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DEPARTMENT OF PLANNING,
INDUSTRY AND ENVIRONMENT

MASTER PLAN NOISE AND VIBRATION ASSESSMENT

SPECIAL ACTIVATION
PRECINCT, PARKES

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Master Plan Noise and Vibration Assessment
Special Activation Precinct, Parkes

Department of Planning, Industry and Environment

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REV	DATE	DETAILS
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B	03/05/2019	Updated with DPE comments
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GLOSSARY

Acoustics	The interdisciplinary science that deals with the study of all mechanical waves in gases, liquids, and solids including vibration, sound, ultrasound and infrasound. A scientist who works in the field of acoustics is an acoustician while someone working in the field of acoustics technology may be called an acoustical engineer.
'A' Frequency Weighting (dBA)	The 'A' frequency weighting roughly approximates to the Fletcher-Munson 40 phon equal loudness contour. The human loudness perception at various frequencies and sound pressure levels is equated to the level of 40 dB at 1 kHz. The human ear is less sensitive to low frequency sound and very high frequency sound than midrange frequency sound (i.e. 500 Hz to 6 kHz). Humans are most sensitive to midrange frequency sounds, such as a child's scream. Sound level meters have inbuilt frequency weighting networks that very roughly approximates the human loudness response at low sound levels. It should be noted that the human loudness response is not the same as the human annoyance response to sound. Here low frequency sounds can be more annoying than midrange frequency sounds even at very low loudness levels. The 'A' weighting is the most commonly used frequency weighting for occupational and environmental noise assessments.
Ambient Noise	The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, both near and far, including all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. Ambient Noise is usually assessed as an energy average over a set time period 'T' ($L_{Aeq,\ T}$).
'C' Frequency Weighting (dBC)	The 'C' frequency weighting approximates the 100 phon equal loudness contour. The human ear frequency response is more linear at high sound levels and the 100 phon equal loudness contour attempts to represent this at various frequencies at sound levels of approximately 100 dB.
Decibel	The decibel (dB) is a logarithmic scale that allows a wide range of values to be compressed into a more comprehensible range, typically 0 dB to 120 dB. The decibel is ten times the logarithm of the ratio of any two quantities that relate to the flow of energy (i.e. power). When used in acoustics it is the ratio of square of the sound pressure level to a reference sound pressure level, the ratio of the sound power level to a reference sound power level, or the ratio of the sound intensity level to a reference sound intensity level. See also Sound Pressure Level and Sound Power Level. Noise levels in decibels cannot be added arithmetically since they are logarithmic numbers. If one machine is generating a noise level of 50 dB, and another similar machine is placed beside it, the level will increase to 53 dB (from $10 \log_{10} (10^{(50/10)} + 10^{(50/10)})$ and not 100 dB. In theory, ten similar machines placed side by side will increase the sound level by 10 dB, and one hundred machines increase the sound level by 20 dB. The human ear has a vast sound-sensitivity range of over a thousand billion to one so the logarithmic decibel scale is useful for acoustical assessments.
Equivalent Continuous Sound Level, L_{Aeq}	Many sounds, such as road traffic noise or construction noise, vary repeatedly in level over a period of time. More sophisticated sound level meters have an integrating/ averaging electronic device inbuilt, which will display the energy time-average (equivalent continuous sound level - L_{Aeq}) of the 'A' frequency weighted sound pressure level. Because the decibel scale is a logarithmic ratio, the higher noise levels have far more sound energy, and therefore the L_{Aeq} level tends to indicate an average which is strongly influenced by short term, high level noise events. Many studies show that human reaction to level-varying sounds tends to relate closer to the L_{Aeq} noise level than any other descriptor.

'F'(Fast) Time Weighting	Sound level meter design-goal time constant which is 0.125 seconds.
Frequency	The number of oscillations or cycles of a wave motion per unit time, the SI unit is the hertz (Hz). 1 Hz is equivalent to one cycle per second. 1000 Hz is 1 kHz.
Octave band	Frequencies are divided into octaves. An octave band is defined as a range of frequencies extending from one frequency to exactly double that frequency. For example, the 1000 Hz octave band is centred at 1000 Hz and extends from 707 Hz to 1414 Hz.
One-third (1/3) octave band	Data in one-third octave bands allow an analysis of spectral characteristics of a noise event at a higher resolution. A one-third octave band is approximately one-third the width of an octave band. One of the more frequent application of one-third octave band data is for the analysis of noise sources with potentially tonal characteristics (i.e. more attention-drawing).
Hertz (Hz)	The unit used to measure frequency of sound expressed by cycles per second.
Human Response to Noise Level Changes	Less than 3 dBA = No perceivable difference 3 dBA = Barely perceptible difference 5 dBA = Readily perceptible difference 10 dBA = 'Doubling' (or 'halving') of performance
Maximum Noise Level, L_{AFmax}	The root-mean-square (rms) maximum sound pressure level measured with sound level meter using the 'A' frequency weighting and the 'F' (Fast) time weighting. Often used for noise assessments other than aircraft.
Noise	Noise is unwanted, harmful or inharmonious (discordant) sound. Sound is wave motion within matter, be it gaseous, liquid or solid. Noise usually includes vibration as well as sound.
Sound Pressure Level (SPL)	The basic unit of sound measurement is the sound pressure level. The pressures are converted to a logarithmic scale and expressed in decibels (dB).
Sound Power	The rms sound power measured in watts (W). The watt is a unit defined as one joule per second. A measures the rate of energy flow, conversion or transfer.
Sound Power Level (SWL)	Sound power level is a logarithmic measure of the sound power in comparison to a specified reference level.
Statistical Noise Levels, L_n	Noise which varies in level over a specific period of time 'T' (standard measurement times are 15 minute periods) may be quantified in terms of various statistical descriptors fro example: — The noise level, in decibels, exceeded for 1% of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as $L_{AF1, T}$. This may be used for describing short-term noise levels such as could cause sleep arousal during the night. — The noise level, in decibels, exceeded for 10% of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as $L_{AF10, T}$. In most countries the $L_{AF10, T}$ is measured over periods of 15 minutes, and is used to describe the average maximum noise level. The noise level, in decibels, exceeded for 90% of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as L_{AF90}, T. In most countries the $L_{AF90, T}$ is measured over periods of 15 minutes, and is used to describe the average minimum or background noise level.
'Z' Frequency Weighting	The 'Z' (Zero) frequency weighting is 0 dB within the nominal 1/3 octave band frequency range centred on 10 Hz to 20 kHz. This is within the tolerance limits given in AS IEC 61672.1-2004: 'Electroacoustics - Sound level meters – Specifications'.

ABBREVIATIONS

NVIA	Noise and Vibration Impact Assessment
SAP	Special Activation Precinct
NSW	New South Wales
NCA	Noise Catchment Area
LGA	Local Government Area
ABS	Australian Bureau of Statistics
LEP	Local Environment Plan
DEC	NSW Department of Environment and Conservation
DECC	NSW Department of Environment and Climate Change
EPA	NSW Environment Protection Authority
Roads and Maritime	NSW Roads and Maritime Services
ICNG	Interim Construction Noise Guideline (ICNG) (2009)
RNP	Road Noise Policy (RNP) (2011)
INP	Industrial Noise Policy (INP) (2000)
NPfI	Noise Policy for Industry (NPfI) (2017)
NCG	Noise Criteria Guideline (NCG) (2015)
NMG	Noise Mitigation Guideline (NMG) (2015).
RING	Rail Infrastructure Noise Guideline (RING) (2013).
EPL	Environment Protection Licence
DPE	Department of Planning and Environment
P2N	Inland Rail Parkes to Narromine
ONVR	Operational Noise and Vibration Review
RBL	Rating Background Level
AVTG	Assessing Vibration: A Technical Guideline
NML	Noise Management Level
POEO	Protection of the Environment Operations
TfNSW	NSW Transport for NSW
CNVS	Construction Noise and Vibration Strategy
CNVG	Construction Noise and Vibration Guideline
EbD	Enquiry by Design

EXECUTIVE SUMMARY

This report summarises the Structure Plan Noise and Vibration Impact Assessment (NVIA) conducted for the proposed Special Activation Precinct (SAP) at Parkes, NSW. This NVIA is generally high level in nature and aims at:

- identifying the location of the proposed SAP development area and potentially impacted sensitive receivers
- identify the existing and approved future noise-generating sites within the SAP
- establish the noise study area and determine the associated existing ambient noise environment
- establish the noise and vibration assessment criteria and trigger levels applicable to the operation of the SAP
- qualitative construction noise and vibration assessment
- operational noise and vibration assessment, based on the selected master plan for the SAP. In addition, assessment findings for the three previously shortlisted development scenarios are also included in this report.

RECEIVER IDENTIFICATION AND ASSOCIATED AMBIENT NOISE ENVIRONMENT

To assist with the noise assessment, upon identification of receivers outside of the SAP boundaries, all noise receivers are grouped to form Noise Catchment Areas (NCA). The characteristics of each NCA are described below:

Table ES.1 Sensitive receivers and NCAs

NOISE CATCHMENT AREA	POTENTIALLY SENSITIVE LAND USE TYPES	DESCRIPTION
NCA1 residential 3 receivers	Residential use on land zoned RU1 Primary Production	Isolated[1] residential receivers located within the SAP and adjacent to the western boundary of the SAP. Acoustic environment was generally quiet and impacted by intermittent noise from rail infrastructure.
NCA2 residential 4 receivers	Residential use on land zoned RU1 Primary Production	Isolated residential receivers located within the SAP and adjacent to the southern boundary of the SAP. Acoustic environment was generally quiet and impacted by intermittent rail noise and possible industrial noise from the existing quarry.
NCA3 residential 20 receivers	Residential use on land zoned RU1 Primary Production	Isolated residential receivers located outside of and to the southeast of the SAP. Acoustic environment was generally affected by existing road noise due to Newell Highway.
NCA4 residential 10 receivers	Residential use on land zoned RU1 Primary Production	Isolated residential receivers located to the north of the SAP. Existing ambient noise levels was generally low and possibly affected by relatively low level of noise from existing solar farms.
NCA5 residential 45 receivers	Residential use on land zoned RU1 Primary Production, RE2 Private Recreation	A mix of isolated and closely-spaced receivers to the northeast of the SAP. Existing ambient noise levels affected by intermittent road traffic noise and possibly affected by a level of noise from existing intermodal facilities. Receivers may be affected by increased road noise due to the possible future Newell Highway Parkes Bypass to the east of NCA5 (not yet approved).

NOISE CATCHMENT AREA	POTENTIALLY SENSITIVE LAND USE TYPES	DESCRIPTION
NCA6 residential 45 receivers	Residential use on land zoned RU1 Primary Production, RE2 Private Recreation	Closely-spaced residential receivers located approximately 1 km east of the SAP and near existing Newell Highway. Existing ambient noise levels at these receivers likely affected by road traffic noise and possibly from existing industrial premises to the south. A golf course also directly adjoins the proposed SAP to the east, as well as a cluster of industrial premises approximately 1 km to the east of the SAP.
NCA7 residential >500 receivers	Residential use on land zoned RU1 Primary Production, RE2 Private Recreation	Generally closely-spaced receivers on the western part of Parkes town. Existing ambient noise levels affected by road traffic noise and likely general neighbourhood noise. Receivers may be affected by increased road noise due to the possible future Newell Highway Parkes Bypass to the east of NCA5 (not yet approved).

CONSTRUCTION NOISE AND VIBRATION

During the construction of the SAP, various activities and construction stages will likely cause notable construction noise and vibration impact at surrounding receivers.

A construction noise and vibration management plan should be developed for the Parkes SAP (overall project as well as for specific sites) prior to commencement of works. Such requirement is generally consistent with development consent granted for other recent projects within the SAP. The management plan would utilise detailed construction methodologies of the contractor and would at a minimum include:

- noise and vibration assessment as per the Interim Construction Noise Guideline
- identified nearby residences and other sensitive land uses
- approved hours of work and what work will be undertaken
- significant noise and vibration generating activities
- details of noise mitigation and management measures to be applied
- information for worker training to minimise noise impacts
- community consultation protocol(s)
- complaints handling protocol(s)
- construction works should be planned and carried out during standard construction hours wherever possible.

ON-SITE INDUSTRIAL NOISE ASSESSMENT

The Parkes SAP masterplan has been developed following studies into three preliminary designs. The proposed SAP has been broken down into individual land parcels, indicated as being potentially developed into different industrial land uses. For the Structure Plan assessment, the SAP is being assessed as one development incorporating all possible maximum developable areas. In general, the following findings are made of the predicted noise impact due to on-site industrial noise associated with the SAP:

- The assessed development scenario is predicted to notably exceed the NPfI project noise trigger levels at all NCAs. It should however be noted that the modelled scenario is likely to represent a worst case acoustic scenario as it assumes the entire indicated developable areas to be fully developed and noise-generating.

- NCA1: three isolated residential receivers as close as 100 metres to the west of the SAP.
  - most stringent NPfI trigger levels applicable
  - exceedance of the trigger levels by up to 16 to 25 dB (dependent on assessment periods).
- NCA2: four isolated residential receivers as close as 40 metres to the west and south of the SAP.
  - most stringent NPfI trigger levels applicable
  - exceedance of the trigger levels by up to 23 to 31 dB (dependent on assessment periods).
- NCA3: 20 isolated residential receivers to the east and southeast of the SAP (as close as 1230 metres from SAP)
  - most stringent NPfI trigger levels generally applicable
  - exceedance of the trigger levels by up to 8 to 17 dB (dependent on assessment periods).
- NCA4: 10 isolated residential properties to the west, northwest and north of the SAP (440 metres to 2 kilometres)
  - most stringent NPfI trigger levels generally applicable
  - exceedance of the trigger levels by up to 7 to 16 dB (dependent on assessment periods).
- NCA5: approximately 45 residential properties, including isolated and closely-spaced receivers to the northeast of the SAP, as close as 140 metres.
  - generally less stringent noise trigger levels during evening and night periods
  - exceedance of the trigger levels by up to 13 to 19 dB (dependent on assessment periods).
- NCA6: receivers to the east of the SAP comprising of approximately 45 closely-spaced residential properties about 850 metres away, existing industrial establishments about 600 metres away and a golf course (active recreation) directly adjoining the SAP.
  - predicted noise impact compliant at all residential receivers during day period
  - exceedances of up to 4 to 9 dB during evening and night periods
  - predicted noise impact compliant at the existing industrial premises and at the golf course.
- NCA7: >500 closely-grouped residential receivers on the western part of the Parkes town, 260 metres to the east of the SAP
  - notably less stringent noise trigger levels during the day and evening periods
  - exceedance of the trigger levels by up to 4 to 17 dB (dependent on assessment periods).

The predicted exceedances of the project trigger noise levels required consideration of mitigation strategies to reduce the likely noise impact per guidance provided in NPfI. Various combinations of mitigation are possible however from an acoustic perspective, a feasible and reasonable assessment of all options should be evaluated and they are typically investigated in the following order (decreasing preference):

1. Land use planning and provision of appropriate buffer distances.
2. Noise control at the noise source.
3. Noise control along the noise transfer path.
4. Noise control at the receiver.

The following considerations are recommended for Parkes SAP:

- Consideration of mitigation as per NPfI should be provided to allow the proposed SAP in achieving the determined NPfI noise trigger levels at all NCAs where possible.
- The NPfI does not consider the trigger levels as mandatory but strong justification must be provided if they cannot be met. Any exceedances will require consideration of receiver-based mitigation. On this basis, achieving the project noise trigger levels for the residential receivers in NCA5, NCA6 and NCA7 is likely to result in better overall project outcome (to the northeast and east of the SAP) as any trigger to consider receiver-based treatment will involve a relatively large number of properties.

- The predicted noise impact and exceedances at the worst impacted receivers in NCA5, NCA6 and NCA7 are dominated by contribution from the future Commercial Gateways, Mixed Enterprise, Regional Enterprise, Freight Terminals (including existing/approved SCT and Pacific National facilities) and the existing Parkes waste facility. An overall noise reduction of up to 20 dB is required to meet the determined triggers levels for night period.
- A service station development is likely to represent the acoustically worst case land use within the Commercial Gateways sub-precinct. It is recommended that such a site be positioned at least 1.2 km from sensitive receivers as well as being shielded by other future buildings within the sub-precinct.
- Due to the isolated nature of the receivers in NCA01 to NCA04, it appears more feasible and reasonable to accept that noise levels will likely remain higher than the trigger levels (residual impact) after assessment of mitigation measures per NPfI and pursue receiver-based treatment for them.

It should be noted that the level of detail of this assessment is considered suitable for the Master Plan stage of the proposed Parkes SAP. Notable exceedances of the determined project noise trigger level are predicted at all assessed sensitive receiver surrounding the SAP, which are likely to represent worse case noise impact scenarios. A high level discussion of possible noise mitigation measures is provided, however it is not possible to determine a more precise range of measures to be implemented (and to determine the likely final noise levels outcome) as this is dependent on numerous variables and can take many forms and combinations. It is expected possible further considerations will be required to account for the following:

- Upon availability of indicative total number of establishments within the SAP, determine the project amenity noise trigger level for each establishments. It should also be noted that individual establishments will be subjected to a further reduced trigger levels than determined for the overall SAP to ensure the overall trigger levels are not exceeded when considering cumulative noise impact from all land uses within the SAP.
- Further development of the overall mitigation approach to be pursued (based on principles of the NPfI).
- Further consideration should be provided in determining strategies in implementing receiver-based treatment at the identified receivers. As the development of Parkes SAP is expected to be progressive in nature, so can the roll-out of these treatments. The noise impact predicted and discussed in this report applies to a generally conservative cumulative impact, assuming all identified developable land areas to be noise generating. This is however not likely to represent the noise conditions in the early phase of development of the SAP.

  One robust way to determine the timing of implementation of receiver-based treatment is by continually assessing in-situ noise levels associated with the SAP as it becomes developed. This can be achieved by:

  - An overarching 3-dimensional computer noise model for the SAP that is being maintained and updated periodically by the Parkes SAP Development Corporation. The computer noise model created as part of this Master Plan assessment can act as the basis for this noise model. (It is noted that the Parkes SAP Development Corporation will be established by NSW Government and responsible in managing all establishments associated with the SAP.)
  - A noise monitoring regime established and managed by the Development Corporation to measure changes in noise level as Parkes SAP becomes developed. The noise monitoring regime will likely comprised of permanent noise monitoring devices as well as regular/strategic operator-attended noise monitoring at strategic locations.
  - These strategies can form part of ‘government led studies’, which has been identified as one of the five key components of Parkes SAP.
- A level of acoustic assessment is likely to be required by future individual proponents to ensure any nominated constraints to limit noise impact in the Structure Plan noise report are complied with. The level of detail of the acoustic assessment required will likely vary depending on the complexity of the proposed development.
- These strategies will also be beneficial in identifying noise contribution associated with on-site, off-site, road and rail noise sources, as these are assessed differently managed using different trigger levels.

OFF-SITE ROAD NOISE

Development of the SAP will generate additional vehicle movements on the surrounding roads which have the potential to impact sensitive receivers along the identified access routes. The preliminary Structure Plan currently identifies that the SAP will primarily be accessible by the Newell Highway (including proposed bypass) as well as the Brolgan Road corridor. Condobolin Road (which becomes Henry Parkes Way further out west) will in turn be used as a secondary access. In addition, it is expected that existing roads surrounding the proposed SAP will likely experience an increase in traffic volumes.

Assessment of road traffic noise increase associated with the SAP is based on an initial screening assessment of a noise level increase threshold of 2 dB or more, per guidance provided in the Road Noise Policy. Acoustically, a road noise level change of 2 dB approximately equates to 60% increase traffic volumes, which is presented below.

Table ES.2 Traffic volume increase

ROAD	EXISTING VOLUME	TRAFFIC VOLUME INCREASE THAT WILL TRIGGER A ≥2 dB INCREASE
Newell Highway (north of Parkes)	4,100	2460
Newell Highway (south of Parkes)	1,600	960
Brolgan Road	1400	840
Condobolin Road	1600	960
Hartigan Avenue	1100	660

Further review is recommended when suitable information becomes available. It should also be noted that certain roads will likely require upgrades to facilitate the development of the SAP (e.g. Brolgan Road). During the planning and design phases of any proposed upgrades, a more detailed road noise assessment is expected to be undertaken to determine any necessary requirements to consider mitigation of road noise impact on existing sensitive receivers.

OFF-SITE RAIL NOISE

Similar to road traffic, the proposed SAP will likely trigger additional traffic on the rail network and this will need to be reviewed when information becomes available. This should be assessed as per guidance provided in the Rail Infrastructure Noise Guideline. It is however understood that all rail infrastructure (including existing and approved Inland Rail) will be operated and subject to conditions within the respective Environment Protection Licence, Development Consent or similar. Any significant changes to the rail traffic will likely trigger a separate noise and vibration assessment to support an application to vary any existing approvals. Such additional processes are expected to identify any additional requirements to consider mitigation relating to operational rail noise and vibration.

1 PROJECT BACKGROUND

1.1 INTRODUCTION

The Parkes Special Activation Precinct (the SAP) is a joint Government Agency initiative, announced by the Deputy Premier, the Hon John Barilaro MP, to create a 20-year vision for job creation and regional development. The Department of Premier and Cabinet and the Department of Planning, Industry and Environment are leading the creation of the Parkes SAP.

Parkes is a location of State and regional significance and the SAP is an economic enabler that will address market failures and leverage catalyst opportunities. The SAPs are a place-based approach to 'activate' this strategic location.

The Parkes SAP was selected because of the economic opportunities associated with the construction of an Inland Rail from Brisbane to Melbourne and the existing east-west Sydney to Perth/Adelaide Rail corridor which cross at Parkes creating an opportunity for an Inland Port.

The Parkes SAP will lead to investment in common-use infrastructure, including roads infrastructure, water, electricity, telecommunication, gas systems and services, high speed internet and data connections and facilities, and other possible infrastructure or services.

A SAP contains five core components and this plan (government led studies) will inform fast track planning for the Precinct and potential future infrastructure investment and government led development:

Figure 1.1 Government vision for the purpose of Special Activation Precincts

1.2 REGIONAL AND LOCAL CONTEXT

Parkes local government area (LGA) is located approximately 350 kilometres west of Sydney, in the Central West and Orana Region. The main townships and settlements in the LGA include Alectown, Bogan Gate, Cookamidgera, Parkes, Peak Hill, Trundle and Tullamore. Other major centres in the region include Condobolin, Cowra, Dubbo, Forbes and Orange.

The Parkes township has a stable population of approximately 11,500 people (ABS, 2016), with around 5,000 dwellings. An industrial estate (zoned IN1 – General Industrial) is located south of the town, adjoining the Newell Highway. The town is serviced by an existing local centre, mixed use areas that contain both commercial, business and retail use. A new hospital and associated health Precinct is located towards the southern end of the town. The Parkes Regional Airport is located east of town, with the Parkes National Logistics Hub located to the west.

The Central West and Orana Regional Plan 2036 identifies the following key features about Parkes:

- development and settlement is clustered around key corridors, including the twin centres of Parkes and Forbes
- Parkes, along with Dubbo, is a major freight hub particularly in the selling, processing, manufacturing and transporting of livestock and agricultural produce
- TransGrid's NSW Connection Opportunities identifies Parkes as having capacity for renewable energy generation; and
- existing regional mining operations (North Parkes Mines and Tomingley) near Parkes.

The establishment of a Parkes SAP is consistent with Parkes Shire Council's vision and strategic planning for the locality.

1.3 PARKES SPECIAL ACTIVATION PRECINCT

The Parkes SAP covers an area of approximately 5,000 hectares and is located to the west of the Parkes township (see Figure 1.2). The Parkes SAP is strategically located at the intersection of:

- the Brisbane to Melbourne Inland Rail
- the Sydney to Perth/Adelaide Rail corridor; and
- is in close proximity to the junction of the Henry Parkes Way and Newell Highway.

The Inland Rail project has received $9.3 billion in funding from the Commonwealth Government to support the upgrade to the freight network from Brisbane to Melbourne. It is projected that the first train will run between the two capital cities in 2025. Parkes is an important connection for the Inland Rail project, as it is the epicentre of inland freight.

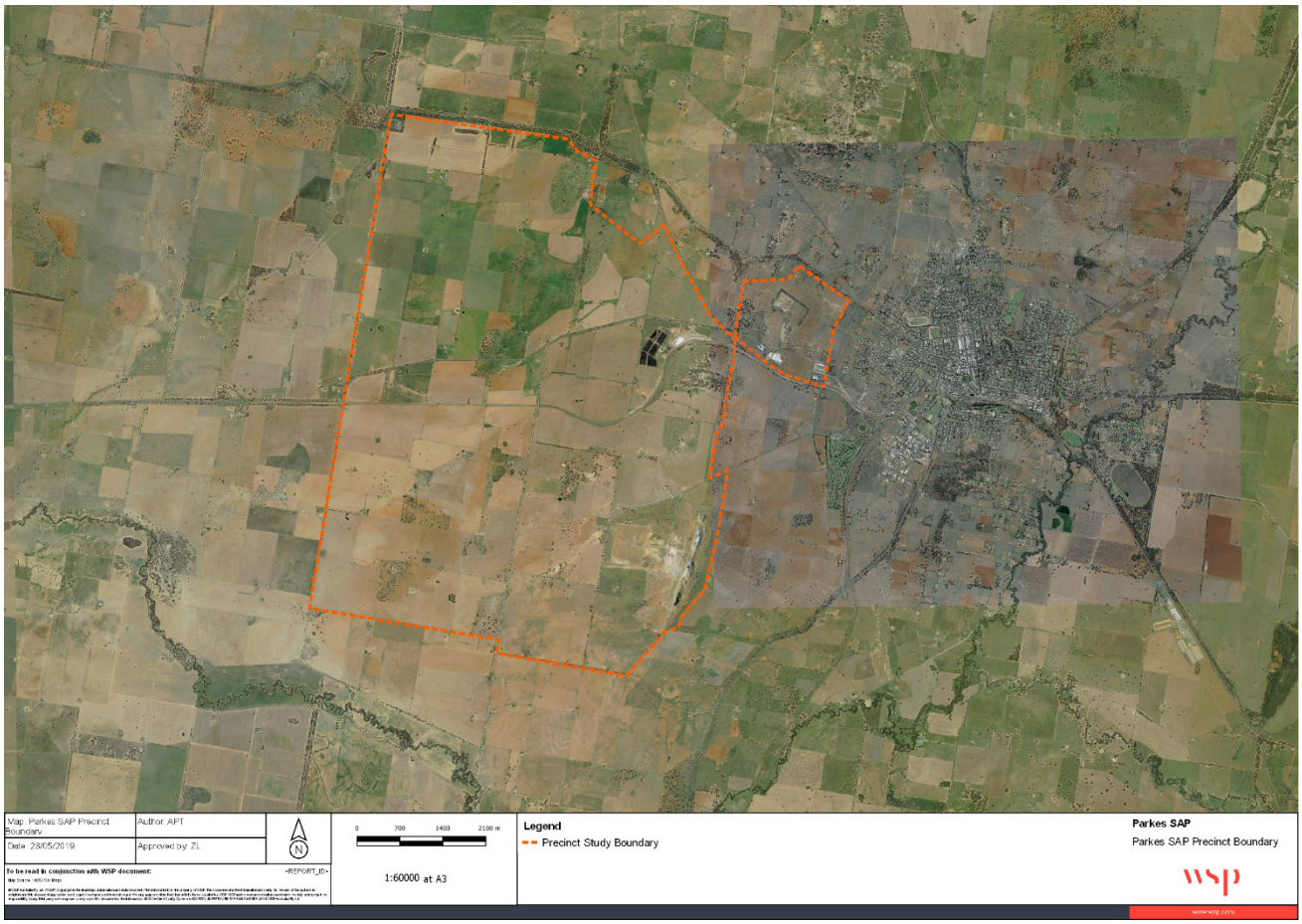


Figure 1.2 Indicative location of Parkes SAP

The Parkes SAP area is predominantly occupied by agricultural land, with a solar energy facility located in the north-western corner and an existing quarry operation located in the south-eastern area of the Precinct.

The existing primary industries in Parkes are focused around freight and logistics, agribusiness and mining. Parkes strategic location within Regional NSW provides the opportunity to capitalise on these industries, along with the potential to expand into warehousing, advanced food manufacturing and renewable energy uses.

1.4 PLANNING FRAMEWORK

Currently under the Parkes Local Environmental Plan (LEP) 2013, the Parkes SAP area is zoned:

- RU1 – Primary Production
- SP1 – Special Activities; and
- SP2 – Infrastructure.

The land zoned SP1 – Special Activities has been identified as the Parkes National Logistics Hub. The Logistics Hub covers approximately 600 hectares. The land includes the Pacific National and SCT Logistics sites among other landholdings. The locality provides the opportunity to create an intermodal site serviced by rail and road connections.

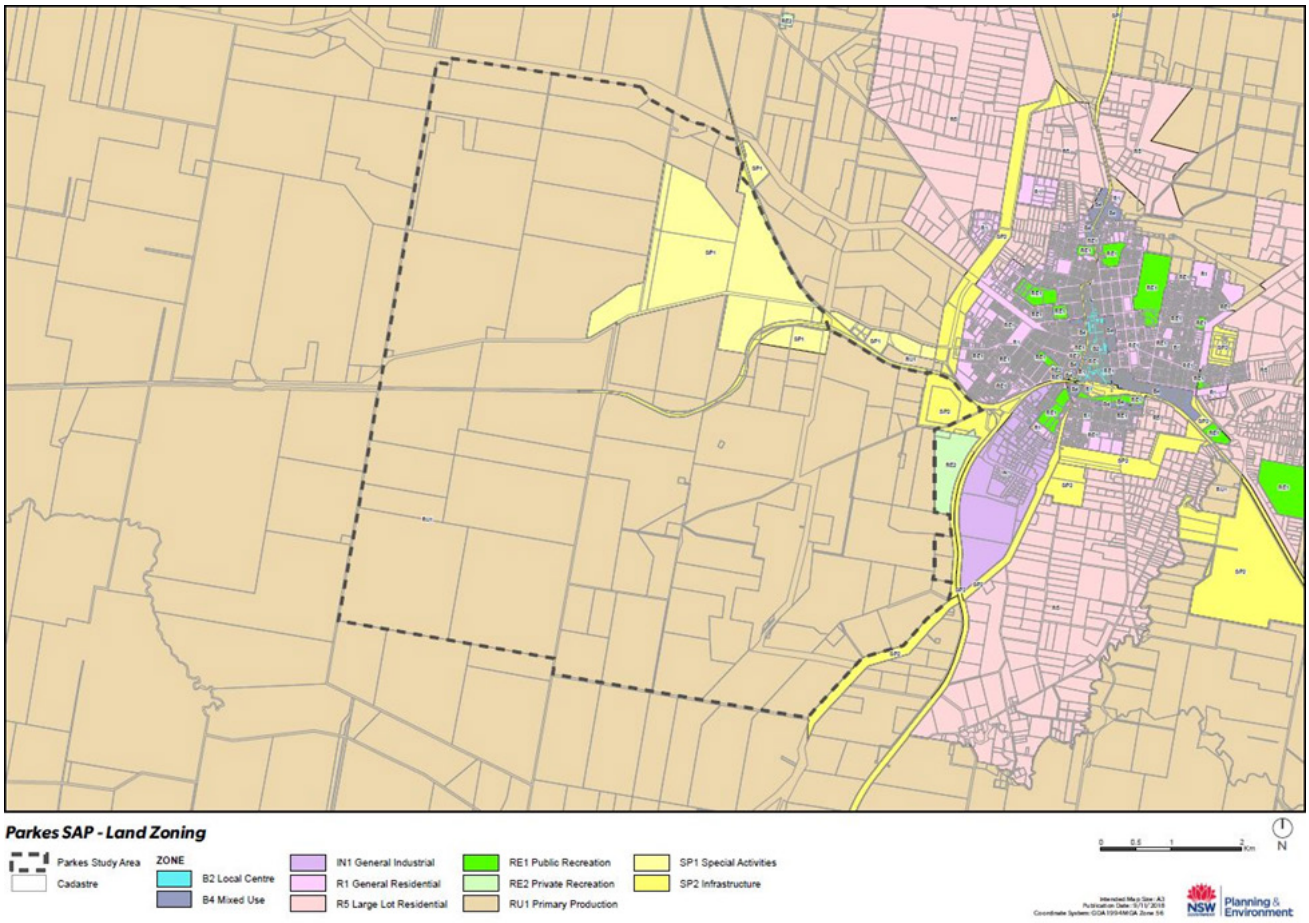


Figure 1.3 Zoning map

1.5 PURPOSE AND STRUCTURE OF THIS REPORT

The purpose of this report is to detail the construction and operational noise and vibration assessment conducted at the Structure Plan stage of the proposed SAP. The report covers and is structured as follows:

- identify the location of the proposed SAP development area and potentially impacted sensitive receivers (**Section 2**)
- identify the existing and approved future noise-generating sites within the SAP (**Section 2**)
- establish the noise study area and determine the associated existing ambient noise environment (**Section 3**)
- establish the noise and vibration assessment criteria and trigger levels applicable to the operation of the SAP (**Section 4**)
- qualitative construction noise and vibration assessment (**Section 5**)
- operational noise and vibration assessment (including maximum noise levels where applicable):
  - on-site sources due to proposed industry types and development areas (**Section 6**)
  - off-site road noise (**Section 7**)
  - off-site train noise (**Section 8**)
  - discussion of possible mitigation measures to manage noise and vibration impact in the respective sections.

