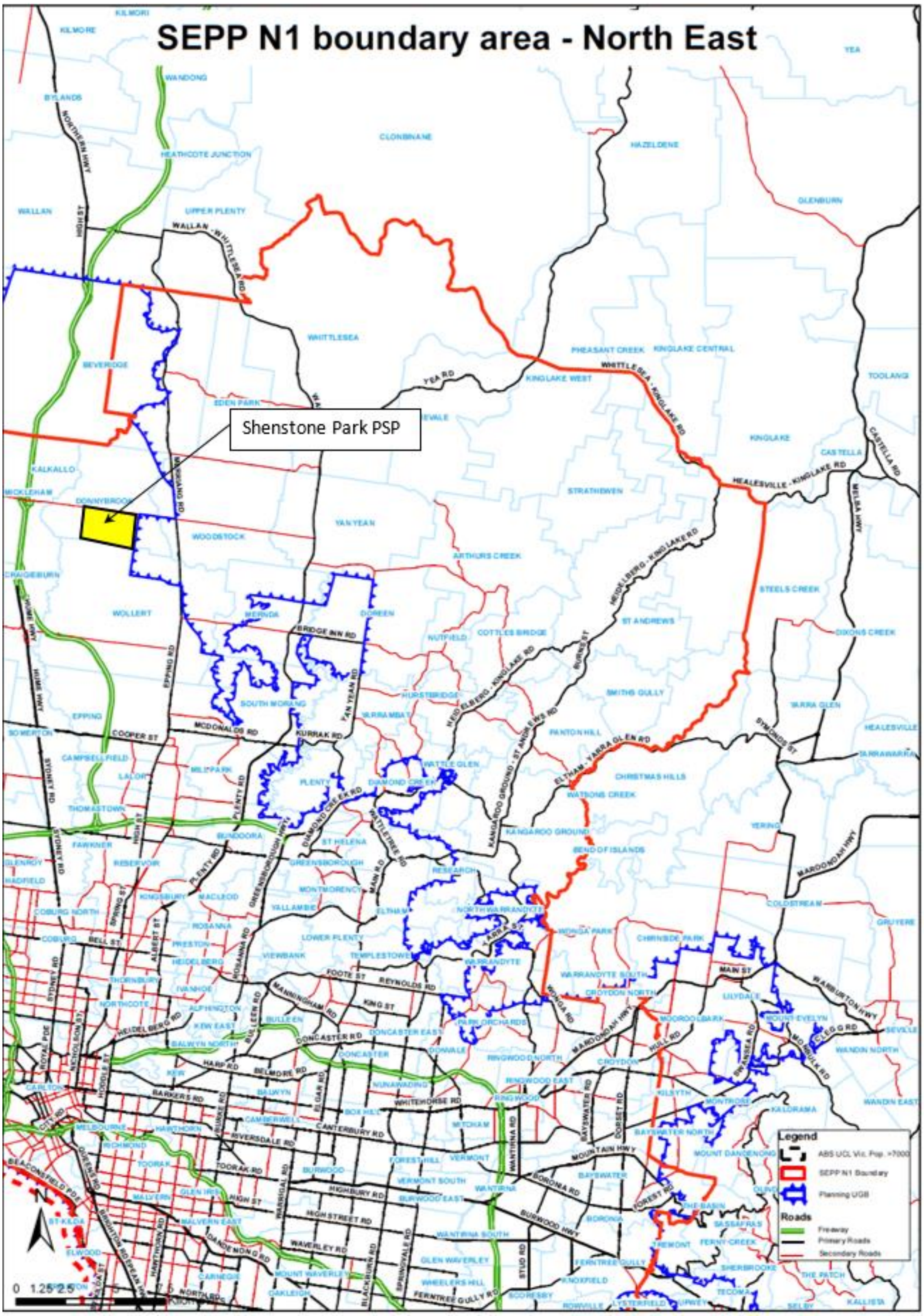


Figure 7 Areas covered by SEPP N-1 and planning UGB (EPA Victoria, 2013)

6.1.1 SEPP N-1

Noise from industry within Melbourne's Planning UGB must comply with SEPP N-1. SEPP N-1 provides limits on noise impacts on residential and other noise-sensitive uses and should be applied when siting or designing new or expanded industry or plant, and when government authorities are assessing applications for new and expanding industry.

SEPP N-1 sets the maximum noise limit allowed in a noise sensitive area emanating from commercial/industrial premises depending on the time of day, evening, or night, land use zoning and existing background noise levels.

The first step in assessing the noise limit is to calculate the prescribed upper noise limit (Zoning Level or Zoning Limit) for the particular land use according to Schedule B2 of the SEPP N-1. Once the zoning level has been developed, the background level is assessed as to whether they are neutral (i.e. not significantly higher or lower than the zoning level) or otherwise. If the background level is neutral, the noise limit adopted is the zoning level. If the background level is significantly lower or higher than the zoning level, then the noise limit is reduced or increased accordingly.

Section 6.1.2 details the derivation of SEPP N-1 noise limits applicable for the project site.

6.1.2 Determination of SEPP N-1 zoning levels

Schedule B2 of the SEPP N-1 outlines how zoning levels for a day period, evening period and night period must be determined using the following equations:

$$Day\ period: zoning\ level = 18\ \times Influencing\ Factor + 50$$

$$Evening\ period: zoning\ level = 17\ \times Influencing\ Factor + 44$$

$$Night\ period: zoning\ level = 17\ \times Influencing\ Factor + 39$$

Where, the Influencing Factor (IF) is calculated using the following formula:

$$IF = \frac{1}{2}\frac{\left(area\ type\ 3 + {}^{1}/_{2}\,(area\ type\ 2)\right)}{(total\ area\ of\ circle)}\ 140m\ circle + \frac{1}{2}\frac{\left(area\ type\ 3 + {}^{1}/_{2}\,(area\ type\ 2)\right)}{(total\ area\ of\ circle)}\ 400m\ circle$$

The two concentric circles of diameter 140 m and 400 m must be drawn or reproduced to scale on the relevant map, centered on the measurement point in the noise sensitive area. The area of all the SEPP N-1 Type 2 and 3 zones and reservations must be measured for each of the two circles from the same map. Following the above procedures and the land use zonings, the calculated zoning levels are then calculated as detailed in Table 6 for this project.

Table 6 Calculated SEPP N-1 zoning levels at the Shenstone Park PSP

Nearby sensitive receiver location	Period	Influencing factor	SEPP N-1 zoning levels dB(A)
Shenstone Park PSP site	Day	0.00	50
	Evening		44
	Night		39

6.1.3 Derived SEPP N-1 noise limits

Using the Zoning Levels in Table 6 and the measured background noise levels (refer to GHD Report #51460), the SEPP N-1 noise limits applicable for the project site can be derived in accordance with Schedule B1 and B3 of the SEPP N-1. The applicable noise limits are presented in Table 7.

Table 7 Derived SEPP N-1 industrial noise criteria for the Shenstone Park PSP

Sensitive receivers location	Period	Influencing factor	SEPP N-1 zoning levels dB(A)	Measured background noise levels dB(A)L_{90}	Background classification	SEPP N-1 noise limits dB(A)$L_{eq(30mins)}$
Shenstone Park PSP	Day	0.00	50	36	Low background	48
	Evening		44	29	Low background	40
	Night		39	28	Low background	37

Note that due to the wide variety of background noise monitoring results, the lowest background noise levels for each of the periods have been adopted.

6.1.4 Operational hours

The Woody Hill Quarry hours of operation are from 6.00 am to 6.00 pm Monday to Saturday.

The Woody Hill Quarry will be required to meet the night-time period criteria between 6.00 am and 7.00 am as the EPA defined night-time period is from 10:00 pm to 7:00 am Monday to Friday. The daytime period is 7:00 am to 6:00 pm, Monday to Friday, and Saturday 7:00 am to 1:00 pm. The evening time criteria applies after 1:00 pm on Saturday to 6:00 pm.

The night time limits are considered the most stringent criteria to be met at the identified sensitive receivers. Generally, if the night-time criteria can be met by the Woody Hill Quarry then the day and evening measurements are also likely to be met from this type of operation.

6.2 Industrial noise assessment methodology

Noise modelling was undertaken using the noise modelling software package Computer Aided Noise Abatement (CadnaA) (Ver. 2017 MR (BMP Set)) to predict the effects of airborne industrial noise from the possible expansions and produce noise impact contours for the adjacent PSP site.

CadnaA is a computer program for the calculation, assessment and prognosis of noise propagation. CadnaA calculates environmental noise propagation according to a number of different algorithms. In this assessment ISO 9613-2, "*Acoustics – Attenuation of sound during propagation outdoors*" was utilised (ISO, 1996). Propagation calculations using ISO 9613 take into account sound intensity losses due to hemispherical spreading, atmospheric absorption and ground absorption.

The ISO 9613-2 algorithm also takes into account the presence of a well-developed moderate ground based temperature inversion, such as that which commonly occurs on clear, calm nights or during 'downwind' conditions, which are favourable to sound propagation.

The noise assessment has been modelled based on available data at the time this report was prepared.

In the absence of quarry specific data, onsite plant and equipment with the potential to be a major noise source, fixed equipment locations, mobile equipment routes, quantity of equipment, and nature of the industrial operation, were based on information illustrated in the publicly available aerial imagery at the time of this report, as well as GHD site boundary inspections.

The following general settings were used in the model:

- Ground absorption was taken into account in the calculations. A general ground absorption coefficient of 0.75 was used throughout the model to represent the surrounding ground type comprising of predominantly vegetative grassland areas.
- All sensitive receptors were modelled at 1.5 m height above ground, in accordance with AS 1055: Acoustics – *Description and measurement of environmental noise*.
- Site topography and three-dimensional terrain with 1 m contour resolution have been used in the model.

6.3 Assessment scenarios

The noise assessment was undertaken for the following modelling scenarios:

- **Scenario 1**: Woody Hill expansion to the south
- **Scenario 2**: Woody Hill expansion to the north

Note that Woody Hill expansion 20 m below the ground surface scenario (refer to section 5.2.1) will not be assessed for noise impact due to the absence of quarry specific topographical design information available at the time this report was prepared. Moreover, it is anticipated that the two assessed scenarios would produce a higher noise impact than the below ground surface quarrying for day to day operations. However, depending on the method of winning rock, a greater number of blast events may be required, as GHD understand the lower rock formation consists largely of bluestone (basalt), a hard igneous rock formation.

6.4 General modelling assumptions

The following general assumptions have been made in undertaking the noise modelling assessment in this report.

- Existing ground topographical contour conditions will be used for assessing all modelling scenarios, due to the absence of quarry site-specific topographical contour data
- The existing orientation of all stationary equipment for the existing Woody Hill Quarry has been applied to all other modelled scenarios

6.5 Equipment modelled

Table 8 details the primary noise generating equipment assumed to be used within the quarry sites and the corresponding sound power levels used in the noise model. Equipment noise data was obtained from the following sources:

- Australian Standard AS 2436:2010 (reconfirmed 2016) – *Guide to noise and vibration control on construction, demolition and maintenance sites*
- BSI British Standards BS 5228.1:2009 – *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise* (BS 5228.1, 2009)
- Engineering Noise Control (ENC) software
- GHD internal database and past project experience

Table 8 Modelled equipment sound power levels SWL (10^{-12} Watt)

Plant item	Quantity of equipment used within the model	Source height (m)	L_w dB(A) per unit	Octave centre frequency (Hz)/dB(linear)									Data source
				31.5	63	125	250	500	1000	2000	4000	8000	
Fixed equipment													
Primary crusher	1	6	113	107	115	114	111	107	108	106	101	96	Albury Waste Management Centre
Secondary crusher	1	6	113	107	115	114	111	107	108	106	101	96	Albury Waste Management Centre
Open conveyor	As per the aerial imagery	Assumed as per the aerial imagery	83/m	93	80	81	81	83	77	72	63	55	Clermont Coal Project
Screener	2	2	108	110	110	107	104	103	103	101	97	96	Kitsault Mine Project
Stacker/reclaimer	1	6	108	98	98	103	100	97	94	92	89	81	Kitsault Mine Project
Concrete batching plant	1	10	113	107	106	103	111	111	107	106	98	98	GHD Database
Mobile power crusher and screener	1	3	103	100	101	103	102	101	97	95	92	86	Hi-Quality Bulla Quarry Project – CR019
Mobile equipment													
Loader	5	2.5	114	108	105	108	111	112	108	105	103	94	Bengalla Development Project - Loader L1800
Haul truck	Refer to modelling assumptions	4	117	120	123	121	117	114	111	109	104	97	Ensham Central Project - CAT 773/777
Grader	1	2.5	110	110	111	113	113	106	99	102	99	91	Moranbah South Project CAT 14H or equivalent
Excavator	2	2.5	107	110	113	106	105	105	101	99	96	91	BS5228-1:2009 – Appendix C.2 Ref no 14
Truck and Dog	Refer to modelling assumptions	3	104	110	114	108	104	101	99	96	92	85	Hi-Quality Bulla Quarry Project
Water cart truck	1	2.5	87	84	92	81	77	80	84	80	74	69	Albury Waste Management Centre
Concrete Mixer Truck	Refer to modelling assumptions	2.5	87	84	92	81	77	80	84	80	74	69	Albury Waste Management Centre

6.6 Model assumptions

A number of conservative assumptions have been used in the prediction of operational noise impacts from the quarry. These include:

- Assuming full quarry operations Monday to Saturday from 6 am to 6 pm
- Assume continuous operation with 1.5 truck movements per hour on haul roads
- Conveyors were all modelled uncovered
- The existing concrete batching plant was modelled in continuous operation
- No reduction in noise due to pit depth and landform shielding has been modelled for Scenarios 1 and 2
- The concrete batching plant has also been modelled in its existing location, which is assumed to be unchanged during the life of the quarry

In addition to this, modelling of noise has assumed that no controls have been placed on noise emissions at the quarry. Reversing beepers have not been modelled.

