Acoustics
Vibration
Structural Dynamics

585-649 MAMRE ROAD, ORCHARD HILLS (SNACKBRANDS)

Noise Emission Assessment of Warehouse Expansion

10 August 2021

TMX

TL950-01D02 SSDA Acoustic Assessment (r1)

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1 Introduction

1.1 Overview and purpose of report

Renzo Tonin & Associates was engaged to undertake an acoustic assessment for a State Significant Development Application (SSDA) for the proposed expansion of the existing Snackbrands warehouse at 585-649 Mamre Road, Orchard Hills.

The site lies within a nine lot industrial subdivision (The First Estate subdivision). The existing Snackbrands warehouse is located on Lot 10 (located centrally within the sub-division). The subject proposal involves an expansion of the existing warehouse to the north (Lot 11).

In this report we will:

- Identify noise emission goals applicable to the site.
- Identify nearby noise sensitive development.
- Examine reasonable worst case operating scenarios with respect to noise emissions to determine if the noise impact on nearby development is acceptable. This examination is conducted having attended similar Snackbrands sites at Smithfield and Blacktown to measure the noise emitting activities that are expected to occur as part of the new warehouse expansion.
- Determine the building and/or management controls necessary to ensure that the cumulative noise from both the existing warehouse and the proposed expansion will meet noise emission requirements.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

1.2 Secretary's environmental assessment requirements

The Secretary's environmental assessment requirements relating to the project are detailed in the SSD-18204994 SEARs. The key issues with respect to noise and vibration are extracted below:

Noise and vibration – including:

- a quantitative noise and vibration impact assessment undertaken by a suitably qualified acoustic consultant in accordance with the relevant Environment Protection Authority guidelines and Australian Standards which includes:
  - the identification of impacts associated with construction, site emission and traffic generation at noise affected sensitive receivers, including the provision of operational noise contours and a detailed sleep disturbance assessment
  - details of noise monitoring survey, background noise levels, noise source inventory and 'worst case' noise emission scenarios
  - consideration of annoying characteristics of noise and prevailing meteorological conditions in the study area
  - a cumulative impact assessment inclusive of impacts from other developments
  - details and analysis of the effectiveness of proposed management and mitigation measures to adequately manage identified impacts, including a clear identification of residual noise and vibration following application of mitigation these measures and details of any proposed compliance monitoring programs.

1.3 Assessment objectives

As part of preparing this assessment, the following policies, guidelines and standards have been considered:

- Approvals currently in place for the existing Snackbrands warehouse.
- NSW *Noise Policy for Industry* (NPfI) (EPA 2016)
- NSW *Road Noise Policy* (RNP) (DECCW July 2011)
- Australian Standard AS 1055:2018 *Acoustics—Description and measurement of environmental noise.*
- NSW *Interim Construction Noise Guideline* (ICNG) (DECC 2009)
- NSW *Assessing Vibration – A Technical Guideline* (AVTG) (DEC 2006)

1.4 Acoustic terms

This report is technical in nature and uses acoustic terminology throughout. A summary and explanation of the common acoustic terms that have been used in this report is presented in Appendix A.

1.5 Reference material

This report is prepared based on:

- Architectural drawings by HLA Architects dated May 2021.
- Transport Assessment by Ason Group dated 28/6/2021 (truck types, vehicle swept paths, traffic generation).

2 Project description

2.1 Site description and development overview

The proposed development consists of the expansion of an existing warehouse located within the First Estate industrial subdivision (585-659 Mamre Road, Orchard Hills – approved in SSDA 7173).

The industrial subdivision is served by an internal roadway (Distribution Road), which then intersects with Mamre Road (an arterial area). There is no necessity for any truck serving the site to use a local road (in fact it is not possible for this to occur).

The existing Snackbrands warehouse was approved in SSD 9429 and is used as a distribution centre. The existing warehouse is located centrally within the nine lot First Estate industrial subdivision.

The proposed expansion is to the north of the existing warehouse and will enable food manufacturing to be conducted on site (in addition to the existing distribution centre usage).

The proposed expanded warehouse development will consist of:

- Approximately 25,000m^2 new warehouse space comprising manufacturing areas, office areas and a water treatment plant.
- External hardstand to accommodate three primary loading docks/areas and an additional 160 passenger vehicle parking spaces.

Primary noise sources associated with the site will be as follows:

- External areas – noise from truck deliveries, unloading activities (forklift, tipper truck, conveyor belts, filling produce "silos" with raw material) and external plant/equipment (water treatment, ventilation fans etc).
- Internal areas – operational noise from plant and equipment.

To the extent feasible, measurements of operational noise from all of the above activities was undertaken at other Snackbrands sites (Blacktown and Smithfield). The results of these measurements is set out in section 4.1 and has been used in noise emission predictions from the site.

2.2 Hours of operation

The proposed operation is 24 hours 7 days per week.

2.3 Nearby Noise Sensitive Receivers

The identified assessment locations are shown in the aerial photo in Figure 2 (below) and are summarised below.

Table 2.1: Assessment locations

ID	Address	Description	Distance from site (m)*
Location B	579 Mamre Road	Double storey residential house located north of the site.	780m
Location C	Mandalong Close	Single storey residential dwellings	600m
Location D	Old MacDonald Child Care Centre	Child Care Centre	320m

*Distance referred to is from approximately the centre of the site to the receiver property boundary, or 30m from the dwelling (whichever is further).

With respect to Location A (5730-577 Mamre Road -see Figure 2, below):

- At the time of development approval of the first Snackbrands Warehouse, this location was occupied for residential purposes.
- We are advised that:
  - The site has since been purchased by Altis Property Partners (developer of the Orchard Hills subdivision)
  - The site is no longer occupied for residential purposes.
  - The site is proposed to be redeveloped for non-residential purposes.

See letter from Altis, Appendix B confirming the above.

As such, the noise impact on the former dwelling at this site will not be assessed in this report as it is no longer a noise sensitive receiver.

Figure 1: Aerial Photo – Orchard Hills Industrial Precinct (Source – Near Maps - June_2021)

Figure 2: Precinct Aerial Photo (Source – Google Maps - June_2021)

3 Project noise goals

Operational noise goals are outlined below.

For construction noise goals, refer to section 5.

3.1 Operational Noise - Existing Approval for Snackbrands Warehouse

The proposed development is an expansion on an existing warehouse.

The existing warehouse was approved in SSDA 9429. This was an approval specific to the Snackbrands development, and not a sub-division wide approval. The operational noise emission limits were set out in condition B19 of the development approval to SSDA9429, and are set out below:

Table 3.1: Current Snackbrands Warehouse Approval – Noise Emission Requirements

Operational Noise Limits

B19. The Applicant must ensure that noise generated by operation of the development does not exceed the noise limits in **Table 2**.

Table 2 *Noise Limits dB(A)*

Location	Day $L_{Aeq(15\ minute)}$	Evening $L_{Aeq(15\ minute)}$	Night $L_{Aeq(15\ minute)}$	Night $L_{A1(1\ minute)}$
Receiver A	39	39	35	48
Receiver B	39	39	38	49
Receiver C	36	36	35	49

Note: *Noise generated by the development is to be measured in accordance with the relevant procedures and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy (EPA, 1999) (as may be updated or replaced from time to time). Refer to the plan in Appendix 4 for the location of residential sensitive receivers.*

With respect to the table above, refer to section 2.3 for identification of Receivers A-C. Note that Receiver A is no longer a residential noise receiver.

The existing Snackbrands site must comply with the noise emission requirements set out in table 2.1..

It is proposed that the cumulative operational noise from the *existing* and *expanded* warehouse will comply with these requirements. In doing this:

- There is no overall noise increase from the combined Snackbrands compared to currently approved noise limits and
- There is no overall increase in First Estate Precinct noise emission as a result of the proposed Snackbrands expansion.

As such:

- There can be no impact on the amenity of nearby land users as there is no change in permitted noise generation and
- It is therefore not necessary to consider operational noise from other noise sources within the First Estate Precinct other than the existing warehouse when considering cumulative noise impacts.

With respect to the Old MacDonald Child Care centre:

- No noise emission target was set in the approval for the original Snackbrands warehouse.
- For the purpose of setting reasonable noise emission goals, an external noise goal of 55dB(A)L_{eq} at the child care centre will be adopted. This is consistent with the noise goals set in the Noise Policy for Industry when assessing impacts on passive outdoor recreation areas and is appropriate in the assessment of a child care centre playground.

3.2 Road traffic noise

Noise impacts from the potential increases in traffic on the surrounding road network due to construction and operational activities from the Proposal is assessed in accordance with the NSW *Road Noise Policy* (DECCW, 2011) (RNP). The RNP sets out criteria to be applied to particular types of road and land uses. These noise criteria are to be applied when assessing noise impact and determining mitigation measures for sensitive receivers that are potentially affected by road traffic noise associated with the construction and operation of the subject site, with the aim of preserving the amenity appropriate to the land use.

The Proposal will be using arterial roads and not local roads. Therefore, for existing residences affected by additional traffic on existing sub-arterial / arterial roads generated by land use developments, the following RNP road traffic noise criteria would apply.

Table 3.2: RNP Road Traffic Noise Criteria, dB(A)

Road Category	Type of Project/Land Use	Assessment Criteria, dB(A)	
		Day 7am – 10pm	Night 10pm – 7am
Freeway/arterial/sub-arterial roads	3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,(15\ hour)}$ 60 (external)	$L_{Aeq,(9\ hour)}$ 55 (external)

Further to the above, the RNP states the following for land use developments generating additional traffic:

> *"For existing residences and other sensitive land uses affected by* **additional traffic on existing roads generated by land use development***, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'."*

The RNP states that in assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

3.3 Historical Noise Survey Data for the Site

While not directly related to the noise emission objectives set out above, the table below presents a summary of ambient noise levels that were measured as part of the First Estate subdivision approval (SSD7173, as reported in *Operational Noise Assessment – Proposed Warehouse and Logistics Estate* by Acoustic Logic dated 5/4/2016 Rev 7):

Table 3.3: Ambient Noise Survey Results (Mandalong Close)

Daytime (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)
50dB(A)$L_{eq(Period)}$ 38dB(A)L_{90}	50dB(A)$L_{eq(Period)}$ 34dB(A)L_{90}	50dB(A)$L_{eq(Period)}$ 34dB(A)L_{90}

These ambient noise levels are discussed primarily in the context of:

- Discussion of impulsive and intermittent noise (see section 4.3.3) and
- Construction Noise (section 5).

4 Operational Noise Emission Assessment

4.1 Noise sources – Survey of Snackbrands Operational Noise

Site attendances were conducted on 28 and 29 April 2021 at Snackbrands manufacturing warehouses at Smithfield and Blacktown. These site attendances enabled measurements of vehicle noise specific to the Snackbrands fleet. In addition, it enabled measurements of incidental noise events that will be specific to the Snackbrands site, being:

- Use of tipper truck for raw produce unloading.
- Conveyors belts.
- Loading of silos with raw produce.
- Measurements of internal areas (corn/potato processing plant etc).

A summary of the measured noise levels is presented below.

Measurements of the noise source levels from the key noise generating plant/equipment were undertaken with a sufficient duration to capture the total activity noise level (eg entire "tipping" activity for material unloading) and all relevant statistical measurement parameters (L_{Amax}, L_{eq}, $L_{A90,T}$) were recorded in accordance with AS1055:2018. For the trucks moving onsite, maximum pass-by noise levels were used to derive conservatively high sound power levels for the assessment. A summary of the measured noise levels for the key activities are presented in the following tables.