1.6 INFORMATION SOURCES

This assessment has been prepared with reference to the following documents:

- Parkes SAP Strategic Business Case including the Structure Plan Report Issue E (Architectus, 29 January 2019) and Land Use Analysis (SGS Economics & Planning, 29 January 2019).
- Parkes SAP Structure Plan Preliminaries Report_Update 3 scenarios for technical testing (Jensen Plus, April 2019).
- Parkes SAP Masterplan, Enquiry by Design Workshop Structure Plan (Jensen Plus, 10 May 2019).
- Inland Rail Parkes to Narromine Operational Noise and Vibration Review (WSP | Mott Macdonald, October 2018).
- Pacific National Parkes Intermodal Facility Development Application operational noise assessment report (WSP, May 2018).
- Newell Highway Parkes Bypass operational noise assessment report (WSP, January 2019).
- Australian Standard AS 1055:2018 – Acoustics – Description and measurement of environmental noise.
- Australian Standard AS 2436:2010 – Acoustics – Guide to noise and vibration control on construction, demolition and maintenance sites.
- Australian Standard AS 2670:2001 – Evaluation of human exposure to whole-body vibration.
- British Standard BS 6841:1987 – Guide to measurement and evaluation of human exposure to whole-body mechanical vibration and repeated shock.
- British Standard BS 7385-2:1993 – Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration.
- ISO 9613-1:1993 - Acoustics – Attenuation of sound during propagation outdoors – Part 1: Calculation of the absorption of sound by the atmosphere.
- CONCAWE – the Propagation of Noise from Petroleum and Petrochemical Complexes to Neighbouring Communities – Report no. 4/81 (1981).
- NSW Department of Environment and Conservation (DEC) – Assessing Vibration: A Technical Guideline (2006).
- NSW Department of Environment and Climate Change (DECC) – Interim Construction Noise Guideline (ICNG) (2009).
- NSW Department of Environment and Climate Change (DECC) – Road Noise Policy (RNP) (2011).
- NSW Environment Protection Authority (EPA) – Industrial Noise Policy (INP) (2000).
- NSW Environment Protection Authority (EPA) – Noise Policy for Industry (NPfI) (2017).
- NSW Environment Protection Authority (EPA) – Implementation and transitional arrangements for the Noise Policy for Industry (2017).
- NSW Roads and Maritime Services (Roads and Maritime) – Noise Criteria Guideline (NCG) (2015).
- NSW Roads and Maritime Services (Roads and Maritime) – Noise Mitigation Guideline (NMG) (2015).
- NSW Environment Protection Authority (EPA) – Rail Infrastructure Noise Guideline (RING) (2013).

2 EXISTING AND APPROVED FUTURE LAND USES

This section provides an overview of the following:

- identification of sensitive noise receivers potentially impacted by the proposed Parkes SAP
- existing noise-generating land uses within the SAP
- approved future developments within the SAP.

2.1 SENSITIVE RECEIVERS

The proposed SAP investigation area is potentially up to 5,000 ha and is in a generally rural area approximately 4 km to the west of Parkes town centre. The currently identified maximum developable area is bounded to the north, west, and south by agricultural properties, a solar farm in the north-west, and the outskirts of Parkes town to the east (Figure 1.2).

There are numerous residential receivers surrounding the SAP as well as within the SAP. These receivers have been grouped into 7 noise catchment areas (NCA1 to NCA7) and are summarised in Table 2.1 and shown on Figure 2.1. The boundaries and positioning of these NCAs have generally been determined based on similarity of the existing acoustic ambient environments of the receivers they encompass as well as relative position to existing noise generating developments (e.g. industries, road, rail). These established NCAs will serve as the study area of the noise assessment.

For the purpose of this noise assessment to inform the Master Plan, land areas within the SAP boundaries currently used for residential purposes have been excluded from this noise assessment.

Table 2.1 Parkes SAP sensitive receivers

NOISE CATCHMENT AREA	APPROXIMATE SHORTEST DISTANCE TO SAP (m)	POTENTIALLY SENSITIVE LAND USE TYPES	DESCRIPTION
NCA1	100	Residential use on land zoned RU1 Primary Production	Isolated[1] residential receivers located within the SAP and adjacent to the western boundary of the SAP. Acoustic environment was generally quiet and impacted by intermittent noise from rail infrastructure.
NCA2	40	Residential use on land zoned RU1 Primary Production	Isolated residential receivers located within the SAP and adjacent to the southern boundary of the SAP. Acoustic environment was generally quiet and impacted by intermittent rail noise and possible industrial noise from the existing quarry.
NCA3	1230	Residential use on land zoned RU1 Primary Production	Isolated residential receivers located outside of and to the southeast of the SAP. Acoustic environment was generally affected by existing road noise due to Newell Highway.
NCA4	440	Residential use on land zoned RU1 Primary Production	Isolated residential receivers located to the north of the SAP. Existing ambient noise levels was generally low and possibly affected by relatively low level of noise from existing solar farms.

NOISE CATCHMENT AREA	APPROXIMATE SHORTEST DISTANCE TO SAP (m)	POTENTIALLY SENSITIVE LAND USE TYPES	DESCRIPTION
NCA5	140	Residential use on land zoned RU1 Primary Production, RE2 Private Recreation	A mix of isolated and closely-spaced receivers to the northeast of the SAP. Existing ambient noise levels affected by intermittent road traffic noise and possibly affected by a level of noise from existing intermodal facilities. Receivers may be affected by increased road noise due to the possible future Newell Highway Parkes Bypass to the east of NCA5 (not yet approved).
NCA6	850	Residential use on land zoned RU1 Primary Production, RE2 Private Recreation	Closely-spaced residential receivers located approximately 1 km east of the SAP and near existing Newell Highway. Existing ambient noise levels at these receivers likely affected by road traffic noise and possibly from existing industrial premises to the south. A golf course also directly adjoins the proposed SAP to the east, as well as a cluster of industrial premises approximately 1 km to the east of the SAP.
NCA7	260	Residential use on land zoned RU1 Primary Production, RE2 Private Recreation	Generally closely-spaced receivers on the western part of Parkes town. Existing ambient noise levels affected by road traffic noise and likely general neighbourhood noise. Receivers may be affected by increased road noise due to the possible future Newell Highway Parkes Bypass to the east of NCA5 (not yet approved).

(1) Definition from Roads and Maritime's Noise Mitigation Guideline adopted – single residences or closely spaced groups of residences in numbers of three or less are considered isolated where they are separated from other residences by more than 100 metres.

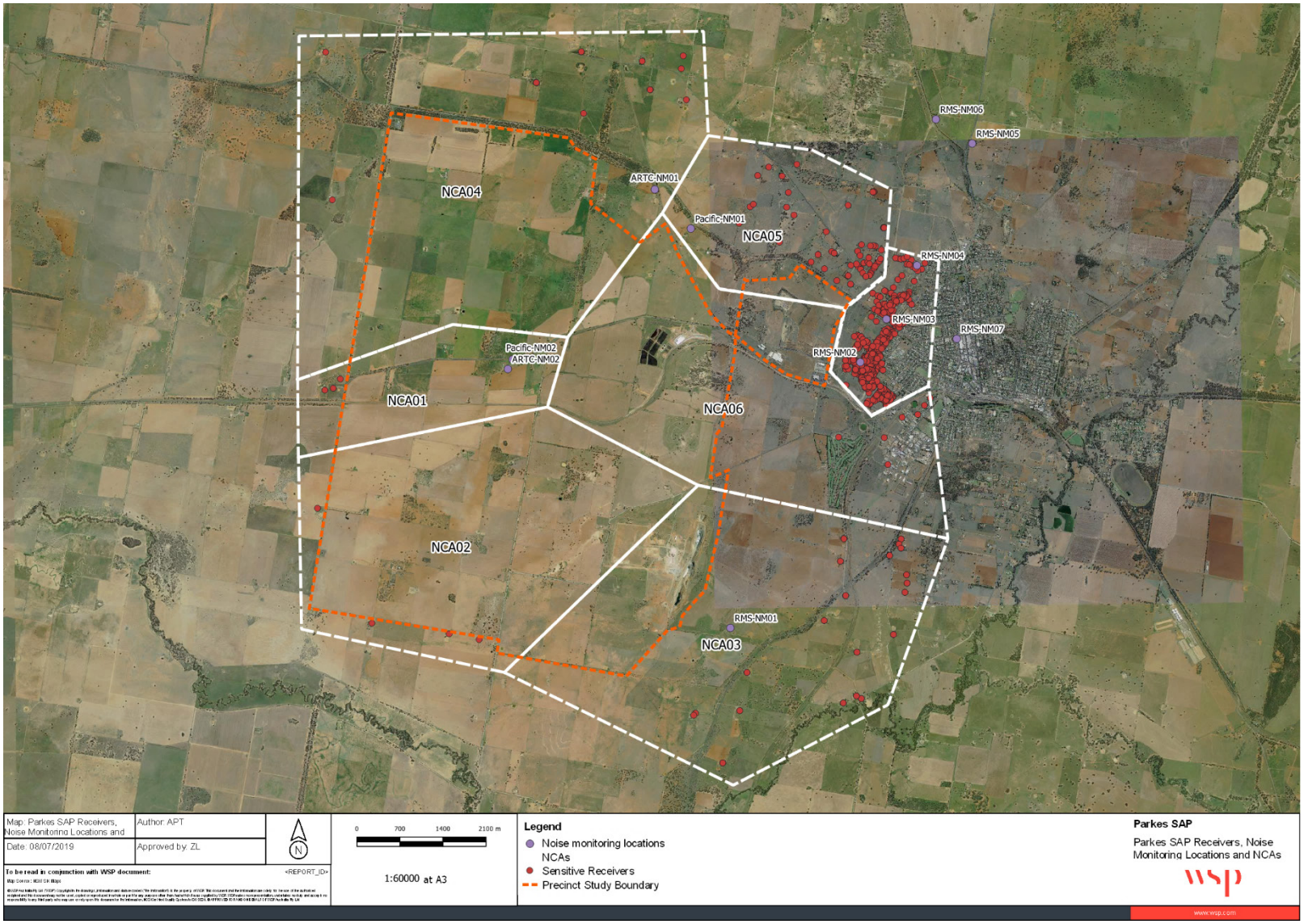


Figure 2.1 Project layout, sensitive receivers and previous noise monitoring locations

2.2 EXISTING DEVELOPMENTS

This subsection provides an overview of existing land uses and potentially noise-generating developments within the SAP.

2.2.1 EXISTING ENVIRONMENT PROTECTION LICENCES (EPL)

Several developments within the SAP have already been issued an EPL for operation. As these limits are a legal requirement for the respective businesses, it is assumed that these limits are the level which will be achieved. Several sites were identified to have EPLs but of these the only relevant operation identified which included noise limits was the Westlime quarry site located off London Road in the south east corner of the investigation area.

Westlime quarry is expected to be in operation for another 15 years, it currently operates under NSW Environment Protection License 11553. Noise conditions of the license require the conditions in Table 2.2 are complied with.

Table 2.2 Westlime quarry noise limits under EPL

RECEIVER	TIME PERIOD	$L_{Aeq\ (15\ min)}$ dB	$L_{A1\ (1\ min)}$ dB
Residence A	Day	39	49
	Evening		
	Night		
All other residences	Day	39	–
	Evening	35	–
	Night	35	45

As residence A has not been specifically identified in the EPL, it is assumed that this residence is the closest to the quarry for determining the likely overall sound level produced by the quarry. The closest residence has been identified as 396 London Road (Lot 720 DP727007) located approximately 220 metres to the northwest of the quarry access road (Figure 2.2). It is noted that the limits are not necessarily representative of the actual sound output of the quarry but provide an upper limit (as allowable by the license conditions) on the sound level produced. This is expected to enable a conservative estimate unless the quarry is operating over the prescribed limits.

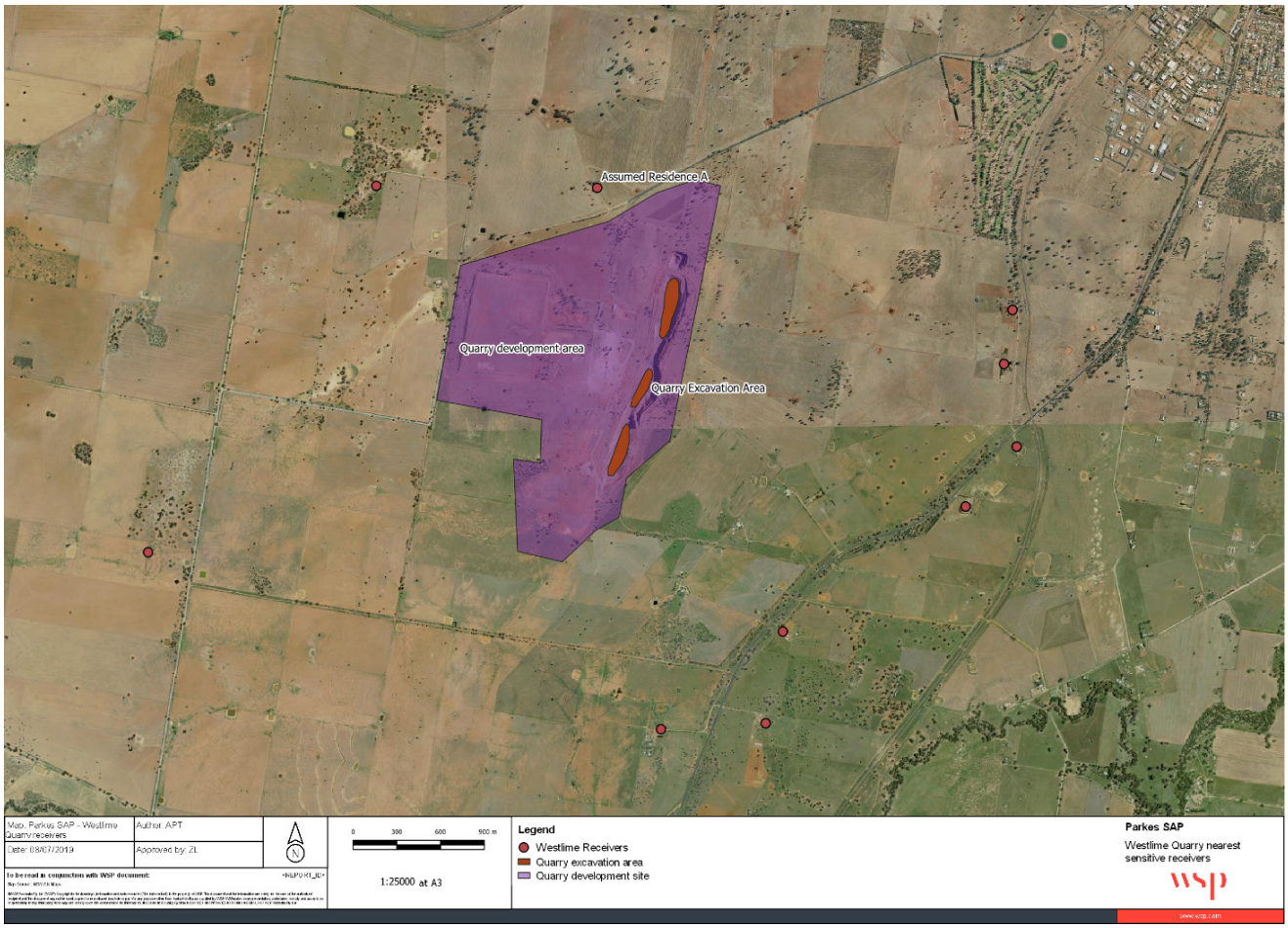


Figure 2.2 Nearest sensitive receivers to the quarry

2.2.2 SCT INTERMODAL TERMINAL

An existing intermodal terminal on Brolgan Road within the SAP is currently in operation as part of the National Logistic Hub. A noise assessment was completed for the facility for Terminals Australia (GHD report reference 22/12447/67144 dated January 2006). As part of this study noise monitoring was conducted at the nearest affected receivers and it was concluded in the report that the most stringent noise assessment criteria as allowable by the INP (superseded by NPfI in 2017) would apply. The project specific noise level was determined to be 35 dB $L_{Aeq\ (15\ min)}$ at the surrounding residential receivers for all assessment periods for on-site noise sources.

The GHD noise report reported that several operational noise sources were modelled and assessed as summarised in Table 2.3. The report stated that under all assessable meteorological conditions and absence of any specific noise barriers or building shielding, noise levels due to on-site noise sources were predicted to comply with the project specific noise level at the identified nearest sensitive receivers.

Table 2.3 Assessed sound power levels – SCT intermodal terminal (GHD, 2006)

SOURCE	SOUND POWER LEVEL dBA
1x Shunting tractor	111 each
15x Forklift – Fantuzzi FDC 450 G4	96 each
1x KONE 15-Tonne Crane during Operation	97 each
2x Overhead Crane 20-Tonne during Operation	82 each
1x Train Approaching Facility (approximately 20 km/h)	76 each

2.2.3 PARKES WASTE FACILITY

A waste disposal and recycling facility has been identified as within the SAP boundary and is currently in operation by Parkes Shire Council. To establish the likely noise impact associated with the operation of the facility, several assumptions have been made. Operational noise for such facility is expected to be generally dominated by trucks accessing the site via the access road off Brolgan Rd and movement of waste on site by diesel-powered mobile machinery (excavator, loader or the like).

For the purpose of this assessment, operational assumptions (for a representative 15-minute period) as presented in Table 2.4 are adopted for the waste facility.

Table 2.4 Assumed sound power levels – Parkes Waste Facility

SOURCE	SOUND POWER LEVEL dBA
1x Truck accessing site along the access road	107 (moving source at 40 km/h)
2x Excavator movements on site (approximately 15 km/h)	107 (operating 75% within a 15-minute period)

2.3 APPROVED DEVELOPMENTS

2.3.1 GOONUMBLA SOLAR FARM

Goonumbla Solar Farm is an approved development outside and to the northwest of the SAP. The operational noise levels reported in the EIS have been considered in this noise assessment as the likely output for the solar farm. A noise and vibration impact assessment was completed for Renewable Energy Developments Pty Ltd by Assured Monitoring Group (AMG report reference 10531 dated September 2016). It is noted that the potentially worst affected receiver is a residence approximately 70 metres from the site with an applicable project specific noise level of 35 dB $L_{Aeq\ (15\ min)}$ for all assessment periods for on-site noise sources.

The AMG report assessed several noise sources as summarised in Table 2.5. It was concluded that noise levels from Goonumbla Solar Farm were expected to meet the applicable noise criteria in the absence of any specific noise mitigation measures.

Table 2.5 Assessed sound power levels – Goonumbla Solar (AMG, 2016)

SOURCE	LOCATION ON SITE	SOUND POWER LEVEL dBA
2800x NexTracker	Evenly distributed across site	58 each
28x Sunny SC2500 Inverter	Evenly distributed, 300 metres to nearest receiver	92 each
1x Transformer	Adjacent to existing electrical substation	75 each
Light vehicle	4 movements per day	88 each

2.3.2 PARKES SOLAR FARM

Parkes Solar Farm is majority-owned by Neoen and has been in operation at full capacity (66 MW) since at least March 2018. It is understood that a noise assessment was previously conducted (not available for review by WSP) with noise monitoring conducted to establish the ambient noise levels (as cited in the noise assessment for Goonumbla Solar Farm). It is expected that similar on-site operational noise assessment criteria as per Goonumbla Solar Farm would be applicable for Parkes Solar Farm in accordance with the Industrial Noise Policy.

It is understood that Parkes Solar Farm has been developed based on the Development Consent provided by DPE (application number SSD6784, 2016). It is noted that the Development Consent does not contain any specific noise limits for operational noise sources associated with the solar farm.

For the purpose of this noise assessment, consideration of the Parkes Solar Farm is proposed to be broadly based on the adopted assumptions for Goonumbla Solar Farm as discussed in Section 2.3.1.

2.3.3 INLAND RAIL – PARKES TO NARROMINE

The Parkes to Narromine (P2N) section is a brownfield section of the Inland Rail project between Parkes and Narromine, NSW. The southern end of this P2N project section is located within the proposed SAP. An Operational Noise and Vibration Review (P2N ONVR) was conducted by WSP | Mott Macdonald in October 2018 for operational rail noise and vibration impact in accordance with the NSW Rail Infrastructure Noise Guideline.

In reference to the P2N ONVR, four different years have been assessed:

- 2016 – For model verification, the "no build" scenario. The existing Parkes to Narromine section is modelled with the existing traffic and existing conditions for model verification.
- 2020 – Represents the actual opening year. A representative version of the 100% Detailed Design rail track alignment is modelled with the existing rail traffic volumes but with increased rail speeds for the Intercapital train type.
- 2025 – Represents the opening year when the whole of Inland Rail will be connected and open. The proposed Parkes North-West Connection and redeveloped Parkes to Narromine section are modelled with the proposed traffic and conditions for Year 2025.
- 2040 – Project design year. The proposed Parkes North-West Connection and redeveloped Parkes to Narromine section are modelled with the proposed traffic and conditions for Year 2040.

The assessed rail traffic volumes are summarised in Table 2.6 and Table 2.7. The ONVR also considered specific train lengths, speed profiles, number/type of locomotives as well as associated source noise levels. It is understood that these assessed parameters had not accounted for the development of the Parkes SAP. These previously assessed conditions therefore serve as the applicable baseline conditions for the assessment of the SAP.

Table 2.6 Existing and proposed daily rail traffic – Parkes to Narromine section

TRAIN TYPE	YEAR 2016 AND 2020		YEAR 2025		YEAR 2040	
	No build	Build	No build	Build	No build	Build
Grain	2.12	2.12	2.12	2.12	2.12	2.12
Mineral	0.43	0.43	0.43	0.43	0.43	0.43
Link	0.43	0.43	0.43	0.43	0.43	0.43
Intercapital	–	–	–	8.42	–	18.02

Table 2.7 Proposed daily rail traffic – Parkes North-West Rail Connection

TRAIN TYPE	YEAR 2016 AND 2020		YEAR 2025		YEAR 2040	
	No build	Build	No build	Build	No build	Build
Grain	–	–	–	–	–	–
Mineral	–	–	–	–	–	–
Link	–	–	–	–	–	–
Intercapital	–	–	–	2.86	–	4.57

The P2N ONVR identified several sensitive receivers requiring consideration of further noise mitigation due to exceedance of the RING trigger levels. None of these are however located within the Parkes SAP noise study area.

2.3.4 PACIFIC NATIONAL LOGISTICS TERMINAL

An intermodal logistic terminal to be operated by Pacific National has been approved and is under construction within the SAP (as of March 2019). An operational noise assessment was previously conducted by WSP Australia for the proposed operation of the facility (report reference PS106787-ACG-REP-001 Rev4 dated May 2018). The proposed facility was assessed in accordance with the current Noise Policy for Industry.

The noise assessment concluded that the most stringent noise trigger level (35 dB $L_{Aeq\ (15\ min)}$) is applicable for the proposed development at certain receivers due to the proposed 24-hour operations. The noise modelling and assessment considered the noise sources as outlined in Table 2.8.

The noise assessment concluded that four sensitive receivers were predicted to exceed the most stringent trigger levels by up to 5 dB. An assessment of feasible and reasonable mitigation measures were undertaken and it was concluded that applying treatment at the receiver property was likely to represent the most feasible and reasonable option due to the exceeding receivers being spaced at least 300 metres apart (i.e. considered isolated). Such spacing between receivers implies that the implementation of noise barriers as an appropriate source control is not likely to be feasible.

It is noted that in the absence of specific noise mitigation measures such as stringent noise source controls and barriers, the noise assessment found that compliance against the 35 dB $L_{Aeq\ (15\ min)}$ trigger level was achievable at approximately 1.1 to 1.5 kilometres from the acoustic centre of the facility under the worst case scenario.

Table 2.8 Assessed sound power levels – Pacific National Logistics Terminal (WSP, 2018)

EQUIPMENT	NUMBER OF ITEMS	SOUND POWER LEVEL, dBA	DURATION OF USE OVER 15 MINUTE PERIOD
Locomotive shifter	1 shifter moving 1 locomotive	95	2 min
Locomotive 10 km/h	2 locomotives at 10 km/h up to position and then idling	106 (per locomotive)	Moving source at 10 km/h on southern access track
Locomotive idling		100	Remaining time (~12 min)
Locomotive 20 km/h on access track	2 locomotives travel at 20 km/h on the northern access track	106 (per locomotive)	Locomotives take 7.5 minutes to travel the 2.5 km access track
Wagons 20 km/h on access track	1,800 m of wagons at 20 km/h on the northern access track	116	Wagons take 13 minutes to travel the 2.5 km access track
Diesel reach stacker	1	106	5 min

EQUIPMENT	NUMBER OF ITEMS	SOUND POWER LEVEL, dBA	DURATION OF USE OVER 15 MINUTE PERIOD
Scissor lift	1	105	3 min
Forklift	1	106	3 min
Mobile crane	1	104	3 min
Truck 10 km/h	2 trucks at 10 km/h up to position and then idling	103	Moving sources at 10 km/h
Truck idling		95	Remaining time (~13 min)
Light vehicle 10 km/h	5	88	Moving sources at 10 km/h

2.3.5 PET FOOD PROCESSING FACTORY (TOTAL PTY LTD)

It is understood that approval has been granted by Parkes Shire Council (DA2018/132) for a 24-hour 7-day factory operation at Lot 97 DP655704. This site is located directly adjacent to the SCT Intermodal Terminal to the west.

A noise assessment was previously conducted for the proposed factory and information available from the associated report has been referenced in this study (Acoustik doc ref. 1807.002 – DA Report_r2 dated: 29 November 2018). The referenced sound power levels are summarised in Table 2.9.

Table 2.9 Assessed sound power levels – Total Pty Ltd pet food factory (Acoustik, 2018)

SOURCE	SOUND POWER LEVEL, dBA
Within Site building	
Multi Mill	104
Extruder	90
Dryer	100
Horizontal Mixer	70
Refrigeration Units (600W/unit)	79
Forklift – 3 Tonne	93
External to Building	
Air-Conditioning Units	65
Delivery truck Arrive/Depart	100
Cars Arrive/Depart from Carpark	93
Cars Accelerating in Carpark	93
Car Door Closing – $L_{A\ max}$	109

2.4 SUMMARY OF EXISTING AND APPROVED DEVELOPMENTS

The identified existing and approved developments are indicated in Figure 2.3. Based on the literature review undertaken for the various identified existing and approved developments within the SAP, the associated on-site noise impacts and/or applicable noise limits are summarised in Table 2.10.

Table 2.10 Summary of noise limits and likely impact associated with existing and approved developments

DEVELOPMENT	ON-SITE INDUSTRIAL NOISE TRIGGER LEVELS (MOST STRINGENT)	NEAREST COMPLIANCE LOCATION	COMMENTS
Westlime Quarry	39 dB $L_{Aeq\ (15\ min)}$ per EPL at Residence A 35 dB $L_{Aeq\ (15\ min)}$ per EPL at other receivers	'Residence A' – assumed to be 396 London Road	Various parts of the quarry site are located between approximately 220 metres and 1 kilometre from the assumed Residence A. This noise assessment will assume the quarry is compliant to the EPL limit.
SCT Intermodal Terminal	35 dB $L_{Aeq\ (15\ min)}$ per noise impact assessment by GHD	Residence approximately 850 metres to the northeast	Compliance predicted to be achievable at 850 metres.
Goonumbla Solar Farm	35 dB $L_{Aeq\ (15\ min)}$ per noise impact assessment by AMG	Residence approximately 70 metres to the south	Compliance predicted to be achievable at 70 metres.
Parkes Solar Farm	35 dB $L_{Aeq\ (15\ min)}$	Residence approximately 300 metres to the north	Compliance predicted to be achievable at ≤70 metres, on the assumption that this solar farm uses similar systems as the Goonumbla Solar Farm.
Inland Rail P2N	N/A	N/A	Project assessed in accordance with Rail Infrastructure Noise Guidelines, but not as an on-site industrial noise.
Pacific National Logistics Terminal	35 dB $L_{Aeq\ (15\ min)}$	Residences approximately 500 meters to the northeast and southwest of site boundary	Four residential receivers predicted to exceed trigger levels. The most feasible and reasonable mitigation was determined to be receiver property treatment.
Total Pty Ltd pet food factory	35 dB $L_{Aeq\ (15\ min)}$	1.2 kilometres to the northwest	Compliance predicted to be achievable at 1.2 kilometres.