6.6.1 Assessment

Resulting noise contours, in five-decibel increments for the noise assessments outlined above are shown in Figure 8 and Figure 9.

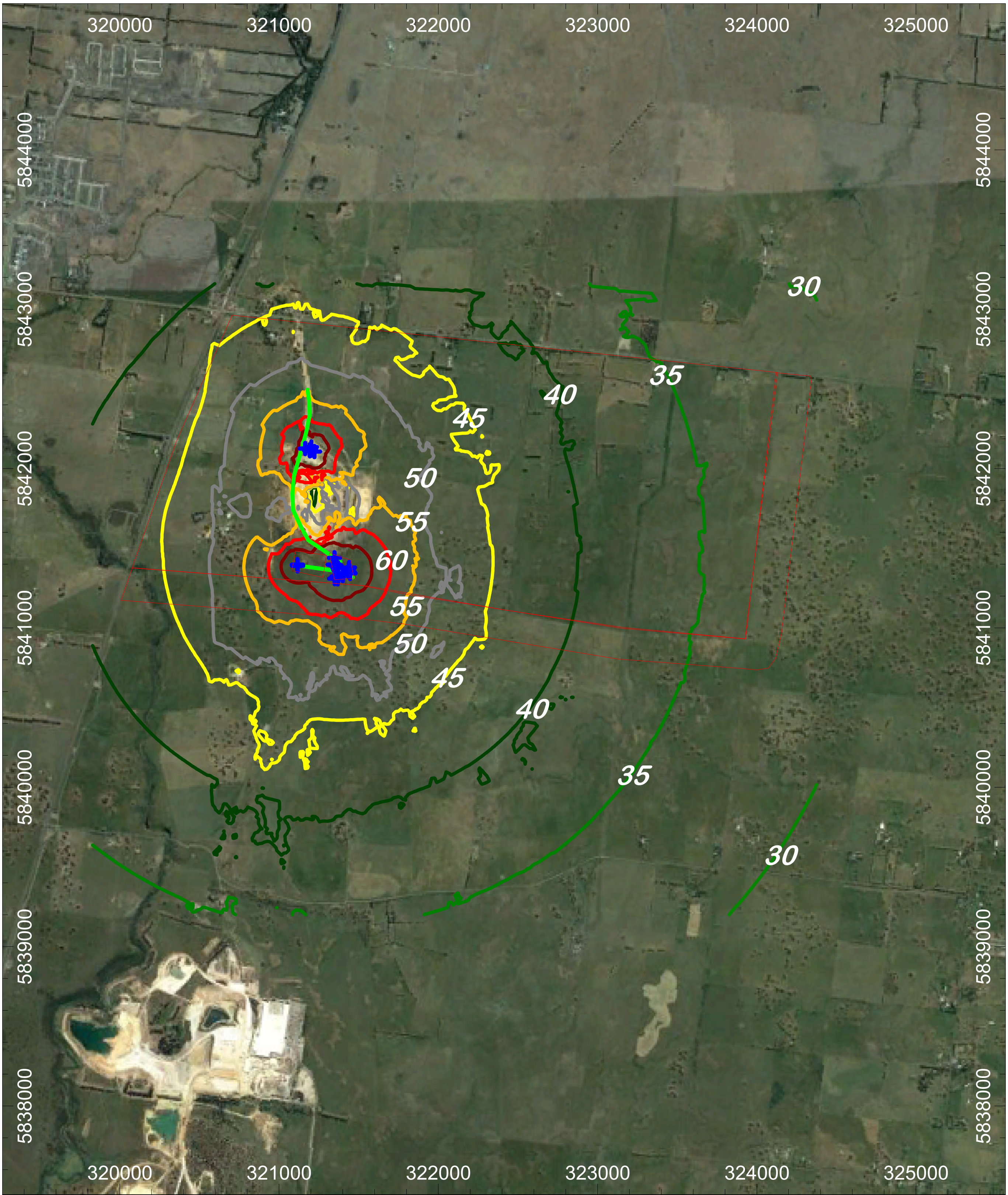
Scenario 1, when compared to the daytime criteria of 48 dB(A), shows predicted exceedances beyond the site's proposed WA 492 boundary of approximately 600 meters, 100 m beyond the 500 m default buffer prescribed for protection against fly rock.

Scenario 2, when compared to the daytime criteria of 48 dB(A), shows predicted exceedances beyond the site's proposed WA 492 boundary of approximately 600 meters, 100 m beyond the 500 m default buffer prescribed for protection against fly rock.

Modelling of the existing approved extraction area for the Woody Hill Quarry was also undertaken in the GHD report entitled *'City Of Whittlesea Council Impact Assessment Report for the Shenstone Park Precinct Structure Plan – December 2017[9]'*. In that report a buffer of 900 m was recommended, which is 300 m greater that that assessed in this report due to the elevated location of existing noise sources combined with the concrete batching plant. However, as the northern and southern extraction scenarios mentioned above will be at a much lower elevation, this has enabled greater attenuation of the noise impact from each of these two scenarios reducing the buffer size by one third down to 600 m.

Hence, it is recommended a 600 m buffer around the extraction area for the future possible expansions of the Woody Hill Quarry be prescribed prior to any noise mitigation being implemented. Should further work be undertaken to determine the noise controls and operations in place at the quarry, it may be possible to reduce the extent of the noise buffer.

[9] GHD Report #51460



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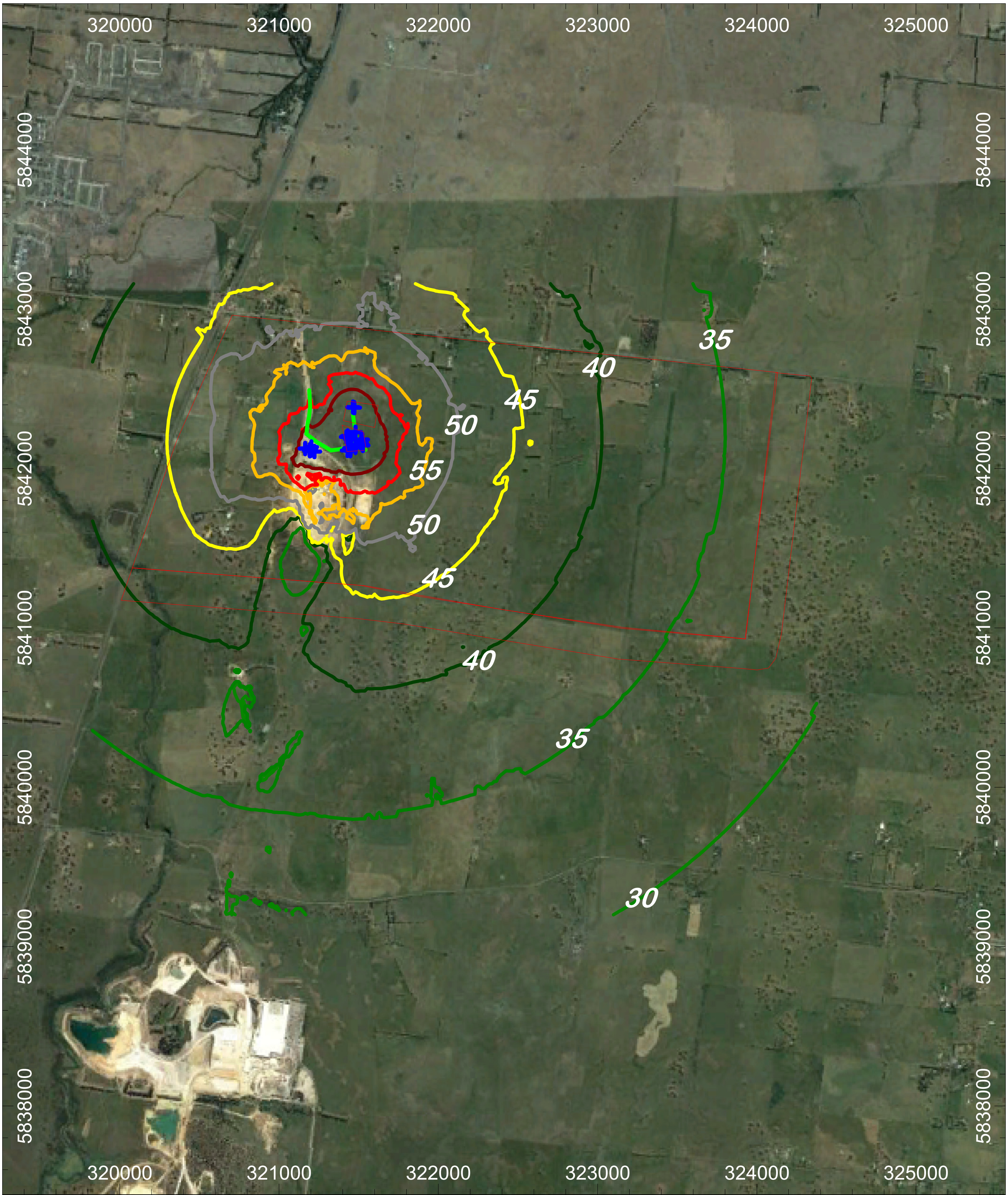
Shenstone PSP Project
Predicted Industrial Noise Impact Contour
Scenario 2: Woody Hill proposed expansion to the south

ISO 9613 Algorithm
Predicted Noise Contours: 5 dB(A)Leq(1 hour) SPL re:20µPa
Contour Elevation: 1.5 m
Note: This figure was re-produced based on assumptions and limitations stipulated in this GHD noise report.

Image sourced from Google Earth©
Whilst every care has been taken to prepare this map. GHD make no representations or warranties about its accuracy, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Figure 8 Scenario 1: Woody Hill proposed expansion to the south



Shenstone PSP Project
Predicted Industrial Noise Impact Contour
Scenario 3: Woody Hill proposed expansion to the north

ISO 9613 Algorithm
Predicted Noise Contours: 5 dB(A)Leq(1 hour) SPL re:20μPa
Contour Elevation: 1.5 m
Note: This figure was re-produced based on assumptions and limitations stipulated in this GHD noise report.

Figure 9 Scenario 2: Woody Hill proposed expansion to the north

6.7 Noise mitigation strategies

Noise mitigation strategies can generally be divided into four different areas from the most to the least preferred (NSW INP, 2000):

1. *Land-use Controls* (separating the location of noise-producing activities from sensitive areas)
2. *Control at Source* (reduce the noise output of the source to provide protection surrounding environment)
3. *Control in Transmission* (reduce noise level at the receiver but not necessarily the environment surrounding the source, e.g. noise barrier, etc.
4. *Receiver Control* (localised acoustic treatment at sensitive receiver)

Discussion with the asset owner may need to be undertaken to provide effective, agreed noise mitigation measures for the quarry, as necessary.

Should a control at source noise mitigation strategy not be possible or practicable, it is not uncommon that the indoor amenity of sensitive receivers subject to quarry operational noise be acoustically treated using a control at receiver strategy, via building acoustic treatments. However, the limitation of this strategy is that it would not preserve the outdoor amenity of the receiver unless a combination of controls aimed at reducing noise during transmission also be implemented.

Development may still be able to occur within the 600 m buffer following appropriate mitigation either at the quarry or via building acoustic treatments at the sensitive receiver location. Without mitigation at the source, ambient levels would remain the same and so some consideration of this would be required during planning as to what type of use was appropriate within the 600 m buffer. The mitigation strategies provided below are in-principle mitigation measures only, and each new sensitive use coming into the area would need to review and design for their site-specific requirements.

6.7.1 Land-use controls

There are several strategies involved in using the land-use control measures:

- **Setbacks strategy** (e.g. open space design adjacent to noisy industries, busy roads and/or railway corridors to provide noise reduction through setback distances to residential uses).
- **Setback distances** between the noise source and the noise sensitive receiver could be one form of treatment in reducing the noise exposure level at the proposed PSP. A setback strategy would also be effective in mitigating ground-borne vibration impacts from the nearby Donnybrook Road, quarry blasting activities, or other vibration sources.
- **Building locations and height controls** for example, taller buildings could be located adjacent to primary noise sources to provide a noise shielding effect to residential uses or the overall PSP.
- **Expansion of cycle and pedestrian facilities**, to discourage the use of motor vehicles and encourage the use of bicycles, scooters or walking, which would result in less noise emission within the area.
- **Impose acoustic control planning conditions on new developments**, this could be in the form of a council's planning permit condition, specifying acoustic treatment on noise sensitive developments.