Table 4.1: Attended noise measurement results – Key distribution centre noise activities (External Areas)

Noise source / activity (and duration)	Measured noise level, dB(A)			Distance from Source	Calculated Sound Power (L_{eq})
	L_{max}	$L_{eq,t}$	$L_{90,t}$		
B-double truck - idle	74	73	72	7m from side	97dB(A)
B-double truck – 5km/h	73	72		8.5m from side	99dB(A)
B-double truck – 10km/h	77	76		8.5m from side	103dB(A)
B-double truck – 5km/h (hill)	77	76		9m from side	103dB(A)
B-double truck – reversing, with beacon*.	80	77	74	10m from side	103dB(A)
B-double – airbake/emergency brake	83	80		5m from side	104dB(A)**
Tipper unloading (potatoes) - >15min	86	70	65	10m from side	98dB(A)
Side unloading (corn) - >15min	85	83	83	7m from side	106dB(A)
Conveyorbelt	80	74	72	2m from side	88dB(A)
Silo filling with corn - >15min	78	76	75	28m from side	113dB(A)
Forklift	86	69	61	4m	89dB(A)
Roof Mech (worst case)	86	85	85	6.5m	109dB(A)

*Also exhibited tonal qualities.
**This is atypically quiet in our experience and for the purpose of assessment an L_{max} of 115d(A) will be adopted, which is more typical on our experience.

Table 4.2: Attended noise measurement results – Key distribution centre noise activities (Internal Areas – Sound Pressure Level within Space)

Noise source / activity (and duration)	Measured noise level, dB(A)		
	L_{max}	$L_{eq,t}$	$L_{90,t}$
Starch Area (Conveyor belt, potato falling, equipment noise)	84	81	80
Starch Area (equipment noise only)	96	82	80
Potato Prep Room	96	95	93
Heat Exchanger Room	90	88	87
Corn Processing	99	88	86
Packaging	91	84	80
Cereal Processing	93	88	86
Water Treatment Plan	85	78	73
Blower Room	93	88	83
Warehouse	88	69	61

Table 4.3: Carpark activity sound power levels

Activity	Metric	Sound Power Level, dB(A) re. 1pW
Vehicle moving (10km/h)	Passby L_W Leq	79
Door Slam	SEL	86
Engine Start	SEL	92

4.2 Prediction methodology

Noise emissions were predicted by modelling the noise sources, receiver locations, topographical features of the intervening area and possible noise control treatments, using CadnaA (version 2021) noise modelling computer software. The software calculates the contribution of each noise source at each specified receptor point and allows for the prediction of the total noise from a site. The noise prediction model takes into account:

- location of noise sources and receiver locations
- height of sources and receivers
- separation distance between sources and receivers
- ground type between sources and receivers
- attenuation from barriers (natural and purpose-built)
- meteorological effects

At relatively large distances from the noise source, meteorological effects are taken into account in the noise prediction because the resultant noise levels at receivers can be influenced by meteorological conditions, particularly temperature inversions and winds.

These noise-enhancing meteorological conditions comprise a ‘D’ atmospheric stability class with 3m/s winds or ‘F’ atmospheric stability class with 2m/s during the night-time periods (as per Fact Sheet D of NPfI), because this atmospheric stability class does not ordinarily occur during the day.

For consistency with the NPfI and in addition to modelling under noise-enhancing meteorological conditions, modelling was also conducted for standard meteorological conditions for the night period using ‘D' atmospheric stability class with 0.5m/s wind.

A summary of model inputs is provided below.

Table 4.4: Modelling inputs

Input Parameters	Description
Ground absorption	Numeric values varied between 0 (hard surface) to 1 (soft ground) Value of 0.5-1.0 was used to represent the ground between the proposed site and the receivers
Receiver heights	1.5 metre above ground level for ground floor, plus 3.0 metres for additional floors
Modelling standard	CONCAWE
Meteorological effects	
Weather category / Stability Class / wind speed	Standard meteorological conditions: 'D' atmospheric stability class with 0.5m/s wind. Noise-enhancing meteorological conditions: 'D' atmospheric stability class with 3m/s winds or 'F' atmospheric stability class with 2m/s winds (for night only as per Fact Sheet D of NPfI)
Wind direction	Worst-case direction to the receiver

4.3 Noise Emission Assessment

4.3.1 Average/L_{eq} Noise Emissions

EPA Noise Policy for Industry typical practice (and the conditions of consent applied to the existing Snackbrands warehouse) requires assessment of noise impacts in 15 minute intervals.

A worst case noise emission scenario has been determined in consultation with Snackbrands and Ason Group (their traffic consultant). This will include proposed and existing warehouse operations and as such will enable a cumulative prediction of the *existing and proposed* operational noise.

For the purpose of determining a worst case 15 minute period, the following will be assumed to occur:

- Potato truck delivery:
  - Truck (b-double) enters site and reverses to the potato delivery dock (2 minute duration).
  - The tipper/unloader is then engaged for the remaining time of the 15 minute period.
  - Potato truck entry path and unloading position as per Appendix C.
- Corn truck delivery:
  - Truck enters site and drives to the corn delivery dock (2 minute duration – no reversing movement required).
  - The side unloading process is then engaged for the remaining time on the 15 minute period.
  - Corn truck entry path and unloading position as per Appendix D.
- Forklifts – five forklifts are assumed to be in operation continuously in external hard stand areas.

- Conveyor belts at the corn and potato unloading areas are in continuous operation.
- Staff car park - 10 passenger vehicles are started, and drive to the site exit (30 second duration).
- Existing warehouse operations:
  - B-double movement leaving the warehouse (1 minute travel duration).
  - Travel path as per Appendix E.

Although this is more likely to occur during the daytime, there is a (unlikely) possibility that it could occur at night time. For this reason, noise from this scenario will be assessed with reference to the night time noise emission goals.

With respect to the corn silo:

- The corn silo at the Snackbrand site at Blacktown is located in an external area.
- The primary noise from its use is from corn hitting the metal walls of the silo when being filled.
- Based on the measured noise levels, this activity is expected to result in exceedances of noise goals.
- Given this, the silos are proposed to be housed in internal areas, and provided this is the case, noise from their loading will not contribute to the external noise emission. This is reflected in the recommendations in section 4.4.

In each noise emission prediction, the sound power levels identified in section 4.1 are adopted. In the case of the truck reversing beacon, a 5B(A) penalty is applied to the noise level given the tonal nature of the noise (as per EPA Noise Policy for Industry Fact Sheet C).

Predicted noise levels set out below. Refer also to Appendix F for presentation of noise contour maps.

Table 4.5: Predicted operational noise levels (Average/$L_{eq(15min)}$ Noise Levels)

Receiver	Predicted Noise Level (dB(A)$L_{eq(15min)}$)			Noise Criteria (dB(A)$L_{eq(15min)}$)			Exceedance (dB)
	Normal Conditions	Adverse Conditions (Wind)[2]	Adverse Conditions (Temperature Inversion)[3]	*Day[1]*	*Evening[1]*	*Night[1]*	
Location B (579 Mamre Road)	33	38	38	*39*	*39*	*38*	0
Location C (23-31 Mandalong Close)	31	35	35	*36*	*36*	*35*	0
Location C (73 Mandalong Close	30	34	34	*36*	*36*	*35*	0
Old MacDonald Child Care Centre	44	49	N/A[4]	*53 (external, when in use)*			0

Notes:
1. Daytime = 7.00am-6.00pm; Evening = 6.00pm-10.00pm; Night = 10.00pm-7.00am.
2. 'D' atmospheric stability class with 3m/s winds - noise-enhancing meteorological conditions
3. 'F' atmospheric stability class with 2m/s winds (night-time only) noise-enhancing meteorological conditions
4. Temperature Inversion only occurs at night time. Child Care Centre not in use at this time.

As noted in the table above, under a worst case scenario noise emissions are predicted to be compliant at nearby development, both under standard weather conditions and in the event of adverse weather conditions.

Management restrictions underpinning the assumptions relating to the worst case scenario are set on in section 4.4 (Recommendations).

4.3.2 Sleep disturbance (10pm-7am Only)

Sleep disturbance would most potentially be caused by a single event of truck airbrake release, a vehicle door closing and/or engine starting in the carpark areas. where there is a limited degree of acoustic shielding (compared with internal activities).

The following noise levels from Renzo Tonin & Associates' database have been used for the assessment and are shown in the table below.

Table 4.6: Sleep disturbance - Sound power levels

Activity	Sound power level, dB(A) re: 1pW
	L_{max}
Truck airbrake	115
Vehicle door closing	96
Vehicle engine starting	97

Noise predictions at the identified assessment locations are presented in the table below and assessment with reference to the sleep disturbance criteria applied to the existing warehouse (as detailed in section 3.1).

Table 4.7: Sleep Disturbance Assessment - Predicted operational noise levels (L_{max} Noise Levels)

Receiver	Predicted Noise Level (dB(A)$L_{eq(15min)}$)			Noise Criteria (dB(A)$L_{eq(15min)}$)	Exceedance (dB)
	Normal Conditions	Adverse Conditions (Wind)[2]	Adverse Conditions (Temperature Inversion)[3]	*Night*[1]	
Location B (579 Mamre Road)	36	41	41	*49*	0
Location C (23-31 Mandalong Close)	34	39	39	*49*	0
Location C (73 Mandalong Close)	33	38	38	*49*	0
Old MacDonald Child Care Centre	N/A[4]	N/A[4]	N/A[4]	*N/A*[4]	-

Notes:
1. Daytime = 7.00am-6.00pm; Evening = 6.00pm-10.00pm; Night = 10.00pm-7.00am.
2. 'D' atmospheric stability class with 3m/s winds - noise-enhancing meteorological conditions
3. 'F' atmospheric stability class with 2m/s winds (night-time only) noise-enhancing meteorological conditions
4. Child Care Centre not in use at this time.

4.3.3 Review of Annoying noise characteristics adjustments

Where the character of the industrial noise is assessed as particularly annoying at a receiver location (ie. if the resulting noise level at a receiver location is tonal, low frequency or is intermittent at night), then an adjustment would be added to penalise the predicted noise for its potential increase in annoyance. The Fact Sheet C of the NPfI provides definitive procedures for determining whether a modifying factor should be applied which will be assessed as part of the Proposal. The corrections are to be added to the predicted noise levels at the receiver before comparison with the project noise trigger levels.

Measurements of the noise source levels from the key noise generating plant/equipment were undertaken at two similar facilities with a sufficient duration to capture the total activity noise level (ie. departure manoeuvre, idle etc), and all relevant statistical measurement parameters (L_{Amax}, $L_{A1,T}$, $L_{A90,T}$) were recorded in accordance with AS1055:2018.

4.3.3.1 Tonality

B-double reversing beacon was identified as tonal. A 5dB(A) penalty was applied when running the noise prediction model (108dB(A) sound power) for this noise source. No other activities were identified as being tonal.

4.3.3.2 Intermittent Noise

The NPfI details that the test for intermittent noise that applies during the night period to be *"The source noise heard at the receiver varies by more than 5 dB(A) and the intermittent nature of the noise is clearly audible."* and *"…where the level suddenly drops/increases several times during the assessment period…"*. During the environmental assessment phase it is not possible to listen and subjectively assess the noise at the receiver as required by the guideline. However, only where all of the following tests are met shall a penalty be applicable to the predicted noise level at the relevant receiver:

- the noise level fluctuates / cycles by more than 5 dB(A);
- this difference relates to a 'sudden' drop/increase in the activity noise level;
- this activity may occur multiple times during a 15-minute assessment period; and
- the predicted noise level from the subject source at a receiver is clearly audible over the ambient noise environment.

The only activity that could potentially fall under this category would be from a reversing beacon during the potato delivery truck inbound movement. However this noise would not be considered intermittent if applying the test outlined above:

- As noted in section 4, the reversing beacon generated a momentary maximum noise level of 80dB(A)L_{max} at 10m distance.
- The corresponding momentary noise levels that would be expected at the noise receivers *from the reversing beacon alone* will be approximately 28dB(A)L_{max}.
- Given that $L_{eq(15min)}$ noise emission prediction from the site is over 30dB(A) at the nearest residences, and bearing in mind that ambient noise levels at the receivers is 33-34dB(A)L_{90} (see section 2.3), the momentary noise level created by the reversing beacon would not result in the overall noise level at receiver increasing by more than 5dB(A).
- As such could not be considered intermittent when considering if a penalty should be applied.

4.3.3.3 Impulsive Noise

An impulsiveness penalty was not included in the NPfI released by the EPA in 2017.

Appendix E of AS1055-2018 provides an objective method for application of an impulse adjustment to measured receiver noise at receivers where deemed necessary. Impulsive noise is defined in this standard as a sound with a sudden onset. Onset is defined in the standard as a sound having a positive slope time history where the gradient exceeds 10 dB/s.