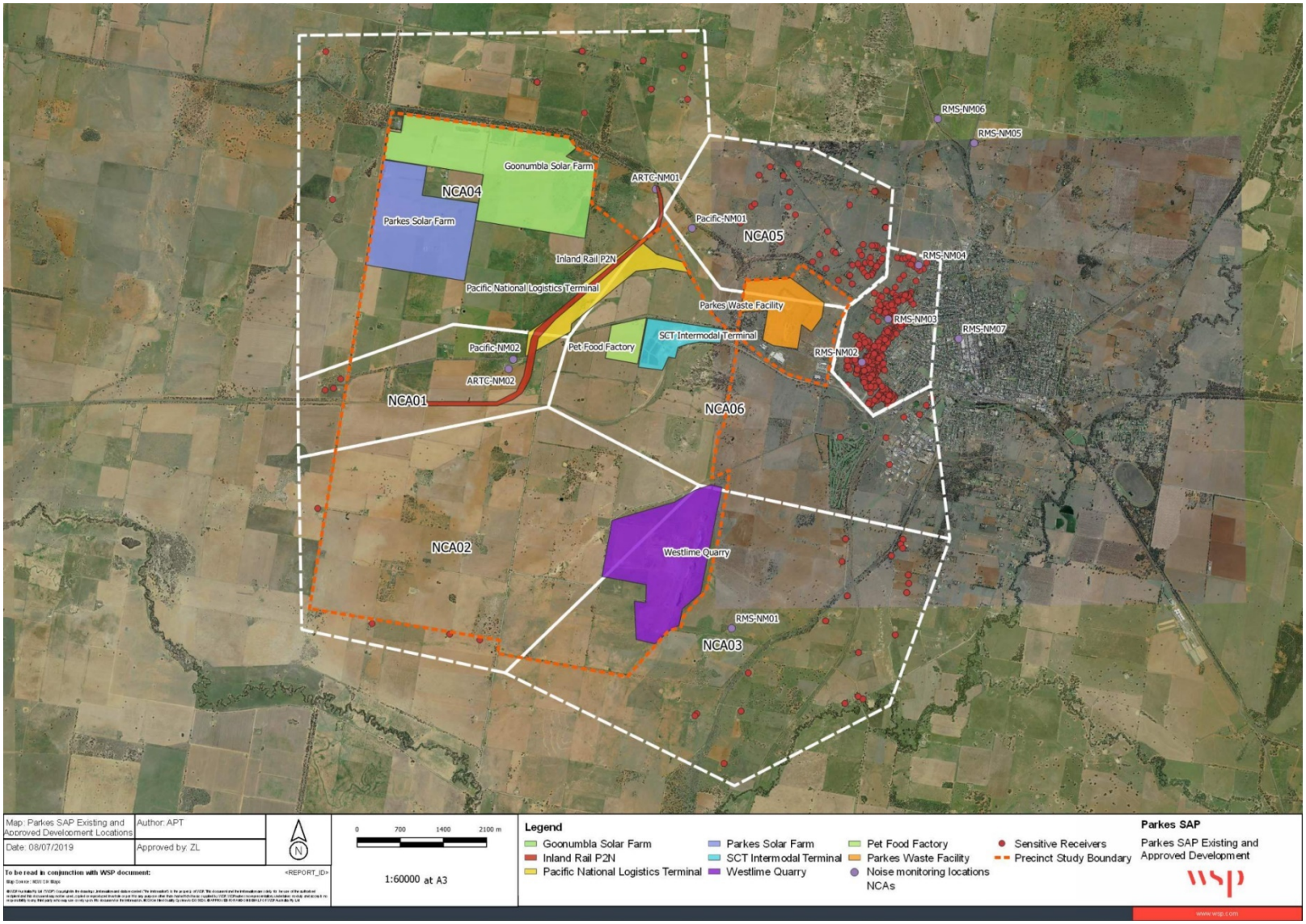


Figure 2.3 Existing and approved developments within the SAP

3 EXISTING NOISE ENVIRONMENT

This section provides a summary of the relevant baseline noise data, including the location, dates, and measured noise levels. As there have been several projects recently during which WSP has conducted unattended noise monitoring surrounding the SAP, it is proposed to use these results in lieu of conducting new monitoring. The details of these are discussed in the following sections. All the noise monitoring locations are collated and presented in Figure 2.1.

3.1 PACIFIC NATIONAL PARKES LOGISTICS TERMINAL

Noise logging was conducted for the Parkes Intermodal terminal between 29 November 2017 and 18 December 2017, the measured ambient noise level as presented in Pacific National's Parkes Intermodal facility are reported in Table 3.1.

Table 3.1 Unattended noise measurement results – Ambient and background noise (Pacific National)

LOCATION	MEASURED NOISE LEVELS, dBA					
	Day 7 am–6 pm		Evening 6 pm–10 pm		Night 10 pm–7 am	
	$L_{eq,15min}$	RBL	$L_{eq,15min}$	RBL	$L_{eq,15min}$	RBL
PACIFIC-NM01	56	33	52	33	56	32
PACIFIC-NM02	53	28	52	26	45	24

It is noted that under the NSW NPfI, where daytime noise levels are below 35 dBA, and evening and night-time levels below 30 dBA, that they be set instead to 35 dBA for day, and 30 dBA for evening and night instead.

3.2 ARTC INLAND RAIL PARKES TO NARROMINE

The Parkes to Narromine component of Inland Rail reported the following unattended measured noise levels at the identified representative receiver locations.

Table 3.2 Unattended noise measurement results – Ambient and background noise (Inland Rail – Parkes to Narromine)

LOCATION	MEASURED NOISE LEVELS, DBA					
	Day 7 am–6 pm		Evening 6 pm–10 pm		Night 10 pm–7 am	
	$L_{eq,15min}$	RBL	$L_{eq,15min}$	RBL	$L_{eq,15min}$	RBL
ARTC-NM01	55	35	52	34	56	32
ARTC-NM02	45	35	44	30	41	30

3.3 ROADS AND MARITIME PARKES BYPASS

Unattended noise monitoring results for Parkes Bypass are presented in Table 3.3.

Table 3.3 Unattended noise measurement results – Ambient and background noise (Parkes Bypass)

MEASUREMENT LOCATION	MEASURED NOISE LEVEL, dBA					
	Day 7 am–6 pm		Evening 6 pm–10 pm		Night 10 pm–7 am	
	$L_{eq(Day)}$	RBL	$L_{eq(Evening)}$	RBL	$L_{eq(Night)}$	RBL
RMS-NM01	52	33	49	31	40	30
RMS-NM02	54	39	52	37	47	31
RMS-NM03	58	41	56	38	50	32
RMS-NM04	56	37	48	31	48	30
RMS-NM05	61	40	60	32	57	30
RMS-NM06	51	31	48	30	47	30
RMS-NM07	66	51	65	45	61	35

In relation to the rating background level (RBL), it is noted that under the NSW NPfI, where daytime noise levels are below 35 dBA, and evening and night-time levels below 30 dBA, that they be set instead to 35 dBA for day, and 30 dBA for evening and night.

4 ASSESSMENT CRITERIA

The following sections provide an overview of the assessment criteria applicable to the proposed SAP. In general, the assessment criteria have been established with reference to the following guidelines, policies, and standards:

- NSW Environment Protection Authority (EPA) – Noise Policy for Industry (NPfI) (2017).
- NSW Department of Environment and Climate Change (DECC) – Interim Construction Noise Guideline (ICNG) (2009).
- NSW Department of Environment and Climate Change (DECC) – Road Noise Policy (RNP) (2011).
- NSW Environment Protection Authority (EPA) – Rail Infrastructure Noise Guideline (RING) (2013).
- NSW Department of Environment and Conservation (DEC) – Assessing Vibration: A Technical Guideline (AVTG) (2006).
- British Standard BS 7385-2:1993 – Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration (1993).

4.1 CONSTRUCTION NOISE

The ICNG details construction noise and vibration criteria for general construction activities. The ICNG uses noise management levels (NML) to determine the noise level at which reasonable and feasible noise management and mitigation should be implemented for the project.

Table 4.1 defines how the noise management levels are applied for residential receivers. They are based on existing RBLs in the vicinity of Parkes SAP plus an additional allowance of 10 dB during the recommended standard hours for construction work and 5 dB outside these hours. Residents deemed likely to be affected by noise where the NML are exceeded. If the predicted noise levels exceed 75 dBA, then residents are deemed to be 'highly affected' and require additional considerations to mitigate potential impacts.

Table 4.1 Construction noise management levels for residential receivers and working hours (Source: Table 2 of the NSW ICNG)

TIME OF DAY	NML dBA $L_{eq;15\ minute}$ [1,2]	HOW TO APPLY
Recommended standard hours: Monday – Friday 7 am – 6 pm Saturday 8 am – 1 pm 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 dBA $L_{eq;15\ minute}$ 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 of any development works within the SAP 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.

TIME OF DAY	NML dBA $L_{eq;15\ minute}$ [1,2]	HOW TO APPLY
	Highly noise affected 75 dBA	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: — times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) — 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 of any development works within the SAP 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 5 dB above the noise affected level, the proponent of any development works within the SAP should negotiate with the community.

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

(2) The RBL is the overall background noise level representing each assessment period (day/evening/night) over the whole monitoring period. The term RBL is described in detail in the NSW NPfI.

Table 4.2 provides a summary of the applicable NML based on the background noise monitoring conducted. In addition, Table 4.3 lists the NML that have been adopted for non-residential sensitive receivers as required by the ICNG.

Table 4.2 Construction noise management levels for residential receivers

RECEIVER	RBL BASED ON NOISE MONITORING FROM PREVIOUS STUDIES (SECTION 3)	NOISE MANAGEMENT LEVELS, $L_{eq\ 15\ min}$ dBA			
		Day (SH)	Day (OOHW)	Evening (OOHW)	Night (OOHW)
NCA1	PACIFIC-NM02	45	40	35	35
NCA2	PACIFIC-NM02	45	40	35	35
NCA3	RMS-NM01	45	40	36	35
NCA4	PACIFIC-NM02	45	40	35	35
NCA5	PACIFIC-NM01	45	40	38	37
NCA6	RMS-NM01	45	40	38	37
NCA7	RMS-NM03	51	46	43	37

(1) SH = recommended standard working hours, OOHW = outside of recommended standard hours work as defined in Table 4.1

Table 4.3 Construction noise management levels for non-residential sensitive land uses

LAND USE	NOISE MANAGEMENT LEVELS, $L_{eq\ 15\ min}$ dBA Applies when properties are being used
School classrooms, places of worship	45 (internal)
Industrial	75 (external)
Passive recreation areas	60

4.2 ON-SITE OPERATIONAL NOISE

The assessment procedure for industrial noise sources has three components:

- controlling intrusive noise impacts in the short-term for residences
- maintaining noise level amenity for particular land uses for residences and other land uses
- assessment of sleep disturbance for residences.

In assessing the noise impact of industrial sources, all three components must be taken into account for residential receivers. In most cases, only one will become the limiting criterion and form the project trigger levels for the industrial source under assessment. Assessment of on-site noise sources is guided by NPfI, which is applicable to industrial noise sources from activities listed in Schedule 1 of the *Protection of the Environment Operations Act 1997* (POEO Act). In general, the types of premises (noise sources) dealt with in NPfI include:

- industrial premises
- extractive industry premises
- commercial premises (generally limited to noise from heating, ventilation, air conditioning and refrigeration, and energy generation equipment)
- warehousing premises
- maintenance and repair facility premises
- intensive agricultural and livestock premises, for example, cattle feedlots and poultry farms
- utility generation/reticulation service premises, for example, energy generation from sources other than wind.

It is also noted that NPfI does not apply to:

- vehicles associated with an industrial premise that are on a public road
- transportation corridors (roadways, railways, waterways and air corridors)
- noise from sporting facilities, including motor sport facilities
- construction activities
- noise sources covered by regulations (domestic/neighbourhood noise)
- blasting activities
- shooting ranges
- internal or occupational noise within any workplace regulated by SafeWork NSW
- wind farms
- amplified music/patron noise from premises including those licensed by Liquor and Gaming NSW.

4.2.1 PROJECT INTRUSIVENESS NOISE LEVEL

The project intrusiveness noise level for residential receivers prescribed in the NSW NPfI is summarised as:

$L_{Aeq;\ 15\ minute} \leq$ Rating Background Level (L_{A90}) + 5 dB(A)

Based on the RBLs as outlined in Section 2.3.5, the project intrusiveness noise level has been established for the proposed SAP in accordance with the NSW NPfI and is presented in Table 4.4.

Table 4.4 Established Project Intrusiveness Noise Level, residential receivers only (dB $L_{Aeq\ 15\text{-}min}$) (cumulative SAP noise levels)

RECEIVER LOCATION	TIME PERIOD[1]	RBL dBA	PROJECT INTRUSIVENESS NOISE LEVEL (RBL + 5 dB)
NCA1, NCA2, NCA4 (Monitoring location PACIFIC-NM02, Section 3)	Day	35[2]	40
	Evening	30[2]	35
	Night	30[2]	35
NCA3 (Monitoring location RMS-NM01, Section 3)	Day	35[2]	40
	Evening	31	36
	Night	30	35
NCA5 (Monitoring location PACIFIC-NM01, Section 3)	Day	35[2]	40
	Evening	33	38
	Night	32	37
NCA6 (Monitoring location RMS-NM01, Section 3)	Day	35[2]	40
	Evening	31	36
	Night	30	35
NCA7 (Monitoring location RMS-NM03, Section 3)	Day	41	46
	Evening	38	43
	Night	32	37
Within Parkes town (per monitoring location RMS-NM7, Figure 2.1)	Day	51	56
	Evening	45	50
	Night	35	40

(1) Day: the period from 7:00 am to 6:00 pm Monday to Saturday; or 8:00 am to 6:00 pm on Sundays and public holidays; evening: the period from 6:00 pm to 10:00pm; night: the remaining periods.

(2) In accordance with NPfI, where the measured rating background level is less than 30 dBA for the evening and night periods, it is set to 30 dBA. When it is found to be less than 35 dBA for the day period, it is set to 35 dBA.

4.2.2 PROJECT AMENITY NOISE LEVELS

To limit continuing increases in ambient noise levels (i.e. background noise level creep), the maximum amenity noise level within an area from industrial noise sources should not normally exceed the amenity noise levels prescribed in the NSW NPfI. For this assessment, the proposed SAP will be considered as one development comprising of separate parcels or noise characteristics. This includes considering the existing industrial noise-generating establishments within and will form part of the SAP. The project amenity noise level nominated here is therefore applicable for the whole precinct rather than individual parcels.

To account for other industrial establishments outside of the SAP that could potentially be impacting on existing receivers in the assessment area, the amenity noise level applicable for the SAP has been determined based on the following per NPfI:

Project amenity noise level = recommended amenity noise level (Table 2.2 of NSW NPfI) minus 5 dB(A)

The established amenity criteria applicable to the proposed development are presented in Table 4.5.

Table 4.5 Established Project Amenity Noise Level (cumulative SAP noise levels)

LOCATION	TYPE OF RECEIVER	RECOMMENDED AMENITY NOISE LEVEL (ANL) dB $L_{eq\ period}$	PROJECT AMENITY NOISE LEVEL (ANL -5 dB) dB $L_{eq\ period}$[1]	PROJECT ADJUSTED ANL dBA $L_{eq\ period}$		
				Day	Evening	Night
NCA1-7	Residential – rural	Day: 50 Evening: 45 Night: 40	Day: 45 Evening: 40 Night: 35	45	40	35
NCA6	Active recreation area	55 (when in use)	50	**50 (when in use)**		
NCA6	Industrial	70 (when in use)	65	**65 (when in use)**		
Possible other land uses (trigger levels apply when premises are in use)	School classroom	35 (internal, noisiest hour)	30	**30**		
	Place of worship	40 (internal)	35	**35**		
	Passive recreation	50	45	**45**		
	Commercial	65	60	**60**		

(1) A -5 dB factor is applied to ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area.

It should be noted that the determined amenity noise levels above are applicable to the cumulative noise impact associated with all existing and future establishments within the proposed SAP, but not for individual establishments. The NPfI contains guidance in prescribing amenity noise levels for each individual establishment as follow:

Individual site's amenity noise level $= 10x\ Log_{10}\left(\frac{10^{(ANL-5)/10}}{N}\right)$, (where N = number of proposed additional premises)

As the total number of establishments within the SAP is not yet established, amenity noise levels applicable for individual establishments can yet be determined. As an example, however, assuming that there is a total of 20 individual establishments within the SAP (including existing and future uses), the project amenity noise level applicable for each site during the night period would be:

Individual site's amenity noise level (example) $= 10x\ Log_{10}\left(\frac{10^{(40-5)/10}}{20}\right)$

$= 22$ dBA

In this example, the calculated amenity noise level is applicable to each individual site. This implies that sites located further away from certain receivers will have the ability to generate more noise due to additional noise reduction achieved through distance, compared to sites located closer to the same group of receivers.

4.2.3 PROJECT NOISE TRIGGER LEVEL

In assessing the noise impact of the proposed development on surrounding residential receivers, both the intrusiveness and amenity criterion must be considered. In most cases, only one criterion will become the limiting criterion and form the project noise trigger levels (PNTL) for the industrial source under assessment.

It is noted that, in order to standardise the time periods for the intrusiveness and amenity noise levels, the following conversion between $L_{eq\ period}$ and $L_{eq\ 15\ min}$ has been applied (as per Section 2.2 of the NSW NPfI):

$$\mathbf{L_{Aeq\ 15min} = L_{Aeq\ period} + 3\ dB}$$

As required in Section 2.2 of the NSW NPfI, all project noise trigger levels and limits are expressed as $L_{Aeq\ (15min)}$, unless otherwise expressed. A summary of all relevant criteria is presented in Table 4.6.

Table 4.6 Summary of Project Noise Trigger Levels (PNTL) (cumulative SAP noise levels)

RECEIVER LOCATION	ASSESSMENT/ RECEIVER TYPE	PROJECT NOISE TRIGGER LEVELS dBA $L_{eq\ 15\ min}$		
		Day[1]	Evening[1]	Night[1]
NCA1, NCA2, NCA4 Residential	*Intrusiveness*	*40*	*35*	*35*
	Amenity	*48*	*43*	*38*
	PNTL – Residential	**40**	**35**	**35**
NCA3 Residential	*Intrusiveness*	40	36	35
	Amenity	*48*	*43*	*38*
	PNTL – Residential	**40**	**36**	**35**
NCA5 Residential	*Intrusiveness*	40	38	37
	Amenity	*48*	*43*	*38*
	PNTL – Residential	**40**	**38**	**37**
NCA6 Residential	*Intrusiveness*	40	36	35
	Amenity	*48*	*43*	*38*
	PNTL – Residential	**40**	**36**	**35**
NCA6 Active recreation	**PNTL**	**53**		
NCA6 Industrial	**PNTL**	**68**		
Residential NCA7	*Intrusiveness*	46	43	37
	Amenity	*48*	*43*	*38*
	PNTL – Residential	**46**	**43**	**37**

(1) Day: the period from 7:00 am to 6:00 pm Monday to Saturday; or 8:00 am to 6:00 pm on Sundays and public holidays; evening: the period from 6:00 pm to 10:00pm; night: the remaining periods.

4.2.4 GUIDANCE ON MANAGING ATTENTION-DRAWING NOISE CHARACTERISTICS

Certain noise characteristics have a higher potential to cause annoyance, generally requiring additional considerations. Tonality, low frequency emphasis and intermittency are generally considered to be attention-drawing and can cause greater disturbance. On the other hand, short-term single noise events are likely to be less disturbing and may warrant some relaxation in the applicable noise criteria.

To address these scenarios, the NPfI prescribes specific modifying factors in the assessment of the relevant noise events, as summarised in Table 4.7.

Table 4.7 Noise Policy for Industry (2017) – modifying factor corrections

FACTOR	ASSESSMENT/ MEASUREMENT	WHEN TO APPLY	CORRECTION (ADDED/ SUBTRACTED TO THE MEASURED/ PREDICTED LEVEL)[1]	COMMENTS
Tonal Noise	One-third octave or narrow band analysis	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: — 5 dB or more if the centre frequency of the band containing the tone is in the range of 500 to 10000 Hz. — 8 dB or more if the centre frequency of the band containing the tone is 160 to 400 Hz inclusive. — 15 dB or more if the centre frequency of the band containing the tone is in the range of 25 to 125 Hz.	+5 dB[2]	Third octave measurements should be undertaken using unweighted or Z-weighted measurements. Note: Narrow-band analysis using the reference method in ISO1996-2:2007, Annex C may be required by the consent/regulatory authority where it appears that a tone is not being adequately identified, e.g. where it appears that the tonal energy is at or close to the third octave band limits of contiguous bands.
Low-frequency noise	Measurement of C-weighted and A-weighted level	— Measure to assess C- and A-weighted levels over same time period. Correction to be applied if the difference between the two levels is 15 dB or more and: — Where any of the one-third octave noise levels are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dBA positive adjustment applies for the evening and night periods.	+5 dB[2]	A difference of 15 dB or more between C- and A-weighted measurements identifies the potential for an unbalance spectrum and potential increased annoyance. The values in Table C2 are derived from Moorhouse (2011) for DEFRA fluctuating low-frequency noise criteria with corrections to reflect external assessment locations.

FACTOR	ASSESSMENT/ MEASUREMENT	WHEN TO APPLY	CORRECTION (ADDED/ SUBTRACTED TO THE MEASURED/ PREDICTED LEVEL)[1]		COMMENTS
		— Where any of the one-third octave noise levels are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dBA positive adjustment applies for the daytime period.			
Intermittent Noise	Subjectively assessed but should be assisted with measurement to gauge extent of change in noise level.	The source noise heard at the receiver varies by more than 5 dBA and the intermittent nature of the noise is clearly audible.	+5 dB, applied for night time only		Adjustment to be applied for night-time only.
Duration	Single-event noise duration	One event in any 24-hour period, with duration as below.	Night	Day and evening	The project noise trigger level may be increased by an adjustment depending on duration of noise (see Table C3).
		1 to 2.5 hours	0	-2	
		15 min to 1 hour	0	-5	
		6 min to 15 min	-2	-7	
		1.5 min to 6 min	-5	-15	
		Less than 1.5min	-10	-20	

(1) Where two or more modifying factors are present, the maximum correction is limited to 10 dB.

(2) Where a source emits noise which has both tonal and low-frequency components, only one 5 dB correction should be applied.

4.3 SLEEP DISTURBANCE

Work activities taking place at night have the potential to disturb people's sleep patterns. Sleep disturbance is considered for operation and construction activities based on the guidelines as follows.

The potential for sleep disturbance from maximum noise level events and operational noise during the night-time period is detailed in the NPfI. The operational sleep disturbance criteria for developments within Parkes SAP area at the nearest residential locations are the following:

- $L_{eq,\ 15min}$ 40 dBA or the rating background level plus 5 dB, whichever is the greater, and/or
- L_{Fmax} 52 dBA or the rating background level plus 15 dB, whichever is the greater.

Where the development night-time noise levels at a residential location exceed the following, a detailed maximum noise level event assessment should be undertaken.

Based on the measurements detailed in Section 2.3.5, the external sleep disturbance criteria are as follows for all residential receivers:

- $L_{eq,\ 15min}$ 40 dBA and L_{Fmax} 52 dBA.

4.4 ROAD TRAFFIC NOISE

Developments within the SAP will generate additional vehicle movements on the surrounding roads which have the potential to impact sensitive receivers along the identified access routes.

The application notes from the RNP detail the requirements for operation-generated traffic noise as follows:

- *For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies where the noise level without the development is within 2 dB of, or exceeds the relevant day or night noise assessment criterion.*

The consideration of mitigation is required where additional construction related traffic or operational off-site traffic on existing roads creates an increase of more than 2 dB at existing sensitive receivers.

Arterial and sub-arterial roads are assessed over day (7 am to 10 pm) and night (10 pm to 7 am) periods and local roads are assessed over a one hour period (typically the peak hour) within the respective day and night periods. Table 4.8 presents a summary of noise level criteria for the arterial, sub-arterial and local roads affected by additional traffic from land use developments and construction activities.

Table 4.8 Road traffic noise criteria for receivers on existing roads affected by the additional traffic from land use developments

ROAD TYPE	EXTERNAL ROAD TRAFFIC NOISE CRITERIA[1]	
	Day 7 am – 10 pm	Night 10 pm – 7 am
Freeway/arterial/sub-arterial roads	60 dB $L_{Aeq\ 15hr}$	55 dB $L_{Aeq\ 9hr}$
Local roads	55 dB $L_{Aeq\ 1hr}$	50 dB $L_{Aeq\ 1hr}$

(1) Façade corrected noise levels

4.5 RAIL TRAFFIC NOISE

The proposed SAP has the potential to introduce additional rail traffic in the existing and future rail infrastructure. Any such rail noise change is assessable under RING. RING provides guidance in relation to environmental assessment requirements for rail traffic-generating developments (RING Appendix 2). This is extracted and summarised in the following:

- Identify the typical offset distance/s of sensitive receivers from the rail line/s that are likely to be affected by increased rail movements.
- Quantify the existing level of rail noise at the offset distance/s identified above using the noise descriptors $L_{Aeq,15/9hr}$ and L_{Amax} (95th percentile) dB.
- Predict the cumulative rail noise level (i.e. from the existing and proposed rail movements) using a calibrated noise model (based on predicted increased rail movements) at the offset distances identified above.
- Compare the cumulative noise level with the rail noise assessment trigger levels: 65 dB $L_{Aeq\ 15hr}$, 60 dB $L_{Aeq\ 9hr}$, and 85 dB L_{Amax} (95th percentile).
- Implement all feasible and reasonable noise mitigation measures where the cumulative noise level exceeds the noise assessment trigger levels and project-related noise increases are predicted.
- Where the L_{Aeq} noise level increases are more than 2 dB, which is equivalent to approximately 60 per cent of the total line or corridor rail traffic, and exceeds the relevant noise assessment trigger level, strong justification should be provided as to why it is not feasible or reasonable to reduce the increase.

RING also notes the following:

- A project-related noise increase is an increase of more than 0.5 dB over the day or night periods.
- The geographical extent of the rail noise assessment ideally should be where project-related rail noise increases are less than 0.5 dB. This roughly equates to where project-related rail traffic represents less than 10 per cent of the total line or corridor rail traffic.

4.6 VIBRATION

Operational and construction vibration can lead to:

- cosmetic building damage (and structural damage in extreme cases)
- loss of amenity due to perceptible vibration, termed human comfort
- impacts on the condition and structural integrity of key infrastructure.

Importantly, cosmetic damage is regard as minor in nature; it is readily repairable and does not affect a building's structural integrity. It is described 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. If there is no significant risk of cosmetic building damage, then structural damage is not considered a significant risk and is not assessed.

4.6.1 COSMETIC DAMAGE

There is not Australian Standard that provides guidance for cosmetic damage due to vibration. Therefore, the evaluation of vibration in relation to cosmetic damage to buildings form vibrational energy is proposed to be conducted in accordance with British Standard BS 7385-2:1993 – Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration. Table 4.9 presents the guideline limits for cosmetic damage for short term vibration.

Table 4.9 Transient vibration guide values for cosmetic damage (BS 7385)

TYPE OF BUILDING	PEAK COMPONENT PARTICLE VELOCITY IN FREQUENCY RANGE OF PREDOMINANT PULSE	
	4 – 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Note: values referred to are at the base of the building

The guide values in Table 4.9 relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings. Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in Table 4.9 may need to be reduced by up to 50%.

4.6.2 HUMAN COMFORT

Table 4.10 presents the limits (vibration dose values) above which it is considered there is a risk that the amenity and comfort of people occupying buildings would be affected by vibration from construction works. These limits are taken from the NSW Assessing vibration: a technical guideline (AVTG).

Table 4.10 Vibration limits (human exposure) for intermittent vibration

LOCATION	DAY 7 am – 10 pm		NIGHT 10 pm – 7 am	
	Preferred	Maximum	Preferred	Maximum
Critical areas	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Schools, educational institution	0.40	0.80	0.40	0.80
Places of worship	0.40	0.80	0.40	0.80

The vibration guideline also specifies limits for continuous and impulsive vibration. These vibration limits are expressed in acceleration (m/s^2) and peak particle velocity (mm/s) as presented in Appendix C of AVTG, reproduced in Table 4.11.

Table 4.11 Preferred and maximum values for continuous and impulsive vibration

LOCATION	ASSESSMENT PERIOD	RMS ACCELERATION m/s^2				PEAK PARTICLE VELOCITY mm/s	
		Preferred Values		Maximum Values		Pref. values	Max. values
		z-axis	x and y axes	z-axis	x and y axes		
Continuous Vibration							
Critical areas	All	0.0050	0.0036	0.010	0.0072	0.14	0.28
Residences	Day 7 am – 10 pm	0.010	0.0071	0.020	0.017	0.28	0.56
	Night 10 pm – 7 am	0.007	0.005	0.014	0.010	0.20	0.40
Schools, educational institutions	All	0.020	0.014	0.040	0.028	0.56	1.1
Places of worship	All	0.020	0.014	0.040	0.028	0.56	1.1
Impulsive vibration							
Critical area	All	0.0050	0.0036	0.010	0.0072	0.14	0.28
Residences	Day 7am – 10pm	0.3	0.21	0.60	0.42	8.6	17.0
	Night 10pm – 7am	0.10	0.071	0.20	0.14	2.8	5.6
Educational institutions	All	0.64	0.46	1.28	0.92	18.0	36.0
Places of worship	All	0.64	0.46	1.28	0.92	18.0	36.0

5 CONSTRUCTION NOISE AND VIBRATION

This section provides a preliminary review and qualitative assessment of potential construction noise and vibration impact associated with the proposed SAP.

5.1 TYPICAL ASSESSMENT PROCESS

Noise and vibration generated during construction is generally subject to assessment by EPA's ICNG as discussed in Section 4.1. General guidance on its assessment and management are also provided by other agencies such as:

- NSW Transport for NSW (TfNSW) – Construction Noise and Vibration Strategy (TfNSW CNVS) (2018).
- NSW Roads and Maritime Services (Roads and Maritime) – Construction Noise and Vibration Guideline (RMS CNVG) (2016).

As indicated in Section 2.1, future establishments within the SAP are likely to be in proximity to various sensitive receivers. Potential construction noise and vibration impacts on these receivers should therefore be considered.

The ICNG broadly nominates the following steps in assessing and managing construction noise:

1. identify sensitive land uses that may be affected
2. identify hours for the proposed construction works
3. identify noise impacts at sensitive land uses
4. select and apply the best work practices to minimise noise impacts.

5.2 MITIGATION AND MANAGEMENT MEASURES

A construction noise and vibration management plan should be developed for Parkes SAP (overall project as well as for specific sites) prior to commencement of works. Such requirement is generally consistent with development consent granted for other recent projects within the SAP. The management plan would utilise detailed construction methodologies of the contractor and would at a minimum include:

- identified nearby residences and other sensitive land uses
- approved hours of work and what work will be undertaken
- significant noise and vibration generating activities
- details of noise mitigation and management measures to be applied
- information for worker training to minimise noise impacts
- community consultation protocol(s)
- complaints handling protocol(s)
- construction works should be planned and carried out during standard construction hours wherever possible.

The following sections present standard mitigation measures contained within the TfNSW CNVS, which deals with similar types of project to Parkes SAP which should be considered as mitigation measures as part of the noise management plan. It should be noted that these are generally generic in nature and is subject to further assessment and review.

5.2.1 MANAGEMENT CONTROLS

The mitigation management measures outlined in Table 5.1 should be implemented and incorporated into development standards where reasonable and feasible to reduce the disturbance to the nearby receivers during construction.

Table 5.1 Management controls

ACTION	DETAILS
Working hours	Construction activities should be undertaken during recommended standard hours unless otherwise approved. To be included in Induction and Pre Start Briefings, Toolbox Talks etc. Work generating high noise levels should be scheduled during less sensitive time periods.
Implementation of any project specific mitigation measures required.	In addition to the measures set out in this table, any project specific mitigation measures identified in this report.
Implement community consultation measures	Periodic notification (monthly letterbox drop or equivalent), website, Project Infoline, Construction Response Line, email distribution list.
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: — all relevant project specific and standard noise and vibration mitigation measures — relevant licence and approval conditions — permissible hours of work — any limitations on high noise generating activities — location of nearest sensitive receivers — construction employee parking areas — designated loading/unloading areas and procedures — site opening/closing times (including deliveries) — environmental incident procedures.
Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors.
Noise monitoring	A noise monitoring program should be carried out for the duration of works in accordance with the Construction Noise and Vibration Management Plan.
Vibration monitoring	Attended vibration measurements shall be undertaken at all buildings within 20 metres of vibration generating activities when these activities commence to confirm that vibration levels are within the acceptable range to prevent cosmetic building damage.
Respite periods	Restricting time when noisy work is carried out. High noise and vibration generating activities may only be carried out in continuous blocks, not exceeding 3 hours each, with a minimum respite period of 1 hour between each block.

