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DRURY QUARRY - SUTTON BLOCK
ASSESSMENT OF NOISE EFFECTS

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Project: **DRURY QUARRY – SUTTON BLOCK EXTENSION**

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1.0 SUMMARY

Stevenson Aggregates Limited (SAL) has asked us to assess the noise effects of Drury Quarry's proposed Sutton Block pit. The Sutton Block is located to the northeast of the existing Drury Quarry pit. The development of the Sutton Block will be staged and will extend incrementally northeast within the proposed Life of Quarry extent over the next 50 years.

Overall, we find that:

- All five stages of the proposed development comply with the daytime and night-time noise limits at all receivers
- Night-time activities in the quarry front-of-house area must be managed to enable compliance at receivers in lower MacWhinney Drive, Peach Hill Road, Drury Hills Road and Davies Road
- The Sutton Block pit will result in a noticeable change in daytime noise levels for some receivers in upper MacWhinney Drive. This is because quarrying activities will occur in a new area that is much closer to those receivers. But, despite this, noise levels will comply with the AUP limits
- The existing ambient noise levels we measured at receivers on MacWhinney Drive are already elevated by quarry and SH1 traffic noise. Sonja Drive and Ponga Road receivers tend to have lower existing noise levels because they are further from the quarry. Natural noise sources, like birds and wind in trees, tend to prevail (unless the wind direction is such that it carries quarry noise to them)
- The character of noise received by the more remote receivers (Ponga Road and Sonja Drive dwellings) will change. But the contribution from any single quarry source will be low, and controlled by mobile plant that we have placed in worst-case locations high on the benches. In reality, this plant will move around the quarry and will often be further away and better shielded
- We consider that overall, the noise effects of the Sutton Block expansion will be reasonable.

Appendix A provides a glossary of terminology.

2.0 PROJECT DESCRIPTION

Stevenson Aggregates Limited (SAL) Drury Quarry is located in Drury, Auckland, and has been in operation for over 80 years. Drury Quarry is a greywacke hard rock quarry supplying concrete, asphalt and roading aggregate to the Auckland market. The pit is located within the wider landholdings owned by SAL which encompasses an area of approximately 562ha. This landholding includes quarry activities, a clean fill, farmland and large swathes of native vegetation.

Based on current demand estimates, the existing pit will provide approximately 20 years of aggregate supply to Auckland. To continue a local supply of aggregate resource, SAL proposes to develop a new pit within the existing site, called the 'Sutton Block'. The Sutton Block pit has been designed to provide approximately 240 Million Tonnes of additional aggregate to supply the market.

The Sutton Block is located to the northeast of the existing pit. Its development will involve the staged development of an area of approximately 108 ha to a maximum pit depth of approximately 60m RL. The overall site layout, including staging plans, is shown in Figure 1-5 of this report.

The Sutton Block is designed to be a separate quarry pit although it will be serviced by the existing Drury Quarry ancillary site infrastructure and facilities. These include the 'Font of House (FOH)' activities such as the weigh bridge, processing plant(s), storage bins and stockpile area, the lamella, staff facilities etc.

The hours of operation in the Sutton Block will ostensibly be 24 hours a day, and activities will scale down as needed to ensure compliance with the AUP noise standards. Section 6.1 sets out the typical night-time activities.

SAL anticipates that, as the existing Drury Quarry pit nears the end of its life and reduces aggregate extraction, the Sutton Block pit will increase its aggregate extraction. This will ensure a continuous aggregate supply to the market.

To enable the development of the Sutton Block, and support the extraction of aggregate, the project will also include the construction of road infrastructure to establish haul road access, overburden removal, stockpiles including bunding; stormwater ponds and supporting infrastructure, and construction of a conveyor belt connecting the Sutton Block pit to the existing Drury Quarry FOH area. The works will also require stream diversions, stream reclamation, wetland reclamation, vegetation removal and mitigation offset. The Sutton Block will generally be developed in the following five stages:

2.1 Stage 1 – Infrastructure establishment (three-year plan)

The initial stage of work (Years 1 -3) involves the construction of the roading infrastructure required to access the site, draining of the existing farm dam to establish a sediment retention pond, associated stream diversion, initial offset planting, commencement of overburden removal, stockpiles (including bunding), and establishment of the conveyor system. Figure 1 below shows the extent of Stage 1.

Figure 1: Sutton Block Stage 1 extent (courtesy of Terra Mining Consultants Ltd)



2.2 Stage 2 – Operating Quarry (15 year plan)

The second stage of work is the 15- year plan which involves the commencement of quarrying within the interim pit boundary (refer to Figure 2 below). Whether the interim pit commences within the west or east of the pit boundary will be determined by market demand for blue or brown rock. Regardless, expansion of the pit will be incremental, deepening and widening as resource is extracted. Internal pit roads will be constructed as the pit expands. Offset planting and weed and pest control will continue.

Figure 2: Sutton Block Stage 2 extent (courtesy of Terra Mining Consultants Ltd)



2.3 Stage 3 – Operating Quarry (30 year plan)

The third stage of works is further expansion of the interim pit boundary (refer to Figure 3 below). Like Stage 2, the direction of the expansion will depend on market demand. However, in indicative staging plan shows the expansion of the pit to the east. During this stage of the works, the expansion of the pit will be incremental, widening and deepening as resource is extracted. Internal pit roads will be constructed as the pit expands.

The works involved in Stage 3 will generally include the same activities as Stage 2.

Figure 3: Sutton Block Stage 3 extent (courtesy of Terra Mining Consultants Ltd)



2.4 Stage 4 – Operating Quarry (40 year plan)

The fourth stage of works is a further expansion of the interim pit boundary (refer to Figure 4 below). Like Stage 3, the direction of the expansion will depend on market demand. However, in indicative staging plan shows the expansion of the pit to the east. During this stage of the works, the expansion of the pit will be incremental, widening and deepening as resource is extracted. Internal pit roads will be constructed as the pit expands. The works involved in Stage 4 will generally include the same activities as Stage 3.

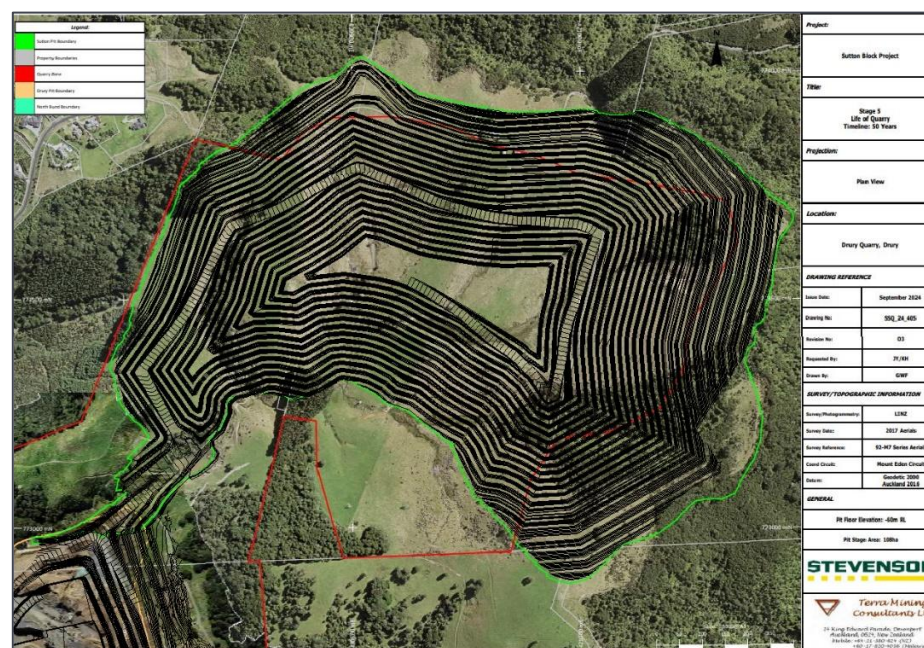
Figure 4: Sutton Block Stage 4 extent (courtesy of Terra Mining Consultants Ltd)



2.5 Stage 5 – Life of Quarry (50 year plan)

The fifth stage reflects the full extent of the quarry pit over an approximate 50-year period (refer to Figure 5). As with Stage 4, expansion of the pit will be incremental, deepening and widening as resource is extracted. The indicative staging plans show the pit expanding to the north and east. During this stage, the temporary northern bund will be removed. Internal pit roads will be constructed as the pit expands.

Figure 5: Sutton Block Stage 5 extent



3.0 EXISTING SOUND ENVIRONMENT

As the new pit expands northeast, it will get gradually closer to rural dwellings located along the top of MacWhinney Drive, Ponga Road, Sonja Drive and Drury Hills Road. These receivers are further from the existing quarry, so noise from the Sutton Block is likely to be more noticeable here, than for other dwellings that are closer to the existing quarry operations.