Section E9 *'Care in the use of methods'* of AS1055-2018 states that:

"It is recommended that the impulse method only be applied where the occurrence of impulsive sounds caused by a subject source are identified audibly to occur at the receiver locations by attended monitoring."

The only activity that could potentially fall within this category would be from a reversing beacon during the potato delivery truck inbound movement. As noted in section 4.3..2, the noise contribution for the reversing beacon is expected to be below ambient L_{90} noise levels at both nearby residential receiver groups. There could therefore be no 10dB(A) increase per second observed at these residences and therefore the penalty should not be applied.

4.3.4 Road traffic noise assessment

Additional noise from traffic generated by a development on the public road network is assessed against the NSW EPA 'Road Noise Policy' (RNP), 2011. The assessment involves consideration of the existing traffic noise levels and the potential change in noise as a result of the development.

The noise impact as result of additional traffic created by the site is reasonable:

- Traffic generated by the development would access and depart the site via Distribution Drive. There are no residential receivers located on Distribution Drive (the nearest residences are over 650m away). Vehicles would then travel to an arterial road (Mamre Road) before passing any residential development.

- We have reviewed *the Transport Assessment report by Ason Group (28/6/2021). Section 5.1.3 of the Transport* Assessment indicates that the combined traffic associated with the Snackbrands warehouses is less than the daily trip generation permitted for the combined lots envisaged as part of the subdivision approval of the Fire Estate Master Plan subdivision (SSD 7173). The traffic generation is therefore consistent with the original sub-division approval.

- Further:

    - Mamre Road is classified as an arterial road for which the RNP recommends a daytime (7am to 10pm) external noise level of $L_{Aeq,15hr}$ 60 dB(A) and a night-time (10pm to 7am) external noise level of $L_{Aeq,9hr}$ 55 dB(A) measured at the facade of a residence.

    - The nearest residences to Mamre Road are located to the north of the site, on Pine Creek Crescent with a 30m setback from Mamre Road to the dwellings.

    - Noise from vehicle movements on straight stretches of roadway (as is the case of Mamre Road) can be modelled using the Cortn noise prediction model. Based on a receiver distance of 30m from the road and average of 10 truck movements per hour period (more than the actual number of heavy vehicles proposed), the noise level at receiver would be less than 55dB(A)L_{eq}. This complies with the RNP daytime criterion of 60dB(A)$L_{eq(15hr)}$ and a night-time criterion of 55dB(A)$L_{eq(9hr)}$.

4.4 Recommendations

In order to ensure that compliant noise emissions are achieved, the following is required:

- Heavy vehicle movements in any 15 minute period should not exceed the worst case scenario assessment outlined in section 4.3.1 being one potato delivery, one con delivery and one outbound movement from the existing warehouse.

- Forklifts should be electric or gas, and must not be diesel.

- Water treatment plant and corn silo must be located within an enclosed building.

- Doors on the northern façade of the warehouse must be kept closed except as required for ingress/egress.

- Roof sheeting and external wall sheeting of the warehouse should be constructed of minimum 0.5mm thick steel (R_w 23) or material of equal or higher surface density.

- Indicative roof top plant and equipment acoustic requirments:

  - Any roof top refrigeration equipment, evaporative cooler, cooling tower air-cooled chiller or similar should have a sound power level of no more than 100dB(A). If equipment noise levels are higher, acoustic treatment (localised screen) would be required.

  - Any roof top fan to have a noise level of no more than 75dB(A) at 3m distance. If fan exceeds his noise level, acoustically treated ductwork will be required.

  - All external plant selections to be acoustically reviewed at CC stage pending final equipment selection and layout design.

5 Construction Noise and Vibration Assessment

5.1 Construction noise objectives

5.1.1 Noise management levels (NMLs)

The NSW *Interim Construction Noise Guideline* (ICNG, 2009) provides guidelines for assessing noise generated during the construction phase of developments.

The key components of the guideline that are incorporated into this assessment include:

- Use of L_{Aeq} as the descriptor for measuring and assessing construction noise.
- Application of reasonable and feasible noise mitigation measures.
- As stated in the ICNG, a noise mitigation measure is feasible if it is capable of being put into practice and is practical to build given the project constraints.
- Selecting reasonable mitigation measures from those that are feasible involves making a judgement to determine whether the overall noise benefit outweighs the overall social, economic and environmental effects.

The ICNG provides two methods described for the assessment of construction noise, being either a quantitative or a qualitative assessment. A quantitative assessment is recommended for major construction projects of significant duration and involves the measurement and prediction of noise levels and assessment against set criteria. A qualitative assessment is recommended for small projects with duration of less than three weeks and focuses on minimising noise disturbance through the implementation of reasonable and feasible work practices, and community notification. Given the scale and duration of the construction works proposed, a quantitative assessment is carried out herein, consistent with the ICNG requirements.

Table 5-1 reproduced from the ICNG, sets out the airborne noise management levels and how they are to be applied for residential receivers.

Table 5-1: Noise management levels at residential receivers

Time of day	Management level $L_{Aeq\ (15\ min)}$ *	How to apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before/ after school for works near schools, or mid-morning or mid-afternoon for works near residences 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see *ICNG* section 7.2.2.

* Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 metres above ground level. If the property boundary is more than 30 metres from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 metres of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Table 5-2 sets out the ICNG noise management levels for other noise sensitive receiver locations.

Table 5-2: Noise management levels at other noise sensitive land uses

Land use	Time of day	Where objective applies	Management level $L_{Aeq\ (15\ min)}$
Active recreation areas	When in use	Outdoor noise level	65 dB(A)
Passive recreation areas	When in use	Outdoor noise level	60 dB(A)
Commercial premises	When in use	Outdoor noise level	70 dB(A)
Industrial premises	When in use	Outdoor noise level	75 dB(A)

Notes: 1. Outdoor noise level based on internal noise level in ICNG and assumes 10 dB loss through an open window

5.1.2 Summary of construction noise management levels

A summary of construction noise management levels is presented below.

Table 5-3: Construction noise management levels

ID	Location description	Noise management level $L_{Aeq(15min)}$[1]
		Monday to Fridays (7:00am to 6:00pm) Saturdays (8:00am to 1:00pm)
Location B and C	Residential premises (579 Mamre Road, Mandalong Close Residences)	48[4]
Location D	Childcare centre - classroom (external)	55[2,3]
	Childcare centre - playground	65[2]

Notes:
1. Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5m above ground level. If the property boundary is more than 30m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise affected residence.
2. Noise management levels apply when receiver areas are in use only.
3. External noise management level. A conversion from internal to external assumes 10dB(A) loss from outside to inside through open window.
4. Based on 38(A) daytime background noise level - see section 3.3.

5.2 Construction vibration objectives

Construction vibration is associated with three main types of impact:

- disturbance to building occupants
- potential damage to buildings, and
- potential damage to sensitive equipment in a building.

Generally, if disturbance to building occupants is controlled, there is limited potential for structural damage to buildings.

Vibration amplitude may be measured as displacement, velocity, or acceleration.

- Displacement (x) measurement is the distance or amplitude displaced from a resting position. The International System of Units (SI unit) for distance is the metre (m), although common industrial standards include mm.
- Velocity ($v=\Delta x/\Delta t$) is the rate of change of displacement with respect to change in time. The SI unit for velocity is metres per second (m/s), although common industrial standards include mm/s. The Peak Particle Velocity (PPV) is the greatest instantaneous particle velocity during a given time interval. If measurements are made in 3-axis (x, y, and z) then the resultant PPV is the vector sum (i.e. the square root of the summed squares of the maximum velocities) regardless of when in the time history those occur.
- Acceleration ($a=\Delta v/\Delta t$) is the rate of change of velocity with respect to change in time. The SI unit for acceleration is metres per second squared (m/s^2). Construction vibration goals are summarised below.

Construction vibration goals are summarised below.

5.2.1 Disturbance to buildings occupants

The acceptable vibration values to assess the potential for human annoyance from vibration are set out in the NSW '*Environmental Noise Management Assessing Vibration: A Technical Guideline*' (AVTG).

To assess the potential for vibration impact on human comfort, an initial screening test will be done based on peak velocity units, as this metric is also used for the cosmetic damage vibration assessment. The screening test is based on the continuous vibration velocity (i.e. vibration that continues uninterrupted for a defined period). If the predicted vibration exceeds the initial screening test, the total estimated Vibration Dose Value (i.e. eVDV) will be determined based on the level and duration of the vibration event causing exceedance.

The initial screening test values and VDVs recommended in BS 6472-1992 for which various levels of adverse comment from occupants may be expected, are presented in Table 5-4. The 'Low probability of adverse comment eVDV' represent the preferred and maximum value presented in the AVTG.

Table 5-4: Vibration management levels for disturbance to building occupants

Place and Time	Initial screening test Velocity, PEAK, mm/s (>8Hz)	Low probability of adverse comment eVDV $m/s^{1.75}$	Adverse comment possible eVDV $m/s^{1.75}$	Adverse comment probable eVDV $m/s^{1.75}$
Critical areas (day or night)[1]	0.28	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8
Residential buildings 16 hr day[2]	0.56	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8 hr night[2]	0.40	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8
Offices, schools, educational institutions and places of worship (day or night)	1.10	0.4 to 0.8	0.8 to 1.6	1.6 to 2.4
Workshops (day or night)	2.20	0.8 to 1.6	1.6 to 3.2	3.2 to 6.4

1. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specify above
2. Daytime is 7am to 10pm and night-time is 10pm to 7am

5.2.2 Building damage

Potential structural damage of buildings as a result of vibration is typically managed by ensuring vibration induced into the structure does not exceed certain limits and standards, such as British Standard 7385 Part 2 and German Standard DIN4150-3. Currently there is no existing Australian Standard for assessment of structural building damage caused by vibration energy.

It is noted that vibration levels required to cause minor cosmetic damage are typically 10 times higher than levels that will cause disturbance to building occupants. Many building occupants assume that building damage is occurring when they feel vibration or observe rattling of loose objects, however the level of vibration at which people perceive vibration or at which loose objects may rattle is far lower than vibration levels that can cause damage to structures.

Within British Standard 7385 Part 1, different levels of structural damage are defined:

- *Cosmetic - The formation of hairline cracks on drywall surfaces, or the growth of existing cracks in plaster or drywall surfaces; in addition the formation of hairline cracks in mortar joints of brick/concrete block construction.*
- *Minor - The formation of large cracks or loosening of plaster or drywall surfaces, or cracks through bricks/concrete blocks.*
- *Major - Damage to structural elements of the building, cracks in supporting columns, loosening of joints, splaying of masonry cracks, etc.*

The vibration limits in Table 1 of British Standard 7385 Part 2 are for the protection against cosmetic damage, however guidance on limits for minor and major damage is provided in Section 7.4.2 of the Standard:

> *7.4.2 Guide values for transient vibration relating to cosmetic damage*
>
> *Limits for transient vibration, above which cosmetic damage could occur are given numerically in Table 1 and graphically in Figure 1. In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the guide values for the building types corresponding to line 2 are reduced. Below a frequency of 4 Hz, where a high displacement is associated with a relatively low peak component particle velocity value a maximum displacement of 0.6 mm (zero to peak) should be used.*
>
> *Minor damage is possible at vibration magnitudes which are greater than twice those given in Table 1, and major damage to a building structure may occur at values greater than four times the tabulated values.*

Within DIN4150-3, damage is defined as "*any permanent consequence of an action that reduces the serviceability of a structure or one of its components*" (p.4). The Standard also outlines:

> *"For buildings as in lines 2 and 3 of Tables 1, 4 or B.1, the serviceability is considered to have been reduced if, for example*
>
> - *cracks form in plastered or rendered surfaces of walls;*
> - *existing cracks in a structure are enlarged;*
> - *partitions become detached from load-bearing walls or floor slabs.*
>
> *These effects are deemed 'minor damage. " (DIN4150.3:2016, p.6)*

While the DIN Standard defines the above damage as 'minor', based on the definitions provided in BS7385, the DIN standard is considered to deal with cosmetic issues rather than major structural failures.