5.2.2 SOURCE CONTROLS

The source noise mitigation measures outlined in Table 5.2 should be implemented and incorporated into development standards where reasonable and feasible to reduce the disturbance to the nearby receivers during the project.

Table 5.2 Source controls

ACTION	DETAILS
Equipment selection	All fixed plant at the work sites should be selected to be as quiet as practicable and where required, fitted with silencers, acoustical enclosures and other noise attenuation measures.
Equipment selection	Use quieter and less vibration emitting construction methods where feasible and reasonable.
Maximum noise levels	The noise levels of plant and equipment must have operating sound power or sound pressure levels that would meet the predicted noise levels.
Rental plant and equipment	Noise emissions should be considered as part of the selection process.
Use and siting of plant	Avoid simultaneous operation of noisy plant within discernible range of a sensitive receiver. The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Plant and vehicles to be turned off when not in use. Noise-emitting plant to be directed away from sensitive receivers.
Plan worksites and activities to minimise noise	Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site. Prevent vehicles and plant queuing to access site.
Non-tonal reversing alarms	Non-tonal reversing beepers (or an equivalent mechanism) will be fitted and used on all construction vehicles and mobile plant used on site.
Minimise disturbance arising from delivery of goods to construction sites	Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers. Site access points and roads as far as possible away from sensitive receivers will be used. Dedicated loading/unloading areas to be shielded if close to sensitive receivers. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible. Delivery to occur during standard hours where possible.
Construction related traffic	Schedule and route vehicle movements away from sensitive receivers and during less sensitive times Limit the speed of vehicles and avoid the use of engine compression brakes Maximise on-site storage capacity to reduce the need for truck movements during sensitive times
Silencers on mobile plant	Where possible reduce noise from mobile plant through additional fittings including: — residential grade mufflers — damped hammers such as “City” Model Rammer Hammers — Air Parking brake engagement is silenced.
Hand tools	As much as practical the use of hand tools will be used in specifically designated areas as far as possible from sensitive receivers and preferably separated by a barrier. Metal on metal contact will be avoided where possible.

5.2.3 PATH CONTROLS

The noise mitigation path controls outlined in Table 5.3 outlined should be implemented to reduce the disturbance to the nearby receivers during the project.

Table 5.3 Path controls

ACTION	DETAILS
Shield stationary noise sources	Stationary noise sources should be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained.
Shield sensitive receivers from noisy activities	Use structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when situating plant.
Acoustic barriers	Erecting barriers on site at source where practical will be considered to reduce the impact of noise at receivers. AS 2436 identifies the options for barriers to reduce noise emissions from construction sites.

6 ON-SITE OPERATIONAL NOISE

This section describes the potential noise impacts associated with the operation of industries within Parkes SAP. This assessment is conducted for the selected final master plan.

6.1 PREVIOUSLY SHORTLISTED DEVELOPMENT SCENARIOS

The final master plan assessed in this report is a result of a thorough evaluation process of potential development options. Prior to its selection, up to seven possible development scenarios were identified and evaluated by the project team. Three of these were subsequently shortlisted for detailed assessment. The findings of the NVIA for these three shortlisted scenarios are reported in Appendix A.

Through further evaluation including an Enquiry by Design (EbD) process of the shortlisted scenarios, a final Master Plan is developed and selected for Parkes SAP (as discussed in the subsequent subsections).

6.2 SELECTED MASTER PLAN

The Master Plan developed and chosen for Parkes SAP consists of the following land uses as indicated in Figure 6.1:

- freight terminals
- regional enterprise
- intensive livestock agriculture
- energy (Solar)
- resources and recycling
- mixed enterprise
- commercial gateways
- green infrastructure.

Further information on the expected activities within each of the above land uses is presented in Section 6.3.

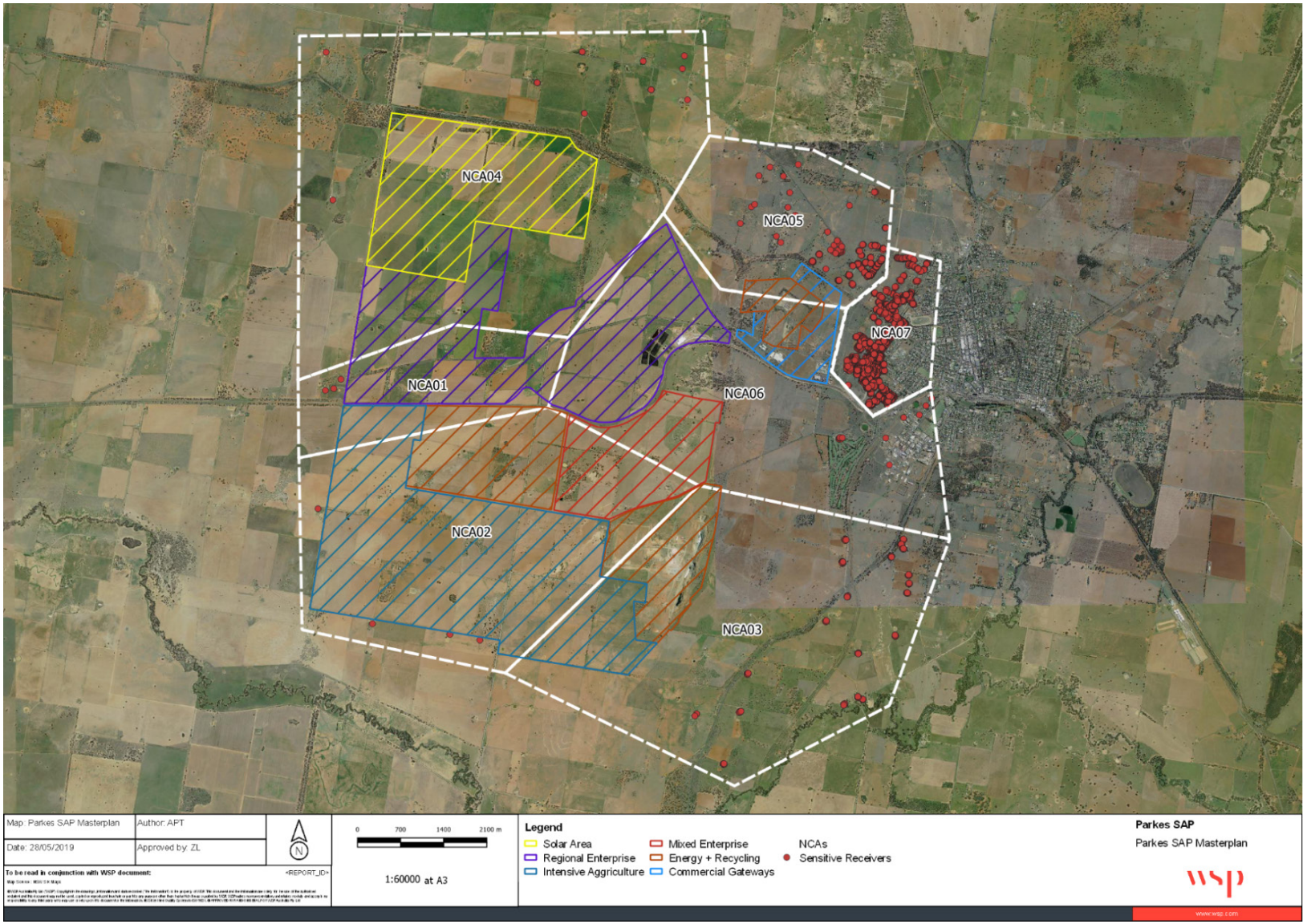


Figure 6.1 Parkes SAP Master Plan land uses

6.3 PROPOSED INDUSTRY TYPES AND LAND USES

Several industry types have been identified for the Parkes SAP in the Master Plan for the precinct. The assessed land use types are summarised in Table 6.1.

Table 6.1 Land use zone and sub-precinct preferred activities – Parkes SAP

INDUSTRY TYPE	PROPOSED ACTIVITIES	
Freight terminals	— Rail/road intermodal freight terminals (e.g. PN, SCT) — Rail siding — Rail provisioning, maintenance, refuelling, wagon maintenance — Container apron, storage and maintenance	— Grain storage — Fuel storage — Freight forwarding companies (e.g. Linfox, SCT; packing/unpacking and associated office) — Truck parking
Regional enterprise	— Advanced manufacturing e.g. food processing and packaging incl. grains, meat, plant, dairy, pet food etc. — Abattoir (factory based) — Data Centre — Distribution centres e.g. supermarket chains, retailers etc. — Warehouse — Container maintenance	— Related small enterprise/office — Truck fuelling, maintenance, truck parking, provisioning centre, sales — Mining services — Hazardous material storage — Large format wholesalers (e.g. mining, agricultural) — Customs facility
Intensive livestock agriculture	— Abattoir and associated holding pens, feedlots, waste treatment — Poultry farm, hatchery — Piggery — Irrigation	— Other intensive livestock growing/processing — Mushroom farm — Water treatment facility — Buffer
Energy (solar)	— Solar farm and associated infrastructure	
Resources and recycling	— Waste-to-energy plant – from small to large — Recycling	— Landfill — Buffer
Mixed Enterprise	— Moderate scale recycling, resource recovery — Agribusiness	— Mix of Regional Enterprise and Resources Recovery
Commercial Gateways	— Support retail — Service station — Takeaway food	— Café — Childcare Centre — Temporary workers' accommodation
Green infrastructure	— Protected vegetation — Offset planting areas, rehabilitation	— Stormwater treatment wetlands etc. — Green/biodiversity corridor

6.4 NOISE MODELLING PARAMETERS

A noise model was created using SoundPLAN 8 modelling software to predict the noise generated during typical operation conditions for both standard and noise-enhancing meteorological conditions. The adopted prediction method for the model was the CONCAWE method. Key modelling parameters and assumptions are shown in Table 6.2.

Table 6.2 Operational noise modelling inputs and assumptions

PARAMETER	MODELLING INPUT
Ground absorption	Ground absorption factors are set to 0 for all roads, hardstand and 0.75 for grass/ vegetation.
Terrain data	Terrain data have been provided by NSW DPIE (LiDAR) and NSW Land and Property Information.
Meteorological conditions	1 Standard conditions: Stability category D, 0.5 m/s wind from source to receiver. 2 Night: Stability category F, 2 m/s wind from noise source to receiver. Historical wind data indicates that the occurrence of light winds up to 3 m/s during stability categories A-D is not significant (<30%) and therefore is not considered (Appendix B).
Buildings	Sensitive receivers are generally modelled as points only. A cluster of existing residential buildings to the northeast of the SAP has been included.
Assessed sensitive receivers	Existing land uses – quantitative assessment for residential receivers outside of the indicated SAP development areas. Future land uses as part SAP – qualitative assessment only.
Receiver height	The receiver heights are set at 1.5 metres above ground level.
Location of noise sources	Across the entire indicated development areas of the SAP up to the external boundaries (for each scenario).
Modelled sound power levels	As described in Section 6.5 (noting limitations described below).
Assessment duration	15 minutes
Assumed hours of operations	It is assumed that all activities will occur at any time of day (day, evening, night).
Attention-drawing characteristics	It is assumed that received noise levels at sensitive receivers will be free from all attention-drawing characteristics that could attract a penalty as described in Section 4.2.4.
Possible limitations	1 The sound power levels adopted in this assessment were based on information obtained from a limited literature review of previous assessments conducted by WSP or other consultants. 2 It should however be noted that the modelled scenarios are likely to represent worst case acoustic scenarios as they assume the entire indicated developable areas to be fully developed and noise-generating. 3 The modelled area sources (as described in Section 6.5) assume an equally distributed sound power across the identified land parcels. This is considered an appropriate methodology considering the high level nature of the noise assessment. Further specific acoustic consideration of individual prominent noise generating items is recommended in future design stages (e.g. elevated exhaust stack, locomotive/ truck movements).

6.5 OPERATIONAL SOURCES AND ASSUMED NOISE LEVELS

To allow a cumulative impact assessment to include consideration of existing and future land uses, Parkes SAP has been modelled in conjunction with the existing and approved land uses within the SAP.

Sound power levels for the existing and approved land uses are modelled per discussed in Sections 2.2 and 2.2.3. The modelled sound power levels corresponding with the respective development scenarios are summarised in Table 6.3. As the exact build form, site configuration, positioning of noise sources are not known at the preliminary Structure Plan phase, noise sources representing the future developments have been modelled using area sources. Source sound power levels have been derived from noise reports for assumed similar land uses. The adopted assumptions in operational nature of respective equipment and activities are summarised in **Error! Reference source not found.**.

Table 6.3 Proposed land use sound power levels (based on likely activities in duration of 15 minutes)

PROPOSED FUTURE LAND USE	ASSUMED SOUND POWER LEVEL PER UNIT AREA (dBA/m^2)	DESCRIPTION
Regional enterprise, mixed enterprise	52	Generally dominated by on-site truck and forklift movements. Overall sound power level from external sources of 103 dBA over an area of approximately 576,000 m^2. Building area assumed to occupy approximately 20% of land area with an internal reverberation noise level of 85 dBA. Factory building of sheet metal building envelope construction.
Freight terminal	Per Pacific National Logistics Terminal as discussed in Section 2.3.4	
Protected cropping	48	Generally dominated by on-site truck and forklift movements. Overall sound power level from external sources of 103 dBA over an area of approximately 300,000 m^2.
Intensive livestock agriculture	55	Significant noise sources include on-site truck movements, exhaust fans, forklift or similar. Overall sound power level from external sources of 106 dBA over an area of approximately 150,000 m^2.
Waste to energy and recycling	59	Significant noise sources include on-site truck movements, exhaust fans, forklift/loader or similar, condensers, transformers. Overall sound power level from external sources of 114 dBA over an area of approximately 300,000 m^2.
Commercial gateway	50	Significant noise sources likely to be building services plant equipment. Does not account for service station noise sources, which will separately assessed/ discussed.

6.6 PREDICTED NOISE LEVELS ($L_{Aeq\ 15\ min}$)

The predicted noise levels at the nearest receivers for a typical 15-minute scenario are presented in Table 6.4.

Table 6.4 Predicted noise levels ($L_{Aeq\ 15\ min}$) at residential receivers – Parkes SAP on-site industrial noise

RECEIVER – NCA	PROJECT NOISE TRIGGER LEVEL (dB $L_{AEQ\ 15\ MIN}$)		PREDICTED NOISE LEVELS (dB $L_{Aeq\ 15\ min}$) AND ASSESSMENT	
			Predicted noise level	Exceedance[1]
NCA1 residential 3 properties	Day	40	57 to 59	17 to 19
	Evening	35	57 to 59	22 to 24
	Night	35	57 to 59	22 to 24
	Night (enhancing)	35	61 to 63	26 to 28
NCA2 residential 4 properties	Day	40	Up to 63	Up to 23
	Evening	35	Up to 63	Up to 28
	Night	35	Up to 63	Up to 28
	Night (enhancing)	35	Up to 66	Up to 31
NCA3 residential 20 properties	Day	40	27 to 48	-13 to 8
	Evening	36	27 to 48	-9 to 12
	Night	35	27 to 48	-8 to 13
	Night (enhancing)	35	31 to 52	-4 to 17
NCA4 residential 10 properties	Day	40	33 to 49	-7 to 9
	Evening	35	33 to 49	-2 to 14
	Night	35	33 to 49	-2 to 14
	Night (enhancing)	35	37 to 54	2 to 19
NCA5 residential 45 properties	Day	40	40 to 53	0 to 13
	Evening	38	40 to 53	2 to 15
	Night	37	40 to 53	3 to 16
	Night (enhancing)	37	44 to 56	7 to 19
NCA6 residential 45 properties	Day	40	Up to 40	Complies
	Evening	36	Up to 40	Up to 4
	Night	35	Up to 40	Up to 5
	Night (enhancing)	35	Up to 44	Up to 9
NCA6 active recreation	When in use	53	Up to 50	Complies
NCA6 industrial	When in use	68	Up to 47	Complies

RECEIVER – NCA	PROJECT NOISE TRIGGER LEVEL (dB $L_{AEQ\ 15\ MIN}$)		PREDICTED NOISE LEVELS (dB $L_{Aeq\ 15\ min}$) AND ASSESSMENT	
			Predicted noise level	Exceedance[1]
NCA7 residential >500 properties	Day	46	41 to 51	-5 to 5
	Evening	43	41 to 51	-2 to 8
	Night	37	41 to 51	4 to 14
	Night (enhancing)	37	45 to 55	8 to 18

(1) A negative value indicates compliance, while a positive value indicate exceedance.

Based on the predicted noise levels reported in Table 6.4 above, the following summarises the likely noise impact at existing receivers surrounding the proposed SAP:

- The assessed development scenario is predicted to notably exceed the NPfI project noise trigger levels at all NCAs. It should however be noted that the modelled scenario is likely to represent a worst case acoustic scenario as they assume the entire indicated developable areas to be fully developed and noise-generating.
- NCA1: three isolated residential receivers as close as 100 metres to the west of the SAP.
  - most stringent NPfI trigger levels applicable
  - exceedance of the trigger levels by up to 19 to 28 dB (dependent on assessment periods).
- NCA2: four isolated residential receivers as close as 40 metres to the west and south of the SAP.
  - most stringent NPfI trigger levels applicable
  - exceedance of the trigger levels by up to 23 to 31 dB (dependent on assessment periods).
- NCA3: 20 isolated residential receivers to the east and southeast of the SAP (as close as 1230 metres from SAP)
  - most stringent NPfI trigger levels generally applicable
  - exceedance of the trigger levels by up to 8 to 17 dB (dependent on assessment periods).
- NCA4: 10 isolated residential properties to the west, northwest and north of the SAP (440 metres to 2 kilometres)
  - most stringent NPfI trigger levels generally applicable
  - exceedance of the trigger levels by up to 9 to 19 dB (dependent on assessment periods).
- NCA5: approximately 45 residential properties, including isolated and closely-spaced receivers to the northeast of the SAP, as close as 140 metres.
  - generally less stringent noise trigger levels during evening and night periods
  - exceedance of the trigger levels by up to 13 to 19 dB (dependent on assessment periods).
- NCA6: receivers to the east of the SAP comprising of approximately 45 closely-spaced residential properties about 850 metres away, existing industrial establishments about 600 metres away and a golf course (active recreation) directly adjoining the SAP.
  - predicted noise impact compliant at all residential receivers during day period
  - exceedances of up to 4 to 9 dB during evening and night periods
  - predicted noise impact compliant at the existing industrial premises and at the golf course.
- NCA7: >500 closely-grouped residential receivers on the western part of the Parkes town, 260 metres to the east of the SAP
  - notably less stringent noise trigger levels during the day and evening periods
  - exceedance of the trigger levels by up to 5 to 18dB (dependent on assessment periods).

To provide a graphical representation of the predicted noise impacts, the following $L_{Aeq\ 15\ min}$ noise contour plots are presented in **Error! Reference source not found.**:

- standard meteorological conditions
- noise enhancing conditions, stability category F, 2 m/s wind from noise source to receiver.

6.7 MAXIMUM NOISE LEVEL ASSESSMENT ($L_{Amax\ 15\ min}$)

The assessment of the potential for sleep disturbance during the night-time period is detailed in the NPfI. Sleep disturbance risk is primarily assessed based on occurrence of maximum noise events due to transient noise source. Possible sources of maximum noise events are listed in Table 6.5, along with the associated approximate setback distance required to meet the L_{max} sleep disturbance screening criterion as discussed in Section 4.3.

Table 6.5 Transient maximum noise events and minimum distance for compliance

EVENT	MAXIMUM SOUND POWER LEVEL, dBA	SLEEP DISTURBANCE SCREENING CRITERION L_{FMAX}, dBA	COMPLIANCE DISTANCE (APPROXIMATE)	NCA(S) LIKELY TO EXCEED SCREENING CRITERION[1]
Train horn	145	52	> 10 kilometres	All NCAs
Pressure release safety valve	130		2 kilometres	All NCAs
Electrical circuit breaker	125		1 kilometre	All NCAs
Trucks air brake release	118		500 metres	NCA1, NCA2, NCA3, NCA5, NCA7
Containers banging noise	118		500 metres	NCA1, NCA2, NCA3, NCA5, NCA7
General material contact noise (e.g. being dropped)	118		500 metres	NCA1, NCA2, NCA3, NCA5, NCA7
Train passby	118		500 metres	NCA1, NCA2, NCA3, NCA5, NCA7
Reverse beepers	105		100 metres	NCA1, NCA2, NCA3

(1) Based on distance between receivers and nearest SAP boundary.

Based on the estimated distances above, it is determined that the proposed SAP is likely to cause maximum noise events that could lead to sleep disturbance at the surrounding residential receivers, assuming night operations.

6.8 MITIGATION ASSESSMENT

Due to the predicted exceedances of the trigger levels, consideration of mitigation strategies to reduce the likely noise impact is required. NPfI states that:

"*Where the project noise trigger level is exceeded, assess the feasible and reasonable mitigation measures that could be implemented to reduce noise down towards the relevant project noise trigger level. If it is reasonable to achieve these levels, the proponents should do so. If not, then achievable noise levels should be identified. It is not mandatory to achieve the trigger levels but the assessment should provide justification if they cannot be met. An assessment of the acceptability of residual impacts should also be provided.*"

Guidance is provided in NPfI in regard to definition of 'feasible' and 'reasonable' mitigation and this is described in Appendix E.

From an acoustic perspective, possible strategies to mitigate noise are typically investigated in the following order (decreasing preference):

1. Land use planning and provision of appropriate buffer distances.
2. Noise control at the noise source.
3. Noise control along the noise transfer path.
4. Noise control at the receiver.

It is also likely that a combination of various strategies will be required to provide the most feasible and reasonable acoustic outcome. These mitigation measures should be listed in the development standards for the Parkes SAP.

NPfI lists a generic list of mitigation measures and this is presented in Appendix E.

6.8.1 LAND USE PLANNING AND PROVISION OF APPROPRIATE BUFFER DISTANCES:

From an acoustic perspective, consideration to provide greater buffer distances between industrial/ noise-generating developments where possible is recommended. This however has its limitations and should be considered with factors other than acoustics.

Noise levels are relatively less sensitive to small variances in distances. A doubling or halving of buffer distances is typically required to provide notable noise level change. Theoretically, every doubling of buffer distance provides a noise reduction in the order of approximately 6 dB, which is demonstrated in the noise contour plots provided in **Error! Reference source not found.**.

Considering the currently predicted levels of exceedance as reported in Section 6.6, it is not considered feasible and reasonable to solely rely on buffer distances to improve the overall acoustic outcome as this will likely preclude significant land areas from development.

6.8.2 SOURCE CONTROLS

For most noise sources, noise control at the source is typically considered as most effective in improving the overall acoustic outcome at sensitive receivers. They can take many forms and some examples include (Table 6.6):

Table 6.6 Industrial noise – source controls

CONTROLS	EXAMPLE OF POSSIBLE ACOUSTIC BENEFIT[1]
Identify the dominant noise sources or noise sources that provide higher noise contribution and consider mitigation for them first.	Varies
Selecting the quietest possible equipment. For example, utilising electrically-powered machinery or equipment rather than traditional diesel-powered options where possible.	Varies >10 dB comparing electrically powered equipment against diesel-powered options.
Providing due considerations for noise sources to reduce or eliminate attention-drawing characteristics	Varies A +5 dB penalty is almost equivalent to doubling the setback distance for that specific noise source.
For fixed physical noise sources or equipment, provide suitable engineering solutions and/or additional physical construction to reduce noise emission. For example local noise barriers or sound-insulating enclosures, in-duct attenuator on external side of fans.	>15 dB reduction for full sound-insulating enclosure compared to no enclosure. >5 dB reduction if an exhaust fan is equipped with an attenuator.
Apply time restrictions to certain activities and/or certain sites. For example, consideration can be given to restricting/ prohibiting certain activities to be undertaken during evening and/or night period due to the generally more onerous noise trigger levels.	3 dB reduction in $L_{Aeq\ 15\ min}$ for every halving of the noise emission duration (for the respective noise contribution from the specific source). A 5 dB relaxation in noise trigger level is approximately equivalent to providing a halving of setback distance.
Provide building envelope constructions that afford better sound insulating properties. For example, this could include increasing the mass of the factory building construction (use of masonry construction instead of lightweight construction).	An improvement of 5 dB in sound insulation rating of the building envelope construction is almost equivalent halving the setback distance for that specific noise source.
Implementation and enforcement of specific management control measures to ensure noise generation is minimised where possible. For example, require on-site trucks' engine to be switched off and not left idling unnecessarily.	3 dB reduction in $L_{Aeq\ 15\ min}$ for every halving of the noise emission duration (for the respective noise contribution from the specific source).
Careful planning of site configuration to maximise shielding provided by building structures. For example, utilise a structure of a factory building to shield receivers from noise due to on-site trucks manoeuvre or loading/ unloading activities (also see Section 6.8.3).	>5 dB reduction if a building structure is relatively near the source and direct line of sight between noise source and receiver is blocked. >10 dB reduction in the direction of the sensitive receivers by positioning/ directing noise sources to be facing away from receivers.

CONTROLS	EXAMPLE OF POSSIBLE ACOUSTIC BENEFIT[1]
Mobile machineries should operate on suitable smooth-finished hardstands to minimise impulsive noise due to irregular/ rough ground surface finish.	>10 dB difference likely between movement over rough and smooth finish.
Site access road should be sealed and not loose gravel type as the latter will generate higher noise levels	
Sites should be designed for forward-in and forward-out movements to limit noise from reversing alarms	>10 dB noise benefit likely is reversing alarms are not required.
Warehouses should have auto rapid opening/ closing doors to allow forklifts/ vehicles to enter and exit whilst keeping doors closed	>15 dB noise benefit likely comparing a building façade opening with and without doors.
Sites should be designed to prevent the need from the vehicles sounding a horn to enter/ exit. Where possible, implement management measures to reduce amount of avoidable or noise events unnecessary for the operation of the sites.	>15 dB noise benefit likely if such noise events can be avoided.

(1) Assuming implementation of appropriate acoustic design measures. The stated possible noise reduction or acoustic benefit is only applicable to the noise contribution from the specific individual noise source only.

The provision of noise source mitigation is typically more challenging for non-stationary noise sources such as mobile machineries (forklifts, loaders or the like) and on-site truck/train locomotive movements and this is further discussed in Section 6.8.5.

6.8.3 PATH CONTROLS

This typically involves the investigation and implementation of noise barriers (in the form of walls or earth mound) to block direct line of sight between noise sources and receivers. Noise barriers are most effective when closer to the noise source or receiver. Implementation of noise barrier is considered more feasible and reasonable to provide protection for groups of closely-spaced receivers and not considered cost-effective for isolated receivers. Groups of closely-spaced receivers are located in both NCA5 and NCA6. The option of noise barriers can therefore be potentially considered in the north-eastern and eastern portions of the SAP.

In addition to specific noise walls or earth mounds to serve as noise barriers, one potential strategy is to utilise future industrial and commercial buildings as noise barriers. An example may be to require buildings on all land lots along the boundaries of the SAP in certain directions to be constructed adjoining each together at a certain height to act as a continuous noise barrier for noise generators within the SAP. Figure 6.2 and Figure 6.3 presents two examples of such strategy in other industrial sites in the state of Victoria (Dandenong and Scoresby). Such approach is beneficial and will encourage noise sources to be pointed in towards the SAP and not out towards the sensitive receivers.

Assuming appropriate and due considerations in acoustic design principles, a noise reduction of >5 dB can be expected with the implementation of an effective noise barrier.

Figure 6.2 Example of industrial – residential interface in Dandenong, Victoria

Figure 6.3 Example of industrial – residential interface in Scoresby, Victoria

6.8.4 RECEIVER CONTROLS (PROPERTY TREATMENT)

Subsequent to complete consideration of all source and pathway feasible and reasonable noise mitigation measures (as discussed in the preceding subsections), the NPfI allows for receiver property treatment to be considered for any residual noise impacts. The NPfI stated that receiver-based treatment is typically only applicable for isolated residences in rural areas and may include upgrade of various construction elements of the dwellings and voluntary property acquisition.

It is expected that consideration of property treatment or voluntary property acquisition can be considered as a feasible and reasonable option for NCA1 to NCA4 and part of NCA5 where residential properties are generally isolated.

Consistent with the noise assessment outcome for the Pacific National's facility as discussed in Section 2.3.4, accepting any possible exceedance of the external noise trigger levels at the existing residential receivers and pursuing receiver-based treatment is likely to be considered feasible and reasonable for the Parkes SAP. Provided that the required assessment and investigation process as per the NPfI is followed and appropriate community consultation is undertaken, a suitable acoustic outcome can likely be achieved while avoiding potentially onerous restrictions to development of future industries and land uses within the SAP.

In accordance with NPfI, a residual noise impact is defined as receivers with exceedances of the project noise trigger levels under the best-achievable acoustic outcome from a development. Residual noise impacts are identified after all source and pathway feasible and reasonable noise mitigation measures have been considered. The significance of the residual impact and the need to assess receiver-based treatment options may need to be considered as part of an authority's determination/approval process. The significance of residual noise impacts in accordance with NPfI and the possible associated level of receiver-based treatment they receive are summarised in Table 6.7 and Table 6.8.

Table 6.7 Significance of residual noise impacts – NPfI

IF THE PREDICTED NOISE LEVEL MINUS THE PROJECT NOISE TRIGGER LEVEL IS:	AND THE TOTAL CUMULATIVE INDUSTRIAL NOISE LEVEL IS:	THEN THE SIGNIFICANCE OF RESIDUAL NOISE LEVEL IS:
≤ 2 dB(A)	Not applicable	Negligible
≥ 3 but ≤ 5 dB(A)	< recommended amenity noise level or > recommended amenity noise level, but the increase in total cumulative industrial noise level resulting from the development is less than or equal to 1 dB	Marginal
≥ 3 but ≤ 5 dB(A)	> recommended amenity noise level and the increase in total cumulative industrial noise level resulting from the development is more than 1 dB	Moderate
> 5 dB(A)	≤ recommended amenity noise level	Moderate
> 5 dB(A)	> recommended amenity noise level	Significant

Table 6.8 Examples of receiver-based treatments to mitigate residual noise impacts (NPfI)

SIGNIFICANCE OF RESIDUAL NOISE LEVEL	EXAMPLE OF POTENTIAL TREATMENT
Negligible	The exceedances would not be discernible by the average listener and therefore would not warrant receiver-based treatments or controls.
Marginal	Provide mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity.
Moderate	As for 'marginal', but also upgraded façade elements, such as windows, doors or roof insulation, to further increase the ability of the building façade to reduce noise levels.
Significant	May include suitable commercial agreements where considered feasible and reasonable.

6.8.5 ADDITIONAL COMMENTARY – ON-SITE TRUCK AND TRAIN MOVEMENTS

As previously discussed, there are typically more challenges in implementing effective mitigation for non-stationary noise sources on-site. This includes on-site truck and train movements. In most land use types these on-site movements also tend to dominate the overall noise generation.