To establish a baseline of the existing sound environment at these dwellings, we undertook noise week-long measurements in November 2023 at the notional boundary of following dwellings:

- 171 MacWhinney Drive (the closest dwelling to Sutton Block Stage 1)
- 359 MacWhinney Drive (the closest dwelling to later Sutton Block stages)
- 1109 Ponga Road (the closest dwelling to the north-east)
- 93 MacWhinney Drive (a dwelling unlikely to be affected by Sutton Block noise)

We also carried out short-term attended measurements at 115 Sonja Drive (the closest dwelling to the north) in October 2022. These measurements give a snapshot of daytime noise levels to put in context with the week-long data.

Figure 6 shows the measurement positions in relation to Sutton Block.

We carried out our measurements generally in accordance with NZS 6801:2008 using 01dB Cube and Duo noise loggers and a Brüel & Kjær 2250 sound level meter. We reviewed wind and rain data from SAL's weather stations to identify and remove any periods affected by weather.

While processing the measurements, we noticed a regular spike of high noise levels between 5 – 6 am each morning, including on Sundays when the quarry is closed. We listened to some audio samples and found it was being generated by birdsong. No quarry activities were audible.

Birdsong occurs from dawn to dusk, and contribute to the average noise levels along with other natural sounds like cicadas (daytime), crickets (night-time) and wind in the trees.

We reprocessed the data, removing these spikes, and found they were increasing the night-time L_{Aeq} value by up to 3 decibels.

Table 1 summarises the measured levels and graphs of the full dataset are attached in Appendix C.

Figure 6: Ambient noise monitoring positions



Table 1: Summary of existing ambient noise levels

Location	Measurement time	Average Sound Levels (dB L _{Aeq})	
		Daytime	Night-time
171 MacWhinney Drive	1pm 15 Nov 23 – 1pm 24 Nov 23	45	39
359 MacWhinney Drive	2pm 24 Nov 23 – 9am 1 Dec 23	46	43
1109 Ponga Road	5pm 17 Nov 23 – 12pm 24 Nov 23	42	38
93 MacWhinney Drive	2pm 24 Nov 23 – 9am 1 Dec 23	52	47

During our attended measurement at 115 Sonja Drive on the afternoon of 7 October 2022, we measured 42 dB L_{Aeq} for 30 mins.

These levels indicate that the current noise environment for MacWhinney Drive receivers is already elevated by quarry and SH1 traffic noise. The balance of quarry and traffic noise varies in different parts of MacWhinney Drive, with the most quarry noise received by the south-western most dwellings.

The average night-time level we measured at 93 MacWhinney Drive is slightly (2 decibels) above the AUP night-time control. This may be due, in part, to quarry activities but it is important to note that this has no bearing over proposed Sutton Block activities, which will not contribute to noise levels at 93 MacWhinney (refer Section 5.4). We address night-time activities in more detail in Section 6.0.

The character of the sound at the Sonja Drive and Ponga Road receivers has less quarry noise, and natural noise sources control the ambient noise environment.

Weekly graphs of our long-term monitoring are attached in Appendix C. You can see the diurnal variation between daytime (orange) and night-time (blue) levels.

We acknowledge these ambient measurements were carried out some time ago, due to the protracted timeframes of this project. They may have increased since this time due to continued development in Drury South Crossing, but higher ambient noise levels would mean a smaller margin to our predicted Sutton Block noise levels (refer Section 7.0). This means that comparing against 2022 – 2023 ambient levels makes for a slightly more conservative effects assessment.

In addition, we have provided predicted noise levels from existing daytime and night-time quarry activity in Appendices D and E. We have based these predictions on other noise modelling of existing daytime and night-time operations that we have done for Stevensons, and checked the results against our ambient noise measurements.

4.0 PERFORMANCE STANDARDS

The quarry has residential neighbours to the north and south, and borders an industrial zone to the west. These dwellings and industrial zones have different noise performance standards in the AUP.

4.1 Dwellings

The quarry site is largely zoned Special Purpose – Quarry Zone in the AUP, with sections of the Year 40 and Year 50 LoQ quarry pits in Rural – Mixed Rural Zone. Neighbouring dwellings to the north-west are in the Rural – Countryside Living Zone, dwellings to the northeast are in the Rural – Mixed Rural Zone, and dwellings to the south are in the Rural – Rural Production Zone.

AUP Section E25.6.3 sets out the noise criteria for the Rural – Mixed Rural Zone. AUP Section H28.6.2.1 sets out the noise criteria for the Special Purpose – Quarry Zone. The same noise limits apply to quarrying within both zones, though the timing of the daytime periods are slightly different. Table 2 summarises these criteria – they apply at the notional boundary¹ of existing dwellings.

Table 2: Noise limits for dwellings

Times (Mixed Rural Zone)	Times (Special Purpose Quarry Zone)	Noise limits
7am-10pm, Monday to Saturday	7am-9pm, Monday to Friday	55 dB L _{Aeq}
9am-6pm, Sunday	7am-4pm, Saturday	55 dB L _{Aeq}
All other times	All other times and on public holidays	45 dB L _{Aeq}
		75 dB L _{Afmax}

We have included the following dwellings in our assessment. These dwellings are clustered together around the existing quarry and future Sutton Block expansion. For predicted noise levels at other dwellings, refer to our noise contour maps.

- 267, 279 & 285 Drury Hills Road (north-west of Sutton Block)
- 73 & 79 Drury Hills Road and 67, 81, 85, 91, 93, 97, 103, 115 MacWhinney Drive – referred to in this report as *lower MacWhinney Drive* (far west of Sutton Block)
- 151, 171, 175, 229, 234, 240, 254 MacWhinney Drive – *middle MacWhinney Drive* (west of Sutton Block)
- 284, 291, 310, 336, 337, 347, 350, 354 & 359 MacWhinney Drive – *upper MacWhinney Drive* (west-north-west of Sutton Block)
- 75, 77 & 77A Davies Road (far south-west of Sutton Block)
- 16, 72, 99, 109 & 115 Sonja Drive (north of Sutton Block)
- 1081, 1101, 1109 & 1598 Ponga Road (north-east of Sutton Block)
- 96 & 98 Peach Hill Road (far south of Sutton Block)

4.2 Industrial zones

The properties immediately to the west are zoned Light and Heavy Industry. AUP Table E25.6.5.1 sets out the relevant noise criteria for these areas. Table 3 summarises these criteria.

Table 3: Noise limits from quarry activities for buildings in Industry zones

Time	Business – Heavy Industry Zone	Business – Light Industry Zone
All times	70 dB L _{Aeq}	65 dB L _{Aeq}

¹ A line 20 metres from any side of a noise-sensitive building, or the legal boundary where this is closer to the building.

Compliance is measured at the site boundary.

4.3 Construction noise

The Stage 1 haul road and bund construction is not part of normal quarry operation. It will be a temporary activity, subject to the construction noise provisions in AUP Section E25.6.27.

Table 4 sets out the weekday construction noise criteria for long-term activities (i.e. more than 20 weeks). We have assumed that construction will not occur in the weekend or on public holidays:

Table 4: Noise limits from construction activities to residential receivers

Time of week	Times	Noise limits	
<i>Weekdays</i>	6.30 – 7.30am	55 dB L _{Aeq}	70 dB L _{Amax}
	7.30am – 6pm	70 dB L _{Aeq}	85 dB L _{Amax}
	6 – 8pm	65 dB L _{Aeq}	80 dB L _{Amax}
	8pm – 6.30am	40 dB L _{Aeq}	70 dB L _{Amax}

Compliance is measured at 1 metre from the dwelling façades.

5.0 PREDICTED LEVELS – DAYTIME

To predict the noise generated by the Sutton Block works, we have updated our existing SoundPLAN model – which includes daytime and night-time scenarios of existing quarrying, overburden and front of house activities. We have updated:

- pit topography for the five Sutton Block scenarios, provided by the mining engineer, and
- quarry machinery and maps showing their locations in the Sutton Block, confirmed by SAL in October 2023 (see Appendix B for list of equipment and sound power levels)

Our model also includes noise from the existing quarry, overburden and front of house operations (as at 2023 – the existing consents of which require compliance with the noise limits in E25.6.3), so the results are cumulative noise levels from all SAL operations.

We have assumed that the topography and activities in the current pit remain unchanged. But, as discussed, we understand that SAL will reduce works in that pit over time as the pit reaches the end of its life. This means that our model is a conservative prediction of future noise levels from that pit.

We understand that SAL has not yet determined rehabilitation plans for the existing Drury Quarry so we haven't included any changes to quarry operation during the rehabilitation phase in this model.