5.2.2.1 British Standard

British Standard 7385: Part 2 '*Evaluation and measurement of vibration in buildings*', can be used as a guide to assess the likelihood of building damage from ground vibration. BS7385 suggests levels at which 'cosmetic', 'minor' and 'major' categories of damage might occur.

The cosmetic damage levels set by BS 7385 are considered 'safe limits' up to which no damage due to vibration effects has been observed for certain particular building types. Damage comprises minor non-structural effects such as hairline cracks on drywall surfaces, hairline cracks in mortar joints and cement render, enlargement of existing cracks and separation of partitions or intermediate walls from load bearing walls. 'Minor' damage is considered possible at vibration magnitudes which are twice those given and 'major' damage to a building structure may occur at levels greater than four times those values.

BS7385 is based on peak particle velocity and specifies damage criteria for frequencies within the range 4Hz to 250Hz, being the range usually encountered in buildings. At frequencies below 4Hz, a maximum displacement value is recommended. The values set in the Standard relate to transient vibrations and to low-rise buildings. Continuous vibration can give rise to dynamic magnifications due to resonances and may need to be reduced by up to 50%. Table 5.5 sets out the BS7385 criteria for cosmetic, minor and major damage.

Regarding heritage buildings, British Standard 7385 Part 2 (1993) notes that "*a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive*" (p.5).

Table 5.5: BS 7385 structural damage criteria

Group	Type of structure	Damage level	Peak component particle velocity, mm/s		
			4Hz to 15Hz	15Hz to 40Hz	40Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	Cosmetic	50		
		Minor*	100		
		Major*	200		
2	Un-reinforced or light framed structures Residential or light commercial type buildings	Cosmetic	15 to 20	20 to 50	50
		Minor*	30 to 40	40 to 100	100
		Major*	60 to 80	80 to 200	200

Notes: Peak Component Particle Velocity is the maximum Peak particle velocity in any one direction (x, y, z) as measured by a tri-axial vibration transducer.

* Minor and major damage criteria established based on British Standard 7385 Part 2 (1993) Section 7.4.2

5.2.2.2 German Standard

German Standard DIN 4150 - Part 3 (2016) '*Vibration in buildings - Effects on Structures*' (DIN 4150-3:2016), also provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are generally recognised to be conservative.

DIN 4150-3:2016 presents the recommended maximum limits over a range of frequencies (Hz), measured at the foundations, in the plane of the uppermost floor of a building or structure or vertically on floor slabs. The vibration limits at the foundations increase as the frequency content of the vibration increases. The criteria are presented in Table 5.6.

Table 5.6: DIN 4150-3:2016 structural damage criteria

Group	Type of structure	Vibration velocity, mm/s				
		At foundation in all directions at frequency of			Plane of floor uppermost storey in horizontal direction	Floor slabs, vertical direction
		1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz	All frequencies	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40	20
2	Residential buildings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15	20
3	Structures that because of their particular sensitivity to vibration, cannot be classified under Groups 1 and 2 <u>and</u> are of great intrinsic value (eg listed buildings)	3	3 to 8	8 to 10	8	20

5.2.3 Damage to buried services

Section 5.3 of DIN 4150-3:2016 also sets out guideline values for vibration velocity to be used when evaluating the effects of vibration on buried pipework. These values, which apply at the wall of the pipe, are reproduced and presented in Table 5-7 below.

Table 5-7: DIN 4150-3:1999 Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on buried pipework

Line	Pipe Material	Guideline values for vibration velocity measured on the pipe, mm/s
1	Steel (including welded pipes)	100
2	Vitrified clay, concrete, reinforced concrete, prestressed concrete, metal (with or without flange)	80
3	Masonry, plastics	50

For long-term vibration the guideline levels presented in Table 5-7 should be halved.

Recommended vibration goals for electrical cables and telecommunication services such as fibre optic cables range from between 50 mm/s and 100 mm/s. It is noted however that although the cables may sustain these vibration levels, the services they are connected to, such as transformers and switch blocks, may not. It is recommended that should such equipment be encountered during the construction process an individual vibration assessment should be carried out. This may include a specific vibration impact statement addressing impact on the utility and consultation with the utility provider to confirm specific vibration requirements.

5.2.4 Construction noise sources

The schedule of items of plant and equipment likely to be used during the construction phases of the Proposal is presented in the table below.

Table 5-8: Typical construction equipment & sound power levels, dB(A) re 1pW

Plant item	Plant description	Sound power levels $L_{Aeq(15min)}$
1	Trucks (concrete/delivery)	108
2	Hand tools	105
3	Mobile/Tower crane (electric)	100
4	Concrete pump	105
5	Bobcat	100
6	Concrete vibrator	100

The sound power levels for the majority of construction plant and equipment presented in the above table are based on maximum noise levels given in Table A1 of Australian Standard 2436 - 2010 'Guide to Noise Control on Construction, Demolition and Maintenance Sites', the Interim Construction Noise Guideline (ICNG), information from past projects and/or information held in our library files.

5.3 Construction noise and vibration assessment

5.3.1 Predicted noise levels

Noise levels at any receiver location resulting from construction works would depend on the location of the receiver with respect to the area of construction, shielding from intervening topography and structures, and the type and duration of construction being undertaken. Furthermore, noise levels at receivers would vary significantly over the total construction program due to the transient nature and large range of plant and equipment that could be used.

Noise emissions were determined by modelling the noise sources, receiver locations, and operating activities,

Error! Reference source not found. presents noise levels likely to be experienced at the nearby affected receivers based on the construction activities and plant and equipment associated with the proposed site. The noise level range presented represents the plant item operating at a location furthest from the receiver and a location closest to the receiver. Noise levels were calculated taking into consideration attenuation due to distance between the construction works and the receiver locations and any intervening structures. The noise predictions are conservative and do not incorporate acoustic shielding provided by hoarding.

The worst affected receivers for are typically in the first row of houses back from the Proposal site, with direct line-of-sight to the construction work area. Receivers in the next row of houses back from the Proposal, or receivers without direct line-of-sight to the construction area would typically be exposed to construction noise levels 5 to 10 dB(A) lower than the levels predicted for the worst affected receivers.

Table 5-9: Predicted noise levels for typical construction works

Plant Item	Plant description	Predicted dB(A)$L_{eq(15min)}$ construction noise levels		
		Location B (579 Mamre Road)	Location C (Mandalong Close)	Location D (Child Care
Noise management level (external) – Standard construction hours		*48*	*48*	*65-playground*
1	Trucks (concrete/delivery)	33-38	30-35	40-45
2	Hand tools	30-35	<30	40-45
3	Mobile/Tower crane (electric)	30	<30	35-40
4	Concrete pump	30-35	<30	40-45
5	Bobcat	<30	<30	35-40

The predicted noise levels presented above indicate that the noise levels during the building construction and building fit-out stages are likely achieve the NML at nearby sensitive receivers. There may be time when loud equipment or a number of concurrent construction activities may result in construction noise levels being over the NML, particularly when these activities are operating near to the corresponding receiver location. However, no residential receivers are predicted to be highly noise affected (i.e., exposed to noise levels greater than 75 dB(A)).

In light of the predicted noise levels above, it is unlikely that construction noise mitigation over and above the general good practice recommendations outlined below is warranted to preserve the amenity of nearby noise sensitive development.

<u>General noise management measures</u>

The following general noise management measures are recommended for all receiver locations:

- Plant and equipment must be properly maintained.
- Strategically position plant on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel.
- Any equipment not in use for extended periods during construction work must be switched off.
- The offset distance between noisy plant and adjacent sensitive receivers is to be maximised where practicable.

- Plant used intermittently to be throttled down or shut down when not in use where practicable.
- In addition to the noise mitigation measures outlined above, a management procedure will need to be put in place to deal with noise complaints that may arise from construction activities. Each complaint will need to be investigated and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits.
- Good relations with people living and working in the vicinity of a construction site should be established at the beginning of a project and be maintained throughout the project, as this is of paramount importance. Keeping people informed of progress and taking complaints seriously and dealing with them expeditiously is critical. The person selected to liaise with the community must be adequately trained and experienced in such matters.
- Given the large distance from the site to noise sensitive development (residences, child care centre), noise monitoring during the construction period is not warranted.

5.3.2 Vibration assessment

5.3.2.1 Minimum working distances

We note that extensive bulk excavation (typically the most vibration intensive construction activity) is not expected.

During the building construction phase vibration intensive plant and equipment are not proposed to be typically used as part of the construction works. As such, considering the distance to other sensitive receiver buildings there is generally considered low to negligible risk of vibration impact, depending on the location of the construction works.

The pattern of vibration radiation is very different to the pattern of airborne noise radiation and is very site specific as final vibration levels are dependent on many factors including the actual plant used, its operation and the intervening geology between the activity and the receiver. Potential vibration generated at receivers for this project will be dependent on separation distances, the intervening soil and rock strata, dominant frequencies of vibration and the receiver building's construction and structure.

The recommended minimum working distances for vibration intensive plant are presented in Table 5-10.

Table 5-10: Recommended minimum working distances for vibration intensive equipment

Plant item	Minimum working distance, m					
	Cosmetic damage			Human disturbance		
	Commercial and industrial buildings1	Dwellings and similar structures1	Sensitive structures (e.g. heritage)[1]	Residences Day[2]	Offices	Workshops
5 Tonne Excavator w/Hydraulic Breaker, Vibratory Compactor	5	5	10	20	15	10

Notes: 1. Vibration limits referenced from DIN 4150 Structural Damage - Safe Limits for Short-term Building Vibration.
2. Daytime is 7 am to 10 pm;

Site specific buffer distances for vibration significant plant items must be measured on site where plant and equipment is likely to operate close to or within the minimum working distances for cosmetic damage.

As previously identified, unlike noise, vibration cannot be 'predicted' due to many variables from site to site, for example soil type and conditions; sub surface rock; building types and foundations; and actual plant on site. The data relied upon in this assessment (tabulated above) is taken from a database of vibration levels measured at various sites or obtained from other sources (eg. BS 5228-2:2009). They are not specific to this project as final vibration levels are dependent on many factors including the actual plant used, its operation and the intervening geology between the activity and the receiver.

5.3.2.2 Vibration mitigation measures

Given the works are unlikely to be vibration intensive, the separation distance to the nearest buildings and he fact that the nearby buildings are industrial (and typically less vibration sensitive), significant vibration mitigation is unlikely to be warranted.

The following vibration management measures are provided to minimise vibration impact from construction activities to the nearest affected receivers and to meet the relevant human comfort and building damage vibration limits:

1. A management procedure should be implemented to deal with vibration complaints. Each complaint should be investigated and where vibration levels are established as exceeding the set limits, appropriate amelioration measures should be put in place to mitigate future occurrences.

2. Where vibration is found to be excessive, management measures should be implemented to ensure vibration compliance is achieved. Management measures may include modification of construction methods such as using smaller equipment, establishment of safe buffer zones as mentioned above, and if necessary, time restrictions for the most excessive vibration activities. Time restrictions are to be negotiated with affected receivers.

3. Where construction activity occurs in close proximity to sensitive receivers, vibration testing of actual equipment on site would be carried out prior to their commencement of site operation to determine acceptable buffer distances to the nearest affected receiver locations.

4. Dilapidation surveys should be conducted at all residential and other sensitive receivers within 50 metres of the construction site. Notification by letterbox drop would be carried out for all occupied buildings within 100m of the construction site. These measures are to address potential community concerns that perceived vibration may cause damage to property.

5.3.3 Complaints management

Noise and vibration levels generated by construction activities associated with the construction of the development must aim to comply with the noise and vibration goals set by the relevant regulations and guidelines.

The contractor is responsible for implementing this Demolition and Excavation Noise and Vibration Management Plan (DENVMP) already approved by (Fairfield City Council) to ensure that all reasonable measures are implemented such as the provision of a Noise and Vibration Complaints Program (which forms part of the DENVMP), to minimise the generation of excessive noise and/or vibration levels from the site to nearby sensitive areas. This should be continued as part of the building construction and building fit-out stages.