Noise generated by truck and train movements can occur on industrial sites as well as on road and rail corridors. Noise associated with truck and train movements on road and rail corridors are subjected to separate assessments per RNP and RING as discussed in Sections 4.4 and 4.5. These assessments are based on noise levels energy-averaged over the day and night time assessment duration of 15 hours and 9 hours respectively. Note that the absolute RNP and RING noise trigger levels are also higher than that required by NPfI and therefore noise assessment of truck and train movements on road and rail corridors is therefore notably less onerous than assessment of such movements on-site.

Consideration of noise mitigation and management measures for these on-site movements is required and recommended to be undertaken as per the NPfI. However, pursued mitigation strategies should take into account the overall acoustic benefit including noise components from off-site traffic. Actual acoustic benefit to implement measures to mitigate on-site noise may be limited. For example, apart from on-site activities such as reverse beeper/ intermittent acceleration while manoeuvring on-site, the acoustic characteristics of truck and train movements both on-site and off-site are likely to be largely similar. Receivers may still be subjected to higher noise levels from road and rail corridor traffic rather than that from an industrial site.

6.9 FUTURE NOISE-SENSITIVE RECEIVERS

It is understood that as part of the SAP development, land uses potentially sensitive to noise will likely be introduced. These land uses may be the likes of child care facilities, retail, professional services providers or the like to service the future work force supporting the SAP. Based on the currently proposed master plan, these land uses are likely to be positioned within the sub-precinct identified as Commercial Gateways in the northeast of the SAP. Potential noise impact on these future land uses due to industrial noise source will require due consideration and any requirements for noise mitigation should follow similar process as described in Section 6.8. It is however likely that appropriate design of receiver-based treatments will be considered more appropriate for these future receivers.

6.10 RECOMMENDATIONS FOR PARKES SAP

From an acoustic perspective, there are different approaches that can be taken to pursue noise mitigation strategies for the SAP. One approach that can be taken is possibly focusing on achieving a better acoustic outcome in NCAs with more receivers and NCAs that contain closely spaced receivers (i.e. NCA5, NCA6, NCA7).

From an acoustic perspective, on the basis of the selected principles above, the following are recommended:

- Consideration of mitigation as per NPfI should be provided to allow the proposed SAP in achieving the determined NPfI noise trigger levels at all NCAs where possible.
- The NPfI does not consider the trigger levels as mandatory but strong justification must be provided if they cannot be met. Any exceedances will require consideration of receiver-based mitigation. On this basis, achieving the project noise trigger levels for the residential receivers in NCA5, NCA6 and NCA7 is likely to result in better overall project outcome (to the northeast and east of the SAP) as any trigger to consider receiver-based treatment will involve a relatively large number of properties.
- The predicted noise impact and exceedances at the worst impacted receivers in NCA5, NCA6 and NCA7 are dominated by contribution from the future Commercial Gateways, Mixed Enterprise, Regional Enterprise, Freight Terminals (including existing/approved SCT and Pacific National facilities) and the existing Parkes waste facility. An overall noise reduction of up to 20 dB is required to meet the determined triggers levels for night period.
- A service station development is likely to represent the acoustically worst case land use within the Commercial Gateways sub-precinct. It is recommended that such a site be positioned at least 1.2 km from sensitive receivers as well as being shielded by other future buildings within the sub-precinct.
- Due to the isolated nature of the receivers in NCA01 to NCA04, it appears more feasible and reasonable to accept that noise levels will likely remain higher than the trigger levels (residual impact) after assessment of mitigation measures per NPfI and pursue receiver-based treatment for them.

It should be noted that the level of detail of this assessment is considered suitable for the Master Plan stage of the proposed Parkes SAP. Notable exceedances of the determined project noise trigger level are predicted at all assessed sensitive receiver surrounding the SAP, which are likely to represent worse case noise impact scenarios. A high level discussion of possible noise mitigation measures is provided, however it is not possible to determine a more precise range of measures to be implemented (and to determine the likely final noise levels outcome) as this is dependent on numerous variables and can take many forms and combinations. It is expected possible further considerations will be required to account for the following:

- Upon availability of indicative total number of establishments within the SAP, determine the project amenity noise trigger level for each establishments. It should also be noted that individual establishments will be subjected to a further reduced trigger levels than that discussed in Section 4.2.2 for the overall SAP to ensure the overall trigger levels are not exceeded when considering cumulative noise impact from all land uses within the SAP.
- Further development of the overall mitigation approach to be pursued (based on principles of the NPfI).
- Further consideration should be provided in determining strategies in implementing receiver-based treatment at the identified receivers. As the development of Parkes SAP is expected to be progressive in nature, so can the roll-out of these treatments. The noise impact predicted and discussed in this report applies to a generally conservative cumulative impact, assuming all identified developable land areas to be noise generating. This is however not likely to represent the noise conditions in the early phase of development of the SAP.

One robust way to determine the timing of implementation of receiver-based treatment is by continually assessing in-situ noise levels associated with the SAP as it becomes developed. This can be achieved by:

- An overarching 3-dimensional computer noise model for the SAP that is being maintained and updated periodically by the Parkes SAP Development Corporation. The computer noise model created as part of this Master Plan assessment can act as the basis for this noise model. (It is noted that the Parkes SAP Development Corporation will be established responsible in managing all establishments associated with the SAP.)
- A noise monitoring regime established and managed by the Development Corporation to measure changes in noise level as Parkes SAP becomes developed. The noise monitoring regime will likely comprised of permanent noise monitoring devices as well as regular/ strategic operator-attended noise monitoring at strategic locations.
- These strategies can form part of the 'government led studies' component as discussed in Section 1.1.
- These strategies will also be beneficial in identifying noise contribution associated with on-site, off-site, road and rail noise sources, as these are assessed differently managed using different trigger levels.

A level of acoustic assessment is likely to be required by future individual proponents to ensure any nominated constraints to limit noise impact in the Structure Plan noise report are complied with. The level of detail of the acoustic assessment required will likely vary depending on the complexity of the proposed development.

7 OFF-SITE ROAD NOISE

This section provides an assessment of the likely change in road noise levels associated with additional vehicles on public roads.

The preliminary Structure Plan currently identifies that the SAP will primarily be accessible by the Newell Highway (including proposed bypass) as well as Brolgan Road corridor. Condobolin Road (which becomes Henry Parkes Way further out west) will in turn be used as a secondary access. In addition, it is expected that existing roads surrounding the proposed SAP will likely experience an increase in traffic volumes.

As discussed in Section 4.4, the assessment of road traffic noise associated with the SAP will be based on an initial screening assessment of a noise level increase threshold of 2 dB or more. Acoustically, a road noise level change of 2 dB approximately equates to 60% increase traffic volumes, assuming a similar mix and speed. In reference to the existing (year 2012 to 2017) traffic volume data adopted in the noise assessment for Newell Highway Parkes Bypass, the threshold of traffic volume increase is summarised in Table 7.1.

Table 7.1 Traffic volume increase

ROAD	EXISTING VOLUME	TRAFFIC VOLUME INCREASE THAT WILL TRIGGER A ≥2 dB INCREASE
Newell Highway (north of Parkes)	4,100	2460
Newell Highway (south of Parkes)	1,600	960
Brolgan Road	1400	840
Condobolin Road	1600	960
Hartigan Avenue	1100	660

Existing road traffic volume for other roads in Parkes town are presented in Appendix F for reference purposes.

8 OFF SITE RAIL NOISE

This section provides an assessment of the likely change in rail noise levels associated with possible changes in rail traffic due to the SAP.

8.1 BASELINE CONDITIONS

Certain future developments and industry types within the SAP will likely rely on the rail transportation mode to facilitate its operations. This could include activities such as general transfer of goods/commodities, importation/ exportation of waste for sorting and processing.

The baseline conditions of rail traffic movements are discussed in Section 2.3.3.

8.2 PARKES SAP TRAFFIC GENERATION

The degree of change to the rail traffic in the nearby rail network due to Parkes SAP is currently unknown. It is however understood that all rail infrastructure (including existing and approved Inland Rail) will be operated and subject to conditions within the respective Environment Protection Licence, Development Consent or similar. Any significant changes to the rail traffic will likely trigger a separate noise and vibration assessment to support an application to vary any existing approvals. Such additional processes are expected to identify any additional requirements to consider mitigation relating to operational rail noise and vibration. When further information becomes available, a more detailed review and assessment should be undertaken per procedure described in Section 4.5.

9 CONCLUSION

This report details the Noise and Vibration Impact Assessment (NVIA) conducted for the proposed Special Activation Precinct at Parkes, NSW. The primary purpose of the noise assessment is to support the development of the Structure Plan by completing the following exercise:

- identifying the location of the proposed SAP development area and potentially impacted sensitive receivers
- identify the existing and approved future noise-generating sites within the SAP
- establish the noise study area and determine the associated existing ambient noise environment
- establish the noise and vibration assessment criteria and trigger levels applicable to the operation of the SAP
- qualitative construction noise and vibration assessment
- preliminary operational noise and vibration assessment, based on the three development scale options for the SAP.

Based on the noise assessment conducted, the findings and requirements for further consideration of assessment and mitigation are summarised below:

Table 9.1 Parkes SAP Structure Plan Noise and Vibration Impact Assessment – findings

ITEM	FINDINGS	FURTHER CONSIDERATION	LIKELY PROJECT RISK
Construction noise and vibration	Noise and vibration impact on existing sensitive receivers will occur during construction of the SAP	A construction noise and vibration management plan should be developed for specific sites within Parkes SAP prior to commencement of works. Such requirement is generally consistent with development consent granted for other recent projects within the SAP.	Moderate
On-site operational noise	All proposed development scenarios are predicted to notably exceed the NPfI noise trigger levels at all assessed receivers.	Consideration of mitigation as per NPfI should be provided to allow the proposed SAP in achieving the determined NPfI noise trigger levels at all NCAs where possible.	Moderate to high
Off-site road traffic noise	Road or traffic volume increase of 60% or more will likely trigger a notable increase in noise impact at existing residential receivers (assuming similar traffic composition).	Consideration of mitigation recommended to address any notable road noise increase.	Moderate
Off-site rail traffic noise		Rail infrastructure (including existing and approved Inland Rail) will be operated and subject to conditions within the respective Environment Protection Licence, Development Consent or similar. Any significant changes to the rail traffic will likely trigger a separate noise and vibration assessment to support an application to vary any existing approvals. Such additional processes are expected to identify any additional requirements to consider mitigation relating to operational rail noise and vibration.	Moderate

APPENDIX A

PREVIOUSLY SHORTLISTED DEVELOPMENT SCENARIOS – ON-SITE OPERATIONAL NOISE

A1 SHORTLISTED DEVELOPMENT SCENARIOS

During the preliminary Structure Plan stage, prior to the selection of the final master plan as assessed in Section 6, three SAP development scenarios were selected for evaluation. These three scenarios were shortlisted from a longer list of possible scenarios through various evaluation process by the project team. These scenarios are briefly described below (and indicated in Figure A.1):

- Scenario 1 – lower development scale comprising the following additional uses:
  - freight terminals, regional enterprise, green infrastructure, intensive livestock agriculture, waste to energy and recycling.
- Scenario 3 – high development scale comprising the following additional uses:
  - freight terminals, regional enterprise, green infrastructure, intensive livestock agriculture, waste to energy and recycling.
- Scenario 6 – high development scale comprising the following additional uses:
  - freight terminals, regional enterprise, green infrastructure, intensive livestock agriculture, protected cropping and airport.

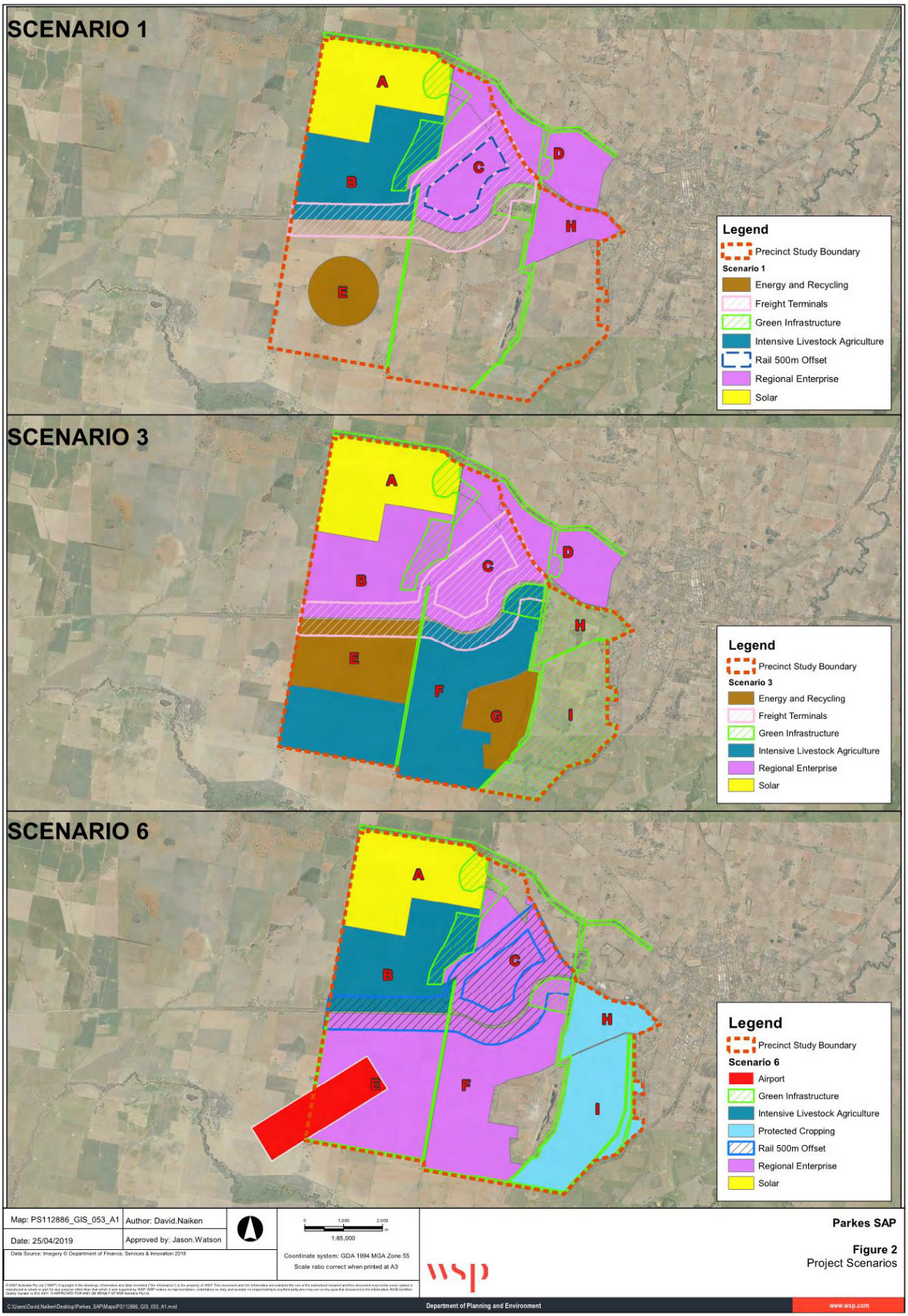


Figure A.1 Three previously shortlisted development scale options for Parkes SAP

A2 PROPOSED INDUSTRY TYPES AND LAND USES

Several industry types have been identified for the Parkes SAP in the Structure Plan for the precinct. The assessed land use types are summarised in Table A.1.

Table A.1 Anticipated future land uses – Parkes SAP

INDUSTRY TYPE	LAND USES	
Freight terminals	— Rail/road intermodal freight terminals (e.g. PN, SCT) — Rail siding — Rail provisioning, maintenance, refuelling, wagon maintenance — Container apron, storage and maintenance	— Grain storage — Fuel storage — Freight forwarding companies (e.g. Linfox, SCT; packing/unpacking and associated office) — Truck parking
Regional enterprise	— Advanced manufacturing e.g. food processing and packaging incl. grains, meat, plant, dairy, pet food etc. — Distribution centres e.g. supermarket chains, retailers etc. — Warehouse — Container maintenance — Related small enterprise/office	— Truck fuelling, maintenance, truck parking, provisioning centre, sales — Mining services — Hazardous material storage — Large format wholesalers (e.g. mining, agricultural) — Customs facility
Intensive livestock agriculture	— Abattoir and associated holding pens, feedlots, waste treatment — Poultry farm, hatchery — Piggery	— Other intensive livestock growing/processing — Mushroom farm — Buffer
Energy (solar)	— Solar farm and associated infrastructure	
Energy and recycling	— Waste-to-energy plant – from small to large — Recycling	— Buffer
Protected cropping	— Commercial greenhouses — Hydroponics — Aquaculture	— Other value-add crops — Associated solar/energy
Green infrastructure	— Protected vegetation — Offset planting areas, rehabilitation	— Stormwater treatment wetlands etc. — Green/biodiversity corridor
Airport	— International standard airport runway, taxiways, terminal, hangar, operational areas, secure areas	

A3 NOISE MODELLING PARAMETERS

A noise model was created using SoundPLAN 8 modelling software to predict the noise generated during typical operation conditions for both standard and noise-enhancing meteorological conditions. The adopted prediction method for the model was the CONCAWE method. Key modelling parameters and assumptions are shown in Table A.2.

Table A.2 Operational noise modelling inputs and assumptions

PARAMETER	MODELLING INPUT
Ground absorption	Ground absorption factors are set to 0 for all roads, hardstand and 0.75 for grass / vegetation.
Terrain data	Terrain data have been provided by NSW DPE (LiDAR) and NSW Land and Property Information.
Meteorological conditions	1 Standard conditions: Stability category D, 0.5 m/s wind from source to receiver. 2 Night: Stability category F, 2 m/s wind from noise source to receiver. Historical wind data indicates that the occurrence of light winds up to 3 m/s during stability categories A-D is not significant (<30%) and therefore is not considered
Buildings	Sensitive receivers are generally modelled as points only. A cluster of existing residential buildings to the northeast of the SAP has been included.
Assessed sensitive receivers	Existing land uses – quantitative assessment for residential receivers outside of the indicated SAP development areas. Future land uses as part SAP – qualitative assessment only.
Receiver height	The receiver heights are set at 1.5 metres.
Location of noise sources	Across the entire indicated development areas of the SAP up to the external boundaries (for each scenario).
Modelled sound power levels	As described in Section 6.5 (noting limitations described below).
Assessment duration	15 minutes
Assumed hours of operations	It is assumed that all activities will occur at any time of day (day, evening, night).
Attention-drawing characteristics	It is assumed that received noise levels at sensitive receivers will be free from all attention-drawing characteristics that could attract a penalty as described in Section 4.2.4.
Possible limitations	1 The sound power levels adopted in this assessment were based on information obtained from a limited literature review of previous assessments conducted by WSP or other consultants. 2 It should however be noted that the modelled scenarios are likely to represent worst case acoustic scenarios as they assume the entire indicated developable areas to be fully developed and noise-generating. Further refinement is possible as the planning process progresses. 3 The modelled area sources (as described in Figure A.1) assume an equally distributed sound power across the identified land parcels. This is considered an appropriate methodology considering the high level nature of the noise assessment. Further specific acoustic consideration of individual prominent noise generating items is recommended in future design stages (e.g. elevated exhaust stack, locomotive/truck movements).

A4 OPERATIONAL NOISE SOURCES AND ASSUMED NOISE LEVELS

To allow a cumulative impact assessment to included consideration of existing and future land uses, the three shortlisted scenarios have been modelled in conjunction with the existing and approved land uses within the SAP.

Sound power levels for the existing and approved land uses are modelled per discussed in Sections 2.2 and 2.2.3. The modelled sound power levels corresponding with the respective development scenarios are summarised in Table A.3. As the exact build form, site configuration, positioning of noise sources are not known at the preliminary Structure Plan phase, noise sources representing the future developments have been modelled using area sources. Source sound power levels have been derived from noise reports for assumed similar land uses. The adopted assumptions in operational nature of respective equipment and activities are summarised in Table A.3.

Table A.3 Proposed land use sound power levels (based on likely activities in duration of 15 minutes)

PROPOSED FUTURE LAND USE	ASSUMED SOUND POWER LEVEL PER UNIT AREA (dBA/m^2)	DESCRIPTION
Regional enterprise	52	Generally dominated by on-site truck and forklift movements. Overall sound power level from external sources of 103 dBA over an area of approximately 576,000 m^2. Building area assumed to occupy approximately 20% of land area with an internal reverberation noise level of 85 dBA. Factory building of sheet metal building envelope construction.
Protected cropping	48	Generally dominated by on-site truck and forklift movements. Overall sound power level from external sources of 103 dBA over an area of approximately 300,000 m^2.
Intensive livestock agriculture	55	Significant noise sources include on-site truck movements, exhaust fans, forklift or similar. Overall sound power level from external sources of 106 dBA over an area of approximately 150,000 m^2.
Waste to energy and recycling	59	Significant noise sources include on-site truck movements, exhaust fans, forklift/loader or similar, condensers, transformers. Overall sound power level from external sources of 114 dBA over an area of approximately 300,000 m^2.
Airport	47	Key mechanical plant items servicing the terminal or internal areas of an airport. It should be noted that while the noisiest equipment at an airport is likely to be the aircraft, noise associated with aircraft movements are covered by federal rather than state regulations and have been excluded from this assessment. As previously discussed, NPfI explicitly excludes noise associated with air transport corridors.

A5 PREDICTED NOISE LEVELS ($L_{Aeq\ 15\ min}$)

The predicted noise levels at the nearest receivers for a typical 15 minutes scenario are presented in Table A.4.

Table A.4 Predicted noise levels ($L_{Aeq\ 15\ min}$) at residential receivers – Parkes SAP on-site industrial noise

RECEIVER – NCA	PROJECT NOISE TRIGGER LEVEL (dB $L_{AEQ\ 15\ MIN}$)		PREDICTED NOISE LEVELS (dB $L_{AEQ\ 15\ MIN}$) AND ASSESSMENT					
			Scenario 1	Exceedance[1]	Scenario 3	Exceedance[1]	Scenario 6	Exceedance[1]
NCA1 residential 3 properties	Day	40	57 to 60	17 to 20	59 to 61	19 to 21	57 to 60	17 to 20
	Evening	35	57 to 60	22 to 25	59 to 61	24 to 26	57 to 60	22 to 25
	Night	35	57 to 60	22 to 25	59 to 61	24 to 26	57 to 60	22 to 25
	Night (enhancing)	35	61 to 63	26 to 28	Up to 64	Up to 29	61 to 63	26 to 28
NCA2 residential 4 properties	Day	40	Up to 58	Up to 18	Up to 62	Up to 22	Up to 57	Up to 17
	Evening	35	Up to 58	Up to 23	Up to 62	Up to 27	Up to 57	Up to 22
	Night	35	Up to 58	Up to 23	Up to 62	Up to 27	Up to 57	Up to 22
	Night (enhancing)	35	Up to 62	Up to 27	Up to 66	Up to 31	Up to 60	Up to 25
NCA3 residential 20 properties	Day	40	26 to 44	-14 to 4	40 to 52	-1 to 12	42 to 53	2 to 13
	Evening	36	26 to 44	-10 to 8	40 to 52	4 to 16	42 to 53	6 to 17
	Night	35	26 to 44	-9 to 9	40 to 52	5 to 17	42 to 53	7 to 18
	Night (enhancing)	35	29 to 48	-6 to 13	43 to 56	8 to 21	46 to 57	11 to 22
NCA4 residential 10 properties	Day	40	33 to 51	-7 to 11	33 to 50	-7 to 10	33 to 51	-7 to 11
	Evening	35	33 to 51	-2 to 16	33 to 50	-2 to 15	33 to 51	-2 to 16
	Night	35	33 to 51	-2 to 16	33 to 50	-2 to 15	33 to 51	-2 to 16
	Night (enhancing)	35	37 to 55	2 to 20	37 to 54	2 to 19	37 to 55	2 to 20

RECEIVER – NCA	PROJECT NOISE TRIGGER LEVEL (dB $L_{AEQ\ 15\ MIN}$)		PREDICTED NOISE LEVELS (dB $L_{AEQ\ 15\ MIN}$) AND ASSESSMENT					
			Scenario 1	Exceedance[1]	Scenario 3	Exceedance[1]	Scenario 6	Exceedance[1]
NCA5 residential 45 properties	Day	40	45 to 57	5 to 17	45 to 57	5 to 17	36 to 48	-4 to 8
	Evening	38	45 to 57	7 to 19	45 to 57	7 to 19	36 to 48	-2 to 10
	Night	37	45 to 57	8 to 20	45 to 57	8 to 20	36 to 48	-1 to 11
	Night (enhancing)	37	49 to 60	12 to 23	49 to 60	12 to 23	39 to 52	2 to 15
NCA6 residential 45 properties	Day	40	Up to 47	Up to 7	Up to 44	Up to 4	Up to 44	Up to 4
	Evening	36	Up to 47	Up to 9	Up to 44	Up to 6	Up to 44	Up to 6
	Night	35	Up to 47	Up to 10	Up to 44	Up to 7	Up to 44	Up to 7
	Night (enhancing)	35	Up to 51	Up to 14	Up to 48	Up to 11	Up to 48	Up to 11
NCA6 active recreation	When in use	53	Up to 57	Up to 4	Up to 54	1	Up to 54	1
NCA6 industrial	When in use	68	Up to 54	Complies	Up to 51	Complies	Up to 52	Complies
NCA7 residential >500 properties	Day	46	45 to 57	-1 to 11	44 to 54	-2 to 8	36 to 52	-10 to 6
	Evening	43	45 to 57	2 to 14	44 to 54	1 to 11	36 to 52	-7 to 9
	Night	37	45 to 57	8 to 20	44 to 54	7 to 17	36 to 52	-1 to 15
	Night (enhancing)	37	49 to 60	12 to 23	48 to 58	11 to 21	40 to 56	3 to 19

(1) A negative value indicates compliance, while a positive value indicate exceedance.

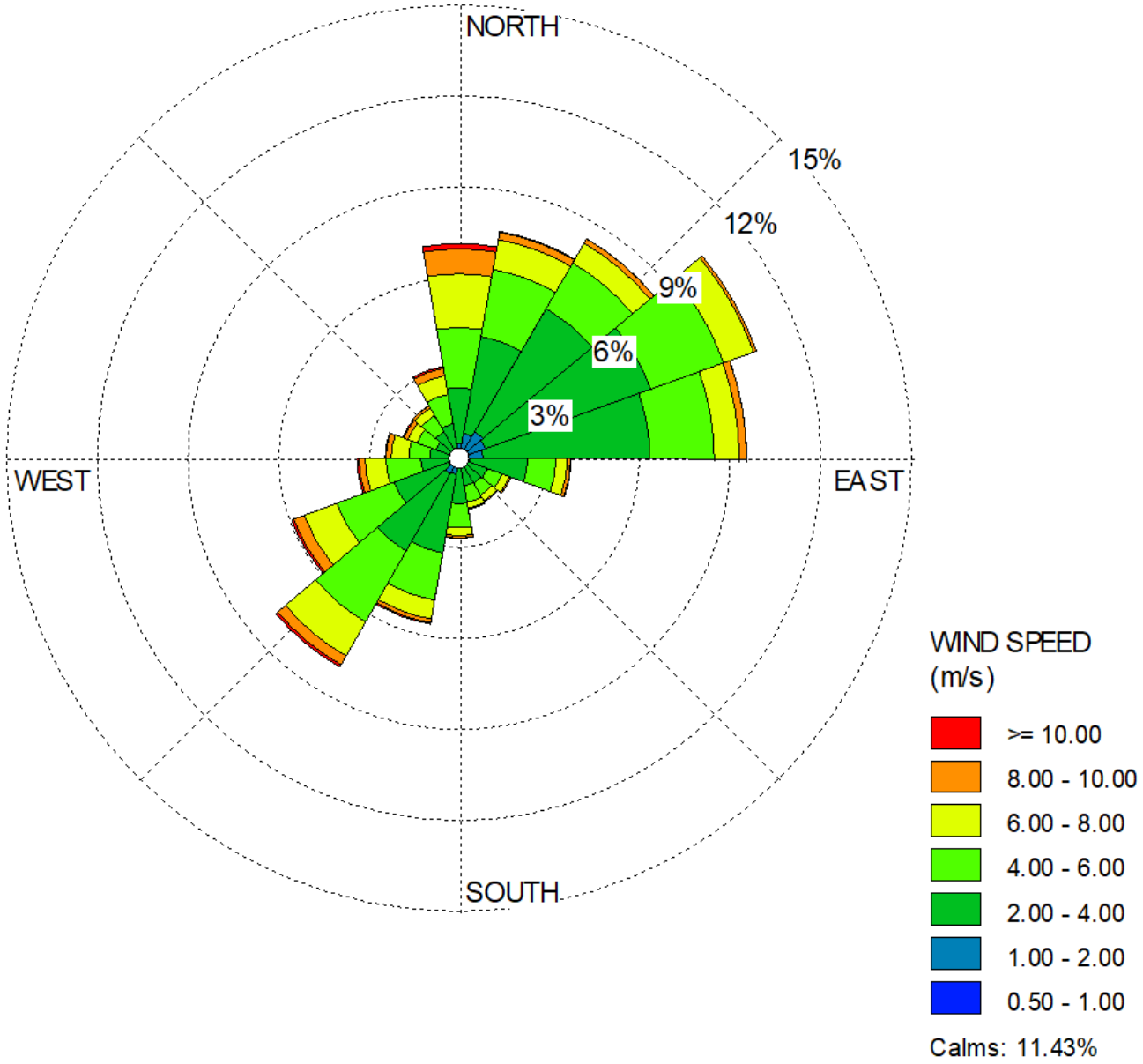
Based on the predicted noise levels reported above, the following summarises the likely noise impact at existing receivers surrounding the proposed SAP:

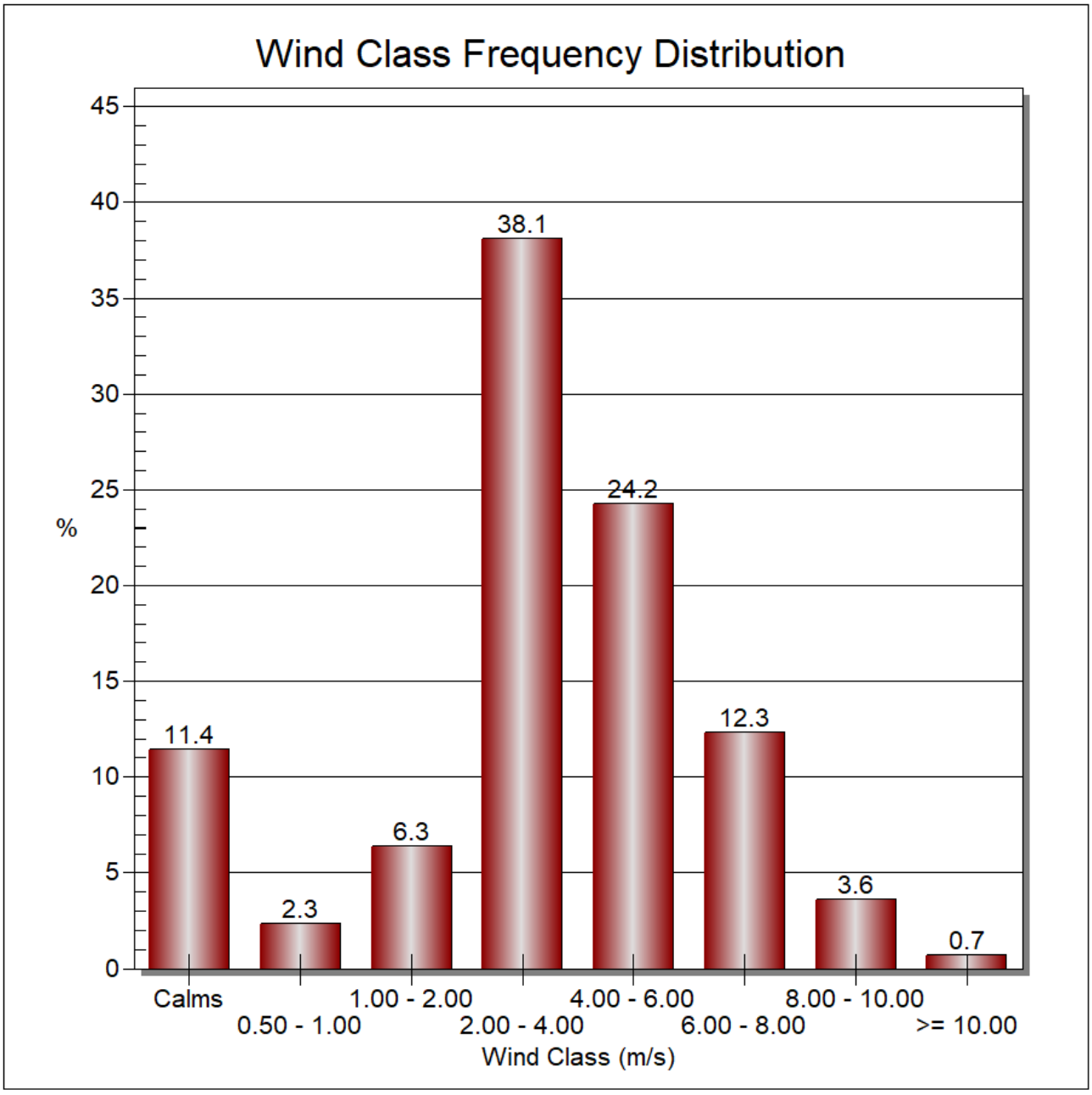
- All proposed development scenarios are predicted to exceed the NPfI noise trigger levels at all assessed receivers.
- NCA1: three isolated residential receivers <350 metres to the west of the SAP.
  - most stringent NPfI trigger levels applicable
  - similar noise impact from the three development scenarios
  - exceedance of the trigger levels by up to 26 dB.
- NCA2: four isolated residential receivers <120 metres to the west and south of the SAP.
  - most stringent NPfI trigger levels applicable
  - in the order of decreasing level of noise impact: Scenario 3 (31 dB exceedance), Scenario 1 (27 dB exceedance), Scenario 6 (25 dB exceedance).
- NCA3: 20 isolated residential receivers to the east and southeast of the SAP (some <250 metres from SAP)
  - most stringent NPfI trigger levels generally applicable
  - in the order of decreasing level of noise impact: Scenario 6 (22 dB exceedance), Scenario 3 (21 dB exceedance), Scenario 1 (13 dB exceedance).
- NCA4: 10 isolated residential properties to the west, northwest and north of the SAP (approximately 750 metres to 2 kilometres)
  - most stringent NPfI trigger levels generally applicable
  - similar noise impact from the three development scenarios
  - exceedance of the trigger levels by up to 20 dB.
- NCA5: approximately 45 residential properties, including isolated and closely-spaced receivers to the northeast of the SAP.
  - generally less stringent noise trigger levels during evening and night periods
  - similar noise impact from Scenario 1 and Scenario 3, with exceedance up to 23 dB. Scenario 6 produces less noise impact with exceedance of up to 15 dB.
- NCA6: receivers to the east of the SAP comprising of approximately 45 closely-spaced residential properties about 900 metres away, existing industrial establishments about 600 metres away and a golf course (active recreation) directly adjoining the SAP.
  - Scenario 1 produces higher noise impact at the residential receivers with exceedance of up to 14 dB. Similar noise impact at the residential receivers due to Scenario 3 and Scenario 6, with exceedance up to 11 dB
  - predicted noise impact compliant at the existing industrial premises and marginally exceed the trigger level for active recreation by 1 dB at the golf course.
- NCA7: >500 closely-grouped residential receivers on the western part of the Parkes town, to the east of the SAP
  - notably less stringent noise trigger levels during the day and evening periods
  - in the order of decreasing level of noise impact: Scenario 1 (23 dB exceedance), Scenario 3 (21dB exceedance), Scenario 6 (19 dB exceedance).