5.1 Our predicted daytime noise levels are conservative

We have modelled all equipment running at the same time and in worst-case positions high on the benches (notwithstanding the pit edge screening addressed in Section 5.4). In reality, the equipment will move around, there will be periods where equipment is turned off and time when it is located deeper in the pit, so better screened.

5.2 We have predicted noise levels and generated noise contour maps

Appendix D shows the full modelling results.

Table D1 summarises our predicted noise levels at each dwelling and at a worst-case boundary position for each of the industrial zones.

We have also included noise contour maps in Figures D1 – D6 that show the predicted noise contours for each scenario at 1.5m above ground level.

Sutton Block is northeast of the existing quarry. This means that noise levels for dwellings located close to or west of the existing quarry (i.e. lower MacWhinney Drive, Davies Road and the Industrial estate) are not affected by the Sutton Block works. Their noise levels are – and will be – controlled by the front of house and existing quarry activities.

5.3 Industrial receivers will comply – but are not impacted by Sutton Block works

We predict up to 57 dB L_{Aeq} at the light industry zone boundary, and 55 dB L_{Aeq} in the heavy industry zone for all scenarios. These levels readily comply with the relevant limits and are not influenced by the Sutton Block works.

5.4 Residential receivers will comply, but pit edge shielding is crucial

We predict 51 – 55 dB L_{Aeq} at the notional boundaries of 91, 93 and 103 MacWhinney Drive. Again, these predicted levels comply with the 55 dB L_{Aeq} daytime limit and are not influenced by the Sutton Block works at all.

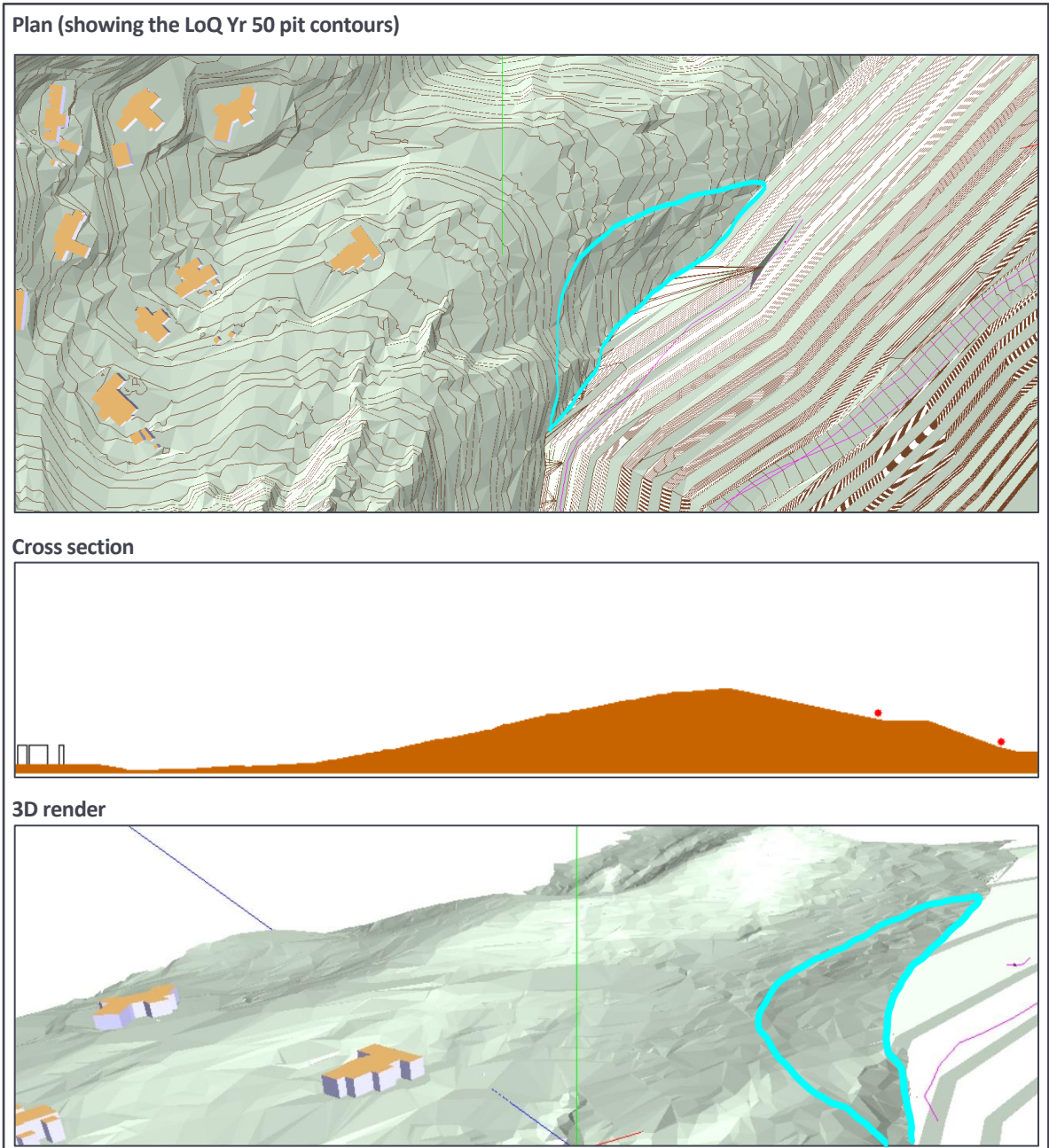
These dwellings aside, the highest noise level we predict from the Sutton Block works is 53 dB L_{Aeq} at 359 MacWhinney Drive during the Year 30 scenario. This complies with the 55 dB L_{Aeq} limit, but is a big increase compared to their existing noise levels – refer Section 7.0 Assessment of Effects.

Note that our predicted level relies on natural screening (terrain) from the north-western pit edge and this must be in place to achieve daytime compliance. Figure 7 shows an example of this screening as a plan, a 2D cross-section and 3D render.

We recommend ensuring that this natural screening is maintained as the pit develops. This, along with effective communication with the residents at the top of MacWhinney Drive and establishing permanent noise monitors are the best practicable options for managing Sutton Block noise. We have recommended consent conditions to address these.

As noted above in Sections 2.1 and 2.5, the overburden from Stage 1 will be used to create a temporary northern bund. It will provide useful shielding to dwellings north of the pit in Stages 1 – 4 and will be removed in Stage 5, but we predict its removal will not affect compliance.

Figure 7: Pit edge screening between noise sources (pink) and 359 MacWhinney Drive dwelling
(Key shielding element highlighted in teal)



5.5 Construction noise will readily comply

We have used our SoundPLAN model to predict the noise level from constructing the haul road and temporary northern bund, including the following activities:

- 5 x dump trucks traveling along the haul road to the north bund and back into the pit
- 2 x bulldozers – one on the western haul road and one at the north bund

We predict levels up to 54 dB L_{Aeq} at the closest MacWhinney Drive dwellings, which readily complies with the 70 dB L_{Aeq} limit.

6.0 PREDICTED LEVELS – NIGHT-TIME

For each of the five Sutton Block scenarios, we have prepared a night-time model. Night-time activities are scaled down compared with daytime, and we understand the objective is to tailor the night-time activities so that they meet the 45 dB L_{Aeq} noise limit at the closest dwellings.

We note that the consents relating to existing pit and FoH activities require compliance with these same limits.

6.1 We have predicted noise levels and generated noise contour maps

See Appendix E for a full list of predicted night-time noise levels, at receivers' notional boundaries.

Table E1 summarises our predicted night-time noise levels at each dwelling and at a worst-case boundary position for each of the industrial zones.

We have also included noise contour maps in Figures E1 – E6 that show the predicted noise contours for each scenario at 1.5m above ground level.

6.2 Industrial receivers will comply

We predict 47-48 dB L_{Aeq} at the light and heavy industry zone boundaries for all night-time scenarios. These levels comfortably comply with the relevant limits and are generally not influenced by the Sutton Block works.

6.3 Residential receivers will comply

Up to 45 dB L_{Aeq} is predicted at the notional boundary of 103 MacWhinney Drive at night. This is equal to the 45 dB L_{Aeq} limit and around 2 decibels less than the average night-time noise level – refer Section 3.0. Predicted night-time noise levels at all other dwellings are less than 45 dB L_{Aeq} .

Pit edge screening is still important at night-time, but less so because there will be no mobile plant working on high benches. SAL has agreed that night-time activities in Sutton Block should be limited to the base of the pit only.

7.0 ASSESSMENT OF NOISE EFFECTS

As noted earlier, compliance with the relevant noise limits doesn't mean that the noise effects will be reasonable. We need to look at how loud future noise will be for receivers, compared to their existing noise environment.

Every person reacts differently to noise level changes, but research shows a general correlation between noise level changes and subjective responses². Table 5 indicates people's subjective responses to noise level change – but these are the impressions of immediate change.