6.7.2 Control at source

There are several strategies involved in using the Control at Source measure:

- Fit and maintain appropriate mufflers on earth-moving and other vehicles on the site
- Enclose noisy equipment
- Provide noise attenuation screens/shields such as buildings, earthen bunds directly adjacent noise sources, where appropriate Traffic management to reduce the need for multiple heavy vehicle deliveries to one location
- Acoustic treatment to specific noise sources from specific nearby industry
- Promoting the use of low pavement surfaces on new roads or the resurfacing of existing roads. The type of road surface has a significant effect on the level of noise generated by the tyre/road interface. Austroads Technical Report "*Austroads Review Report: Traffic Noise/Long-life Surfacings*" (Austroads, January 2011) provides relative noise emission levels of conventional road surfacings in Australia, based on studies conducted by (Campbell & Isles, 2001), (Parnell, 2006) and (Samuels, 2008) (refer to Table 9).

Table 9 Relative noise emission levels of conventional surfacings in Australia

Surfacing type	Noise level variation dB(A)		
	Traffic Noise	Individual vehicles pass-by noise	
		Cars	Trucks
Size 14 single/single seal	+4.0	+4.0	+4.0
Size 7 single/single seal	+1.0	-	-
Portland cement concrete (PCC) tyned and dragged	0 to +3.0	+1.0 to +3.5	=1.0 to +1.0
Cold overlay	+2.0	+2.0	+2.0
Dense Graded Asphalt (DGA)	0	0	0
Portland Cement Concrete (PCC): exposed aggregate	-0.5 to -3.0	-0.1	-6.7
Stone Mastic Asphalt (SMA)	-2.0 to -3.5	-2.2	-4.3
Open Graded Asphalt (OGA)	0 to -4.5	-0.2 to -4.2	-4.9

In general, sealed surfaces would not be recommended for low noise surfacing purposes, as they tend to generate higher traffic noise levels compared to asphalt surfacing. Similarly, to concrete surfacing, they tend to generate higher noise levels than asphalt surfacing. The ageing of pavement and its construction quality can also affect the noise performance, Table 10 details the change in acoustic performance of road pavement due to ageing.

Table 10 Change in acoustic performance due to aging

Road surface	Noise level variation dB(A)		
	When fresh	Several years old	Change
Sprayed seal	+4	+2	-2
Dense Graded Asphalt (DGA)	0	+1	+1
Open Graded Asphalt (OGA)	-4	-2	+2

For more detailed information on traffic mitigation please refer to GHD Report #51460.

6.7.3 Control in transmission

The noise reduction strategy used to control in noise transmission usually involves the installation of noise barriers. Noise barriers may include an existing feature, such as:

- An elevated road or a natural slope (e.g. earth mound)
- A purpose designed feature such as a solid boundary fence
- A purpose designed feature of the building, such as a partially enclosed carport
- A purpose designed building which acts as a barrier block

In general, the noise barrier should provide sufficient screening to avoid direct line of sight between the shielded noise sources and the protected sensitive receivers. Noise barriers would not be effective in reducing noise impacts if the line of sight from the noise source to the residence is not reduced. Hence, it may not be practical to install a noise barrier for elevated receivers.

6.7.4 Receiver control

There are several strategies involved in using the Receiver Control measure:

- Building orientation layout. This involves configuring the development's floor plan to have sleeping areas/habitable areas facing away from the noise sources
- Minimise lightweight external wall construction facing the dominating noise sources
- Thicker glazing construction for the window façade
- Minimise window size and maximise masonry external wall construction
- Minimise the use of openable window construction
- Configure any discharge/intake duct grill layout (above ceiling level) facing away from the noise sources
- Balustrade/balcony design/configuration to avoid direct line of sight from the balcony to the noise sources (this shall be confirmed following the design of the development and landscape layout)
- Installation of foam rubber pad along the required building foundation plate, where necessary, depending the magnitude of the potential exposed vibration across the building structures

7. Vibration impact assessment (non-blasting)

The operation of the Woody Hill Quarry would have the potential to generate vibration impacts within the Shenstone Park PSP site.

The purpose of this vibration assessment is to assess the likelihood of impact from possible expansions of the Woody Hill Quarry.

7.1 Legislation, policy and guidelines

7.1.1 Human comfort

In the absence of any local guidelines, human comfort vibration criteria have been set with consideration to the NSW EPA *Environmental Noise Management – Assessing Vibration: A Technical Guideline (AVTG)* (NSW EPA, February 2006). British Standard 6472:2008, *Guide to Evaluation of Human Exposure to Vibration in Buildings Part 1: Vibration Sources Other than Blasting* (BS 6472, 2008) is recognised by the NSW EPA AVTG as the preferred standard for assessing 'human comfort'.

BS 6472:2008 is commonly recognised in Australia as the preferred standard for assessing human comfort criteria for residential receptors. Table 11 includes the acceptable values of vibration dose for residential receptors during daytime and night-time periods.

These values represent the best judgement available at the time the standard was published and may be used for both vertical and horizontal vibration, providing that they are correctly weighted.

Table 11 Vibration dose value (VDV) ranges and probabilities for adverse comment to intermittent vibration ($m/s^{1.75}$)

Location	Low probability of adverse comment[a]	Adverse comment possible	Adverse comment probable[b]
Residential buildings 16 hour day (7.00 am to 11.00 pm)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8 hour night (11.00 pm to 7.00 am)	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Notes:
[a] Below these ranges adverse comment is not expected.
[b] Above these ranges adverse comment is very likely.

BS 6472 outlines vibration limits, which would cause minimal adverse reactions from the occupant. The assessment of response to vibration in BS 6472 is based on VDV, for construction related vibration (similar to quarry operations), it is considered more appropriate to provide guidance in terms of peak particle velocity (PPV) in millimetres per second, since this parameter is likely to be more routinely measured due to concerns over potential building damage.

BS 5228-2:2009 *Code of Practice for Noise and Vibration on Construction and Open Sites – Part 2: Vibration* (BS 5228.2, 2009) recommends that the guidance values presented in Table 12 are appropriate for construction type works, as it is easier to assess the intermittent vibration criteria against peak value rather than a dose value. BS 5228.2 also recognises that higher vibration levels are tolerable for short-term projects, as undue restriction on vibration levels can substantially prolong projects and result in greater annoyance.

Many of the types of equipment used at the Woody Hill Quarry are the same or similar to those commonly used in construction such as excavators, bull dozers, dump trucks and graders, and as such, BS 5528.2.2009 is considered to be relevant for this report.

Humans are capable of detecting vibration at levels that are well below those with the potential risk of causing damage to a building. The degree of perception for humans is suggested by the vibration level categories given in BS 5228-2:2009, as shown in Table 12.

Table 12 Guidance on the effects of vibration levels (BS 5228.2)

Approximate vibration level	Typical degree of perception
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

Based on Table 12, the human response to vibration could be summarised as:

- A vibration level in the range between 0.14 mm/s to 0.3 mm/s would generate a low probability of adverse comment or complaint
- A vibration level in the range between 0.3 mm/s to 1 mm/s would generate the possibility of adverse comment or complaint
- A vibration level greater than 1 mm/s would likely cause adverse comment or complaint

The vibration limits in Table 12 have been adopted for this assessment.

7.1.2 Structural damage

Currently, there is no Australian Standard that sets the criteria for the assessment of building or other structural damage caused by vibration. Australian Standard 2436:2010 – *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites;* does refer to the control of vibration in Section 4.8.1. The supplied information in AS 2436 is general in nature and refers to other standards and guidelines if a more detailed assessment is required, i.e. quantification of vibration exposure. British Standard BS 7385.2:1993 – *Evaluation and Measurement for Vibration in Buildings: Part 2 – Guide to Damage Levels from Ground Borne Vibration* and British Standard BS 5228.2:2009 – *Code of Practice for Noise and Vibration Control on Construction and Open Sites: Part 2 Vibration*; are referenced in AS 2436 as being able to supply detailed vibration quantification.

Additional to the detailed British Standards, the German Standard *DIN 4150-3: 1999 Structural Vibration – Part 3: Effects of Vibration on Structures* (German Standards, 1999) provides more stringent vibration criteria as opposed to BS 7385.2:1993 for above ground structures, but less stringent criteria for below ground structures when compared to BS 5228.2:2009. Therefore, a combination of the German and British Standards is recommended, in the absence of specific criteria being supplied by the asset owner, as shown in Table 13.

Table 1 of Section 5 of DIN 4150.3:1999 presents guideline values for the maximum absolute value of the velocity "*at the foundation and in the plane of the highest floor of various types of building. Experience has shown that if these values are compiled with, damage that reduces the serviceability of the building will not occur. If damage nevertheless occurs, it is to be assumed that other causes are responsible.*"

Measured values exceeding those listed in Table 13 "*… does not necessarily lead to damage; should they be significantly exceeded, however further investigations are necessary.*"

Table 13 Guidance values for short-term vibration on structures

Line	Type of structure	Guideline values for velocity v(t)[a] (mm/s)		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz[b]
At grade structures (DIN 4150.3:1999)				
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design.	20	20 to 40	40 to 50
2	Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10
Underground structures (BS 5228.2:2009)				
Competent structure such as steel or concrete pipeline		30		
Dilapidated brickwork		15		

[a] The term vi refers to vibration levels in any of the x, y or z axis.

[b] Where frequencies are above 100 Hz the values given in this column may be used as minimum values.

The vibration criteria presented in German Standard DIN 4150.3:1999 exceeds the human comfort criteria presented in Table 12. Therefore, for facilities that people occupy, the human comfort criteria should override the structural damage criteria for the assessment of any vibration.

7.2 Vibration assessment

Many of the types of equipment used in the quarry are similar in nature to those used in construction activities such as loaders, trucks and excavators and some of the equipment used has the potential to generate vibration.

Energy from the types of equipment used in the quarry is transmitted into the ground and transformed into vibrations, which attenuate with distance. The magnitude and attenuation of ground vibration is dependent on:

- The efficiency of the energy transfer mechanism of the equipment (i.e. impulsive, reciprocating, rolling or rotating equipment)
- The frequency characteristics of the vibrations produced

- The impact medium stiffness (where vibrations are passing through)
- The type of wave (surface or body)
- The ground type and topography (i.e. transmissivity and trough isolation effects)

Due to the above factors, there is an inherent variability in ground vibration predictions without site-specific measurement data. In lieu of Woody Hill Quarry based information, the NSW RTA *Environmental Noise Management Manual (ENMM) 2001* (RTA NSW, 2001) provides typical construction equipment ground vibration levels at 10 m.

The ENMM states that: "*in obtaining an initial indication of likely vibration levels, it can be assumed that the vibration level is inversely proportional to distance. Note, however, that field data show a wide variation in distance attenuation, with the distance relationship generally varying between* $d^{-0.8}$ *and* $d^{-1.6}$ *rather than being fixed at* d^{-1}.", where *d*=distance.

The rate of vibration attenuation can be calculated from the following regression analysis formula:

$$V = kd^{-n}$$

Where:

V = PPV (peak particle velocity)

d = Distance

n = attenuation exponent. The value of n generally lies between 0.8 and 1.6 with a relatively common value of 1.5[10].

k = Velocity (PPV) at d=1 unit of distance

The predicted ground vibrations at various distances are shown in Table 14 for typical equipment used at quarries and in construction of haul roads and movement of earthen materials.

Given the distances involved between site works and the nearest receivers, vibrations affecting human comfort and building integrity are not expected to be an issue.

Table 14 Predicted construction equipment vibration levels (mm/s PPV)

Plant item[11]	Human perception preferred criteria (mm/s PPV) *(maximum criteria)*		Predicted ground vibration (mm/s PPV)				
	Day	Night	10 m	50 m	100 m	200 m	500 m
15 t roller	0.28 *(0.56)*	0.2 *(0.4)*	7.5	0.7	0.2	0.1	<0.1
Dozer	0.28 *(0.56)*	0.2 *(0.4)*	3.3	0.3	0.1	<0.1	<0.1
7 t compactor	0.28 *(0.56)*	0.2 *(0.4)*	6.0	0.5	0.2	0.1	<0.1
Excavator[12]	0.28 *(0.56)*	0.2 *(0.4)*	3.6	0.3	0.1	<0.1	<0.1
Grader[13]	0.28 *(0.56)*	0.2 *(0.4)*	2.0	0.2	0.1	<0.1	<0.1

[10] Construction Vibrations: State of the Art (Wiss, 1981)
[11] NSW RTA Environment noise management manual
[12] The predicted ground vibration values were based on data stipulated in Cenek.P.D, et al. *Ground vibration from road construction* (May 2012) Research paper.
[13] Tynan, A.E. Ground Vibrations. Damaging effects to Buildings. Australian Road Research Board 1973

7.3 Summary

It is expected that any vibrational impact from equipment such as graders or excavators onsite within the Woody Hill Quarry would be not be perceptible by a human beyond a distance of approximately 100 m from the work authority boundary.

It is also unlikely that operational vibrations from the Woody Hill Quarry would be perceptible in residential environments after 50 m from the work authority boundary.

Given the distances involved between site works and the most likely future location of receivers, vibrations affecting human comfort and building integrity are not expected to be an issue beyond 100 m from a potential northern or southern quarry operation.