Owners and occupants of nearby affected properties are to be informed by direct mail of a direct telephone line and contact person where any noise and/or vibration complaints related to the operation of the construction activities are to be reported.

6 Conclusion

Renzo Tonin & Associates has carried out an acoustic assessment to support a Development Application (DA) for the proposed expansion of the existing Snackbrands warehouse located within the First Estate site at Mamre Road, Orchard Hills.

The report has quantified operational noise emission from the proposed development and has assessed noise at the nearest sensitive receivers. Based on the assumptions and inputs within this report, it has been established that operation of the site is capable of complying with relevant EPA and Council noise emission requirements. Recommendations with respect to operational noise control are presented in section 4.4.

An assessment of construction noise is presented in section 5.

APPENDIX A Glossary of terminology

Glossary of terminology - Noise

Absorption Coefficient α	The absorption coefficient of a material, usually measured for each octave or third-octave band and ranging between zero and one. For example, a value of 0.85 for an octave band means that 85% of the sound energy within that octave band is absorbed on coming into contact with the material. Conversely, a low value below about 0.1 means the material is acoustically reflective.
Adverse weather	Weather effects that enhance noise (particularly wind and temperature inversions) occurring at a site for a significant period of time. In the NSW INP this occurs when wind occurs for more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of nights in winter.
Air-borne noise	Noise which is fundamentally transmitted by way of the air and can be attenuated by the use of barriers and walls placed physically between the noise source and receiver.
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Amenity	A desirable or useful feature or facility of a building or place.
AS	Australian Standard
Assessment period	The time period in which an assessment is made. e.g. Day 7am-10pm & Night 10pm-7am.
Assessment Point	A location at which a noise or vibration measurement is taken or estimated.
Attenuation	The reduction in the level of sound or vibration.
Audible Range	The limits of frequency which are audible or heard as sound. The normal hearing in young adults detects ranges from 20 Hz to 20 kHz, although some people can detect sound with frequencies outside these limits.
A-weighting	A filter applied to the sound recording made by a microphone to approximate the response of the human ear.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the LA90 noise level if measured as an overall level or an L90 noise level when measured in octave or third-octave bands.
Barrier (Noise)	A natural or constructed physical barrier which impedes the propagation of sound and includes fences, walls, earth mounds or berms and buildings.
Berm	Earth or overburden mound.
Buffer	An area of land between a source and a noise-sensitive receiver and may be an open space or a noise-tolerant land use.
Bund	A bund is an embankment or wall of brick, stone, concrete or other impervious material, which may form part or all of the perimeter of a compound.
BS	British Standard
CoRTN	United Kingdom Department of Environment entitled "Calculation of Road Traffic Noise (1988)"
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our environment:

threshold of hearing	0 dB	The faintest sound we can hear, defined as 20 micro Pascal
	10 dB	Human breathing

	almost silent	20 dB	
		30 dB	Quiet bedroom or in a quiet national park location
	generally quiet	40 dB	Library
		50 dB	Typical office space or ambience in the city at night
	moderately loud	60 dB	CBD mall at lunch time
		70 dB	The sound of a car passing on the street
	loud	80 dB	Loud music played at home
		90 dB	The sound of a truck passing on the street
	very loud	100 dB	Indoor rock band concert
		110 dB	Operating a chainsaw or jackhammer
	extremely loud	120 dB	Jet plane take-off at 100m away
	threshold of pain	130 dB	
		140 dB	Military jet take-off at 25m away

dB(A)	A-weighted decibel. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies. The dB(C) level is not widely used but has some applications.
Deemed-to-Satisfy Provisions	The Deemed-to-Satisfy Provisions are an optional means of achieving compliance with the mandatory Performance Requirements of the National Construction Code. (also see Alternate Solution)
Diffraction	The distortion of sound waves caused when passing tangentially around solid objects.
DIN	German Standard
Discontinuous Construction	A wall system having a minimum 20mm cavity between two separate leaves, where, for other than masonry there is no mechanical linkage between leaves except at the periphery.
DnT,w	Weighted Standardised Field Level Difference A measure of sound insulation performance of a building element. It is characterised by the difference in noise level on each side of a wall or floor. It is measured in-situ. It is a field measurement that relates to the Rw laboratory measured value but is not equal to it because an in-situ space is not of the same quality as a laboratory space. The value is indicative of the level of speech privacy between spaces. The higher its value the better the insulation performance.
ECRTN	Environmental Criteria for Road Traffic Noise, NSW, 1999
ENMM	Environmental Noise Management Manual, Roads and Maritime Services (Transport for NSW)
EPA	Environment Protection Authority
Field Test	A test of the sound insulation performance in-situ. See also 'Laboratory Test' The sound insulation performance between building spaces can be measured by conducting a field test, for example, early during the construction stage or on completion. A field test is conducted in a non-ideal acoustic environment. It is generally not possible to measure the performance of an individual building element accurately as the results can be affected by numerous field conditions.

FIIC	Field Impact Isolation Class. A measure of the noise impact performance of a floor. The value indicates the resistance of the floor to the transmission of impact sound and is measured using a standard tapping machine. It is measured in-situ and is therefore subject to the inherent accuracies involved in such a measurement. The term is defined in ASTM E492 and E1007. It is a field measure of the level of impact sound transmitted to a space via a floor. The equivalent measurement in a laboratory is termed the IIC. The higher the value the better the performance.
Flanking	Flanking is the transfer of sound through paths around a building element rather than through the building element material directly. For example, sound travelling through a gap underneath a door or a gap at the top of a wall.
Fluctuating Noise	Noise that varies continuously to an appreciable extent over the period of observation.
Free-field	An environment in which there are no acoustic reflective surfaces. Free field noise measurements are carried out outdoors at least 3.5m from any acoustic reflecting structures other than the ground.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
FSTC	Field Sound Transmission Class A measure of the sound insulation performance of a building element. . It is characterised by the difference in noise level on each side of a wall or floor. It is measured in the field and is therefore subject to the inherent inaccuracies involved in such a measurement. The term was referred to in older superseded versions of the Building Code of Australia and has now been replaced with the term DnT,w.
Ground-borne noise	Vibration propagated through the ground and then radiated as noise by vibrating building elements such as wall and floor surfaces. This noise is more noticeable in rooms that are well insulated from other airborne noise. An example would be vibration transmitted from an underground rail line radiating as sound in a bedroom of a building located above.
Habitable Area	Includes a bedroom, living room, lounge room, music room, television room, kitchen, dining room, sewing room, study, playroom, family room, home theatre and sunroom. Excludes a bathroom, laundry, water closet, pantry, walk-in wardrobe, corridor, hallway, lobby, photographic darkroom, clothes drying room, and other spaces of a specialised nature occupied neither frequently nor for extended periods.
Heavy Vehicle	A truck, transporter or other vehicle with a gross weight above a specified level (for example: over 8 tonnes).
IGANRIP	Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects, NSW DEC 2007
IIC	Impact Isolation Class A measure of the noise impact performance of a floor. It is measured in very controlled conditions in a laboratory and is characterised by how much sound reaches the receiving room from the operation a standard tapping machine placed on the floor. The term is defined in ASTM E492 and E1007. The higher the number the better the performance.
Impact Noise	The noise in a room, caused by impact or collision of an object onto the walls or the floor. Typical sources of impact noise are footsteps on the floor above a tenancy and the slamming of doors on cupboards mounted on the common wall between tenancies.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
INP	NSW Industrial Noise Policy, EPA 1999
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation.
Intertenancy wall	Walls that separate buildings or units within a building. They may provide sound resistance or serve as a fire wall. Synonymous with 'party wall'.
Intrusive noise	Refers to noise that intrudes above the background level by more than 5 dB(A).

ISEPP	State Environmental Planning Policy (Infrastructure), NSW, 2007
ISEPP Guideline	Development Near Rail Corridors and Busy Roads - Interim Guideline, NSW Department of Planning, December 2008
L1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L10	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L10(1hr)	The L10 level measured over a 1 hour period.
L10(18hr)	The arithmetic average of the L10(1hr) levels for the 18 hour period between 6am and 12 midnight on a normal working day.
L90	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
LAeq or Leq	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time, which would produce the same energy as a fluctuating sound level. When A-weighted, this is written as the LAeq.
LAeq(1hr)	The LAeq noise level for a one-hour period. In the context of the NSW EPA's Road Noise Policy it represents the highest tenth percentile hourly A-weighted Leq during the period 7am to 10pm, or 10pm to 7am (whichever is relevant).
LAeq(8hr)	The LAeq noise level for the period 10pm to 6am.
LAeq(9hr)	The LAeq noise level for the period 10pm to 7am.
LAeq(15hr)	The LAeq noise level for the period 7am to 10pm.
LAeq (24hr)	The LAeq noise level during a 24 hour period, usually from midnight to midnight.
Lmax	The maximum sound pressure level measured over a given period. When A-weighted, this is usually written as the LAmax.
Lmin	The minimum sound pressure level measured over a given period. When A-weighted, this is usually written as the LAmin.
Ln,w	Weighted Normalised Impact Sound Pressure Level A measure of the sound level transmitted from impacts on a floor to a tenancy below. It is measured in very controlled conditions in a laboratory and is characterised by how much sound reaches the receiving room from a standard tapping machine. A lower value indicates a better performing floor.
LnT,w	Weighted Standardised Field Impact Sound Pressure Level As for Ln,w but measured in-situ and therefore subject to the inherent accuracies involved in such a measurement. The equivalent measurement in a laboratory is the Ln,w. A lower value indicates a better performing floor.
Laboratory Test	The performance of a building element when measured in a laboratory. The sound insulation performance of a building element installed in a building however can differ from its laboratory performance for many reasons including the quality of workmanship, the size and shape of the space in which the measurement is conducted, flanking paths and the specific characteristics of the material used which may vary from batch to batch.
Loudness	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on. That is, the sound of 85 dB is four times or 400% the loudness of a sound of 65 dB.
Microphone	An electro-acoustic transducer which receives an acoustic signal and delivers a corresponding electric signal.
NCA	Noise Catchment Area. An area of study within which the noise environment is substantially similar.
NCG	Noise Criteria Guideline, Roads and Maritime Services (Transport for NSW)

NMG	Noise Mitigation Guideline, Roads and Maritime Services (Transport for NSW)
Noise	Unwanted sound
Normalised	A method of adjusting the measured noise indices in a laboratory so that they are independent of the measuring space. The noise level in a room is affected by reverberation in the room. For example, the Ln,w impact sound pressure level measured in a laboratory is dependent upon the amount of absorptive material in the receiving room. The value is adjusted to what would be measured if the sound absorption in the receiving room is set at 10m2. This enables all laboratories to report the same value when measured under slightly different conditions. See also 'Standardised'.
NRC	Noise Reduction Coefficient. A measure of the ability of a material to absorb sound. The NRC is generally a number between 0 and 1 but in some circumstances can be slightly greater than 1 because of absorption at the edges of the material. A material with an NRC rating of 1 absorbs 100% of incoming sound, that is, no sound is reflected back from the material. The NRS is the average of the absorption coefficient measured in the octave bands 250Hz, 500Hz, 1kHz & 2kHz which correspond to the predominant frequencies associated with the human voice.
Partition wall	A wall dividing two rooms.
Party wall	A wall dividing two tenancies. Synonymous with 'Intertenancy Wall'.
Pre-construction	Work in respect of the proposed project that includes design, survey, acquisitions, fencing, investigative drilling or excavation, building/road dilapidation surveys, minor clearing (except where threatened species, populations or ecological communities would be affected), establishing ancillary facilities such as site compounds, or other relevant activities determined to have minimal environmental impact (e.g. minor access roads).
RBL	Rating Background Level is the representative LA90 background noise level for a period, as defined in the NSW EPA's noise ploicies.
Reflection	Sound wave reflected from a solid object obscuring its path.
RING	Rail Infrastructure Noise Guideline, NSW, May 2013
RMS	Root Mean Square value representing the average value of a signal.
Rw	Weighted Sound Reduction Index A measure of the sound insulation performance of a building element. It is measured in very controlled conditions in a laboratory. The term supersedes the value STC which was used in older versions of the Building Code of Australa. Rw is measured and calculated using the procedure in ISO 717-1. The related field measurement is the DnT,w. The higher the value the better the acoustic performance of the building element.
R'w	Weighted Apparent Sound Reduction Index. As for Rw but measured in-situ and therefore subject to the inherent accuracies involved in such a measurement. The higher the value the better the acoustic performance of the building element.
RNP	Road Noise Policy, NSW, March 2011
Sabine	A measure of the total acoustic absorption provided by a material. It is the product of the Absorption Coefficient (alpha) and the surface area of the material (m2). For example, a material with alpha = 0.65 and a surface area of 8.2m2 would have 0.65 x 8.2 = 5.33 Sabine. Sabine is usually calculated for each individual octave band (or third-octave).
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sole-occupancy Unit	An area within a building for the exclusive use of the owner or occupier.
Sound	A fluctuation of air pressure which is propagated as a wave through air.