² For instance, LTNZ Research Report No. 292: Road traffic noise: determining the influence of New Zealand Road surfaces on noise levels and community annoyance, Table 18.

Sutton Block will develop gradually over several years (to Stage 1) so the subjective impression will likely be more moderate. Neighbours' opinion and acceptance (or otherwise) of the development will also affect their annoyance at the noise it generates.

Table 5: Noise level change and the compared with general subjective perception

Noise level change	General subjective perception ³
1 – 2 decibels	Insignificant/imperceptible change
3 – 4 decibels	Just perceptible change
5 – 8 decibels	Appreciable to clearly noticeable change
9 – 11 decibels	Halving/doubling of loudness
> 11 decibels	More than halving/doubling of loudness

7.1 We predict that overall, noise effects will be reasonable

As discussed in Section 3.0, the existing background noise is typically 42 to 52 dB L_{Aeq} during the day and 40 to 50 dB L_{Aeq} at night, depending on the dwelling location (i.e. it is louder in lower MacWhinney Drive).

Using the dwellings in our existing ambient survey to represent the general noise level in their vicinity, we can look at the potential noise effects.

Table 6 shows their existing ambient levels, the predicted levels for Sutton Block Stage 1 (i.e. the initial noise increase) and Stage 3 (the loudest Sutton Block scenario), and their noise level change. Green indicates where Sutton Block activity will not be louder than their existing noise level, and red indicates where it will be louder.

Table 6: Comparing existing ambient and future Sutton Block noise (at notional boundaries)

Location	Existing ambient level (dB L _{Aeq})		Predicted Stage 1 level (and change) (dB L _{Aeq})		Predicted Stage 3 level (and change) (dB L _{Aeq})	
	Daytime	Night-time	Daytime	Night-time	Daytime	Night-time
171 MacWhinney	45	39	47 (+2)	40 (+1)	47 (+2)	36 (-3)
359 MacWhinney	46	43	40 (-6)	34 (-9)	53 (+7)	34 (-9)
1109 Ponga Rd	42	38	28 (-14)	24 (-14)	38 (-4)	26 (-12)
93 MacWhinney	52	47	55 (+3)	44 (-3)	52 (0)	43 (-3)

These results allow us to conclude that:

- Noise levels in lower MacWhinney Drive (e.g. No. 93 – refer to Section 4.1 for a full list) will stay consistent over time because they generally aren't affected by Sutton Block activity.

The increase in outdoor noise levels, within their notional boundaries, may be just perceptible (+3 dB) for Stage 1, and quieter for all later stages. This is based on the worst-case activity scenarios we have modelled, and the noise level increase will generally be less than this.

We predict little to no noise effects from the Sutton Block on these dwellings

³ Based on research by Zwicker & Scharf (1965); and Stevens (1957, 1972)

- Noise levels in middle MacWhinney Drive (e.g. No. 171 – refer to Section 4.1 for a full list) will also stay more or less consistent over time. The predicted level increases of +1 and +2 dB within notional boundaries will be imperceptible. Their noise from Sutton Block development will fluctuate a little as stages develop, but not by a noticeable amount.

We predict little to no noise effects from the Sutton Block on these dwellings

- Noise levels in upper MacWhinney Drive (e.g. No. 359 – refer to Section 4.1 for a full list) will generally be less than they currently experience, except during Stage 3. During this stage, we predict worst-case Sutton Block noise levels within notional boundaries could increase by up to:
 - 7 dB at 359 MacWhinney Drive
 - 6 dB at 347 and 354 MacWhinney Drive
 - 4 dB at 291 MacWhinney Drive
 - 3 dB at 337 MacWhinney Drive

These are just-perceptible to appreciable changes (as per Table 5), but because the increases will occur slowly over 30 years they will have much less impact than an immediate change over days or weeks. Also, the highest predicted level (53 dB L_{Aeq}) complies with the AUP permitted daytime noise limit.

The property boundaries of 337 and 347 MacWhinney Drive extend past the notional boundaries towards Sutton Block, so there are locations on these properties that may receive higher noise levels than we have predicted. But it is reasonable to limit our effects assessment to the notional boundary, which contains the dwelling and its immediate outdoor living areas.

Overall, we consider the effects on these dwellings will be reasonable.

- Noise levels to the north and north-east of Sutton Block (e.g. Ponga Road) will not increase due to Sutton Block activity. All our predicted noise levels within notional boundaries (daytime and night-time) are less than their existing ambient levels. This isn't to say that Sutton Block activity won't be audible – it will be at times, depending on the wind direction.

We predict the effects of Sutton Block noise on these dwellings will be negligible.

7.2 Some dwellings will experience a change in daytime sound character

For dwellings further away from the existing quarry and State Highway 1 (i.e. upper MacWhinney Drive, Sonja Drive and Ponga Road), the current noise environment consists mainly of bird song and other natural sounds. Our predicted levels, while complying with the AUP limits and consistent with the existing noise levels may change the character of the sound environment.

They may hear a general broadband noise from quarrying, and intermittent engine noise from particular mobile plant, which will move around the quarry and be shielded to a greater or lesser degree.

7.3 Long-term noise monitors help to monitor compliance and manage effects

Prior to this Sutton Block proposal, we discussed the idea of long-term noise monitoring with you. Having permanently installed noise loggers at strategic locations around the quarry will help you to track your noise levels over time, and respond quickly to any issues that neighbours may raise.

The significant changes associated with Sutton Block provide additional impetus to consider long-term monitors, and we have recommended a condition that requires them. They will work in conjunction with our noise model to keep a digital twin of your quarrying operations up to date, and consolidate the accuracy of future predictions.

7.4 Communication with neighbours will be important during Sutton Block development

We have predicted that noise levels from the Sutton Block expansion will comply with AUP controls, and effects will be reasonable. But your neighbours' reactions to ongoing quarry development will rely on many subjective factors, not all of which can be anticipated or satisfied by expert advice.

Communication is an essential tool in managing perceived effects. People are less likely to complain if they receive regular updates, know what to expect as the quarry develops, and have met the Stevensons personnel involved.

We recommend developing a Communication Plan to deal with these matters, and have written a draft condition that requires this.

8.0 RECOMMENDED CONDITIONS

We have identified those aspects of the Sutton Block development that may generate effects.

The AUP rules we set out in Section 4.0 contain permitted levels, so don't need to be enforced by way of consent conditions. We recommend the following conditions to ensure compliance with those rules, and to manage effects in accordance with the best practicable option:

- The existing ground levels at RL215.3 and RL217.1 in the northwest corner, between coordinates 1776965 / 5890479 and 1777028 / 5890528, shall be maintained to provide pit edge (terrain) screening for 359 MacWhinney Drive. Refer to Drawing BM210632_32 for the approximate location
- The consent holder shall establish two permanent noise monitoring sites around Sutton Block – one to the west (i.e. near upper MacWhinney Drive) and one to the north-east (i.e. near Sonja or Laurie Drive) of the proposed development
- The consent holder shall develop a Communication Plan which outlines how neighbours are informed of the activities and timing associated with Sutton Block development

APPENDIX A GLOSSARY OF TERMINOLOGY

SPL or L_p	<u>Sound Pressure Level</u> A logarithmic ratio of a sound pressure measured at distance, relative to the threshold of hearing (20 μPa RMS) and expressed in decibels.
SWL or L_w	<u>Sound Power Level</u> A logarithmic ratio of the acoustic power output of a source relative to 10^{-12} watts and expressed in decibels. Sound power level is calculated from measured sound pressure levels and represents the level of total sound power radiated by a sound source.
dB	<u>Decibel</u> The unit of sound level. Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of $P_r=20 \mu\text{Pa}$ i.e. $\text{dB} = 20 \times \log(P/P_r)$
A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
$L_{Aeq}(t)$	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
L_{Amax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
NZS 6801:2008	New Zealand Standard NZS 6801:2008 <i>"Acoustics – Measurement of environmental sound"</i>