Hence, it is recommended a 100 m operational (non-blast) vibration buffer around the approved extraction area for the Woody Hill Quarry therefore be prescribed.

8. Blast generated fly rock

Fly rock and fly (other debris) occur when the explosive energy from the gas expansion in a blast event is vented violently into the atmosphere, and forces rocks and debris to be thrown outward from the blast location.

The major cause of fly rock is due to incorrectly drilled and stemmed charges or natural weakness in rocks causing premature gas venting. However, there are a number of contributing factors as outlined in AS 2187.2:2006 *Explosives – storage and use of explosives*, as follows:

- Weak rock structure
- Insufficient front row blast hole burdens
- Stemming depth
- Initiation sequence
- Blast hole diameter
- Blast pattern shape, or
- Stemming material

Generally, through carefully implemented control measures, most fly rock can be contained within the active pit area to approximately 50 m in front of the face. Industry practice is to allow at least a factor of four times this distance as a safety factor.

DEDJTR's advice[14] indicates that a 200 m radial buffer distance from the boundary of the extraction area is sufficient to mitigate against safety issues from fly rock during blasting.

This 200 m buffer is to be radial in shape as the fly rock component will be independent of wind speed and direction due to the projectile speed of fly rock, negating any meteorological influence.

[14] Meeting with DEDJTR on 17 October 2017

9. Blast generated noise

The quarrying operations at the Woody Hill Quarry would have the potential to generate environmental blast noise impacts onto the Shenstone Park PSP site. This section discusses the potential impacts for each of the possible expansion scenarios.

Air blast is the pressure wave (sound) produced by a blast event being transmitted through the air causing a pressure change at the human ear. The sources of air blast include:

- A small air pressure pulse generated by the ground vibration
- A direct air pressure pulse from rock movement
- A direct air pressure pulse from blast gas venting

An air blast can be heard when the frequencies are within the normal human hearing range of between 20 Hz and 20 kHz and can travel large distance during temperature inversions causing sound waves to reflect back to ground long distances from the source.

Air blast frequencies below the natural human hearing range (low frequency) are often noticed by residents as pressure waves that cause rattling of windows and sliding doors.

Air blast is normally heard after the ground vibration, as the waves travelling in the ground move faster than those through the air. Air blast is known to cause more complaints than vibration.

9.1 Legislation, policy and guidelines

9.1.1 Blast overpressure

Guidance on potential blast overpressure (noise) is provided from the Australian and New Zealand Environment Council (ANZEC) *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (1990).* This guideline recommends noise and vibration limits for human comfort for residential dwellings as shown in Table 15.

Table 15 Recommended ANZEC 1990 blasting limits for residential dwellings (human comfort)

Parameter	Vibration Criteria
Maximum level	115 dB(lin) peak
Allowances	The level of 115 dB may be exceeded on up to 5% of the total number of blasts over a period of 12 months, but never over 120 dB(lin) peak.

Table J5.4(A) of AS 2187.2 – 2006 provides a slight variation on the ANZEC guideline to differentiate between operations lasting less than 12 months and longer term operations, as well as providing guidance on criteria for occupied non-sensitive sites, such as factories and commercial premises, refer to Table 16.

Table 16 Air blast limits for human comfort chosen by some regulatory authorities (Table J5.4(A) of AS 2187.2 – 2006)

Category	Type of blasting operations	Peak sound pressure level (dBL)
Human Comfort Limits		
Sensitive Site*	Operations lasting longer than 12 months or more than 20 blasts	115 dBL for 95% blasts per year. 120 dBL maximum unless agreement is reached with occupier that a higher limit may apply.
Sensitive Site*	Operations lasting for less than 12 months or less than 20 blasts	120 dBL for 95% blasts. 125 dBL maximum unless agreement is reached with occupier that a higher limit may apply.
Occupied non-sensitive sites, such as factories and commercial premises	All blasting	125 dBL maximum unless agreement is reached with occupier that a higher limit may apply. For sites containing equipment sensitive to vibration, the vibration should be kept below manufacturer's specifications or levels that can be shown to adversely affect the equipment operation.

*A sensitive site is defined under AS 2187.2 as including houses and low rise residential buildings, hospitals, theatres, schools, etc., occupied by people.

Table J5.4(B) of AS 2187.2 – 2006 provides recommended air blast limits for structural damage control, refer to Table 17.

Table 17 Air blast limits for damage control (Table J5.4(B) of AS 2187.2 – 2006)

Category	Type of blasting operations	Peak sound pressure level (dBL)
Damage Control Limits		
Structures that include masonry, plaster and plasterboard in their construction and also unoccupied structures of reinforced concrete or steel construction	All blasting	133 dBL maximum unless agreement is reached with owner that a higher limit may apply.
Service structure such as pipelines power lines and cables located above the ground.	All blasting	Limit to be determined by structural design methodology

9.2 Blast generated noise assessment

Ground blast overpressure was estimated using the distance relationship calculation outlined in AS 2187.2 – 2006.

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

Where

P = pressure in kilopascals

R = distance from charge, in metres

Q = explosive charge mass, in kg

K_a = Site constant

a = Site exponent

The standard recommends a site constant of K_a=10 to 100 and site exponent of a=-1.45. Air blast is proportional to the cube root of the charge mass. A variety of factors are important in reducing the noise level (blast overpressure) from the blast event such as the blast design parameters such as charge size, stemming height, delay timing and site specific site constants.

A preliminary assessment of air blast overpressure impacts was considered using the three site constants of K_a=10, K_a=50, and K_a=100 and site exponent of a=-1.45. Blast distances are taken as distance from charge, however for the purpose of this report assume as being taken at the extraction limit boundary, as this would likely be the worst-case scenario.

As the blast size Maximum Instantaneous Charge (MIC) is unknown at this stage, the equation above was used to identify possible MIC values based on the receiver distance and air blast criteria at sensitive receivers.

Further analysis was undertaken to compare the airblast overpressure in relation to the MIC quantum using the same formula, however taken from the standpoint of charge selection. Three charge quantum's of Q=10, Q=50, and Q=100 and a site exponent of a=-1.45 were assessed for a range of K_a values.

Air blast overpressure predictions are presented in Figure 10 through Figure 15 below.

The variation in buffer distance demonstrated by the range of K_a and MIC values indicates that the residential development is feasible providing the blasts are implemented appropriately at the quarry. It is recommended that site constants be confirmed using small test blasts to further refine the predictions. Historical blast monitoring results may also be useful in providing additional information.

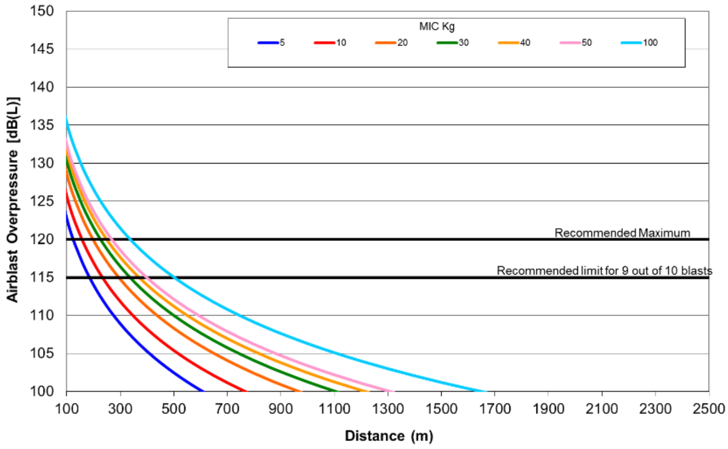


Figure 10 Airblast overpressure at distance over various maximum instantaneous charge (MIC) quantum in kilograms (where, K_a=10, and a=-1.45)

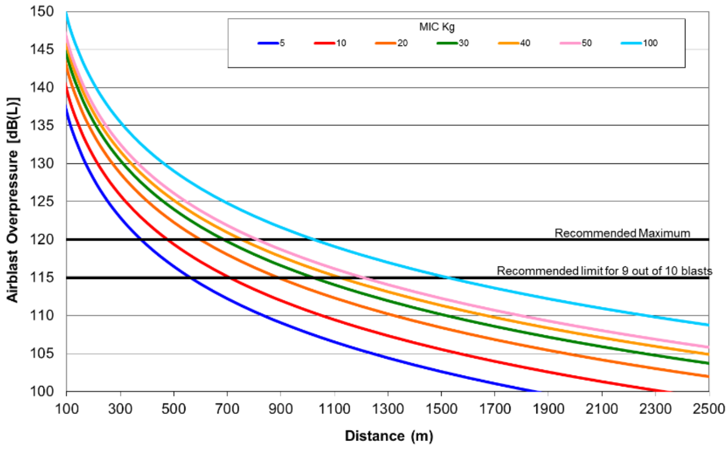


Figure 11 Airblast overpressure at distance over various maximum instantaneous charge (MIC) quantum in kilograms (where, K_a =50, and a=-1.45)

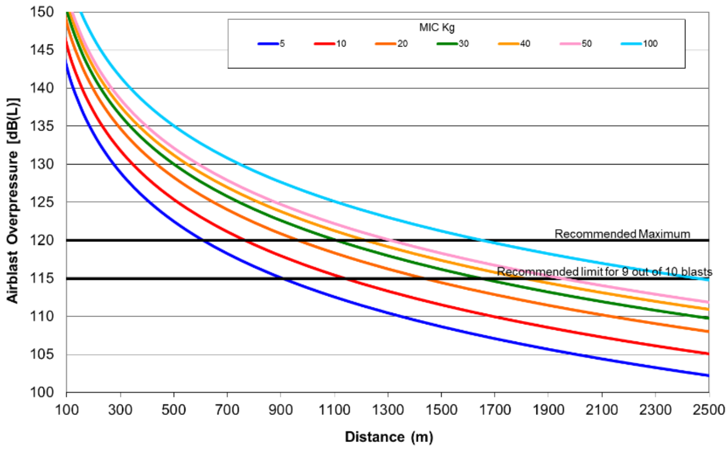


Figure 12 Airblast overpressure at distance over various maximum instantaneous charge (MIC) quantum in kilograms (where, K_a =100, and a=-1.45)

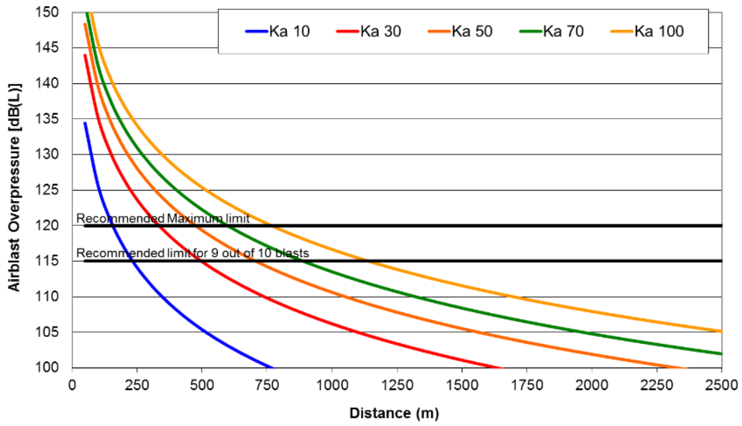


Figure 13 Airblast overpressure at distance over various site constants (K_a) (where, Q=10, and a=-1.45)

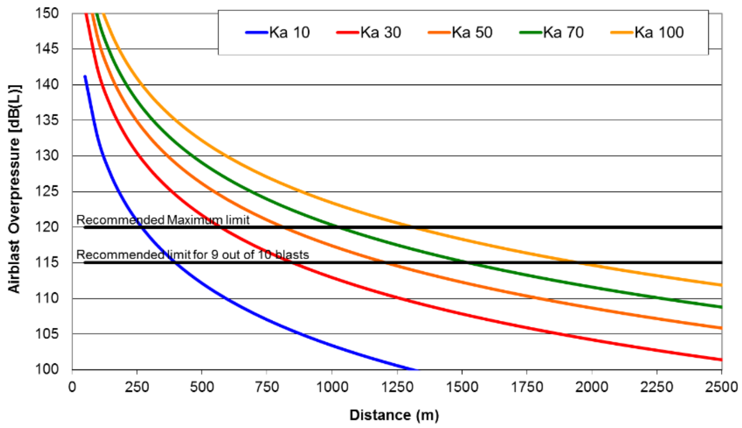


Figure 14 Airblast overpressure at distance over various site constants (K_a) (where, Q=50, and a=-1.45)

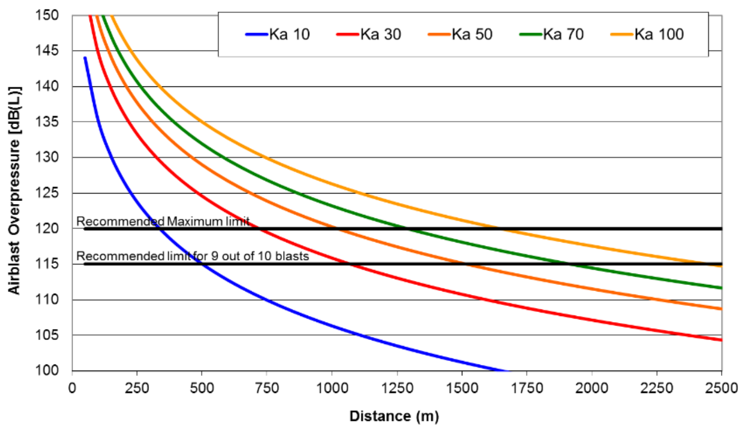


Figure 15 Airblast overpressure at distance over various site constants (K_a) (where, Q=100, and a=-1.45)

9.3 Summary

The predictions summarised in Figure 10 through Figure 15 show the high sensitivity of blast overpressure to the various blast design parameters and site constants. The variation in buffer distance demonstrated by the range of K_a and MIC values indicates that the residential development is feasible providing the blasts are implemented appropriately at the quarry. It is recommended that site constants are confirmed using small test blasts to further refine the predictions. Historical blast monitoring results may also be useful in providing additional information.