APPENDIX B

HISTORICAL WIND DATA – PARKES AIRPORT

B1 ANNUAL 2013 – 2018

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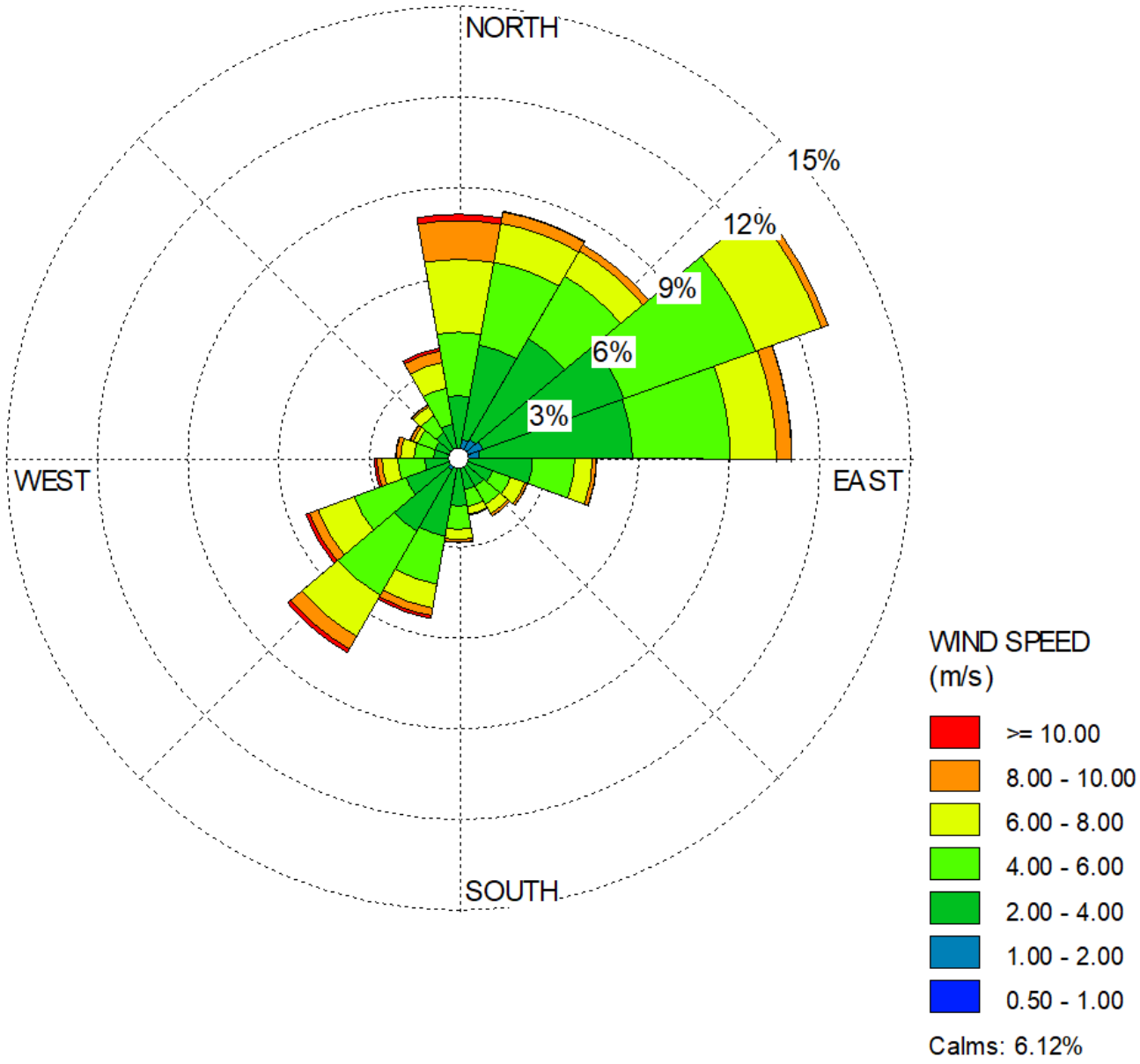
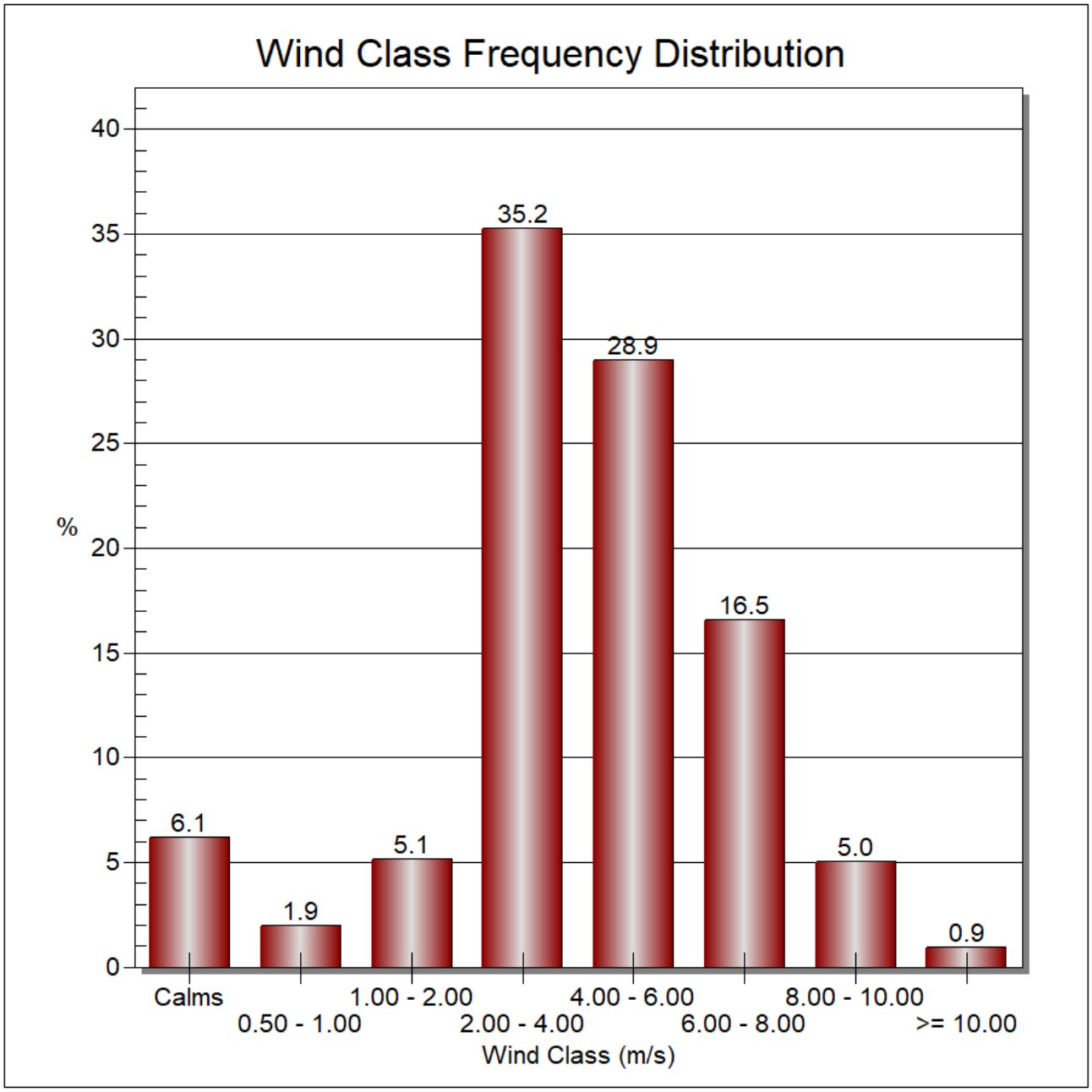
45
40
35
30
25
20
15
10
5
0
%
11.4
2.3
6.3
38.1
24.2
12.3
3.6
0.7
Calms
0.50 - 1.00
1.00 - 2.00
2.00 - 4.00
4.00 - 6.00
6.00 - 8.00
8.00 - 10.00
>= 10.00
Wind Class (m/s)

B2 SEASONAL

B2.1 SUMMER

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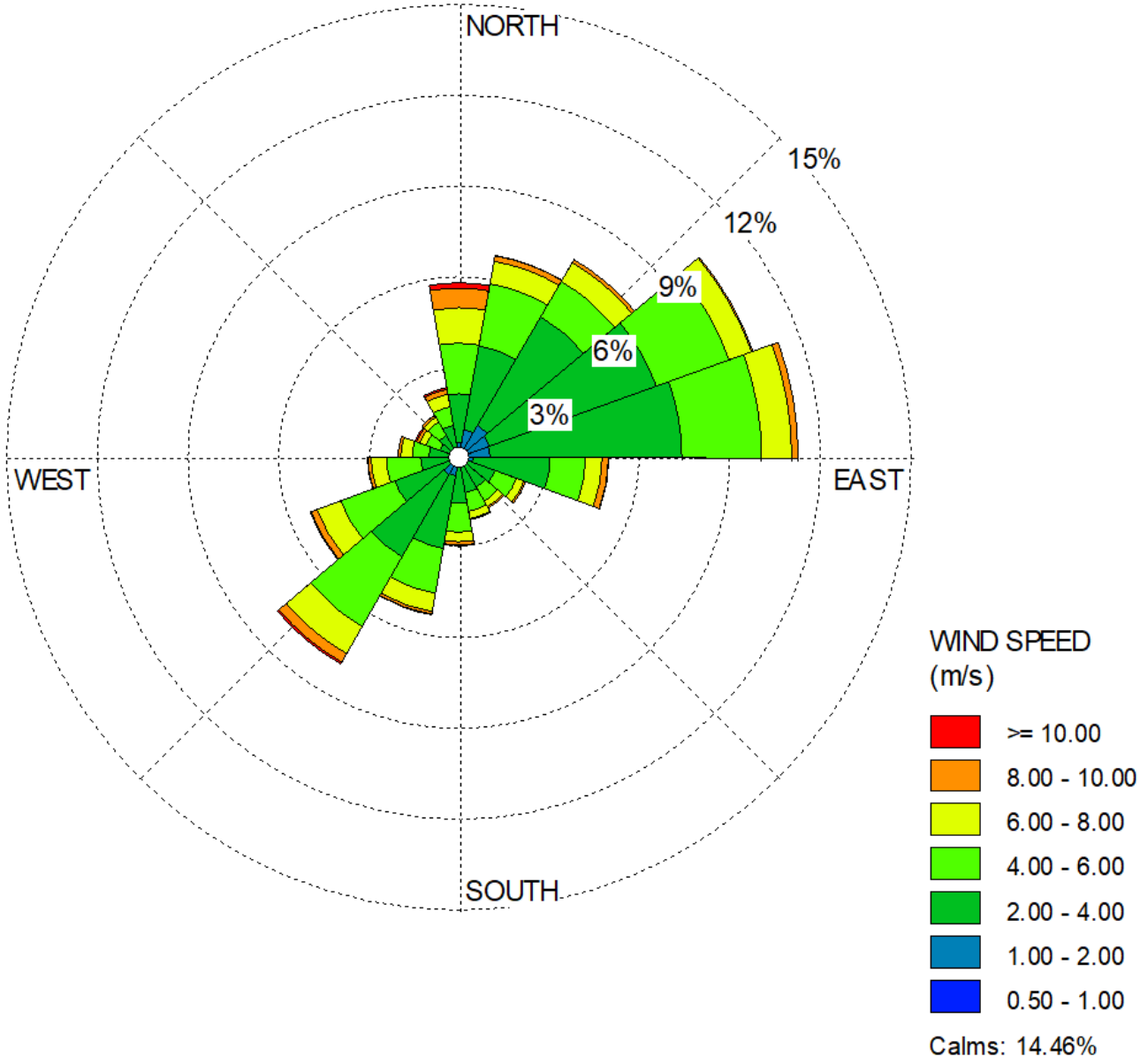
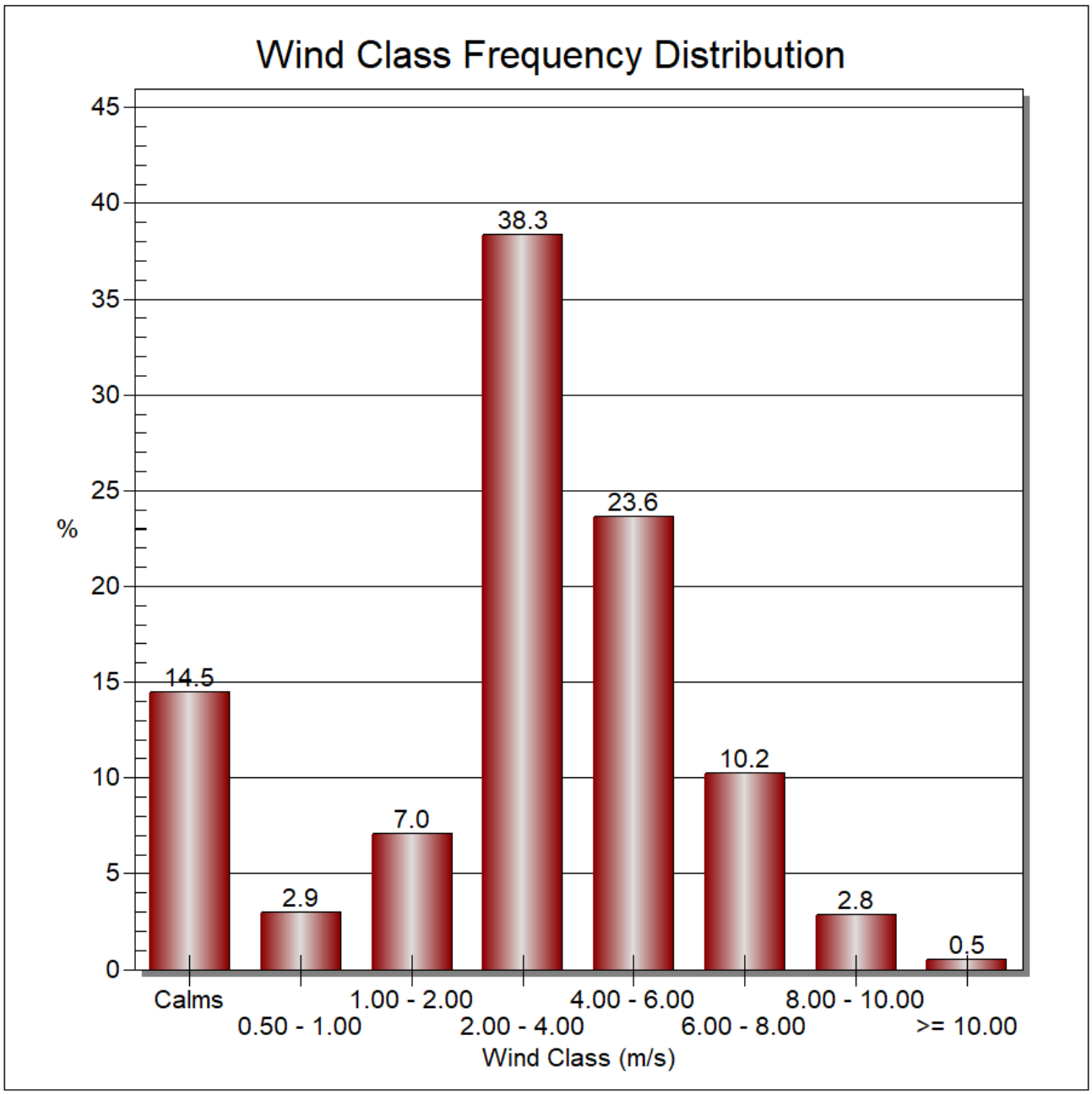
30
25
20
15
10
5
0
%
35.2
28.9
16.5
6.1
5.1
5.0
1.9
0.9
Calms
0.50 - 1.00
1.00 - 2.00
2.00 - 4.00
4.00 - 6.00
6.00 - 8.00
8.00 - 10.00
>= 10.00
Wind Class (m/s)

B2.2 AUTUMN


NORTH
15%
12%
9%
6%
3%
WEST
EAST
SOUTH
WIND SPEED
(m/s)
>= 10.00
8.00 - 10.00
6.00 - 8.00
4.00 - 6.00
2.00 - 4.00
1.00 - 2.00
0.50 - 1.00
Calms: 14.46%


Wind Class Frequency Distribution
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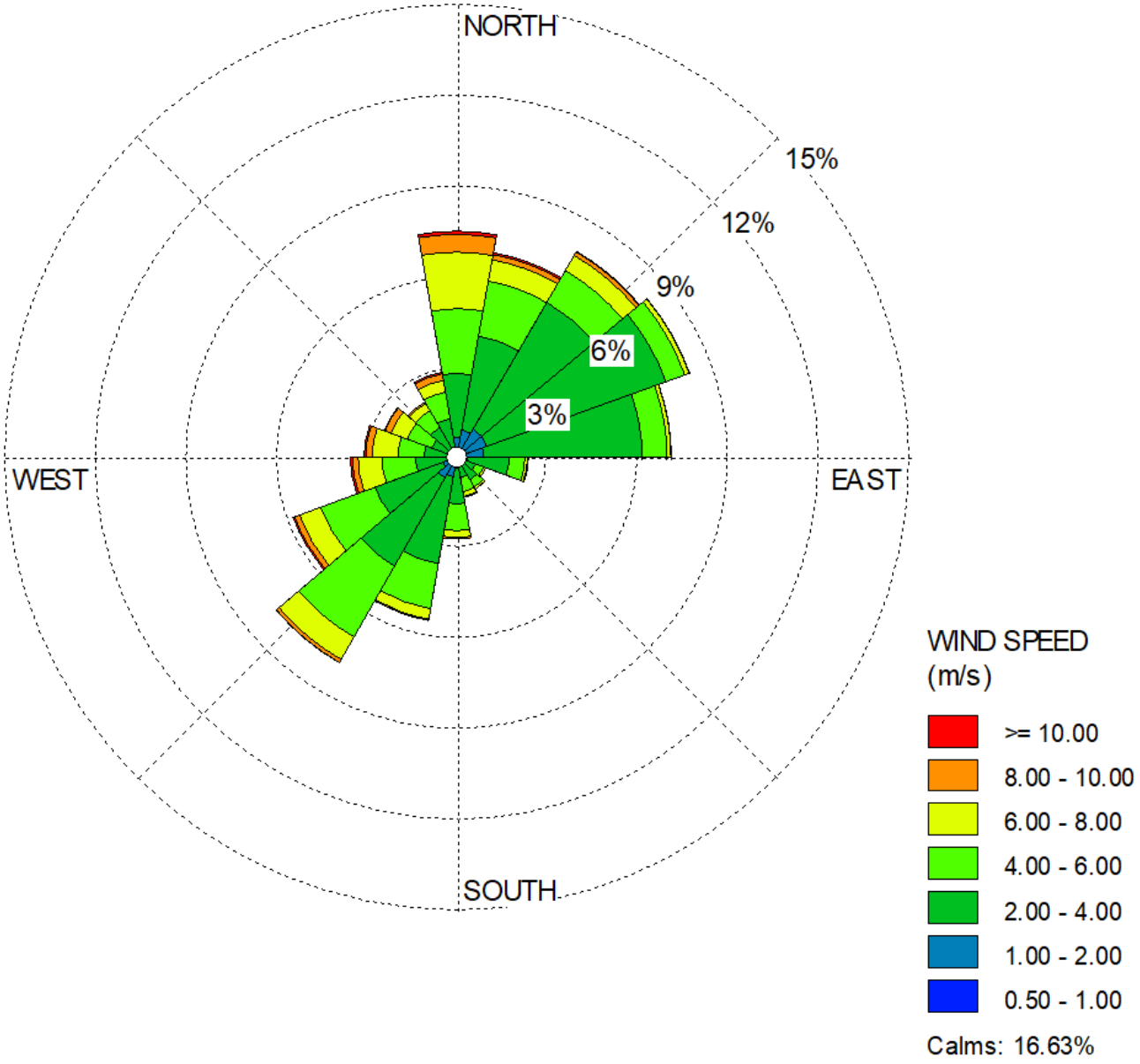
40
35
30
25
20
15
10
5
0
%
14.5
2.9
7.0
38.3
23.6
10.2
2.8
0.5
Calms
0.50 - 1.00
1.00 - 2.00
2.00 - 4.00
4.00 - 6.00
6.00 - 8.00
8.00 - 10.00
>= 10.00
Wind Class (m/s)

B2.3 WINTER


NORTH
15%
12%
9%
6%
3%
WEST
EAST
SOUTH
WIND SPEED
(m/s)
>= 10.00
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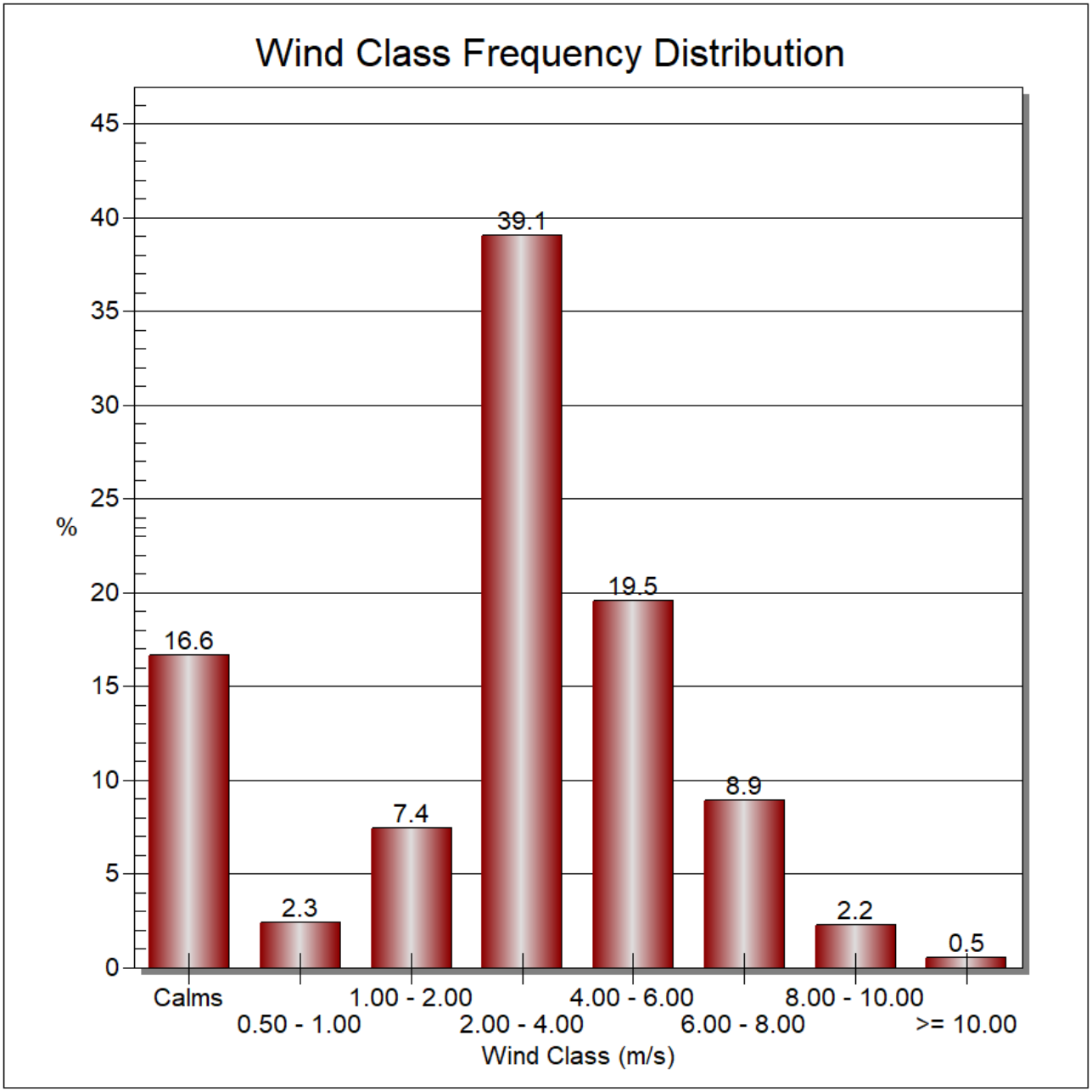
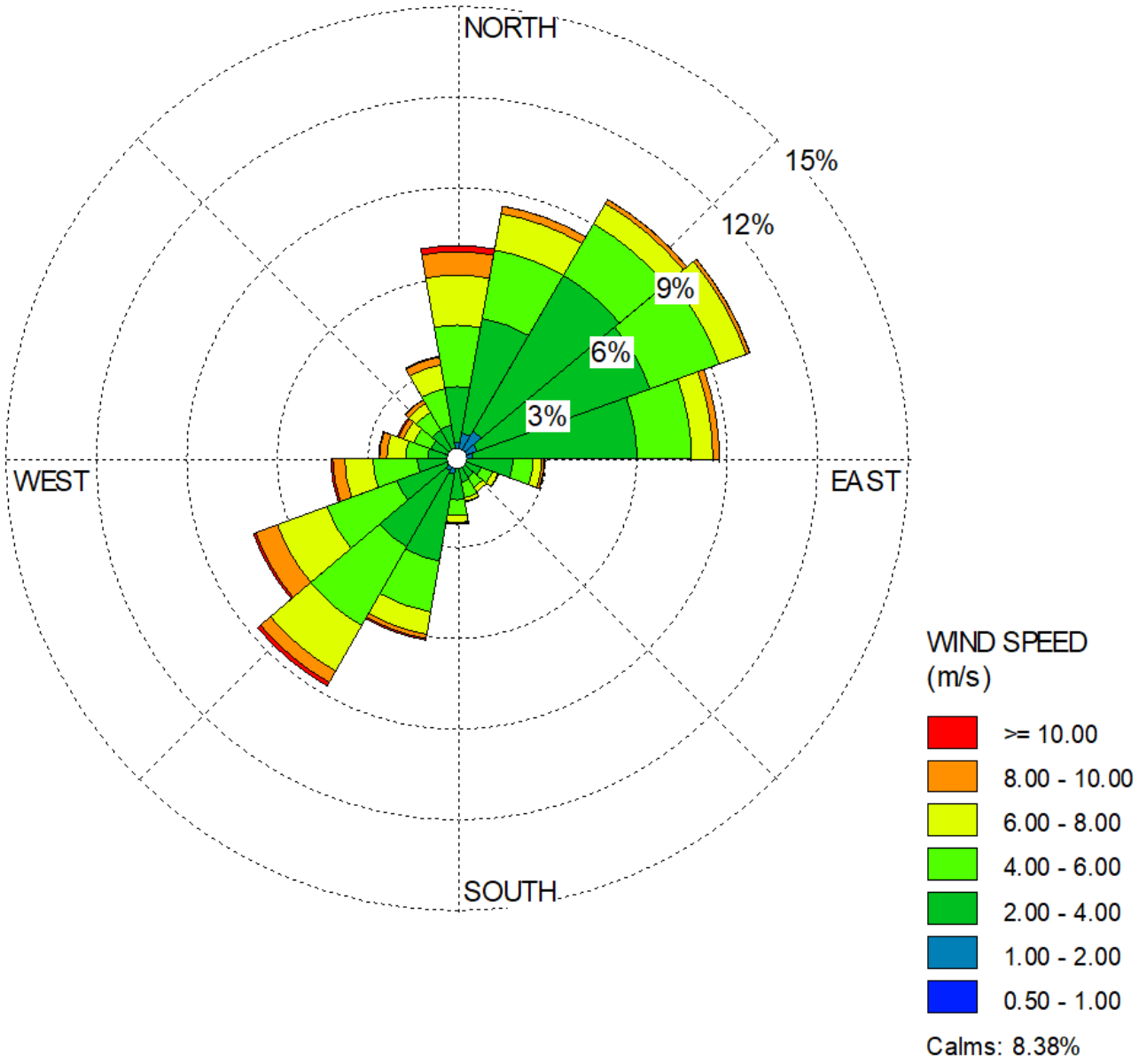
4.00 - 6.00
2.00 - 4.00
1.00 - 2.00
0.50 - 1.00
Calms: 16.63%