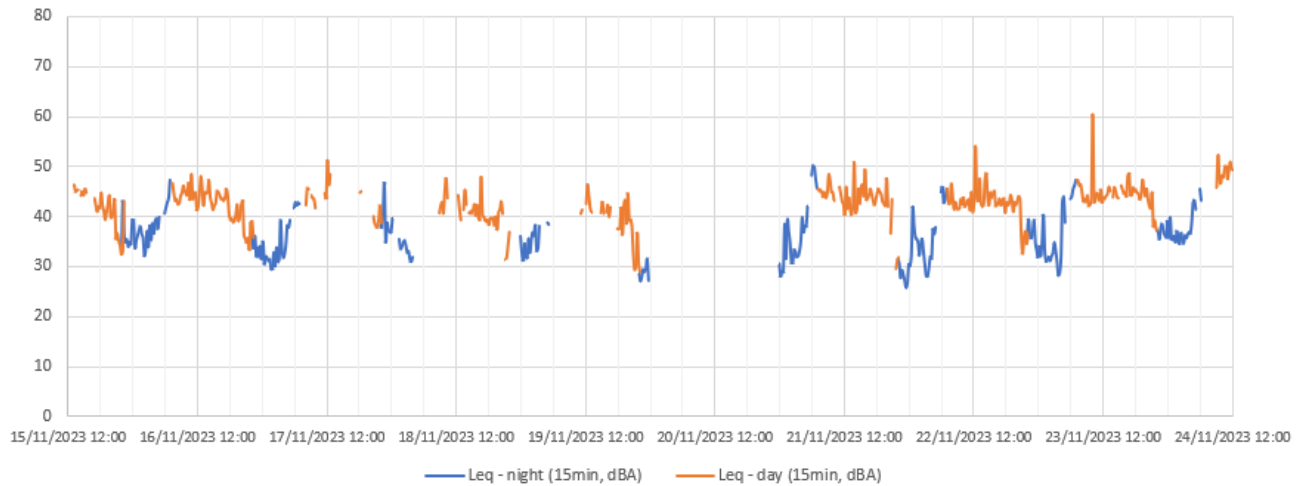
APPENDIX B SUTTON BLOCK QUARRY EQUIPMENT

Equipment	Sound Power Level (dB LW _{Aeq})
Excavator with rockbreaker attachment	121
Drills	120
Dump Trucks	114 – 116
Cone Crusher	112 – 114
Jaw Crusher	114
Bulldozer	111
Screens	105 – 115
Excavator	104 – 110
Surge Pile	107
Barmac Crusher	107
Loader	104 – 106
Road trucks on gravel road (average)	103
Road trucks on sealed road (average)	102

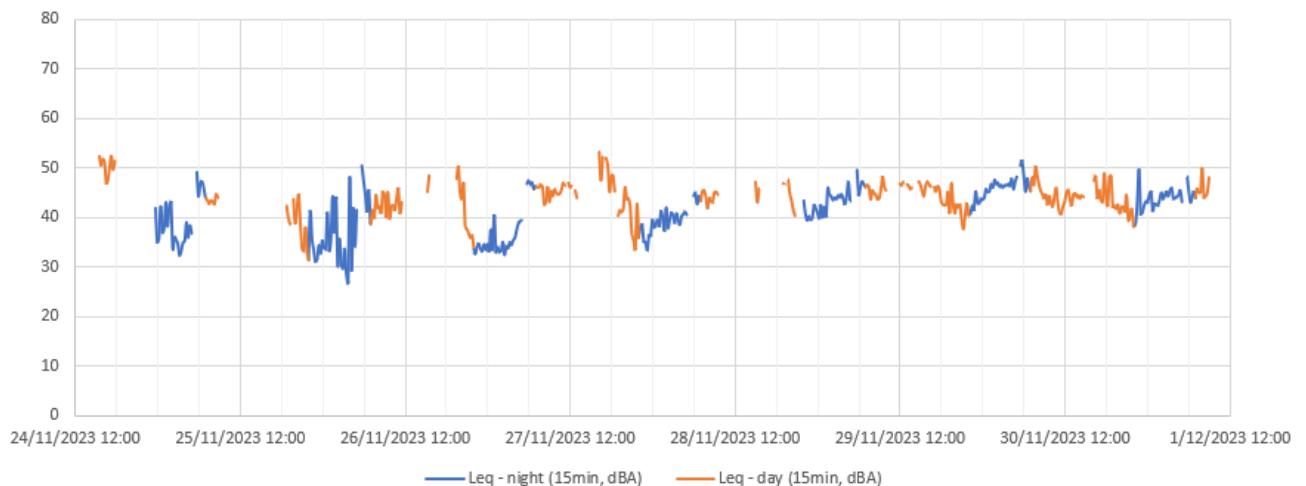
APPENDIX C EXISTING AMBIENT LEVELS

(Gaps are where data has been removed due to high wind and rain events, and early morning birdsong)

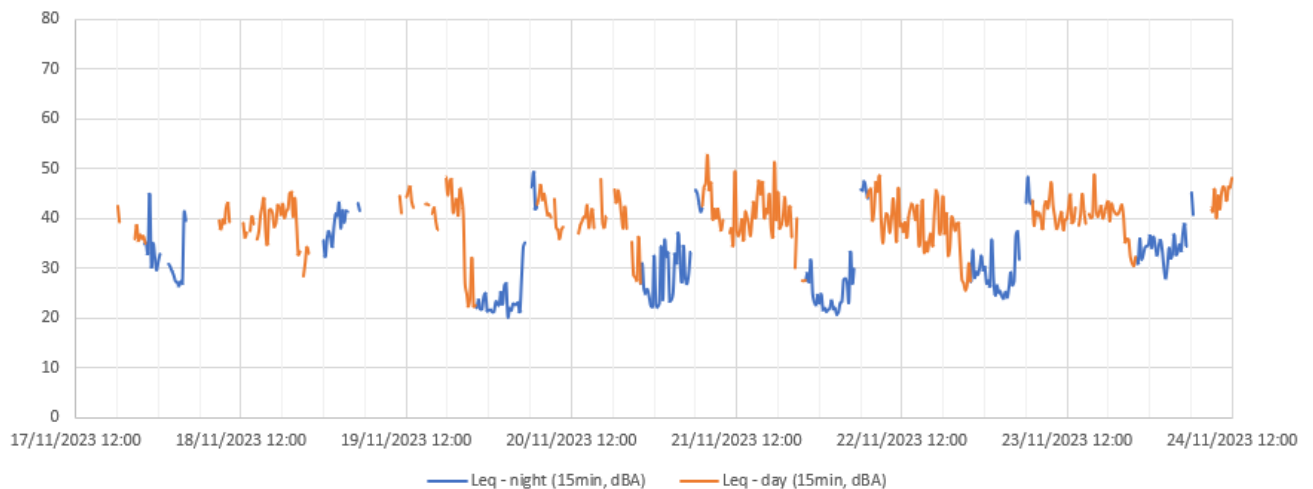
171 Macwhinney Drive - 15/11/2023 to 24/11/2023



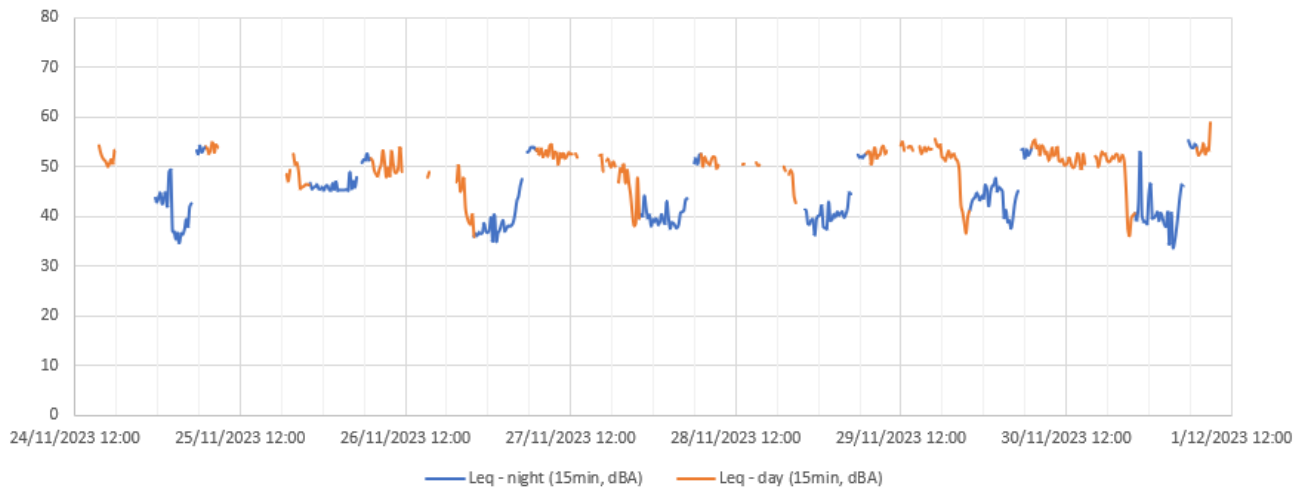
359 Macwhinney Drive - 24/11/2023 to 01/12/2023



1109 Ponga Road - 17/11/2023 to 24/11/2023



93 Macwhinney Drive - 24/11/2023 to 01/12/2023



APPENDIX D MODEL RESULTS - DAYTIME

Table D1: Predicted daytime noise levels. Limits are 55 dB L_{Aeq} (residential) and 65/70 dB L_{Aeq} (light/heavy industry)