Air blast is a short-lived impact of approximately one second per blast, however even when prepared for the sound, people at sensitive receiver locations are often still startled when it occurs, therefore warnings from the quarry as to an impending blast, such as a warning siren or similar, will be important for notifying the local community.

Over a 12-month period, where blasting occurs one time per month, the total air blast overpressure time would amount to approximately 12 seconds per year.

10. Blast generated vibration

The operation of the Woody Hill Quarry would have the potential to generate environmental blast vibration impacts onto the Shenstone Park PSP site. This section discusses the potential impacts from this type of impact for the possible expansion scenarios.

10.1 Legislation, policy and guidelines

10.1.1 Blast vibration

Guidance on potential blast overpressure (noise) is provided from the Australian and New Zealand Environment Council (ANZEC) *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (1990).* This guideline recommends noise and vibration limits for human comfort for residential dwellings as shown in Table 18.

Table 18 Recommended ANZEC 1990 blasting limits for residential dwellings (human comfort)

Parameter	Vibration Criteria
Maximum level	5 mm/s PPV
Allowances	The level of 5 mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months, but never over 10 mm/s.
Long term	It is recommended that a level of 2 mm/s (PPV) be considered as the long-term regulatory goal.

AS 2187.2 – 2006 *Explosives – Storage and use, Part 2: Use of explosives* references to British Standard, BS 7385-2 – 1993 *Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration* for guidance values to limit cosmetic and minor building structural damage. These limits are shown in Table 19.

Table 19 Transient vibration guide values for cosmetic damage (BS 7385-2)

Line	Type of building	PPV in frequency of predominant pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures. Industry and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structure. Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Requirements for building vibration may not be sufficient to cover high-rise buildings, buildings with long span floors, specialist structures including hospitals or those with sensitive equipment. These cases require special consideration, which may include measurement on the structure itself with particular attention given to suspended floors. Further consideration will also be required in relation to underground services including pipes and cables. For heritage structures this assessment has adopted the DIN 4150-3: 1999 criteria found in Table 13 of this report as ‘line 3’ structures.

10.1.2 Buried pipework

GHD understand a 35 m wide Gas and Fuel Commission easement exists to the east of the Phillips Quarry. Based on the City of Whittlesea Planning Permit 704901 issued for the quarry, a 300 mm high-pressure gas main is buried within the easement boundary.

DIN 4150-3:1999 – *Structural Vibration Part 3: Effects of vibration on* structures provides guidance on the effect of short-term vibration on buried pipework such as may occur through blasting. Table 20 includes the acceptable values of vibration from DIN 4150-3:1999 in mm/s for short-term vibration on buried pipework. The values provided are based on measurements to be taken on the pipe surface.

The guideline values provided in Table 20 can be reduced by 50% without further analysis when assessing the impact of long-term vibrational impacts on the pipework.

Table 20 Guideline values for short-term vibration on buried pipework

Line	Pipe material	Guideline values for velocity measured on the pipe, v_i, in mm/s
1	Steel (including welded pipes)	100
2	Clay, concrete, reinforced concrete, pre-stressed concrete, metal with or without flange)	80
3	Masonry, plastic	50

10.2 Vibration assessment

Blasting may be required during the quarrying process. Depending on the actual ground conditions encountered, there is the potential that if development is too close to the quarry, vibrations for sensitive receivers may exceed the blasting vibration limits.

Ground vibration was estimated using the distance relationship calculation outlined in AS 2187.2 – 2006.

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

Where

V = ground vibration as a vector peak particle velocity in mm/s

R = distance between charge and point of measurement, in metres

Q = maximum instantaneous charge (effective charge mass delay), in kg

K_g = Site constant related to rock properties

B = Site exponent

The standard recommends a site constant of K_g=1140 and site exponent of B=1.6 for average conditions when blasting is to be carried out in free face conditions, however the resulting vibration predictions are a median value with 50% probability of exceedance and actual vibration levels may vary from 40 percent to 400 percent of the predictions.

For a preliminary assessment scenario for vibration impacts, blasting was considered to occur at the extraction limit boundary. As blast size Maximum Instantaneous Charge (MIC) is unknown at this stage, the equation was used to identify possible MIC values based on the receiver distance and vibration criteria levels. Ground vibration predictions are presented in Table 21, where pink outline values above the long-term regulatory goal of 2 mm/s.

Further assessment comes from Table J7.3.1 of AS 2187.2:2006 which outlines the 2 m/s, 5 m/s, and 10 mm/s criteria outline in the ANZEC guideline as well as a 25 mm/s criteria for occupied non-sensitive sites, such as factories and commercial premises, refer to Table 22.

British Standard BS 6472-2 provides in Table B.1 data from measurements of blast vibrations at three maximum instantaneous charge levels of 75 kg, 100 kg, and 120 kg. The produced charts shows compliance with the ANZEC short-term guideline generally occurs around a distance of 550 m.

Table 21 Predicted blast ground vibration PPV, mm/s (AS 2187.2:2006)

Distance to nearest blast location (m)	Predicted Blast Ground Vibration PPV (mm/s) site constant K(ground) = 1140 MIC (kg)									
	0.5	1.0	2.0	5.0	10	20	30	40	50	100
50	1.25	2.18	3.80	7.90	13.76	23.95	33.13	41.71	49.86	86.81
100	0.41	0.72	1.25	2.61	4.54	7.90	10.93	13.76	16.45	28.64
150	0.22	0.38	0.65	1.36	2.37	4.13	5.71	7.19	8.60	14.97
200	0.14	0.24	0.41	0.86	1.50	2.61	3.61	4.54	5.43	9.45
250	0.10	0.17	0.29	0.60	1.05	1.82	2.52	3.18	3.80	6.61
300	0.07	0.12	0.22	0.45	0.78	1.36	1.88	2.37	2.84	4.94
350	0.06	0.10	0.17	0.35	0.61	1.06	1.47	1.85	2.22	3.86
400	0.04	0.08	0.14	0.28	0.49	0.86	1.19	1.50	1.79	3.12
450	0.04	0.06	0.11	0.23	0.41	0.71	0.99	1.24	1.48	2.58
500	0.03	0.05	0.10	0.20	0.35	0.60	0.83	1.05	1.25	2.18
550	0.03	0.05	0.08	0.17	0.30	0.52	0.71	0.90	1.08	1.87
600	0.02	0.04	0.07	0.15	0.26	0.45	0.62	0.78	0.94	1.63
650	0.02	0.04	0.06	0.13	0.23	0.40	0.55	0.69	0.82	1.43
700	0.02	0.03	0.06	0.12	0.20	0.35	0.49	0.61	0.73	1.27
750	0.02	0.03	0.05	0.10	0.18	0.31	0.44	0.55	0.65	1.14
800	0.01	0.03	0.04	0.09	0.16	0.28	0.39	0.49	0.59	1.03
850	0.01	0.02	0.04	0.08	0.15	0.26	0.36	0.45	0.54	0.93
900	0.01	0.02	0.04	0.08	0.13	0.23	0.32	0.41	0.49	0.85
950	0.01	0.02	0.03	0.07	0.12	0.22	0.30	0.38	0.45	0.78
1000	0.01	0.02	0.03	0.07	0.11	0.20	0.27	0.35	0.41	0.72
1050	0.01	0.02	0.03	0.06	0.11	0.18	0.25	0.32	0.38	0.67
1100	0.01	0.02	0.03	0.06	0.10	0.17	0.24	0.30	0.35	0.62

Table 22 Free face vibration at distance compared to MEC (AS 2187.2:2006)

Vibration (VPPV) mm/s	Estimated maximum effective charge per delay, kg													
	Distance, m													
	1	5	10	20	30	50	80	100	150	200	300	500	800	1000
2	-	0.010	0.035	0.145	0.3	0.9	2.3	3.6	8	14	32	90	230	360
5	0.001	0.030	0.110	0.450	1.0	2.8	7.2	11.3	25	45	100	280	720	1,130
10	0.003	0.070	0.270	1.050	2.4	6.7	17.2	26.9	60	105	240	670	1,720	2,700
25	0.008	0.210	0.840	3.400	7.6	21.0	54.0	84.2	190	340	760	2,100	5,400	8,400

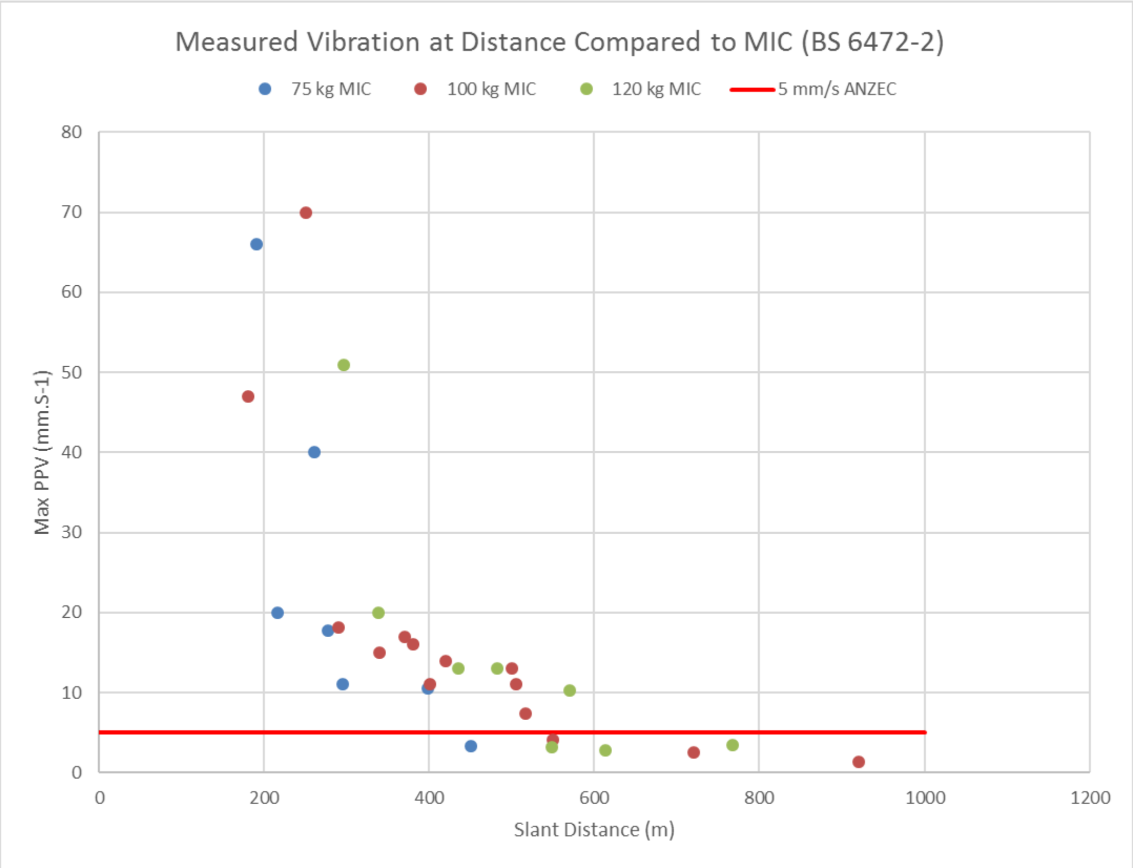


Figure 16 Measured vibration at distance compared to MIC (BS 6472-2)

10.3 Summary

It is expected that any vibrational impact from blasting at the Woody Hill Quarry would require a distance of approximately 550 m from the extraction boundary to provide sufficient attenuation for a blast with MIC of approximately 100 kg to meet the 2 mm/s (PPV) long-term regulatory goal.

11. Future land use planning considerations

11.1 Key findings and development constraints

This report has highlighted that potential amenity impacts from the possible expansions of the Woody Hill Quarry and the encroachment of incompatible land uses, must be managed through the development of the PSP and planning controls for the precinct. Protecting significant assets whilst enabling sustainable development to occur is important, as incompatible land uses may adversely impact the operations and viability of the quarry into the future and in turn impact the amenity and health of the community

Dust

Two possible expansion scenarios were assessed for the Woody Hill Quarry. From the EPA guideline, an active quarry with blasting has a recommended buffer of 500 m. Though not specified in the guideline, the 250 m difference in separation distance applying to blasting activities at 500 m and auxiliary activities appears to account for possible transport of dust particles.

The default 500 m buffer applied to the extraction boundaries for the two scenarios extend onto the PSP area.