Sound absorption	The ability of a material to absorb sound energy by conversion to thermal energy.
Sound Insulation	Sound insulation refers to the ability of a construction or building element to limit noise transmission through the building element. The sound insulation of a material can be described by the Rw and the sound insulation between two rooms can be described by the DnT,w.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 pico watt.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone referenced to 20 mico Pascal.
Spoil	Soil or materials arising from excavation activities.
Standardised	A method of adjusting the measured noise indices in-situ so that they are independent of the measuring space. The noise level in a room is affected by reverberation in the room. For example, the L'n,w impact sound pressure level measured in a room is dependent upon the amount of absorptive material in the receiving room. The value is adjusted to what would be measured if the reverberation time in the receiving room is set at 0.5 seconds. This enables the same value to be reported independent of whether the room contains carpet and furnishings and the like. See also 'Normalised'.
STC	Sound Transmission Class A measure of the sound insulation performance of a building element. It is measured in controlled conditions in a laboratory. The term has been superseded by Rw.
Structure-borne Noise	Audible noise generated by vibration induced in the ground and/or a structure. Vibration can be generated by impact or by solid contact with a vibrating machine. Structure-borne noise cannot be attenuated by barriers or walls but requires the isolation of the vibration source itself. This can be achieved using a resilient element placed between the vibration source and its support such as rubber, neoprene or springs or by physical separation (using an air gap for example). Examples of structure-borne noise include the noise of trains in underground tunnels heard to a listener above the ground, the sound of footsteps on the floor above a listener and the sound of a lift car passing in a shaft. See also 'Impact Noise'.
Tonal Noise	Sound containing a prominent frequency and characterised by a definite pitch.
Transmission Loss	The sound level difference between one room or area and another, usually of sound transmitted through an intervening partition or wall. Also the vibration level difference between one point and another. For example, if the sound level on one side of a wall is 100dB and 65dB on the other side, it is said that the transmission loss of the wall is 35dB. If the transmission loss is normalised or standardised, it then becomes the Rw or R'w or DnT,w.

Glossary of terminology - Vibration

Acceleration	The rate of change of velocity, often measured in m/s2 or g's. 1 g = 9.81 m/s2. Commonly used to assess human response to vibration and for machine condition monitoring.
Accelerometer	A vibration transducer sensor that is used to measure acceleration.
ANC	The Association of Noise Consultants, UK.
Ambient vibration	The all-encompassing vibration occurring at a given location, at a given time, composed of all vibration sources near and far.
Amplification	Vibration amplification refers to an increase in vibration. Amplification may occur due to resonance, when an object or structure is excited at its natural frequency.

Attenuation	Attenuation refers to a reduction in vibration. This may occur due to damping of a vibration system, the inclusion of attenuating devices or, in the case of ground vibration, during propagation through the ground. Ground attenuation is determined by the dynamic properties of the site's soil and rock.
AVTG	Assessing Vibration: A Technical Guideline. NSW Department of Environment and Conservation's (DEC) 2006 guideline for assessing human responses to vibration. Based on BS 6472–1992.
Axis	A fixed reference line for the measurement for the measurement of vibration in a particular direction. Vibration is commonly measured in transverse (T), longitudinal (L) and vertical (V) axes (or X, Y and Z).
Background vibration	The underlying level of vibration present in the ambient environment, measured in the absence of the vibration sources of interest.
Blasting	Excavation or demolition using explosives.
Borehole transducer	A geophone transducer rigidly mounted at the bottom of a borehole (either permanently or temporarily) to measure underground vibration.
Broadband vibration	The overall vibration level which encompasses a wide range of frequencies. As opposed to vibration levels for specific frequency bands (see Octave) or narrowband vibration levels as produced by FFT.
BS	British Standard.
Continuous vibration	Vibration that continues uninterrupted over a defined period.
Cosmetic damage	Damage to a structure due to vibration that only affects the appearance of the structure and can be easily repaired, e.g. hairline cracks in mortar joints of brick or concrete constructions, or cracks in plasterwork.
Coupling loss	The change in vibration level when vibration is transmitted from the ground to a building's foundations.
Crest factor	The ratio of the peak value of a vibration event to the RMS value of a vibration event.
Damping	Reduction of vibrational energy due to friction or other forces.
DEC	NSW Department of Environment and Conservation, now the Department of Planning, Industry and Environment.
Decibel [dB]	The logarithmic unit used to represent sound and vibration levels. A vibration level in dB equals 20 times the logarithm to the base 10 of the ratio of the vibration level relative to the reference level. For vibration velocity, the reference level is commonly 1 nm/s. For vibration acceleration, the reference level is commonly 1 $\mu m/s^2$. Other reference values are commonly used. The reference value should always be stated.
DIN	German Standard.
Displacement	Change in position of a body from a reference point. Usually measured in m or mm.
EPA	Environment Protection Authority.
eVDV	Estimated Vibration Dose Value. See also VDV.
Filter	An electrical circuit that allows signals of certain frequency ranges to pass through, and blocks all other frequencies. Types of filters include low pass filters, high pass filters, and band pass filters.
FFT	Fast Fourier Transform. An algorithm that converts a signal from the time domain to the frequency domain.
Frequency	In the case of vibration, frequency is the number of oscillations that occurs per second. Frequency is measured in units of Hertz (Hz).
Geophone	A vibration transducer sensor that is used to measure velocity.
Ground-borne noise	Vibration propagated through the ground and then radiated as noise by vibrating building elements such as wall and floor surfaces. This noise is more noticeable in rooms that are well insulated from other airborne noise. An example would be vibration transmitted from an underground rail line radiating as sound in a bedroom of a building located above.

Ground spike	A metal stake with a flat top that is driven into the ground and used to mount a vibration transducer to measure vibration levels.
Habitable Area	Includes a bedroom, living room, lounge room, music room, television room, kitchen, dining room, sewing room, study, playroom, family room, home theatre and sunroom. Excludes a bathroom, laundry, water closet, pantry, walk-in wardrobe, corridor, hallway, lobby, photographic darkroom, clothes drying room, and other spaces of a specialised nature occupied neither frequently nor for extended periods.
Intermittent vibration	Either interrupted periods of continuous vibration or repeated periods of impulsive vibration.
Impulsive vibration	Vibration that rapidly builds up to a peak followed by a damped decay. May consist of multiple impulsive events, typically less then 2 seconds in duration.
Isolation	The process of reducing the vibrational energy transmitted to an object, such as a piece of equipment or building, from the source of vibrations.
Minor damage	Damage to a structure due to vibration that affects the serviceability of residential style buildings or other sensitive structures but does not affect the structural elements. E.g. cracks in plastered or rendered surfaces, existing cracks enlarged or partitions detached.
Mode	A mode of vibration is a characteristic pattern or shape in which a mechanical system will vibrate. The actual vibration of a structure is a combination of all the vibration modes, but to varying degrees, depending on the vibration source.
Natural frequency	The frequency at which a system tends to oscillate in the absence of any driving or damping force.
Noise floor	The residual level of unwanted signal measured by an instrumentation system. The signal of interest must be above the noise floor to be measured accurately. See also Signal to noise ratio.
Octave	An octave represents a doubling or halving in frequency. Noise or vibration levels across a frequency spectrum are commonly given in octave or one-third octave frequency bands.
Peak-to-peak	The difference between the highest positive peak level and the lowest negative peak of a vibration event.
Peak vibration velocity	The absolute maximum value of the vibration velocity signal measured in the X, Y or Z axis during a given time interval. Also referred to as the peak component particle velocity.
PPV	Peak Particle Velocity. The absolute maximum value of the vibration velocity signal measured in any axis during a given time interval.
PVS	Peak Vector Sum. The vector sum of the peak vibration velocities measured in the three orthogonal axes.
Resonance	The phenomenon of increased amplitude that occurs when the frequency of an applied force is equal or close to the natural frequency of the system.
RMS	Root Mean Square value representing the average value of a signal.
Sampling rate	The number of samples per second taken from a continuous signal to make a discrete or digital signal. Measured in Hertz. To accurately record the signal and determine the spectrum, the sampling rate must two or more times the maximum frequency of interest.
Settlement	The movement of soil due to vibration or other forces, often in relation to a building's foundations. The indirect effect of settlement and ground movement may cause building damage, separately from the direct of effect of building vibration.
Signal to noise ratio	A ratio of the level of a desired signal to the level of the background, often expressed in decibels.
Source vibration	A source that generates vibration. Can be quantified by the amplitude, frequency content and duration of the vibration. Common sources of vibration include rail and road traffic, construction and demolition activities and blasting.
Spectrum	The result of transforming a signal from the time domain to the frequency domain.
Structural damage	Damage to a structure due to vibration that may affect its serviceability due to damage to structural elements. May result in the reduced stability of the building and/or reduction in load-bearing capacities.
Structural fatigue	The weakening of a material caused by cyclic loading that results in progressive and localised structural damage and the growth of cracks.

Structure-borne Noise	Audible noise generated by vibration induced in the ground and/or a structure. Vibration can be generated by impact or by solid contact with a vibrating machine. Structure-borne noise cannot be attenuated by barriers or walls but requires the isolation of the vibration source itself. This can be achieved using a resilient element placed between the vibration source and its support such as rubber, neoprene or springs or by physical separation (using an air gap for example). Examples of structure-borne noise include the noise of trains in underground tunnels heard to a listener above the ground, the sound of footsteps on the floor above a listener and the sound of a lift car passing in a shaft.
Tactile vibration	Vibration of a level that can be felt by humans, dependant on the amplitude and frequency of the source. Note that vibration may also be perceived through indirect effects such as ground-borne noise or the shaking of building elements.
Transducer	A device that converts energy from one form to another. Vibration transducers convert either acceleration, velocity or displacement to an electrical signal that is processed by the monitoring system.
Triaxial	Three axes. Measurement systems often consist of three vibration transducers arranged triaxially – oriented at 90° from each other.
VDV	Vibration Dose Value. A measure of tactile vibration levels used to assess intermittent vibration.
Velocity	The rate of change of vibration displacement, usually measured in mm/s.
Vibration	A mechanical phenomenon whereby oscillations occur about an equilibrium point; a periodic back-and-forth motion of an elastic body or medium, commonly resulting when almost any physical system is displaced from its equilibrium condition.
Vrms	Root mean square (RMS) vibration level for the train passby, typically expressed in mm/s
Waveform	A graphical representation of a vibration event in the time domain, showing the measured vibration levels for each sample.

APPENDIX B Letter from Altus Property Partners

ALTIS
PROPERTY PARTNERS

Tuesday 08 June 2021

To whom it may concern,

Re: Lot 1 DP 1117416 ("the Property") and proposed manufacturing facility

I write in my capacity of Project Director of the Property.

I confirm that:

1. The Property is not currently occupied, however may be tenanted on a short term basis (for the next 6 – 9 months) only;
2. Altis Property Partners Pty Ltd is the responsible entity on behalf of the owner in a Trustee capacity;
3. Altis Property Partners Pty Ltd intends to develop the Property in the short to medium term. Altis Property Partners Pty Ltd does not intend to develop the property for residential purposes; and
4. Altis Property Partners Pty Ltd supports the development of the new manufacturing facility proposed by Snackbrands.