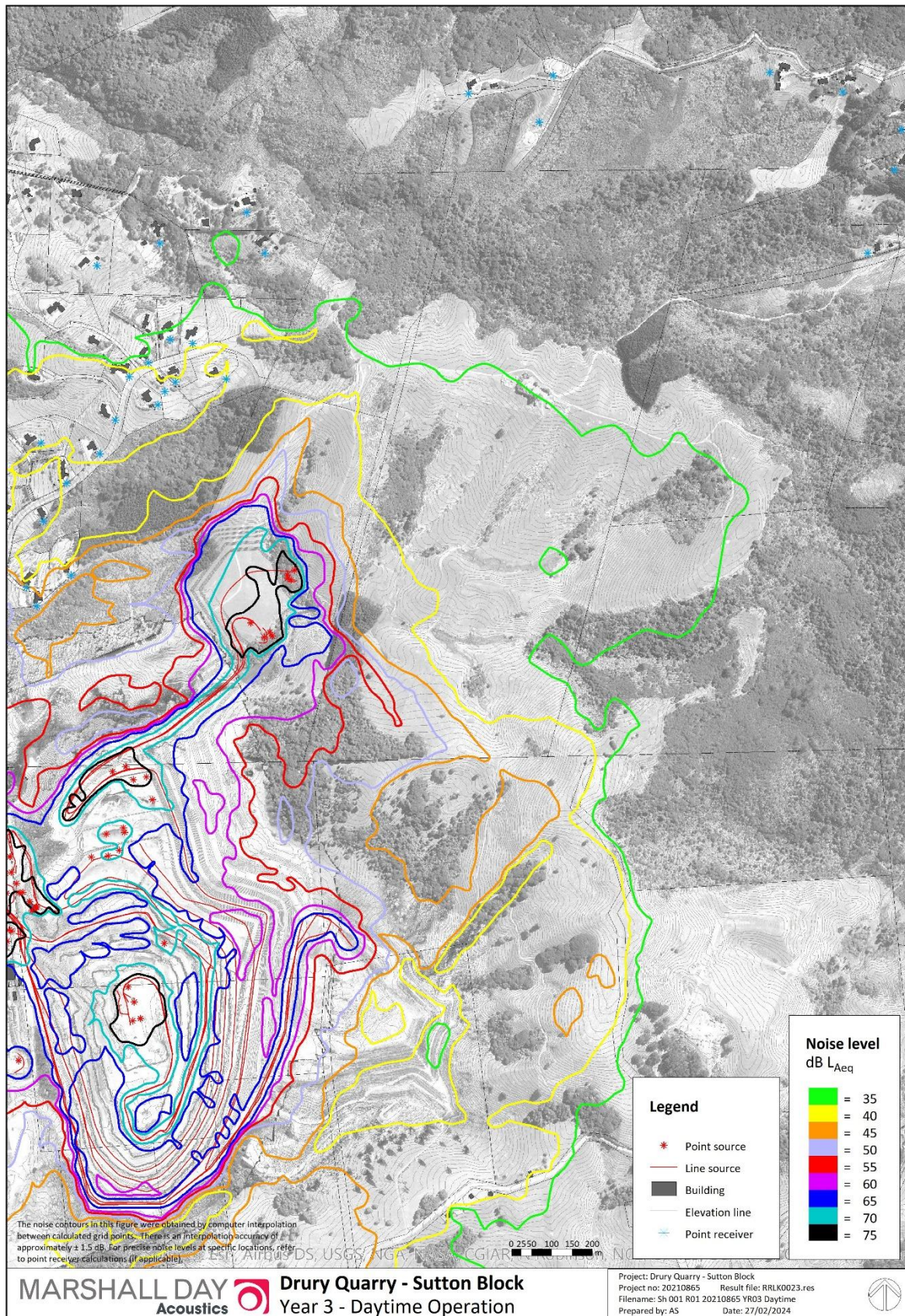
Receiver	Predicted Noise Levels at notional boundaries (dB L_{Aeq})					
	Existing†	Year 3	Year 15	Year 30	Year 40	Year 50 (LoQ)
Heavy Industry Zone* [§]	57	57	56	56	56	56
Light Industry Zone* [§]	55	55	54	55	54	55
77 Davies Road*	47	47	46	46	46	46
75 Davies Road*	45	46	46	46	45	45
77A Davies Road*	44	45	44	44	44	44
79 Drury Hills Road*	48	48	47	47	47	47
73 Drury Hills Road*	46	46	45	45	45	45
267 Drury Hills Road	29	31	33	36	33	31
273 Drury Hills Road	28	32	33	33	32	31
279 Drury Hills Road	36	38	40	44	42	39
285 Drury Hills Road	26	30	34	33	33	31
81 MacWhinney Drive*	50	50	49	49	49	49
85 MacWhinney Drive*	50	51	48	49	48	48
91 MacWhinney Drive*	52	52	51	51	51	51
93 MacWhinney Drive*	54	55	52	52	52	52
97 MacWhinney Drive*	51	52	49	49	49	50
103 MacWhinney Drive*	55	55	53	53	53	54
67 MacWhinney Drive*	48	49	46	47	47	46
115 MacWhinney Drive*	51	51	49	50	49	49
151 MacWhinney Drive*	49	50	48	49	49	48
171 MacWhinney Drive	45	47	44	47	45	44
175 MacWhinney Drive	47	48	45	46	46	45
229 MacWhinney Drive	43	44	43	45	44	44
234 MacWhinney Drive	42	43	41	42	42	41
240 MacWhinney Drive	44	45	43	45	44	43
254 MacWhinney Drive	42	43	42	45	43	42
284 MacWhinney Drive	41	43	42	46	44	41
291 MacWhinney Drive	40	43	43	50	45	43
310 MacWhinney Drive	40	42	41	45	42	41
336 MacWhinney Drive	37	39	39	44	41	39

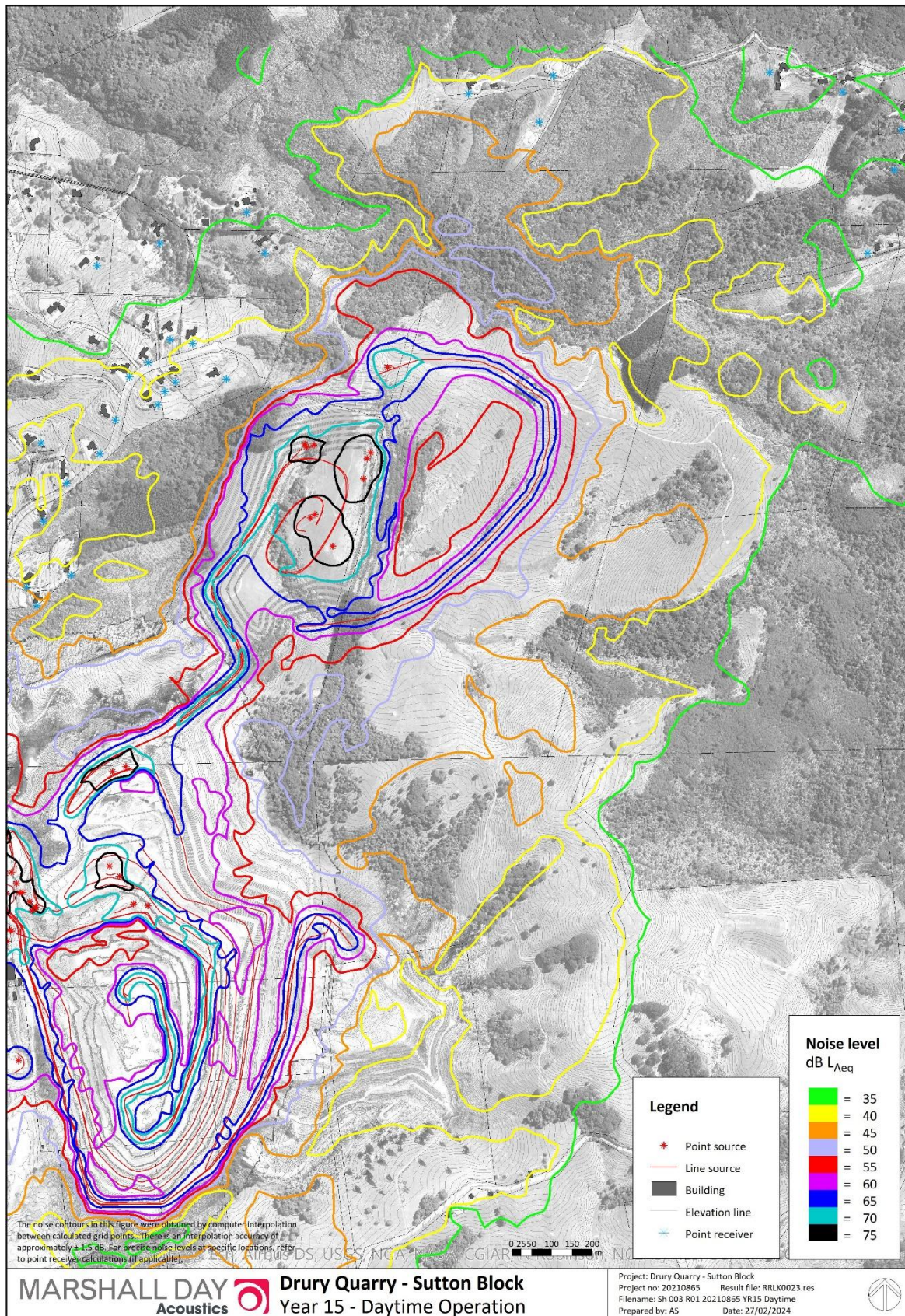
Receiver	Predicted Noise Levels at notional boundaries (dB L _{Aeq})					
	Existing [†]	Year 3	Year 15	Year 30	Year 40	Year 50 (LoQ)
337 MacWhinney Drive	40	42	43	49	45	43
347 MacWhinney Drive	39	41	42	52	45	43
350 MacWhinney Drive	36	39	39	47	40	38
354 MacWhinney Drive	35	39	40	52	44	43
359 MacWhinney Drive	38	40	42	53	45	43
96 Peach Hills Road	46	47	46	46	45	45
98 Peach Hills Road	46	47	46	46	46	46
1081 Ponga Road	30	31	35	39	40	35
1101 Ponga Road	30	32	38	40	39	37
1109 Ponga Road	25	28	39	38	38	35
1598 Ponga Road	27	29	33	36	37	34
16 Sonja Drive	25	27	34	35	35	33
72 Sonja Drive	29	30	39	40	39	37
99 Sonja Drive	30	32	43	44	43	37
109 Sonja Drive	30	32	44	44	44	36
115 Sonja Drive	30	32	44	45	45	36