The EPA also allow for a site-specific variation to the default buffer distance for a given industry and identifies six criteria to consider in Table 4 of the guideline. It is likely that some of the factors listed in that table could vary the default buffer, if specific operational details about the industry are known.

Two criteria that allow for site specific variations which would have the biggest impact in varying the default buffers are considered to be size of the facility (de-rating a default buffer) and local meteorology (directional buffer).

GHD considers that the relevant buffer for the active quarry area with blasting should be the default 500 m buffer irrespective of the throughput of the quarry.

However, GHD considers that the directional buffer would apply to the default 500 m buffer given that the default buffer accounts for possible transport of dust particles, which would be subject to meteorological influences. The local meteorology would only apply during daytime hours for the quarries as blasting would only occur during the daytime.

DEDJTR's advice[15] indicates that a 200 m radial buffer distance from the extraction boundary of the extraction area is sufficient to mitigate against safety issues from flyrock during blasting, with which GHD agrees. This buffer is to be radial as the flyrock component will be independent of wind speed and direction, as the projectile speed of flyrock is much higher than the wind speed.

The directional buffer assessment shows that the default buffer can be retracted and extended in the directions of good and poor dispersion. A large extension of the default buffer occurs to the east and northeast into the PSP, while the default buffer is retracted in the west due to anticipated meteorology conditions.

Dust dispersion modelling was also undertaken for dust impacts from the northern and southern extraction scenarios. The criterion for PM_{10} (60 µg/m^3) did marginally extend into PSP area. The PM_{10} 24 hour criterion was predicted to be met at all existing sensitive receptors, and was predicted to be contained within the default and directional separation distances for the various scenarios. For an expansion of 20 m below the ground surface the impacts would be similar in nature to Scenario 1 presented in the earlier GHD Report #51460, albeit a slight 5% reduction for pit emission retention.

[15] Meeting with DEDJTR on 17 October 2017

In order to manage the conflicts between land uses, there must be a balance between selecting measures that sufficiently mitigate amenity impacts and avoiding over regulation, therefore impacting on the ability to achieve other objectives, such as urban growth and environmental sustainability. However, in this instance, due to the adverse amenity impacts anticipated by the operation on the existing quarry, a conservative and cautious approach to any form of urban intensification surrounding the existing and future industries is the preferred approach.

Noise and vibration

Noise from the operation of the Woody Hill Quarry was audible at the noise logger located within the property at 960 Donnybrook Road.

Noise levels noted at this logger location are consistent with those predicted in modelling (Figure 8 and Figure 9), suggesting a good fit of the model to the current existing conditions occurring at the quarry, noting there is some conservatism in the model and also in the noise criteria to ensure adequate protection.

It is expected that the daytime noise levels generated from the two expansion scenarios for the Woody Hill Quarry will require a buffer of approximately 600 m from the extraction area to meet the daytime criteria of 48 dB(A), prior to any noise mitigation measures being implemented.

Modelling of the existing approved extraction area for the Woody Hill Quarry was also undertaken in the GHD report entitled *'City Of Whittlesea Council Impact Assessment Report for the Shenstone Park Precinct Structure Plan – December 2017[16]'*. In that report a buffer of 900 m was recommended, which is 300 m greater that that assessed in this report due to the elevated location of existing noise sources combined with the concrete batching plant. However, as the northern and southern extraction scenarios will be at a much lower elevation, this has enabled greater attenuation of the noise impact from each of these two scenarios reducing the buffer size by one third down to 600 m.

Generally, through carefully implemented control measures, most flyrock can be contained within the active pit area to approximately 50 m in front of the face. Industry practice is to allow at least a factor of four times this distance as a safety factor, this indicates that a 200 m radial buffer distance from the extraction boundary is sufficient to mitigate against safety issues.

Blast generated noise is very dependent on site specific constants and can vary significantly based on the blast methodology being used. Onsite measurements would be required prior to any future development to understand the air blast overpressure from each quarry's operation and what restrictions this would have on future development.

It is expected that any vibrational impact from blasting at the Woody Hill Quarry would require a distance of approximately 550 m from the extraction boundary to provide sufficient attenuation for a blast with an MIC of approximately 100 kg.

The existing quarry will likely remain throughout the precinct development and the quarry asset owner will remain obligated to comply with the SEPP N-1 noise policy. However, it is expected any sensitive receivers proposed to be built within the PSP, would be required to design and build future structures in a manner so as to minimise any existing noise impacts on persons utilising the proposed building.

Development may still be able to occur within the 600 m buffer following appropriate mitigation either at the quarry or via building acoustic treatments at the sensitive receiver location.

Discussion with the asset owner may need to be undertaken to provide effective as well as agreed noise mitigation measures for the quarry, as necessary.

[16] GHD Report #51460

Should a control at source noise mitigation strategy not be possible or practicable, it is common that the indoor amenity of sensitive receivers subject to operational noise be acoustically treated using a control at receiver strategy, via building acoustic treatment. However, the limitation of this strategy is that it would not preserve the outdoor amenity of the receiver unless a combination of controls such as noise controls at the source of transmission be implemented.

Noise mitigation strategies have been identified into four different areas from the most to the least preferred (NSW INP, 2000):

- *Land-use Controls* (separating the location of noise-producing activities from sensitive areas)
- *Control at Source* (reduce the noise output of the source to provide protection surrounding environment)
- *Control in Transmission* (reduce noise level at the receiver but not necessarily the environment surrounding the source, e.g. noise barrier, etc.
- *Receiver Control* (localised acoustic treatment at sensitive receiver)

Use of mitigation strategies involving land-use control such as:

- A setback strategy (e.g. Non sensitive uses adjacent to noisy industries, busy road and/or railway corridor to provide noise reduction through setback distances to residential and other sensitive uses).
- Use of acoustic control planning conditions on new developments will enable a blending of light industrial, commercial and residential lands uses to occur along the buffer boundary, allowing staged development to occur.

11.2 Recommended buffers

Figure 17 (aerial base map) provides a visual display of the impact assessments undertaken as part of this report.

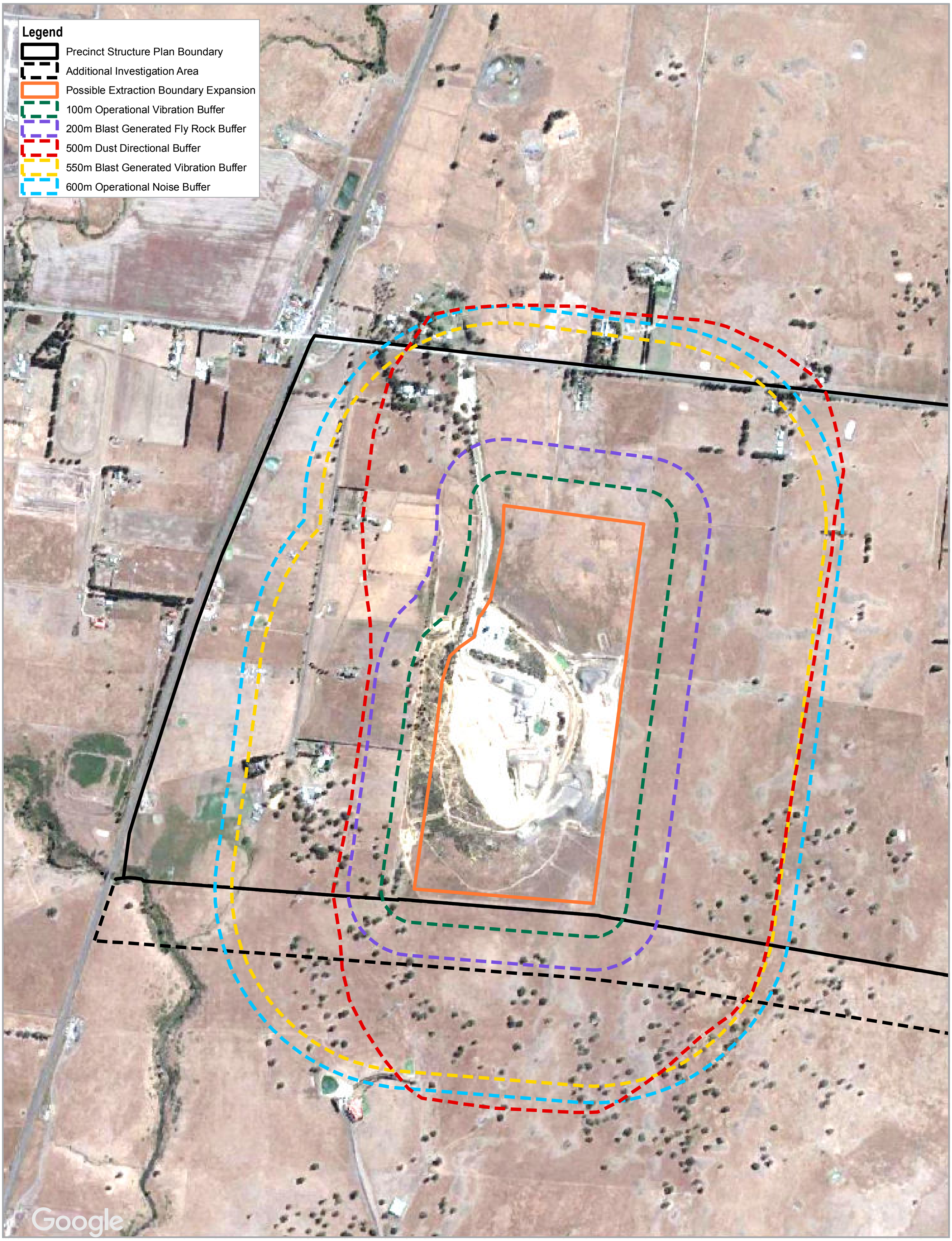
Figure 17 shows the following information:

- 500 m dust directional buffers from the extraction area boundaries for the two expansion scenarios.
- Operational noise buffer for the Woody Hill Quarry of 600 m from the extraction area boundaries for the two expansion scenarios prior to any operational noise mitigation being implemented. Should further work be undertaken to determine the noise controls and operations in place at the quarry, it may be possible to reduce the extent of the noise buffer.
- 100 m operational vibration buffer from the approved extraction area boundaries for the two expansion scenarios.
- Blast generated flyrock buffer of 200 m from the approved extraction area boundaries for the two expansion scenarios.
- Blast generated noise would require empirical measurements prior to any proposed development to assess the site specific conditions experienced during a blast event. Any proposed development would be limited by the requirement to achieve 115 dB (linear) at the proposed development location.
- Blast generated vibration buffer of 550 m for the Woody Hill Quarry from the approved extraction area boundaries for the two expansion scenarios for an MIC of approximately 100 kg to meet the 2 mm/s (PPV) long-term regulatory goal for human comfort.

The intent of the buffers from the quarry would be to restrict additional sensitive land use intensification in these buffer areas (including land inside and outside of the PSP), due to the risks from, dust, operational noise and vibration, blast noise, blast vibration and blast generated flyrock.

The inclusion of buffer controls within the PSP should achieve separation of non-compatible uses and delineate land available for urban development.

The PSP planning process must protect significant assets, whilst enabling sustainable development to occur. Inappropriate planning may adversely impact the operations and viability of the quarry into the future and, in turn, impact the amenity and health of the community.



Paper Size ISO A4

0 150 300 450 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

City of Whittlesea
Shenstone Park PSP - Impact Assessment

Possible Buffer Areas -
Woody Hill Expansions

Project No. 31-35311
Revision No. -
Date 12 Dec 2017

FIGURE 17

G:\31\35311\GIS\Maps\Working\3135311_Fig17_PossibleBuffer_Map.mxd
Print date: 12 Dec 2017 - 15:36

Data source: Data Source: Image © 2016 Google, DigitalGlobe dated 2017/07/10 and VicMap, DELWP (2017).. Created by: lrsmith

Appendices

Appendix A – Dust emission factors

Emission factors used for the assessment of PM_{10};

Activity	Source	Emission Factor	Reference
Winning	Excavator	0.012 kg/t	NPI 2012
	Dump Truck	0.0043 kg/t	NPI 2012
	Grader	0.085 kg/VKT	NPI 2012
	Loading	0.0017 kg/t	NPI 2012
	Wheel Generated Dust	1.25 kg/VKT	NPI 2012
Processing	Conveyor Transfer	0.00015 kg/t	NPI 2012
	Primary Crusher	0.0012 kg/t	AP-42
	Secondary Crusher	0.0012 kg/t	AP-42
	Screening	0.0043 kg/t	AP-42
	Fines Screening	0.036 kg/t	AP-42
Other	Blasting	3.0780 kg/blast	NPI 2012
	Misc. Transfer Points	0.00015 kg/t	NPI 2012
	Wind Blown	0.2 kg/ha/h	NPI 2012

Notes

* Emission factor for PM_{10} primary and secondary crushing from AP42 (tertiary crusher)