Wind Class Frequency Distribution
%
45
40
35
30
25
20
15
10
5
0
16.6
2.3
7.4
39.1
19.5
8.9
2.2
0.5
Calms
0.50 - 1.00
1.00 - 2.00
2.00 - 4.00
4.00 - 6.00
6.00 - 8.00
8.00 - 10.00
>= 10.00
Wind Class (m/s)

B2.4 SPRING


NORTH
15%
12%
9%
6%
3%
WEST
EAST
SOUTH
WIND SPEED
(m/s)
>= 10.00
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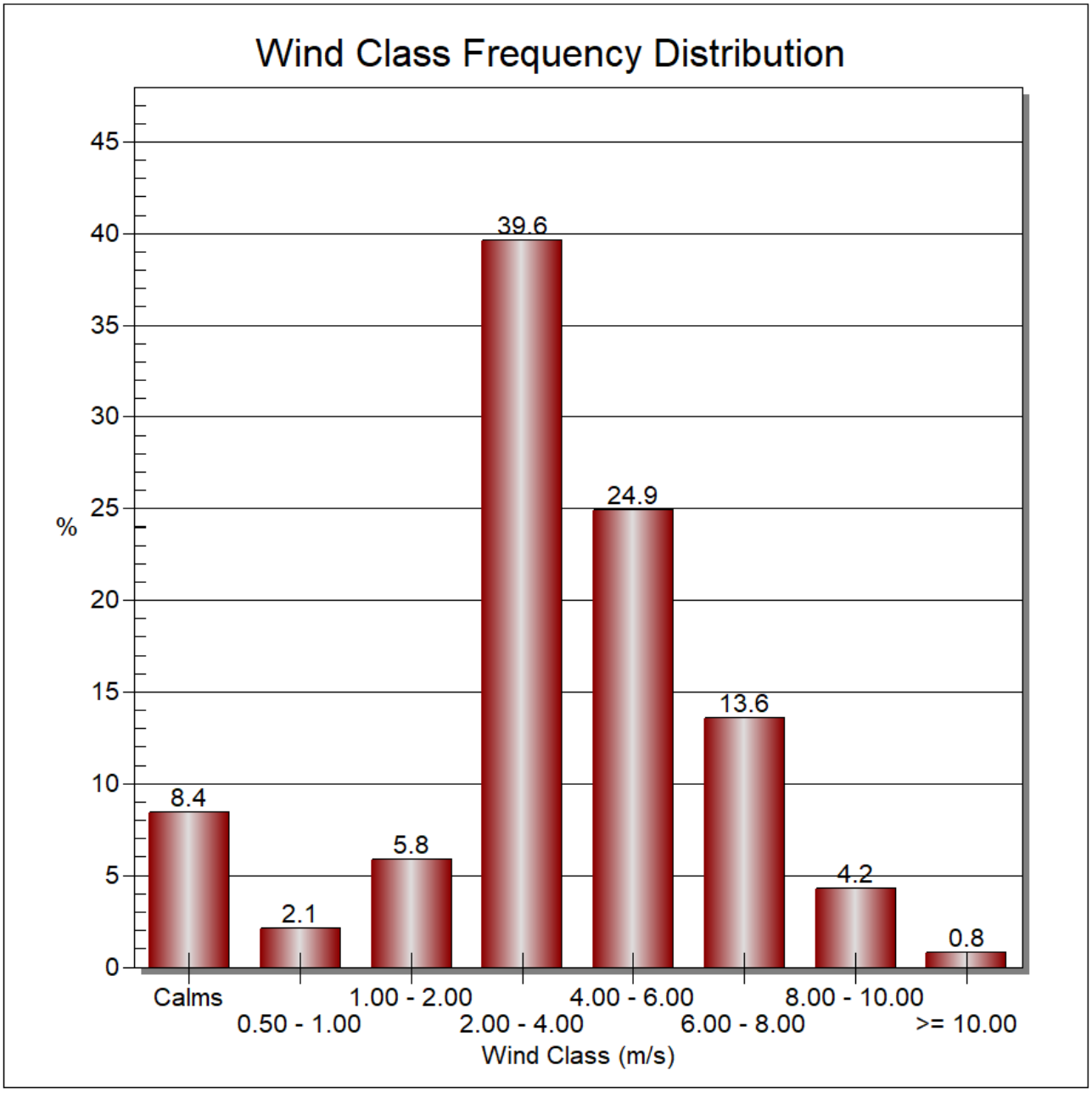
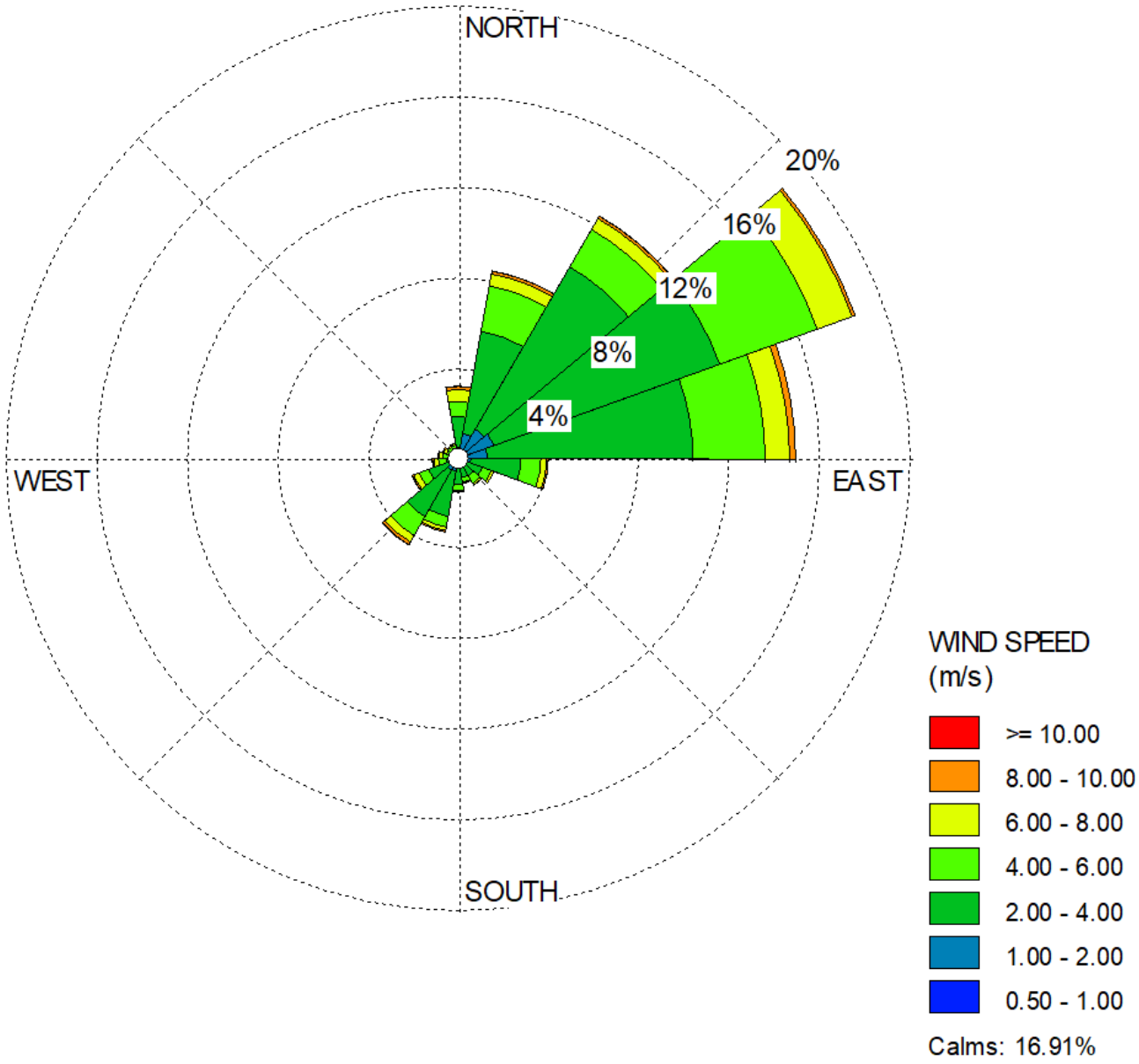
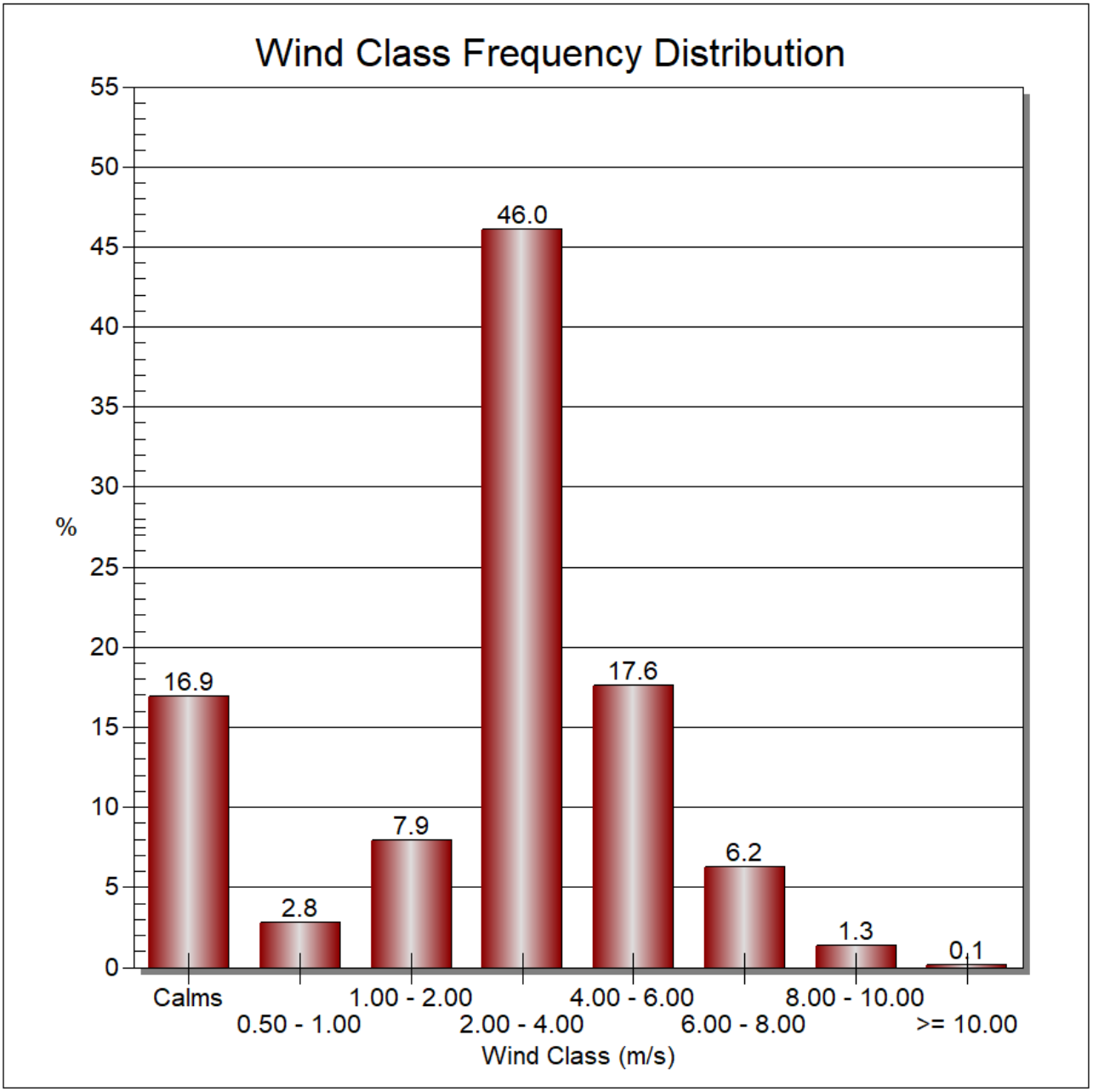
6.00 - 8.00
4.00 - 6.00
2.00 - 4.00
1.00 - 2.00
0.50 - 1.00
Calms: 8.38%


Wind Class Frequency Distribution
45
40
35
30
25
20
15
10
5
0
%
39.6
24.9
13.6
8.4
5.8
4.2
2.1
0.8
Calms
0.50 - 1.00
1.00 - 2.00
2.00 - 4.00
4.00 - 6.00
6.00 - 8.00
8.00 - 10.00
>= 10.00
Wind Class (m/s)

B3 DIURNAL

B3.1 00:00 - 06:00

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55
50
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%
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20
15
10
5
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16.9
2.8
7.9
46.0
17.6
6.2
1.3
0.1
Calms
0.50 - 1.00
1.00 - 2.00
2.00 - 4.00
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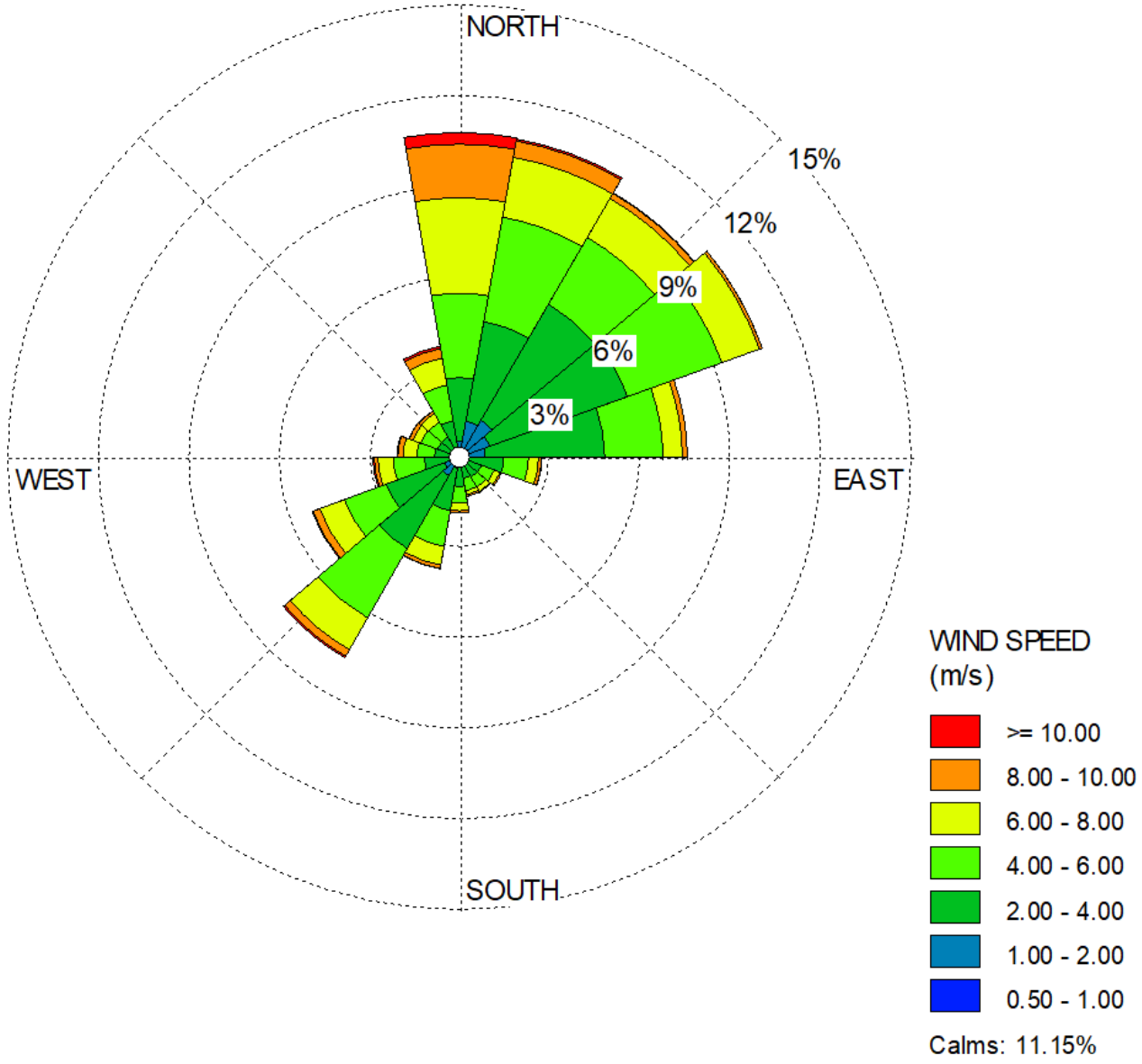
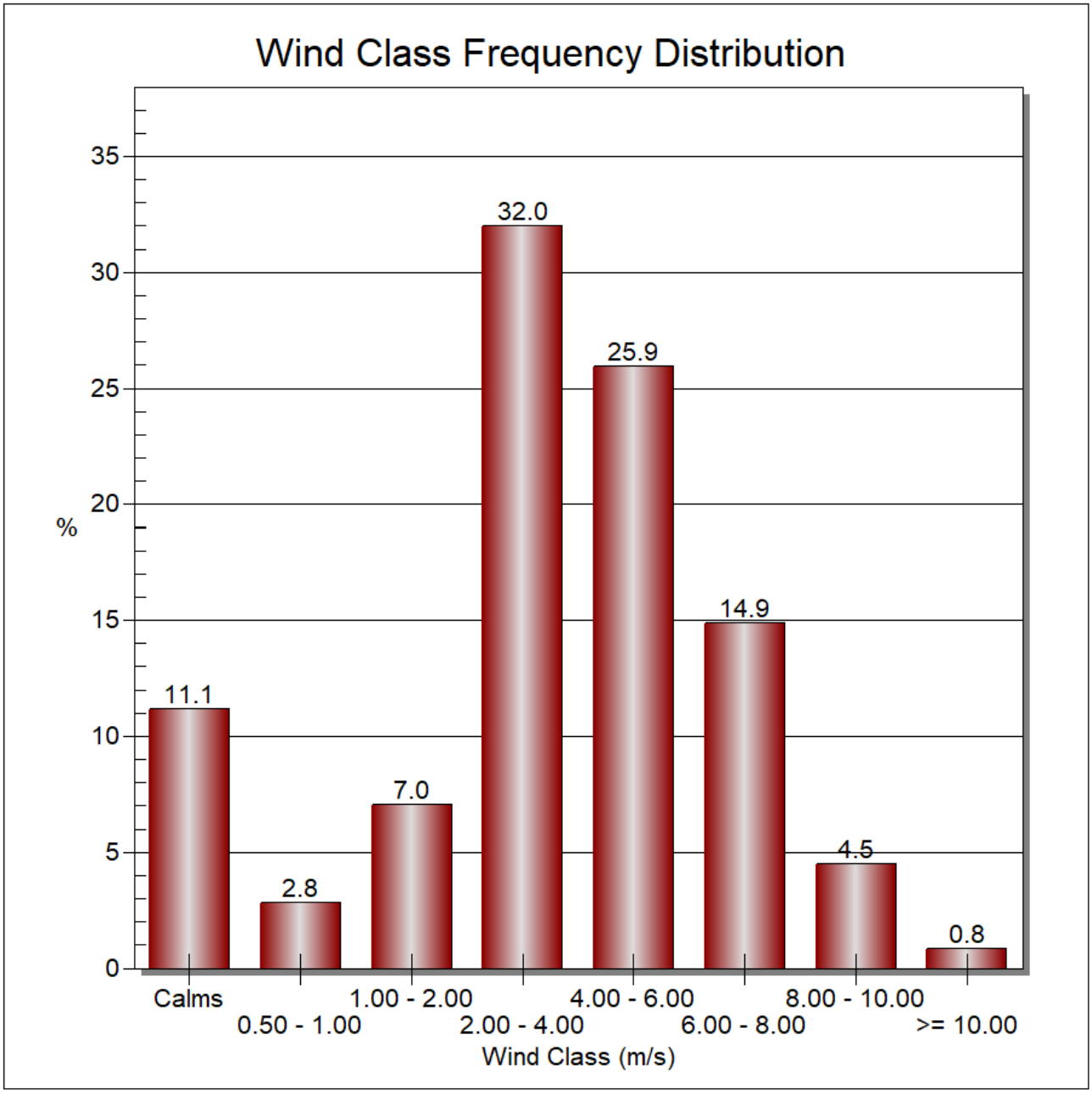
8.00 - 10.00
>= 10.00
Wind Class (m/s)

B3.2 06:00 – 12:00




Wind Class Frequency Distribution
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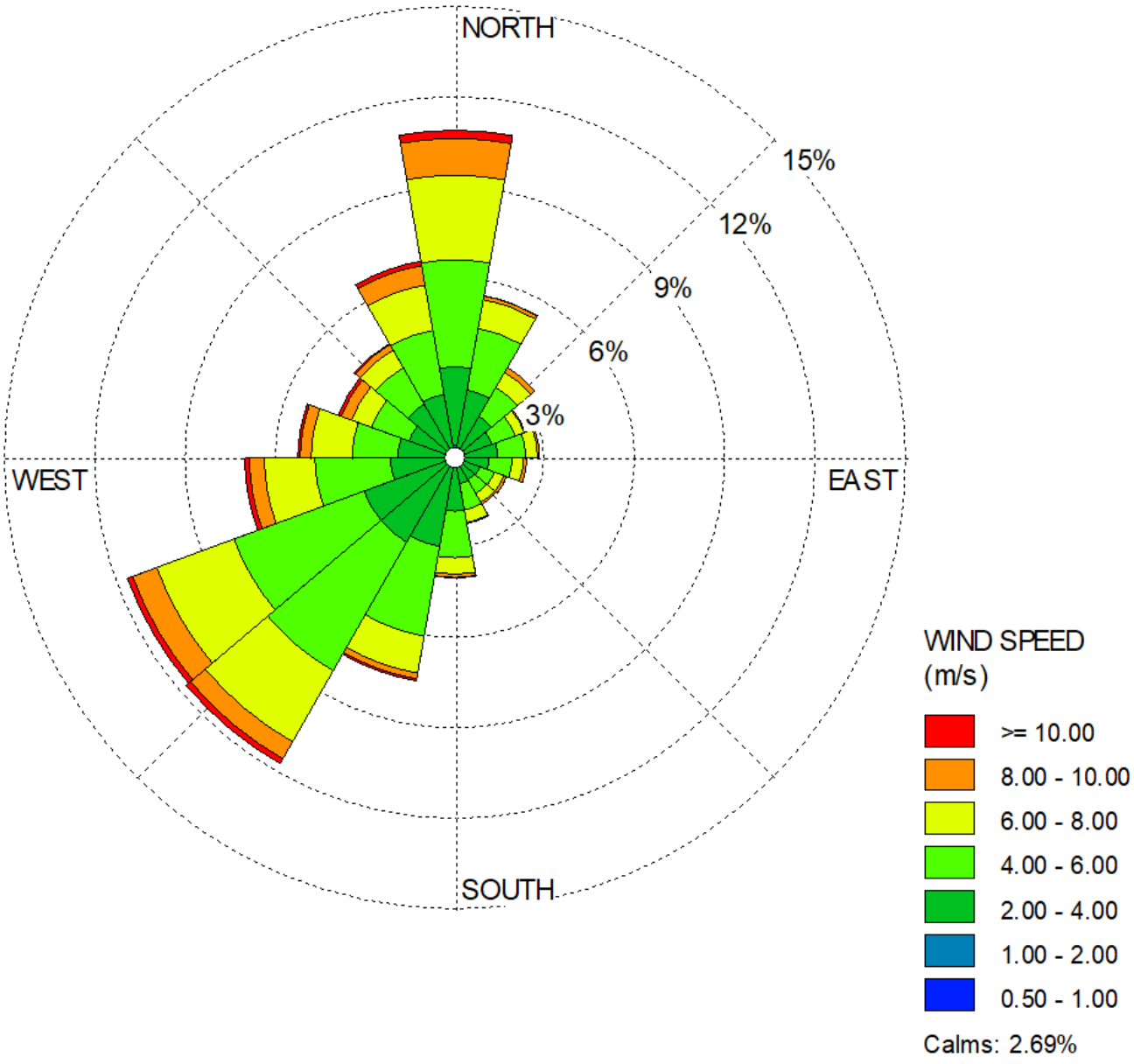
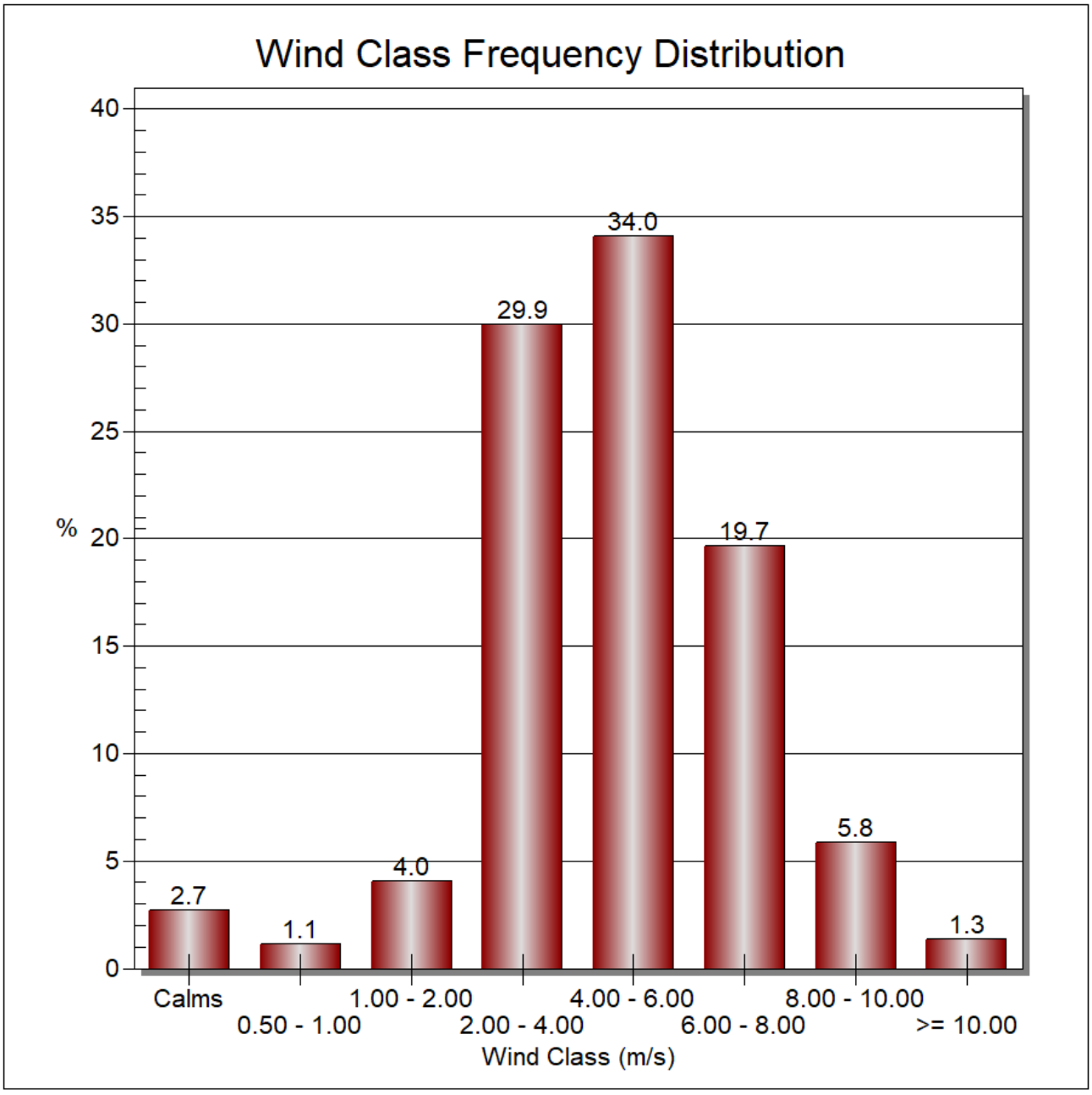
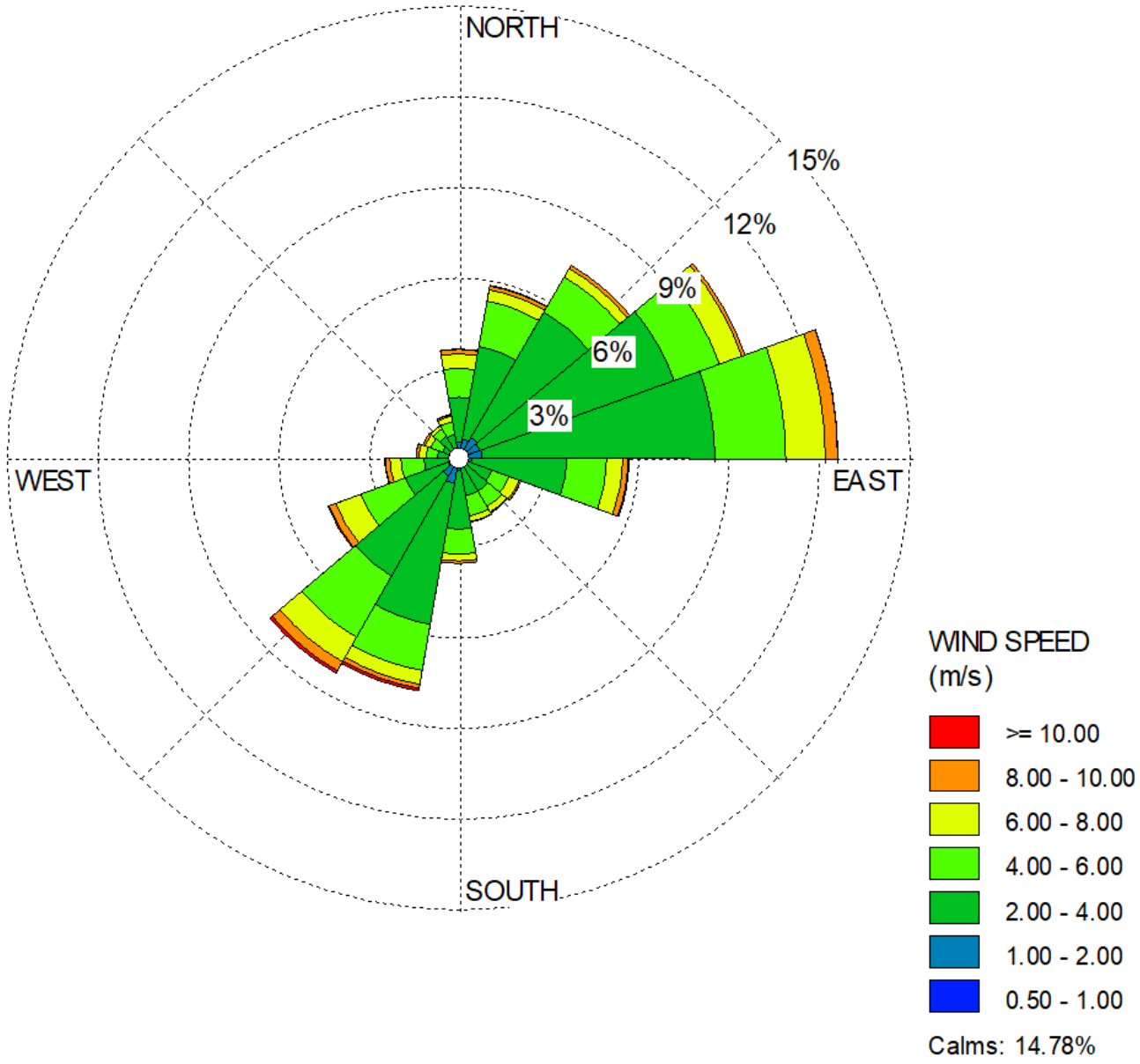
30
25
20
15
10
5
0
%
11.1
2.8
7.0
32.0
25.9
14.9
4.5
0.8
Calms
0.50 - 1.00
1.00 - 2.00
2.00 - 4.00
4.00 - 6.00
6.00 - 8.00
8.00 - 10.00
>= 10.00
Wind Class (m/s)