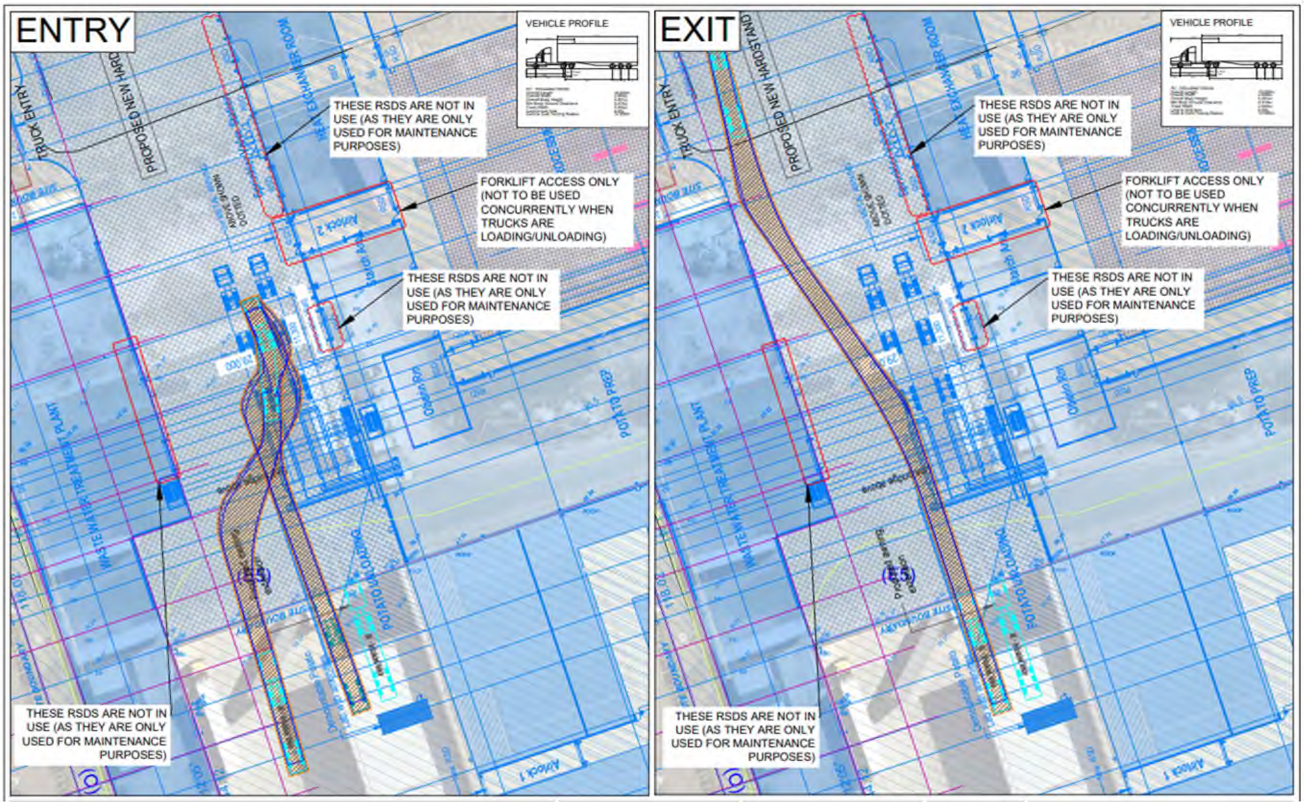
Should you have any questions, please contact me on the details provided below.

Yours faithfully,

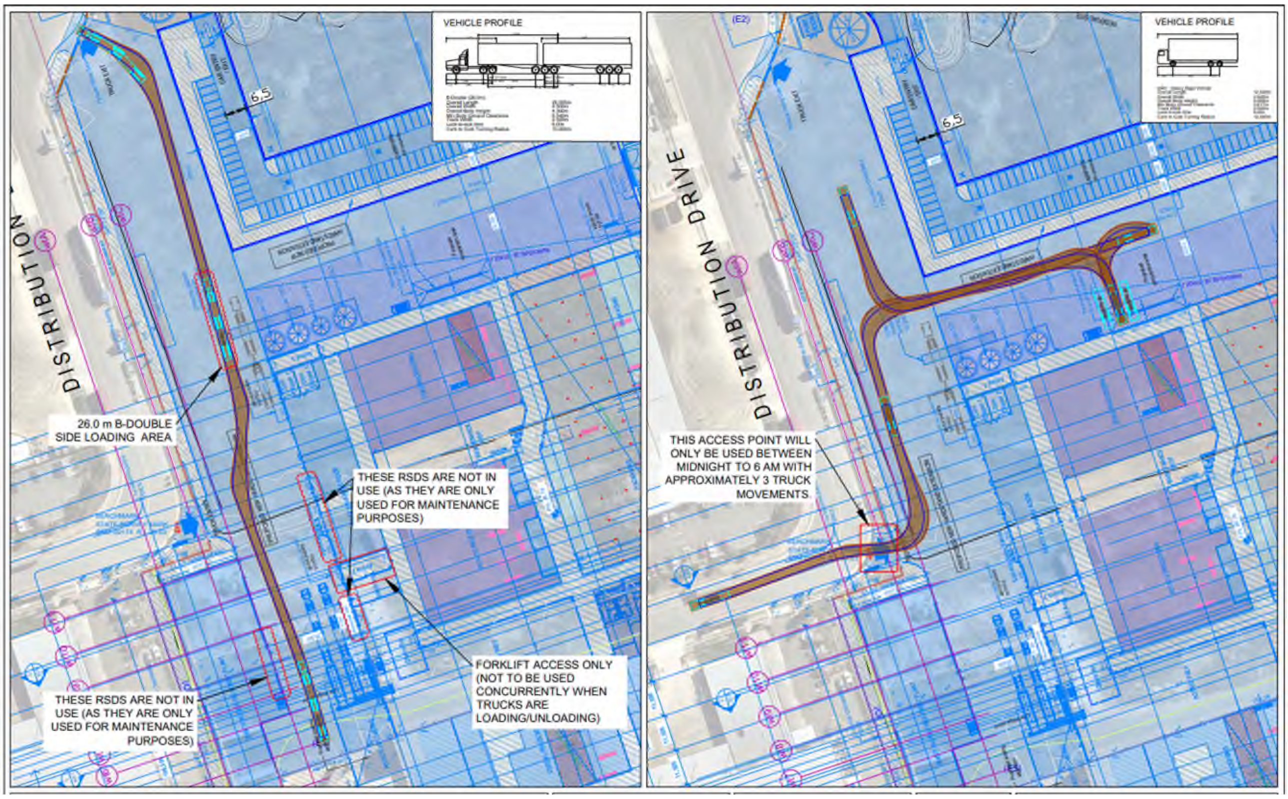
Stephen O'Connor
Project Director
stephen.oconnor@altisproperty.com.au
+61 420 546 491

Altis Property Partners Pty Ltd
Level 14, 60 Castlereagh Street, Sydney NSW 2000 | GPO Box 4456, Sydney NSW 2001
P 02 9233 9566 | F 02 9233 9577 | www.altisproperty.com.au

APPENDIX C Swept Path Movement – Potato Delivery Truck



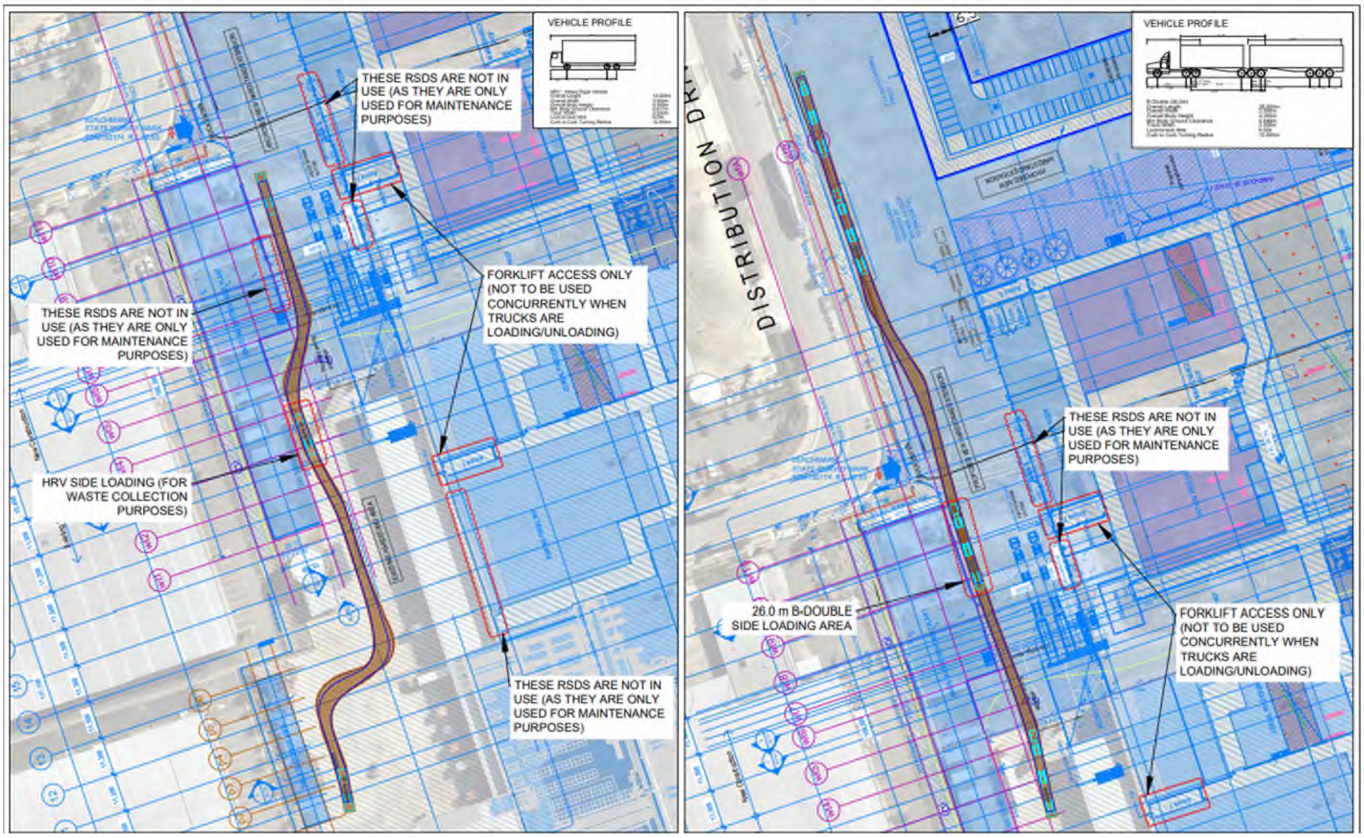
APPENDIX D Swept Path Movement – Corn Delivery and Waste Removal Truck



Corn Delivery (B-double)

Waste Removal (Heavy Rigid)