Appendix B – AERMOD INPUT file

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** AERMOD View Ver. 9.2.0
** Lakes Environmental Software Inc.
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** AERMOD Control Pathway
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   TITLETWO PM10 Woody Hill
   MODELOPT CONC FLAT BETA LOWWIND3
   AVERTIME 24
   POLLUTID PM_10
   RUNORNOT RUN
   ERRORFIL woody_hill.err
CO FINISHED
**
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****************************************
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   LOCATION L0000016     VOLUME   321185.619 5841864.258 0.0
   LOCATION L0000017     VOLUME   321183.366 5841883.677 0.0
   LOCATION L0000018     VOLUME   321181.112 5841903.096 0.0
   LOCATION L0000019     VOLUME   321178.859 5841922.516 0.0
   LOCATION L0000020     VOLUME   321176.605 5841941.935 0.0
   LOCATION L0000021     VOLUME   321174.351 5841961.354 0.0
   LOCATION L0000022     VOLUME   321180.674 5841971.465 0.0
   LOCATION L0000023     VOLUME   321199.844 5841967.631 0.0
   LOCATION L0000024     VOLUME   321219.014 5841963.797 0.0
   LOCATION L0000025     VOLUME   321238.184 5841959.963 0.0
   LOCATION L0000026     VOLUME   321257.354 5841956.129 0.0
   LOCATION L0000027     VOLUME   321276.524 5841952.295 0.0
   LOCATION L0000028     VOLUME   321295.695 5841948.461 0.0
   LOCATION L0000029     VOLUME   321314.865 5841944.627 0.0
   LOCATION L0000030     VOLUME   321314.293 5841928.074 0.0
   LOCATION L0000031     VOLUME   321309.861 5841909.033 0.0
   LOCATION L0000032     VOLUME   321305.429 5841889.992 0.0
   LOCATION L0000033     VOLUME   321300.997 5841870.951 0.0
   LOCATION L0000034     VOLUME   321296.565 5841851.911 0.0
   LOCATION L0000035     VOLUME   321292.133 5841832.870 0.0
** End of LINE VOLUME Source ID = STCK1
   LOCATION WIND         AREAPOLY   321210.000  5841993.000          0.0
** DESCRSRC wind erosion
** ----------------------------------------------------------------------
** Line Source Represented by Adjacent Volume Sources
** LINE VOLUME Source ID = ROAD2
** DESCRSRC
** PREFIX
** Length of Side = 10.00
** Configuration = Adjacent
** Emission Rate = 0.26
** Vertical Dimension = 6.80
** SZINIT = 3.16
** Nodes = 4
** 321280.000, 5841861.000, 0.00, 2.00, 4.65
** 321387.000, 5841940.000, 0.00, 2.00, 4.65
** 321148.000, 5842040.000, 0.00, 2.00, 4.65
** 321218.000, 5842494.000, 0.00, 2.00, 4.65
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   LOCATION L0000036     VOLUME   321284.022 5841863.970 0.0
   LOCATION L0000037     VOLUME   321292.067 5841869.910 0.0
   LOCATION L0000038     VOLUME   321300.112 5841875.849 0.0
   LOCATION L0000039     VOLUME   321308.157 5841881.789 0.0
   LOCATION L0000040     VOLUME   321316.202 5841887.729 0.0
   LOCATION L0000041     VOLUME   321324.247 5841893.668 0.0
   LOCATION L0000042     VOLUME   321332.292 5841899.608 0.0
   LOCATION L0000043     VOLUME   321340.337 5841905.548 0.0
   LOCATION L0000044     VOLUME   321348.382 5841911.487 0.0
   LOCATION L0000045     VOLUME   321356.426 5841917.427 0.0
   LOCATION L0000046     VOLUME   321364.471 5841923.367 0.0
   LOCATION L0000047     VOLUME   321372.516 5841929.306 0.0
   LOCATION L0000048     VOLUME   321380.561 5841935.246 0.0
   LOCATION L0000049     VOLUME   321385.158 5841940.771 0.0
   LOCATION L0000050     VOLUME   321375.933 5841944.630 0.0
   LOCATION L0000051     VOLUME   321366.708 5841948.490 0.0
   LOCATION L0000052     VOLUME   321357.483 5841952.350 0.0
   LOCATION L0000053     VOLUME   321348.258 5841956.210 0.0
   LOCATION L0000054     VOLUME   321339.033 5841960.070 0.0
   LOCATION L0000055     VOLUME   321329.808 5841963.930 0.0
   LOCATION L0000056     VOLUME   321320.583 5841967.789 0.0
   LOCATION L0000057     VOLUME   321311.358 5841971.649 0.0
   LOCATION L0000058     VOLUME   321302.133 5841975.509 0.0
   LOCATION L0000059     VOLUME   321292.908 5841979.369 0.0
   LOCATION L0000060     VOLUME   321283.683 5841983.229 0.0
   LOCATION L0000061     VOLUME   321274.458 5841987.089 0.0
   LOCATION L0000062     VOLUME   321265.233 5841990.949 0.0
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   LOCATION L0000063     VOLUME   321256.008 5841994.808 0.0
   LOCATION L0000064     VOLUME   321246.783 5841998.668 0.0
   LOCATION L0000065     VOLUME   321237.558 5842002.528 0.0
   LOCATION L0000066     VOLUME   321228.333 5842006.388 0.0
   LOCATION L0000067     VOLUME   321219.108 5842010.248 0.0
   LOCATION L0000068     VOLUME   321209.883 5842014.108 0.0
   LOCATION L0000069     VOLUME   321200.657 5842017.968 0.0
   LOCATION L0000070     VOLUME   321191.432 5842021.827 0.0
   LOCATION L0000071     VOLUME   321182.207 5842025.687 0.0
   LOCATION L0000072     VOLUME   321172.982 5842029.547 0.0
   LOCATION L0000073     VOLUME   321163.757 5842033.407 0.0
   LOCATION L0000074     VOLUME   321154.532 5842037.267 0.0
   LOCATION L0000075     VOLUME   321148.445 5842042.885 0.0
   LOCATION L0000076     VOLUME   321149.969 5842052.768 0.0
   LOCATION L0000077     VOLUME   321151.493 5842062.651 0.0
   LOCATION L0000078     VOLUME   321153.016 5842072.535 0.0
   LOCATION L0000079     VOLUME   321154.540 5842082.418 0.0
   LOCATION L0000080     VOLUME   321156.064 5842092.301 0.0
   LOCATION L0000081     VOLUME   321157.588 5842102.184 0.0
   LOCATION L0000082     VOLUME   321159.112 5842112.067 0.0
   LOCATION L0000083     VOLUME   321160.636 5842121.951 0.0
   LOCATION L0000084     VOLUME   321162.159 5842131.834 0.0
   LOCATION L0000085     VOLUME   321163.683 5842141.717 0.0
   LOCATION L0000086     VOLUME   321165.207 5842151.600 0.0
   LOCATION L0000087     VOLUME   321166.731 5842161.483 0.0
   LOCATION L0000088     VOLUME   321168.255 5842171.367 0.0
   LOCATION L0000089     VOLUME   321169.779 5842181.250 0.0
   LOCATION L0000090     VOLUME   321171.302 5842191.133 0.0
   LOCATION L0000091     VOLUME   321172.826 5842201.016 0.0
   LOCATION L0000092     VOLUME   321174.350 5842210.900 0.0
   LOCATION L0000093     VOLUME   321175.874 5842220.783 0.0
   LOCATION L0000094     VOLUME   321177.398 5842230.666 0.0
   LOCATION L0000095     VOLUME   321178.922 5842240.549 0.0
   LOCATION L0000096     VOLUME   321180.446 5842250.432 0.0
   LOCATION L0000097     VOLUME   321181.969 5842260.316 0.0
   LOCATION L0000098     VOLUME   321183.493 5842270.199 0.0
   LOCATION L0000099     VOLUME   321185.017 5842280.082 0.0
   LOCATION L0000100     VOLUME   321186.541 5842289.965 0.0
   LOCATION L0000101     VOLUME   321188.065 5842299.848 0.0
   LOCATION L0000102     VOLUME   321189.589 5842309.732 0.0
   LOCATION L0000103     VOLUME   321191.112 5842319.615 0.0
   LOCATION L0000104     VOLUME   321192.636 5842329.498 0.0
   LOCATION L0000105     VOLUME   321194.160 5842339.381 0.0
   LOCATION L0000106     VOLUME   321195.684 5842349.265 0.0
   LOCATION L0000107     VOLUME   321197.208 5842359.148 0.0
   LOCATION L0000108     VOLUME   321198.732 5842369.031 0.0
   LOCATION L0000109     VOLUME   321200.255 5842378.914 0.0
   LOCATION L0000110     VOLUME   321201.779 5842388.797 0.0
   LOCATION L0000111     VOLUME   321203.303 5842398.681 0.0
   LOCATION L0000112     VOLUME   321204.827 5842408.564 0.0
   LOCATION L0000113     VOLUME   321206.351 5842418.447 0.0
   LOCATION L0000114     VOLUME   321207.875 5842428.330 0.0
   LOCATION L0000115     VOLUME   321209.399 5842438.213 0.0
   LOCATION L0000116     VOLUME   321210.922 5842448.097 0.0
   LOCATION L0000117     VOLUME   321212.446 5842457.980 0.0
   LOCATION L0000118     VOLUME   321213.970 5842467.863 0.0
   LOCATION L0000119     VOLUME   321215.494 5842477.746 0.0
   LOCATION L0000120     VOLUME   321217.018 5842487.630 0.0
** End of LINE VOLUME Source ID = ROAD2
   BACKGRND ANNUAL 14.8
   BACKUNIT UG/M3
** Source Parameters **
   SRCPARAM EXC1              0.33     2.000     1.000     1.000
   SRCPARAM EXC2              0.33     2.000     1.000     1.000
   SRCPARAM EXC3              0.33     2.000     1.000     1.000
   SRCPARAM EXC4              0.33     2.000     1.000     1.000
   SRCPARAM EXC5              0.33     2.000     1.000     1.000
   SRCPARAM EXC6              0.33     2.000     1.000     1.000
   SRCPARAM EXC7              0.33     2.000     1.000     1.000
   SRCPARAM DUMP              0.24     2.000     1.000     1.000
   SRCPARAM LOAD              0.09     2.000     1.000     1.000
   SRCPARAM TP1               0.01     2.000     1.000     1.000
   SRCPARAM TP2               0.01     2.000     1.000     1.000
   SRCPARAM TP3               0.01     2.000     1.000     1.000
   SRCPARAM TP4               0.01     2.000     1.000     1.000
   SRCPARAM TP5               0.01     2.000     1.000     1.000
   SRCPARAM GRADE             0.06     2.000     1.000     1.000
   SRCPARAM PRIMC             0.07     3.000     5.000     1.500
   SRCPARAM SECC              0.05     3.000     5.000     1.500
   SRCPARAM SCREEN            0.24     1.000     0.500     0.500
   SRCPARAM FINES              1.6     1.000     0.500     0.500
   SRCPARAM BLAST             0.86     2.000     7.000     1.000
** LINE VOLUME Source ID = STCK1
   SRCPARAM L0000001     0.0074285714      2.00       9.09      3.16
   SRCPARAM L0000002     0.0074285714      2.00       9.09      3.16
   SRCPARAM L0000003     0.0074285714      2.00       9.09      3.16
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   SRCPARAM L0000004     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000005     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000006     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000007     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000008     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000009     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000010     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000011     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000012     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000013     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000014     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000015     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000016     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000017     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000018     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000019     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000020     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000021     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000022     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000023     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000024     0.0074285714      2.00      9.09      3.16
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   SRCPARAM L0000027     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000028     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000029     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000030     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000031     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000032     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000033     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000034     0.0074285714      2.00      9.09      3.16
   SRCPARAM L0000035     0.0074285714      2.00      9.09      3.16
** -----------------------------------------------------------------------
   SRCPARAM WIND           5.6E-06     1.000       8
   AREAVERT WIND         321210.000 5841993.000 321376.000 5841947.000
   AREAVERT WIND         321363.000 5841906.000 321301.000 5841908.000
   AREAVERT WIND         321306.000 5841781.000 321138.000 5841737.000
   AREAVERT WIND         321125.000 5841904.000 321194.000 5841916.000
** LINE VOLUME Source ID = ROAD2
   SRCPARAM L0000036     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000037     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000038     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000039     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000040     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000041     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000042     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000043     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000044     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000045     0.0030588235      2.00      4.65      3.16
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   SRCPARAM L0000055     0.0030588235      2.00      4.65      3.16
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   SRCPARAM L0000058     0.0030588235      2.00      4.65      3.16
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   SRCPARAM L0000061     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000062     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000063     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000064     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000065     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000066     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000067     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000068     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000069     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000070     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000071     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000072     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000073     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000074     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000075     0.0030588235      2.00      4.65      3.16
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   SRCPARAM L0000079     0.0030588235      2.00      4.65      3.16
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   SRCPARAM L0000081     0.0030588235      2.00      4.65      3.16
   SRCPARAM L0000082     0.0030588235      2.00      4.65      3.16
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   SRCPARAM L0000083     0.0030588235      2.00       4.65       3.16
   SRCPARAM L0000084     0.0030588235      2.00       4.65       3.16
   SRCPARAM L0000085     0.0030588235      2.00       4.65       3.16
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   SRCPARAM L0000087     0.0030588235      2.00       4.65       3.16
   SRCPARAM L0000088     0.0030588235      2.00       4.65       3.16
   SRCPARAM L0000089     0.0030588235      2.00       4.65       3.16
   SRCPARAM L0000090     0.0030588235      2.00       4.65       3.16
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   SRCPARAM L0000093     0.0030588235      2.00       4.65       3.16
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   SRCPARAM L0000100     0.0030588235      2.00       4.65       3.16
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   SRCPARAM L0000104     0.0030588235      2.00       4.65       3.16
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   SRCPARAM L0000120     0.0030588235      2.00       4.65       3.16
** ---------------------------------------------------------------------