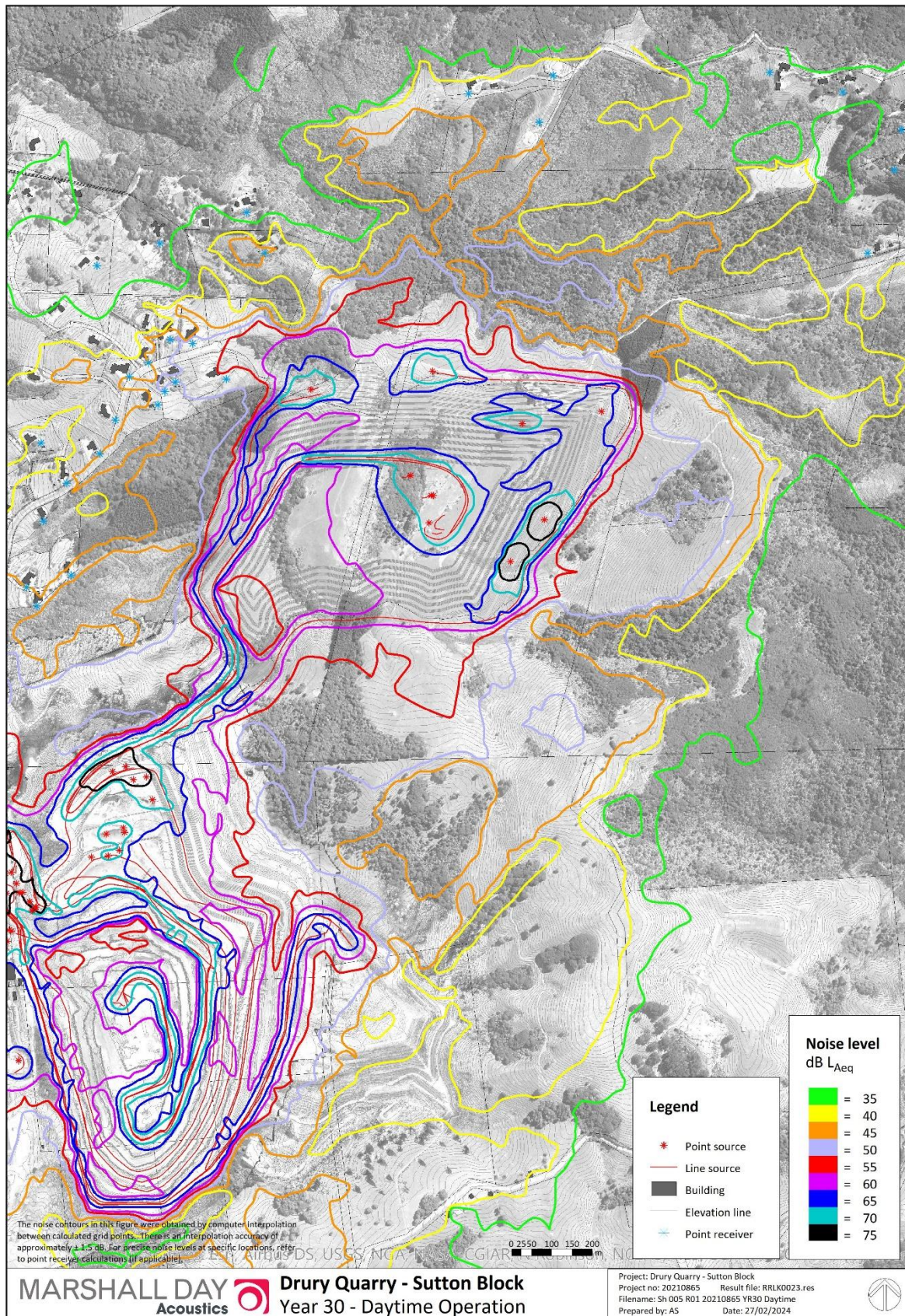
* Predicted noise level is not influenced by the Sutton Block works

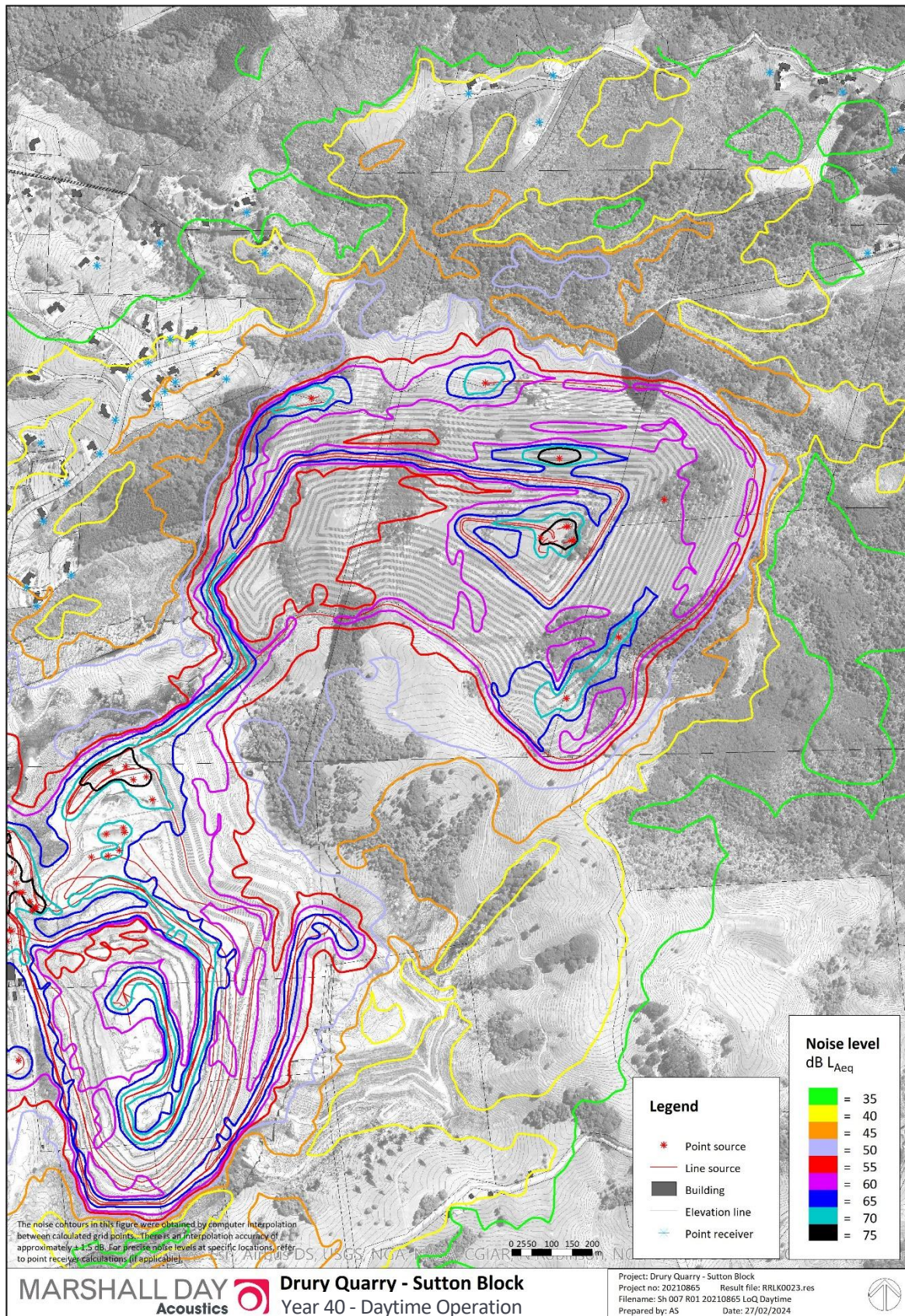
[§] Predicted noise level is at zone boundary, not notional boundary (as per AUP zone rules)