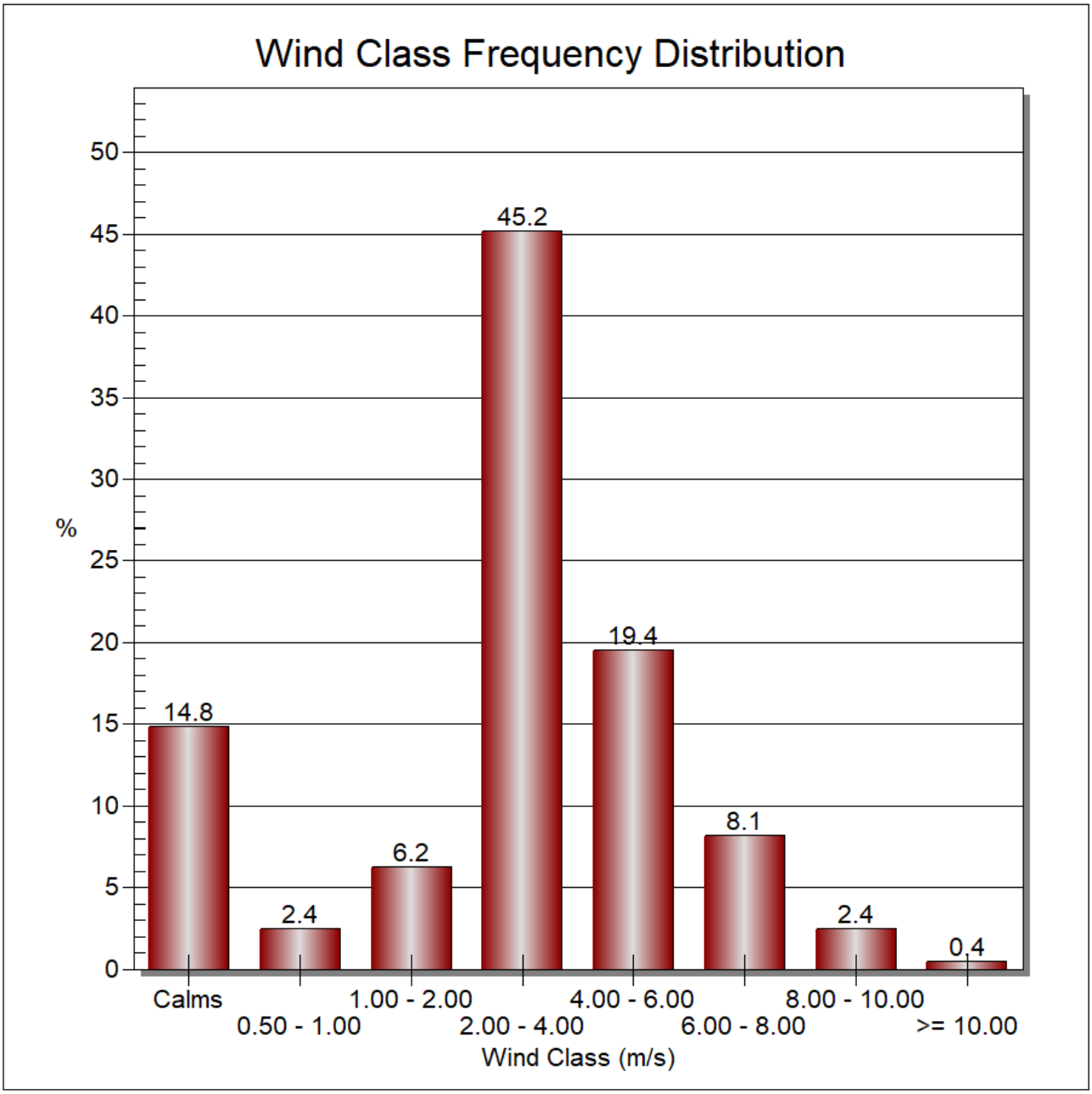
B3.3 12:00 – 18:00




Wind Class Frequency Distribution
40
35
30
25
20
15
10
5
0
%
34.0
29.9
19.7
5.8
4.0
2.7
1.1
1.3
Calms
0.50 - 1.00
1.00 - 2.00
2.00 - 4.00
4.00 - 6.00
6.00 - 8.00
8.00 - 10.00
>= 10.00
Wind Class (m/s)

B3.4 18:00 – 00:00




Wind Class Frequency Distribution
%
50
45
40
35
30
25
20
15
10
5
0
14.8
2.4
6.2
45.2
19.4
8.1
2.4
0.4
Calms
0.50 - 1.00
1.00 - 2.00
2.00 - 4.00
4.00 - 6.00
6.00 - 8.00
8.00 - 10.00
>= 10.00
Wind Class (m/s)

APPENDIX C

LITERATURE REVIEW OF NOISE SOURCES ASSOCIATED WITH PROPOSED LAND USES

C1 NOISE SOURCES

The list of noise sources and associated with assumptions informing the sound power level per unit area for each identified land uses are summarised in Table C.1.

Table C.1 Noise sources – proposed future land uses for Parkes SAP

NOISE SOURCE	NUMBER (PER 15 MINUTES)	SOUND POWER LEVEL PER UNIT[1]	COMMENTS/ ASSUMPTIONS
Regional enterprise[2]			
Factory building	1	Indoor reverberant sound pressure level of 85 dBA	Building area occupies approximately 20% of land area with an internal reverberation noise level of 85 dBA. Factory building of sheet metal building envelope construction.
Forklift	4	93	Assume each forklift operate 50% of the entire assessment duration of 15 minutes.
General building services outdoor unit	10	65	
On-site truck movement	4 movements	106	Assume each on-site movement takes 60 seconds to complete and engine not left idling during loading/ unloading.
On-site light vehicle movement	20 movements	85	
Protected cropping[3]			
Forklift	4	93	Assume each forklift operate 50% of the entire assessment duration of 15 minutes.
On-site truck movement	4 movements	106	Assume each on-site movement takes 60 seconds to complete and engine not left idling during loading/ unloading.
General building services outdoor unit	10	65	
On-site light vehicle movement	20 movements	85	

NOISE SOURCE	NUMBER (PER 15 MINUTES)	SOUND POWER LEVEL PER UNIT[1]	COMMENTS/ ASSUMPTIONS
Intensive livestock agriculture[4]			
Ventilation fan	48	80	Likely to represent an axial fan fitted with an in-duct silencer at the external side of the fan.
On-site truck movement	2 movements	106	Assume each on-site movement takes 60 seconds to complete and engine not left idling during loading/ unloading.
Forklift	2	93	Assume each forklift operate 50% of the entire assessment duration of 15 minutes.
On-site light vehicle movement	20 movements	85	
Waste to energy and recycling[5]			
Tipping hall	1	Indoor reverberant sound pressure level of 85 dBA	
Waste bunker	1	Indoor reverberant sound pressure level of 82 dBA	
Boiler house	2	Indoor reverberant sound pressure level of 85 dBA	
Flue gas treatment	4	98	
Turbine hall	2	Indoor reverberant sound pressure level of 88 dBA	
Ash Bunker Extraction fan	2	93	
Ventilation fans	4	100	
Ventilation fan duct	4	79/m	
Exhaust stack tip	4	91	
Lime blowers	2	92	
Silo air compressors	2	97	
Pac blowers	2	92	
Air cooled condensers	24	102 (per cluster of 6 units)	
Transformer	2	102	
High pressure steam line	2	96	
On-site truck movement	16	106	

NOISE SOURCE	NUMBER (PER 15 MINUTES)	SOUND POWER LEVEL PER UNIT[1]	COMMENTS/ ASSUMPTIONS
Airport			
General building services outdoor unit	5	105	

(1) Reported sound level represents sound power level unless otherwise stated (e.g. indoor reverberant noise level).

(2) Assessment of Regional Enterprise generally based on the food processing facility proposed at Lot 97 Brolgan Road, Parkes, Development Application noise report by Total Pty Ltd dated November 2018).

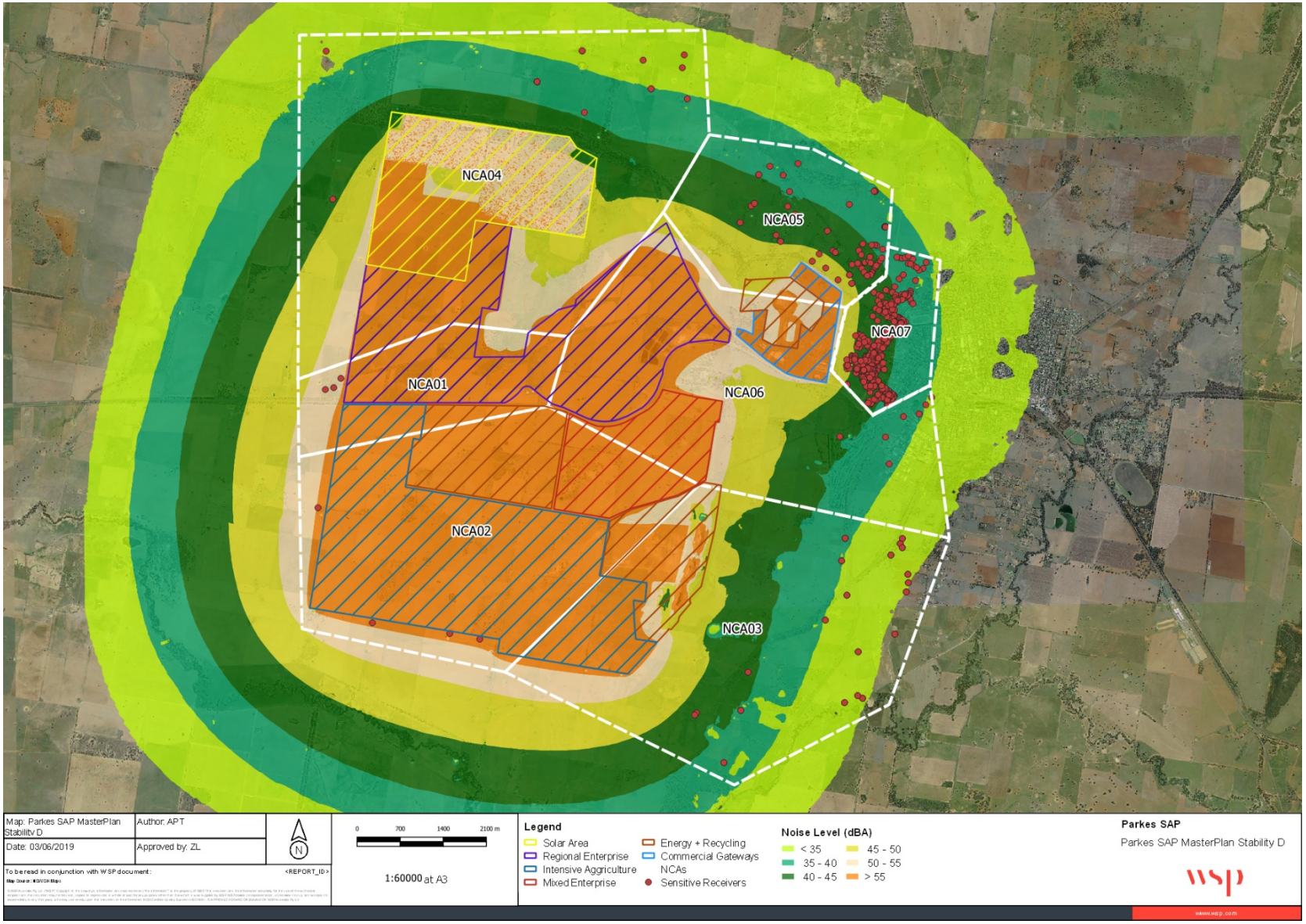
(3) Assessment of Protected Cropping generally based on interpretation of literature from www.protectedcroppingaustralia.com.

(4) Assessment of Intensive livestock agriculture generally based on NIA for Pheasants Nest Poultry Farm (Advitech Environmental report J0160298 dated December 2017), *Noise Management at Intensive Livestock Installations* (UK Environment Agency's, November 2005), *Farm Noise Emissions During Common Agricultural Activities* (2005, J. Depczynski, R. C. Franklin, K. Challinor, W. Williams, L. J. Fragar).

(5) Assessment of Waste to energy and recycling facility generally based on Next Generation Pty Ltd's Eastern Creek Energy from Waste proposal, Pacific Environment Limited Noise Impact Assessment dated 31 March 2015.

APPENDIX D

PREDICTED L_{Aeq} NOISE CONTOURS – ON-SITE INDUSTRIAL NOISE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NCA05
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NCA01
NCA06
NCA02
NCA03
Map: Parkes SAP MasterPlan Stability D
Author: APT
Date: 03/06/2019
Approved by: ZL
To be read in conjunction with WSP document:
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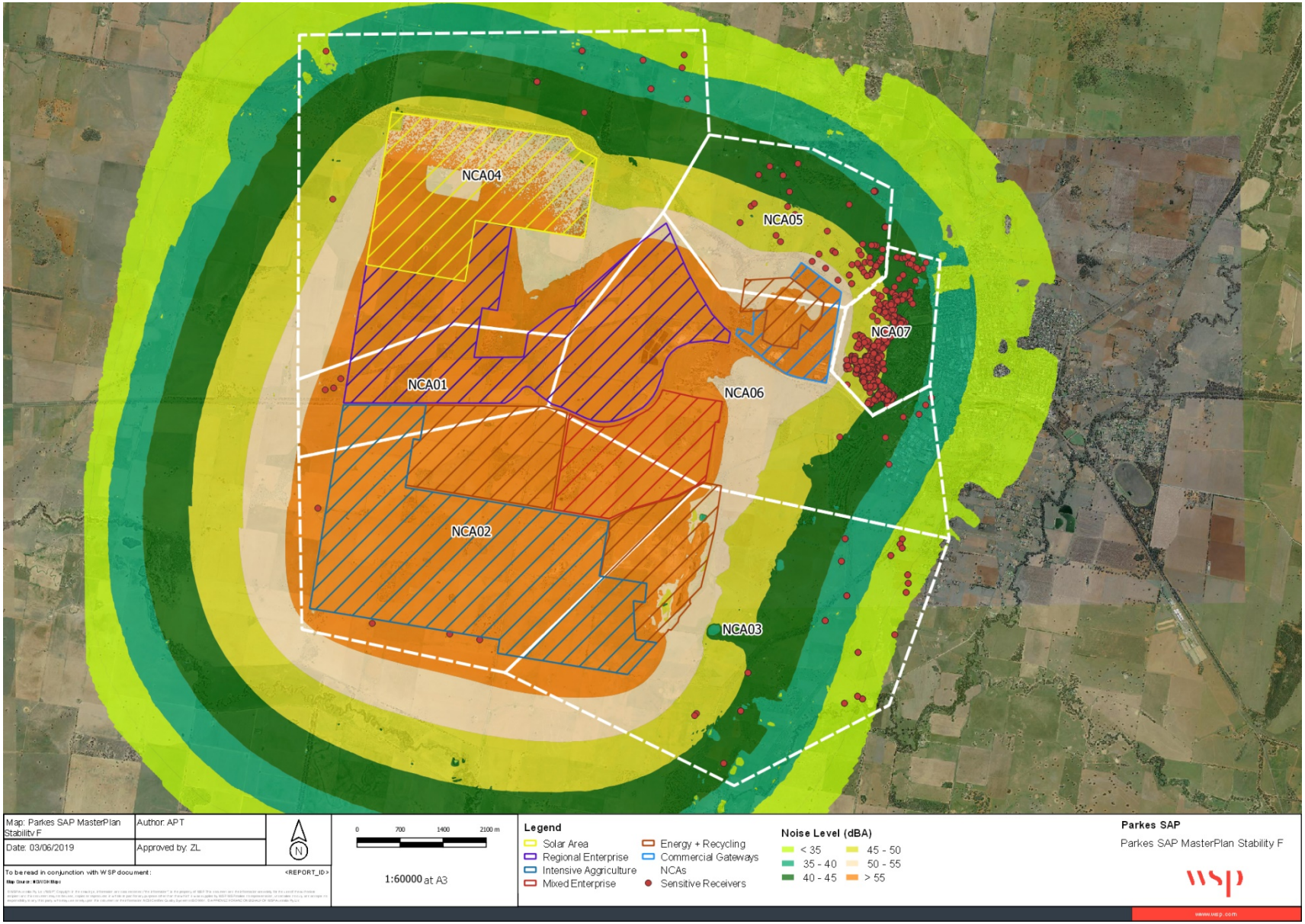
700
1400
2100 m
1:60000 at A3
Legend
Solar Area
Regional Enterprise
Intensive Aggriculture
Mixed Enterprise
Energy + Recycling
Commercial Gateways
NCAs
Sensitive Receivers
Noise Level (dBA)
< 35
35 - 40
40 - 45
45 - 50
50 - 55
> 55
Parkes SAP
Parkes SAP MasterPlan Stability D


NCA04
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NCA06
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NCA03
Map: Parkes SAP MasterPlan Stability F
Author: APT
Date: 03/06/2019
Approved by: ZL
To be read in conjunction with WSP document:
<REPORT_ID>
0 700 1400 2100 m
1:60000 at A3
Legend
Solar Area
Regional Enterprise
Intensive Aggriculture
Mixed Enterprise
Energy + Recycling
Commercial Gateways
NCAs
Sensitive Receivers
Noise Level (dBA)
< 35
35 - 40
40 - 45
45 - 50
50 - 55
> 55
Parkes SAP
Parkes SAP MasterPlan Stability F

APPENDIX E

GUIDANCE IN INDUSTRIAL NOISE MITIGATION (NPFI)

NPfI provides detailed guidance in the process of investigating noise mitigation options and these are extracted and described here for information.

E1 DEFINITION OF 'FEASIBLE' AND 'REASONABLE' MITIGATION

In reference to NPfI, 'feasible' and 'reasonable' mitigation is defined as follows:

A feasible mitigation measure is a noise mitigation measure that can be engineered and is practical to build and/or implement, given project constraints such as safety, maintenance and reliability requirements. It may also include options such as amending operational practices (for example, changing a noisy operation to a less-sensitive period or location) to achieve noise reduction.

Selecting reasonable measures from those that are feasible involves judging whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the mitigation measure. To make such a judgement, consider the following:

- Noise impacts:
  - existing and future levels, and projected changes in noise levels
  - level of amenity before the development, for example, the number of people affected or annoyed
  - the amount by which the triggers are exceeded.
- Noise mitigation benefits:
  - the amount of noise reduction expected, including the cumulative effectiveness of proposed mitigation measures, for example, a noise wall/mound should be able to reduce noise levels by at least 5 decibels
  - the number of people protected.
- Cost effectiveness of noise mitigation:
  - the total cost of mitigation measures
  - noise mitigation costs compared with total project costs, taking into account capital and maintenance costs
  - ongoing operational and maintenance cost borne by the community, for example, running air conditioners or mechanical ventilation.
- Community views:
  - engage with affected land users when deciding about aesthetic and other impacts of noise mitigation measures
  - determine the views of all affected land users, not just those making representations, through early community consultation
  - consider noise mitigation measures that have majority support from the affected community.

Take into account the above considerations when determining the mitigation measures proposed to be incorporated into the development. In practice, the detail of the mitigation measures applied will largely depend on project-specific factors. These are the measures that minimise, as far as practicable, the local impacts of the project. Project approval conditions that flow from this process should be achievable. They need to provide clarity and confidence for the proponent, local community, regulators and the ultimate operator that the proposed mitigation measures can achieve the predicted level of environmental protection.

E2 NPfI GENERIC LIST OF MITIGATION MEASURES

Typical noise sources on industrial sites include:

- engines
- exhausts
- fans
- transport of materials, such as on conveyors and trucks
- milling and stamping (metal works)
- sawing and debarking (wood mills)
- processors such as crushing and separating plant
- pumps and compressors
- whistles and alarms
- material dumping and scraping
- electrical transformers and switching equipment.

The choice of noise-control measures depends on both the degree of mitigation required and the undesirable characteristics of the noise source that need to be controlled. The actual measures chosen will also depend on site factors, such as the ability of the site to accommodate particular engineering measures relative to other measures and their site costs.

A generic set of noise-control measures is set out below, with additional measures shown that may apply to particular developments.

E2.1 GENERIC LIST OF MITIGATION MEASURES

Noise-source controls can include:

- selecting quieter equipment (including noise as a consideration in procurement policies and practices)
- enclosing the source; the design of the enclosure and materials used to absorb sound will affect the attenuation achieved
- closing doors on enclosures/buildings at sensitive times
- silencing exhausts – muffler design and noise-barrier systems
- active noise control, effective on a limited range of noise sources
- times of operation
- smooth roadways and vehicular access points.

Controls along the sound-transmission path can include:

- noise barriers: more effective if near source or receiver; effectiveness also controlled by materials used (reflective or absorptive) and by height
- mounds and bunds
- site design to maximise the distance from the critical noise source to the receiver, and with intervening buildings to act as barriers.

Controls at the noise receiver include:

- insulation
- upgraded glazing of windows and use of mechanical ventilation and/or air conditioning
- other mutually accepted trade-offs for benefits
- voluntary acquisition.

E2.2 ADDITIONAL MITIGATION MEASURES FOR EXTRACTIVE INDUSTRIES

Noise mitigation measures for on-site transport of materials can include:

- selecting vehicles with minimum noise output, including tyre noise, exhaust and compressor/fan noise
- using rolling stock with quiet couplings and brakes
- using locomotives with components that do not emit tonal or low-frequency noise
- using trenches, cuttings, tunnels and barriers for transport routes
- restricting times for truck operations on ridgelines and in locations that are line-of- sight with receivers
- giving preference to haul routes with low grades
- using conveyor systems with low noise output, paying particular attention to rollers
- enclosing conveyors where necessary
- maintaining plant and equipment to ensure that the designers' noise-output specifications continue to be met
- using 'smart' or broad-band reversing alarms.

Noise mitigation measures for mine and quarry operation can include:

- locating materials processing in the least noise-sensitive area, or enclosing it if necessary
- dumping spoil and waste behind barriers
- using reactive management systems that allow for operations to be modified under adverse meteorological conditions.

E2.3 ADDITIONAL MITIGATION MEASURES FOR SITES WITH SPECIFIC NOISE CHARACTERISTICS

Noise mitigation measures for piling can include:

- using piling shrouds or vibratory piling instead of impact piling to control impulsive noise.

Noise mitigation measures for milling and metal works include:

- using efficient enclosures, where needed, to reduce the impact of impulsive noise from metal stamping
- reducing the impact or output of tonal noise from cutting equipment and saws, by using enclosures, or through equipment redesign.

Noise mitigation methods for pumps, transformers and machinery producing low-frequency or tonal noise can include:

- where low-frequency noise is difficult to isolate, seeking specialist advice about machinery redesign and restricted operating times
- reducing tonal noise through machinery redesign, enclosure, or restricted operating times, or by applying active noise control.

Noise mitigation for sites producing intermittent noise during night-time operations can include:

- control that may be specific to the way the noise source is designed or how it fits into the overall industrial process. Using barriers, enclosing or redesigning the source, or changing the operation to provide for a more continuous output, are possible measures.

E2.4 NOISE MITIGATION FOR NIGHT-TIME COLLECTION OF POULTRY

- Vehicles should have engine compression brakes disabled on approach, departure, and while manoeuvring on the premises where it is safe to do so. No harsh acceleration or braking should occur on or near the premises.
- Vehicular crossing points and access driveways should be smooth and free of deformities (such as pot holes) to avoid impact noises.
- Gates should be well maintained and opened/closed by site personnel to avoid vehicles stopping or accelerating, or vehicle doors slamming at the access point.
- Vehicle engines should be switched off during loading activities.
- Raised voices and amplified music should not occur during night-time periods.
- Soft rubber pads between cages or use of plastic cages and other measures to avoid impact noises should be investigated and applied where practical.
- Reversing beepers should be avoided by the use of forward manoeuvring where practical.
- Non-tonal reversing beepers should be used on site plant and equipment where determined to be safe.
- Regular maintenance of noise-control equipment of site mobile plant and equipment should be undertaken (for example, integrity of mufflers and silencers).
- Drive-through loading enclosures and localised barriers should be considered where feasible and reasonable.

Note: Further resource documents for best-practice management of intensive poultry activities are available, such as *Best Practice Management for Meat Chicken Production in NSW, Manuals 1 & 2* (Department of Primary Industry, 2012), and *National Environmental Management System for the Meat Chicken Industry - Version 2*.

Proponents may wish to use the following matrix, or develop a similar decision-making tool, to determine and justify what mitigation measures are feasible and reasonable. This maybe taken into account by the planning authority.

NPfI Table 3.1: Example of 'feasible and reasonable' mitigation decision-making matrix for inclusion within an environmental impact assessment.

Table E.1 NPfI Table 3.1: Example of 'feasible and reasonable' mitigation decision-making matrix for inclusion within an environmental impact assessment

MITIGATION OPTION	FEASIBLE MITIGATION TEST	REASONABLE MITIGATION TEST	JUSTIFICATION FOR ADOPTING OR DISREGARDING THIS OPTION
Mitigation at the source Option 1 Option 2 (… and so on, for all mitigation options)	Comment on whether the option under consideration is feasible. Refer to Fact Sheet F for further advice.	Comment on whether the option under consideration is reasonable. Refer to Fact Sheet F for further advice.	Provide details why the particular option under consideration will be included or disregarded, based on: — the noise impacts with and without the option — the noise mitigation benefits — the cost effectiveness of noise mitigation — community views. Refer to Fact Sheet F for further advice.
Mitigation in the transmission path to the receiver Option 1 Option 2 (…)	As above	As above	As above
Mitigation at the receiver Option 1 Option 2 (…)	As above	As above	As above

APPENDIX F

EXISTING ROAD TRAFFIC VOLUMES

Table F.1 Existing Traffic Volumes (2016)

ROAD	DIRECTION	EXISTING TRAFFIC VOLUMES 2017					
		15 HOUR (DAY)			9 HOUR (NIGHT)		
		TOTAL VOLUME	HEAVY VEHICLE	MEAN SPEED (KM/H)	TOTAL VOLUME	HEAVY VEHICLE	MEAN SPEED (KM/H)
Newell Highway							
North of Grey Dove Lane (South of Parkes)	NB	2,069	211	85.6	255	50	83.7
	SB	2,124	257	88.2	219	27	85.9
Between Maguire Road & Nock Road (North of Parkes)	NB	1,701	306	91.9	247	70	90.1
	SB	1,754	331	88.3	197	52	88.2
Brolgan Road							
West of Friendship Place	EB	615	49	46.8	49	0.3	47.2
	WB	572	37	46.9	52	6.5	44.7
Condobolin Road							
Between Westlime Road & Flinders Street	EB	717	69	61.9	40	1.8	62.8
	WB	738	69	65.9	61	5.1	65.6
Thomas Street							
East of Reedsdale Road	EB	226	36	53.3	13	1.1	54.2
	WB	207	32	56.9	15	2.8	56.7
Bogan Road							
Goonumbla Lane	NB	206	41	87.3	163	21	80.4
	SB	309	55	82.8	41	3.5	83.1
Bogan Street							
At 60 Bogan Street (Within the Parkes Township)	NB	4,058	353	44.6	431	78	45.9
	SB	4,512	374	42.9	376	53	46.2

Table F.2 Existing Traffic Volumes (2012–2017)

ROAD	LOCATION	AVERAGE WEEKDAY TRAFFIC VOLUME (VEH/DAY)			AVERAGE WEEKLY TRAFFIC VOLUME (VEH/DAY)		
		ALL VEHICLES	HEAVY VEHICLES	HEAVY VEHICLE %	ALL VEHICLES	HEAVY VEHICLES	HEAVY VEHICLE %
Newell Highway	North of Grey Dove Lane	5,042	982	19%	4,792	918	19%
Westlime Road	South of Coronation Avenue	943	194	21%	846	160	19%
Hartigan Avenue	South of Billy Mac Place	1,182	205	17%	1,032	175	17%
Brolgan Road	West of Friendship Place	1,369	115	8%	1,289	97	8%
Condobolin Road	Between Westlime Road and Flinders Street	1,684	182	11%	1,559	155	10%
Thomas Street	East of Reedsdale Road	497	78	16%	459	71	16%
Newell Highway	Between Maguire Road and Nock Road	4,020	818	20%	3,892	753	19%
Bogan Road	Between Deep Lead Road and Reedsdale Road	1,294	261	20%	1,117	213	19%
Bogan Street	Outside Property 60	10,132	926	9%	9,364	848	9%
Bleechmore Road	Between Maguire Road and Nock Road	173	11	7%	164	10	6%
Henry Parkes Way	10 m west of Billabong Creek, east Parkes	2,175	413	19%	1,998	336	17%
Newell Highway	Forbes/Parkes LGA Boundary	4,004	1,039	26%	3,689	923	25%
Newell Highway	Narromine/Parkes LGA Boundary	2,902	949	33%	2,731	857	31%
Brolgan Road	East of Westlime Road	737	106	14%	696	90	13%
Brolgan Road	West of Westlime Road	833	190	23%	791	155	20%
Westlime Road	North of Brolgan Road	556	139	25%	510	112	22%
Westlime Road	South of Brolgan Road	652	231	35%	564	184	33%
Newell Highway	100 m north of Cecile Street	9,286	1,275	14%	8,446	1,127	13%
Newell Highway	5 km north of Parkes	3,782	899	24%	3,608	837	23%
Henry Parkes Way	West of Russell Street	5,440	767	14%	5,260	656	12%
Condobolin Road	West of Moulden Street	1,334	233	17%	1,274	214	17%
Back Trundle Rd	Eastern 40 km/h school zone approach to Christian School	810	70	9%	695	60	9%
Condobolin Road	East of Moulden Street	1,493	283	19%	1,387	230	17%

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