** Variable Emissions Type: "By Hour-of-Day (HROFDY)"
** Variable Emission Scenario: "Scenario 2"
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   EMISFACT DUMP         HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
   EMISFACT DUMP         HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT EXC1         HROFDY 0.0 0.0 0.0 0.0 0.0 1.0
   EMISFACT EXC1         HROFDY 1.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT EXC1         HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
   EMISFACT EXC1         HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT EXC2         HROFDY 0.0 0.0 0.0 0.0 0.0 1.0
   EMISFACT EXC2         HROFDY 1.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT EXC2         HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
   EMISFACT EXC2         HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT EXC3         HROFDY 0.0 0.0 0.0 0.0 0.0 1.0
   EMISFACT EXC3         HROFDY 1.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT EXC3         HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
   EMISFACT EXC3         HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT EXC4         HROFDY 0.0 0.0 0.0 0.0 0.0 1.0
   EMISFACT EXC4         HROFDY 1.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT EXC4         HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
   EMISFACT EXC4         HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT EXC5         HROFDY 0.0 0.0 0.0 0.0 0.0 1.0
   EMISFACT EXC5         HROFDY 1.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT EXC5         HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
   EMISFACT EXC5         HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT EXC6         HROFDY 0.0 0.0 0.0 0.0 0.0 1.0
   EMISFACT EXC6         HROFDY 1.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT EXC6         HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
   EMISFACT EXC6         HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT EXC7         HROFDY 0.0 0.0 0.0 0.0 0.0 1.0
   EMISFACT EXC7         HROFDY 1.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT EXC7         HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
   EMISFACT EXC7         HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT FINES        HROFDY 0.0 0.0 0.0 0.0 0.0 1.0
   EMISFACT FINES        HROFDY 1.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT FINES        HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
   EMISFACT FINES        HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT GRADE        HROFDY 0.0 0.0 0.0 0.0 0.0 1.0
   EMISFACT GRADE        HROFDY 1.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT GRADE        HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
   EMISFACT GRADE        HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT LOAD         HROFDY 0.0 0.0 0.0 0.0 0.0 1.0
   EMISFACT LOAD         HROFDY 1.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT LOAD         HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
   EMISFACT LOAD         HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
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EMISFACT PRIMC        HROFDY 1.0 1.0 1.0 1.0 1.0 1.0
EMISFACT PRIMC        HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
EMISFACT PRIMC        HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
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EMISFACT SCREEN       HROFDY 1.0 1.0 1.0 1.0 1.0 1.0
EMISFACT SCREEN       HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
EMISFACT SCREEN       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
EMISFACT SECC         HROFDY 0.0 0.0 0.0 0.0 0.0 1.0
EMISFACT SECC         HROFDY 1.0 1.0 1.0 1.0 1.0 1.0
EMISFACT SECC         HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
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EMISFACT L0000019     HROFDY 1.0 1.0 1.0 1.0 1.0 1.0
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EMISFACT L0000034      HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
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EMISFACT L0000035      HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
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EMISFACT TP2           HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
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EMISFACT TP3           HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
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EMISFACT TP4           HROFDY 0.0 0.0 0.0 0.0 0.0 1.0
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EMISFACT TP4           HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
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   EMISFACT L0000117     HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
   EMISFACT L0000117     HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT L0000118     HROFDY 0.0 0.0 0.0 0.0 0.0 1.0
   EMISFACT L0000118     HROFDY 1.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT L0000118     HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
   EMISFACT L0000118     HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT L0000119     HROFDY 0.0 0.0 0.0 0.0 0.0 1.0
   EMISFACT L0000119     HROFDY 1.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT L0000119     HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
   EMISFACT L0000119     HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT L0000120     HROFDY 0.0 0.0 0.0 0.0 0.0 1.0
   EMISFACT L0000120     HROFDY 1.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT L0000120     HROFDY 1.0 1.0 1.0 1.0 1.0 0.0
   EMISFACT L0000120     HROFDY 0.0 0.0 0.0 0.0 0.0 0.0

** Variable Emissions Type: "By Month / Hour / Seven Days (MHRDOW7)"
** Variable Emission Scenario: "Scenario 3"
** Month = January;  Day of Week = Monday
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   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = February;  Day of Week = Monday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = March;  Day of Week = Monday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = April;  Day of Week = Monday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = May;  Day of Week = Monday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = June;  Day of Week = Monday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = July;  Day of Week = Monday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = August;  Day of Week = Monday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = September;  Day of Week = Monday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = October;  Day of Week = Monday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = November;  Day of Week = Monday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = December;  Day of Week = Monday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = January;  Day of Week = Tuesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = February;  Day of Week = Tuesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = March;  Day of Week = Tuesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = April;  Day of Week = Tuesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = May;  Day of Week = Tuesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = June;  Day of Week = Tuesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = July;  Day of Week = Tuesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = August;  Day of Week = Tuesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = September;  Day of Week = Tuesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = October;  Day of Week = Tuesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
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   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = November;  Day of Week = Tuesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = December;  Day of Week = Tuesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = January;  Day of Week = Wednesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 1.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = February;  Day of Week = Wednesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 1.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = March;  Day of Week = Wednesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 1.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = April;  Day of Week = Wednesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 1.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = May;  Day of Week = Wednesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 1.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = June;  Day of Week = Wednesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 1.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = July;  Day of Week = Wednesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 1.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = August;  Day of Week = Wednesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 1.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = September;  Day of Week = Wednesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 1.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = October;  Day of Week = Wednesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 1.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = November;  Day of Week = Wednesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 1.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = December;  Day of Week = Wednesday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 1.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = January;  Day of Week = Thursday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = February;  Day of Week = Thursday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = March;  Day of Week = Thursday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = April;  Day of Week = Thursday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = May;  Day of Week = Thursday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = June;  Day of Week = Thursday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = July;  Day of Week = Thursday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = August;  Day of Week = Thursday
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   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = September;  Day of Week = Thursday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = October;  Day of Week = Thursday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = November;  Day of Week = Thursday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = December;  Day of Week = Thursday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = January;  Day of Week = Friday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = February;  Day of Week = Friday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = March;  Day of Week = Friday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = April;  Day of Week = Friday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = May;  Day of Week = Friday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = June;  Day of Week = Friday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = July;  Day of Week = Friday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = August;  Day of Week = Friday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = September;  Day of Week = Friday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = October;  Day of Week = Friday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = November;  Day of Week = Friday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = December;  Day of Week = Friday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = January;  Day of Week = Saturday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = February;  Day of Week = Saturday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = March;  Day of Week = Saturday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = April;  Day of Week = Saturday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = May;  Day of Week = Saturday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
```

```
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = June;  Day of Week = Saturday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = July;  Day of Week = Saturday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = August;  Day of Week = Saturday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = September;  Day of Week = Saturday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = October;  Day of Week = Saturday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = November;  Day of Week = Saturday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = December;  Day of Week = Saturday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = January;  Day of Week = Sunday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = February;  Day of Week = Sunday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = March;  Day of Week = Sunday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = April;  Day of Week = Sunday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = May;  Day of Week = Sunday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = June;  Day of Week = Sunday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = July;  Day of Week = Sunday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = August;  Day of Week = Sunday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = September;  Day of Week = Sunday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = October;  Day of Week = Sunday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = November;  Day of Week = Sunday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
** Month = December;  Day of Week = Sunday
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST        MHRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   SRCGROUP SRCGP1   BLAST DUMP EXC1 EXC2 EXC3 EXC4 EXC5 EXC6 EXC7 FINES
   SRCGROUP SRCGP1   GRADE LOAD PRIMC SCREEN SECC TP1 TP2 TP3 TP4 TP5
   SRCGROUP SRCGP2   L0000001 L0000002 L0000003 L0000004 L0000005 L0000006
   SRCGROUP SRCGP2   L0000007 L0000008 L0000009 L0000010 L0000011 L0000012
   SRCGROUP SRCGP2   L0000013 L0000014 L0000015 L0000016 L0000017 L0000018
   SRCGROUP SRCGP2   L0000019 L0000020 L0000021 L0000022 L0000023 L0000024
   SRCGROUP SRCGP2   L0000025 L0000026 L0000027 L0000028 L0000029 L0000030
   SRCGROUP SRCGP2   L0000031 L0000032 L0000033 L0000034 L0000035 L0000036
   SRCGROUP SRCGP2   L0000037 L0000038 L0000039 L0000040 L0000041 L0000042
```

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   SRCGROUP SRCGP2   L0000043 L0000044 L0000045 L0000046 L0000047 L0000048
   SRCGROUP SRCGP2   L0000049 L0000050 L0000051 L0000052 L0000053 L0000054
   SRCGROUP SRCGP2   L0000055 L0000056 L0000057 L0000058 L0000059 L0000060
   SRCGROUP SRCGP2   L0000061 L0000062 L0000063 L0000064 L0000065 L0000066
   SRCGROUP SRCGP2   L0000067 L0000068 L0000069 L0000070 L0000071 L0000072
   SRCGROUP SRCGP2   L0000073 L0000074 L0000075 L0000076 L0000077 L0000078
   SRCGROUP SRCGP2   L0000079 L0000080 L0000081 L0000082 L0000083 L0000084
   SRCGROUP SRCGP2   L0000085 L0000086 L0000087 L0000088 L0000089 L0000090
   SRCGROUP SRCGP2   L0000091 L0000092 L0000093 L0000094 L0000095 L0000096
   SRCGROUP SRCGP2   L0000097 L0000098 L0000099 L0000100 L0000101 L0000102
   SRCGROUP SRCGP2   L0000103 L0000104 L0000105 L0000106 L0000107 L0000108
   SRCGROUP SRCGP2   L0000109 L0000110 L0000111 L0000112 L0000113 L0000114
   SRCGROUP SRCGP2   L0000115 L0000116 L0000117 L0000118 L0000119 L0000120
   SRCGROUP SRCGP3   WIND
   SRCGROUP SRCGP4   PRIMC SCREEN SECC FINES
   SRCGROUP ALL      BACKGROUND
SO FINISHED
**
****************************************
** AERMOD Receptor Pathway
****************************************
**
**
RE STARTING
   GRIDCART UCART1 STA
                    XYINC 318950.00 91 50.00 5839500.00 91 50.00
   GRIDCART UCART1 END
RE FINISHED
**
****************************************
** AERMOD Meteorology Pathway
****************************************
**
**
ME STARTING
   SURFFILE "..\..\..\Meteorology\Melbourne Airport\SITE ouputs\3135311.SFC"
   PROFFILE "..\..\..\Meteorology\Melbourne Airport\SITE ouputs\3135311.PFL"
   SURFDATA 0 2012
   UAIRDATA 11111111 2012
   SITEDATA 11111111 2012
   PROFBASE 10.0 METERS
ME FINISHED
**
****************************************
** AERMOD Output Pathway
****************************************
**
**
OU STARTING
   RECTABLE ALLAVE 1ST 3RD 5TH
   RECTABLE 24 1ST 3RD 5TH
** Auto-Generated Plotfiles
   PLOTFILE 24 ALL 1ST woody_hill.AD\24H1GALL.PLT 31
   PLOTFILE 24 SRCGP1 1ST woody_hill.AD\24H1G001.PLT 32
   PLOTFILE 24 SRCGP2 1ST woody_hill.AD\24H1G002.PLT 33
   PLOTFILE 24 SRCGP3 1ST woody_hill.AD\24H1G003.PLT 34
   PLOTFILE 24 SRCGP4 1ST woody_hill.AD\24H1G004.PLT 35
   PLOTFILE 24 ALL 3RD woody_hill.AD\24H3GALL.PLT 36
   PLOTFILE 24 SRCGP1 3RD woody_hill.AD\24H3G001.PLT 37
   PLOTFILE 24 SRCGP2 3RD woody_hill.AD\24H3G002.PLT 38
   PLOTFILE 24 SRCGP3 3RD woody_hill.AD\24H3G003.PLT 39
   PLOTFILE 24 SRCGP4 3RD woody_hill.AD\24H3G004.PLT 40
   PLOTFILE 24 ALL 5TH woody_hill.AD\24H5GALL.PLT 41
   PLOTFILE 24 SRCGP1 5TH woody_hill.AD\24H5G001.PLT 42
   PLOTFILE 24 SRCGP2 5TH woody_hill.AD\24H5G002.PLT 43
   PLOTFILE 24 SRCGP3 5TH woody_hill.AD\24H5G003.PLT 44
   PLOTFILE 24 SRCGP4 5TH woody_hill.AD\24H5G004.PLT 45
   SUMMFILE woody_hill.sum
OU FINISHED
**
****************************************
** Project Parameters
****************************************
** PROJCTN  CoordinateSystemUTM
** DESCPTN  UTM: Universal Transverse Mercator
** DATUM    World Geodetic System 1984
** DTMRGN   Global Definition
** UNITS    m
** ZONE     -55
** ZONEINX  0
**
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