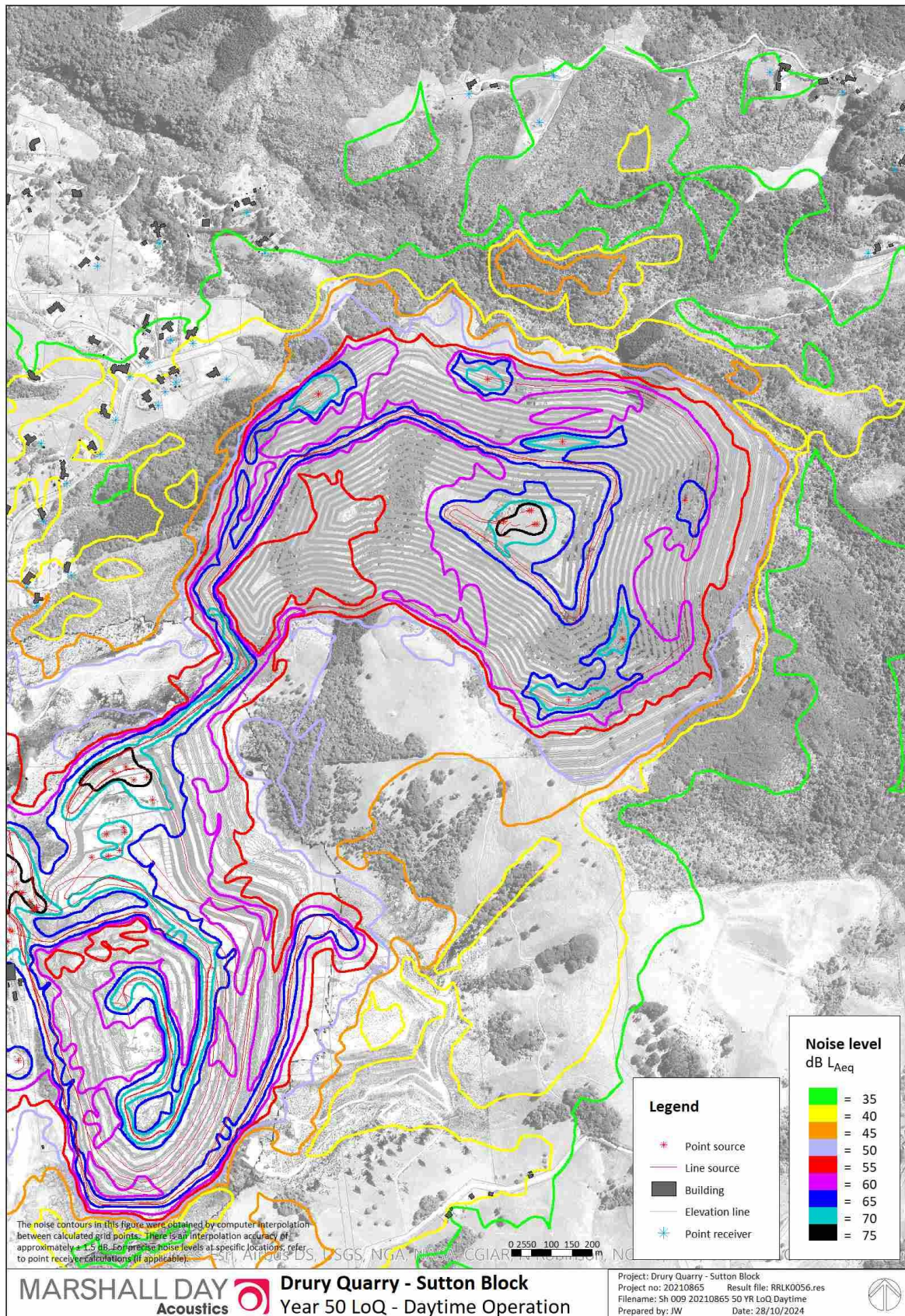
[†] Predicted noise level from existing quarry activity only. Does not include ambient noise from other sources











APPENDIX E MODEL RESULTS – NIGHT-TIME

Table E1: Predicted night-time noise levels. Limits are 45 dB L_{Aeq} (residential) and 65/70 dB L_{Aeq} (light/heavy industry)

Receiver	Predicted Noise Level (dB L _{Aeq})					
	Existing†	Year 3	Year 15	Year 30	Year 40	Year 50 (LoQ)
Heavy Industry Zone* [§]	46	47	47	47	47	47
Light Industry Zone* [§]	47	48	48	48	48	48
77 Davies Road*	35	39	38	38	37	37
75 Davies Road*	35	39	39	38	37	37
77A Davies Road*	34	39	38	37	36	36
79 Drury Hills Road*	38	40	39	39	39	39
73 Drury Hills Road*	35	37	37	37	36	36
267 Drury Hills Road	20	26	29	26	24	23
273 Drury Hills Road	19	27	30	26	24	23
279 Drury Hills Road	26	32	34	31	30	30
285 Drury Hills Road*	18	25	29	26	24	23
81 MacWhinney Drive*	40	42	41	41	41	41
85 MacWhinney Drive*	37	40	40	39	39	39
91 MacWhinney Drive*	40	43	42	42	41	42
93 MacWhinney Drive*	42	44	43	43	43	43
97 MacWhinney Drive*	39	41	41	40	40	40
103 MacWhinney Drive*	44	45	45	45	45	45
67 MacWhinney Drive*	36	39	38	38	37	37
115 MacWhinney Drive*	40	41	41	41	41	40
151 MacWhinney Drive*	39	42	40	40	40	40
171 MacWhinney Drive*	33	40	37	36	35	35
175 MacWhinney Drive*	36	40	37	37	37	37
229 MacWhinney Drive*	32	37	36	35	34	34
234 MacWhinney Drive*	31	34	34	33	33	33
240 MacWhinney Drive*	32	37	37	35	35	34
254 MacWhinney Drive*	31	37	37	35	34	33
284 MacWhinney Drive*	31	37	36	35	34	33

Receiver	Predicted Noise Level (dB L _{Aeq})					
	Existing [†]	Year 3	Year 15	Year 30	Year 40	Year 50 (LoQ)
291 MacWhinney Drive*	29	37	37	36	35	33
310 MacWhinney Drive*	31	36	35	34	33	33
336 MacWhinney Drive	26	34	34	31	30	30
337 MacWhinney Drive	29	37	37	35	34	33
347 MacWhinney Drive*	27	35	37	36	33	32
350 MacWhinney Drive	26	33	34	30	29	29
354 MacWhinney Drive	27	35	35	33	31	31
359 MacWhinney Drive	27	34	37	34	32	31
96 Peach Hills Road	38	42	41	41	40	40
98 Peach Hills Road	38	42	42	41	41	41
1081 Ponga Road	22	27	29	29	26	26
1101 Ponga Road	22	28	29	29	26	26
1109 Ponga Road	< 20	24	26	26	25	24
1598 Ponga Road	22	26	26	26	26	25
16 Sonja Drive	< 20	23	25	24	23	22
72 Sonja Drive	21	26	28	27	26	26
99 Sonja Drive	21	28	29	27	26	28
109 Sonja Drive	20	27	29	28	26	26
115 Sonja Drive	< 20	27	29	28	27	27

* Predicted noise level is largely uninfluenced by the Sutton Block works

[§] Predicted noise level is at zone boundary, not notional boundary (as per AUP zone rules)

[†] Predicted noise level from existing quarry activity only. Does not include ambient noise from other sources

Figures E1 – E6: Noise contours for existing and proposed night-time activities