APPENDIX E Swept Path Movement – Exit Movement from Existing Warehouse

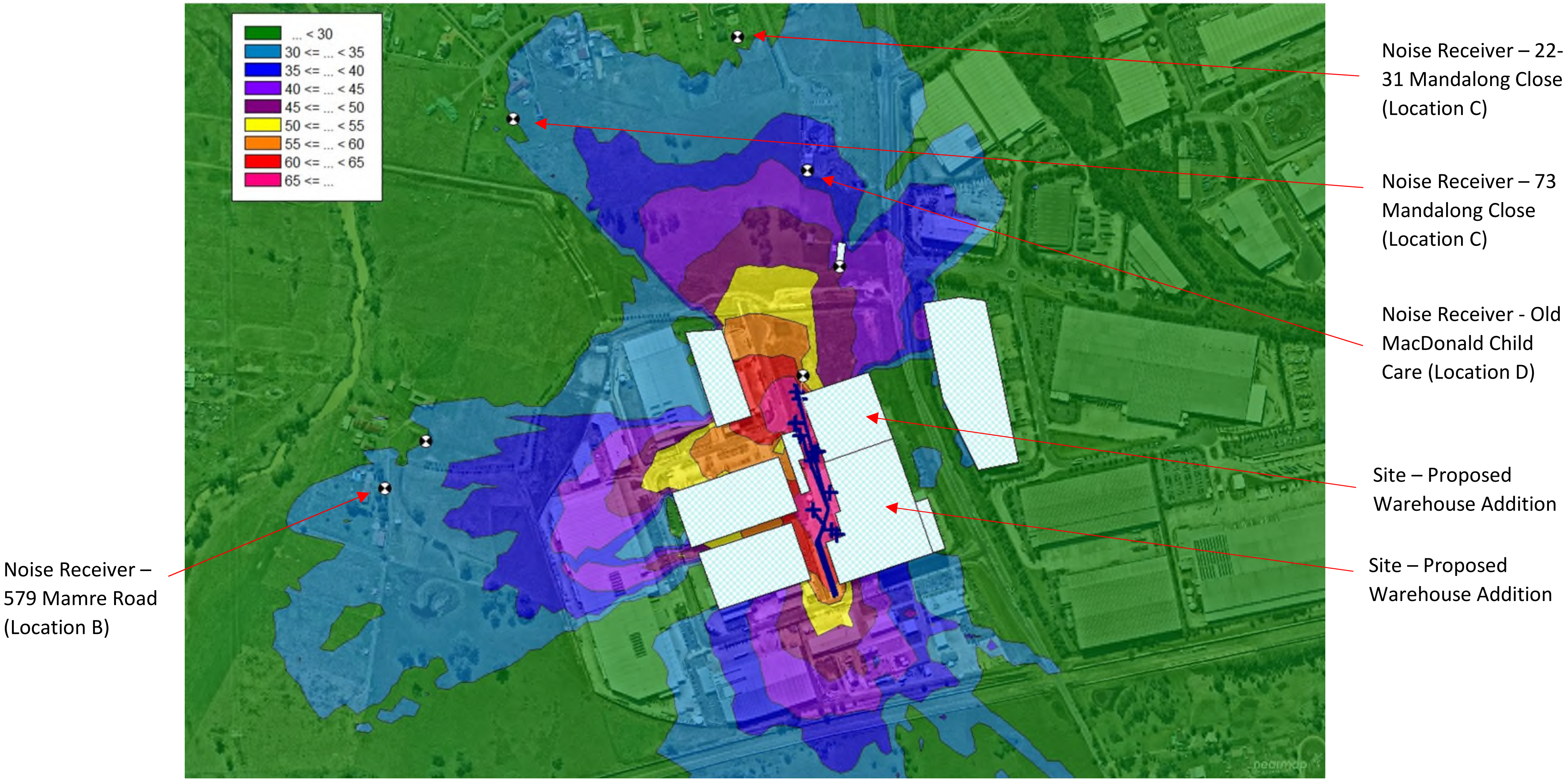


APPENDIX F Operational Noise Emission Predictions

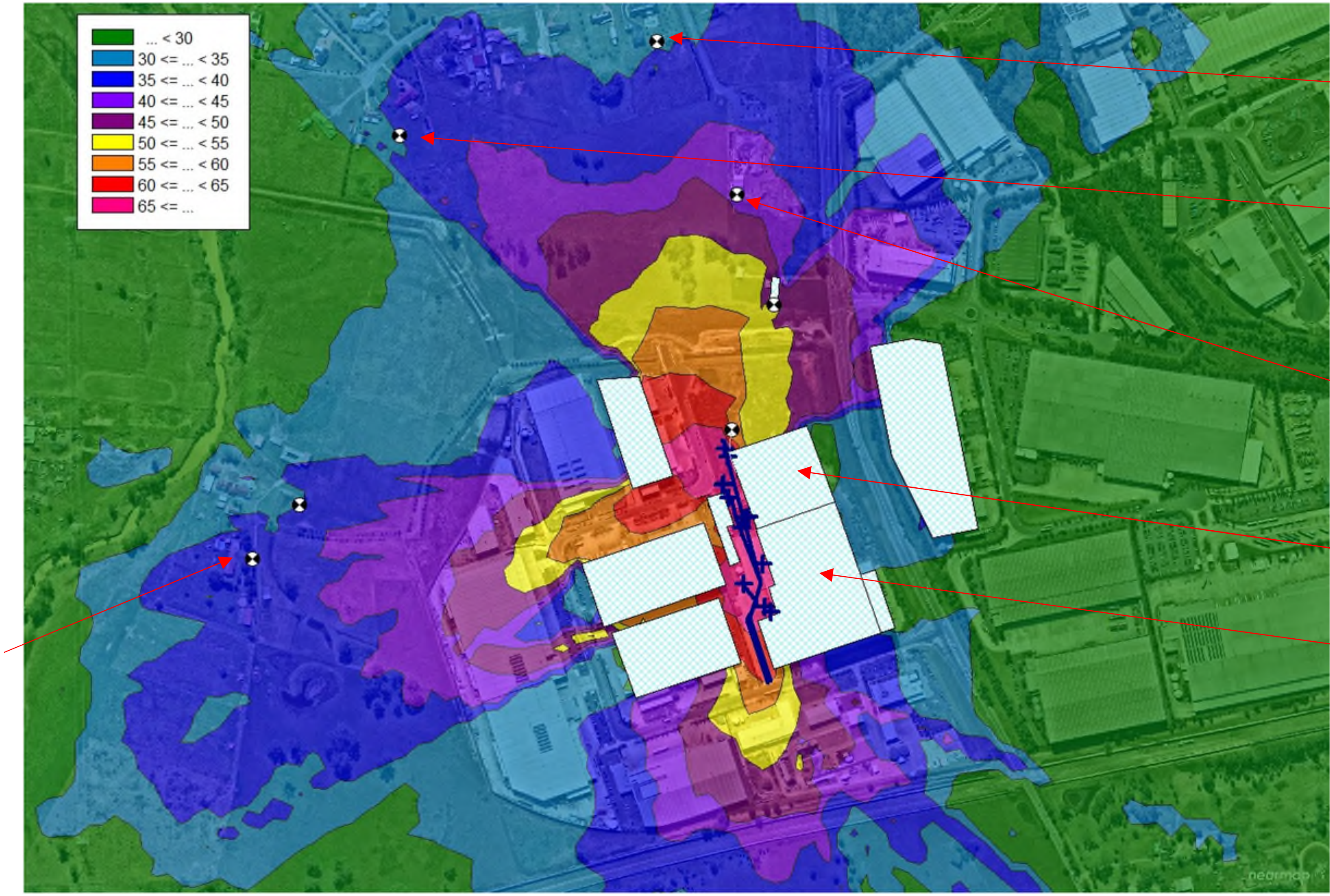
Scenario – Peak Night Time 15 minute activity:

- Potato truck delivery:
  - o Truck (b-double) enters site and reverses to the potato delivery dock (2 minute duration).
  - o The tipper/unloader is then engaged for the remaining time of the 15 minute period.
  - o Potato truck entry path and unloading position as per Appendix C.
- Corn truck delivery:
  - o Truck enters site and drives to the corn delivery dock (2 minute duration – no reversing movement required).
  - o The side unloading process is then engaged for the remaining time on the 15 minute period.
  - o Corn truck entry path and unloading position as per Appendix D.
- Forklifts – five forklifts are assumed to be in operation continuously in external hard stand areas.
- Conveyor belts at the corn and potato unloading areas are in continuous operation.
- Staff car park - 10 passenger vehicles are started, and drive to the site exit (30 second duration).
- Existing warehouse operations:
  - o B-double movement leaving the warehouse (1 minute travel duration).
  - o Travel path as per Appendix E.

Meteorological Conditions - Calm Weather Conditions (No Meteorological Conditions Affecting Noise Propagation)



Meteorological Conditions – Wind at 3m/s in direction critical for noise propagation.



Noise Receiver – 22-31 Mandalong Close (Location C)

Noise Receiver – 73 Mandalong Close (Location C)

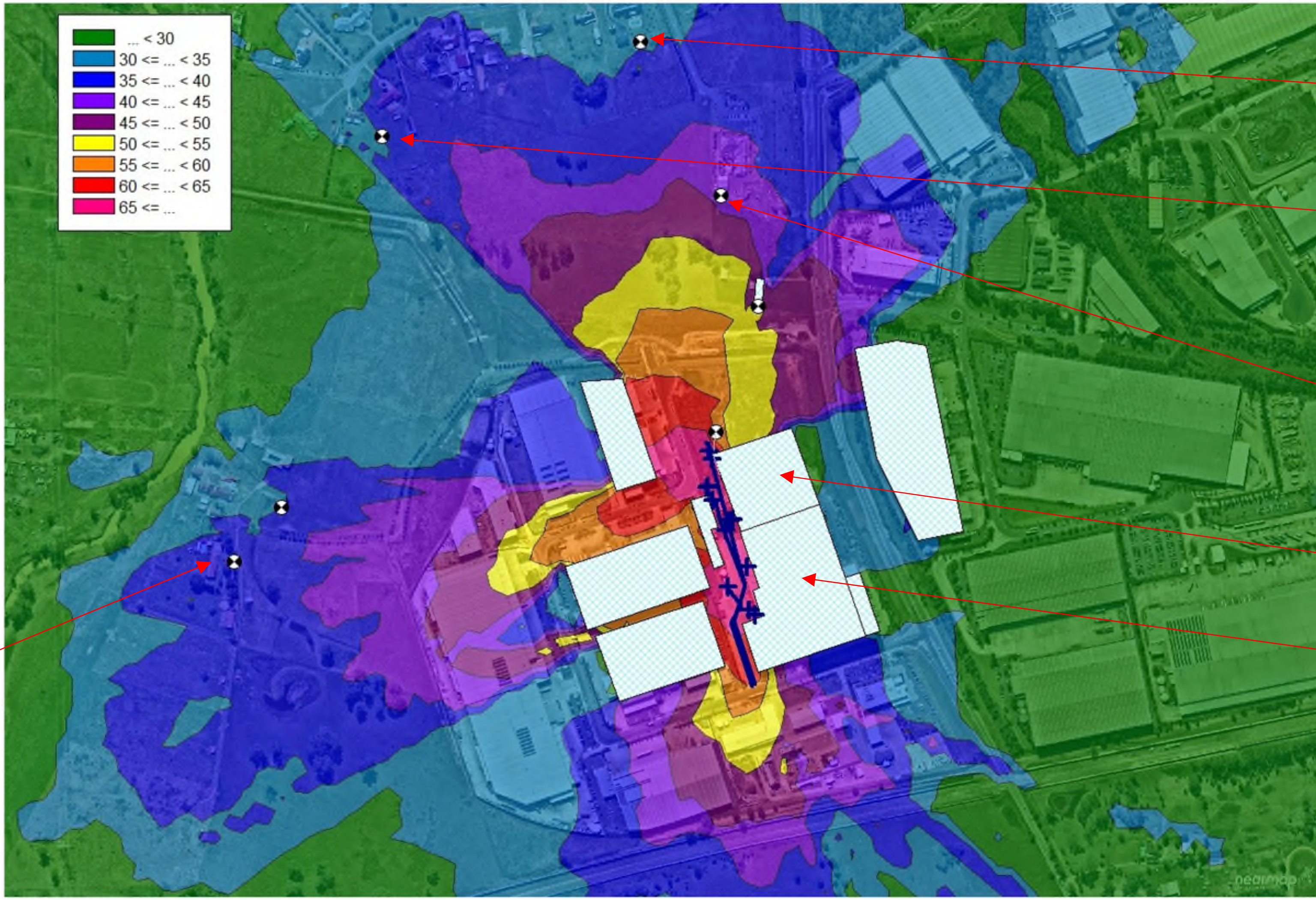
Noise Receiver - Old MacDonald Child Care (Location D)

Site – Proposed Warehouse Addition

Site – Proposed Warehouse Addition

Noise Receiver – 579 Mamre Road (Location B)

Meteorological Conditions – F Class Inversion and Wind at 2m/s in direction critical for noise propagation.



Noise Receiver – 22-31 Mandalong Close (Location C)

Noise Receiver – 73 Mandalong Close (Location C)

Noise Receiver - Old MacDonald Child Care (Location D)

Site – Proposed Warehouse Addition

Site – Proposed Warehouse Addition

Noise Receiver – 579 Mamre Road (Location B)