Kempsey Airport

Noise Management Plan and Fly Neighbourly Advice

FINAL REPORT 2019

KEMPSEY
Shire Council

Prepared for Kempsey Shire Council by The Airport Group - June 2019

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Abbreviations

AGL	Above Ground Level
AMSL	Above Mean Sea Level
AIAC	Australian International Aviation College
AIP	Aeronautical Information Package
ANE	Air Noise Environment
ANEF	Australian Noise Exposure Forecast
AMSL	Above Mean Sea Level
AsA	Airservices Australia
AS	Australian Standard
AWIS	Automated Weather Information System
BOM	Bureau of Meteorology
CASA	Civil Aviation Safety Authority
DA	Development Application
DAP	Departure and Approach Procedures
dB(A)	A weighted decibel
DCP	Development Control Plan
ERSA	En Route Supplement Australia
EPNL dB	Effective Perceived Noise Levels,
FNA	Fly Neighbourly Advice
FY	Financial Year
GA	General Aviation (e.g.light aircraft)
IMC	Instrument Meteorological Conditions
KARG	Kempsey Airport Reference Group
KIAS	(Knots) Indicated Air Speed
KPS	Kempsey Airport
KSC	Kempsey Shire Council
LEP	Local Environment Plan
LGMS	Local Growth Management Strategy
L/V	Light and Variable
MTOW	Maximum Take Off Weight
NASF	National Airports Safeguarding Framework
Nm	Nautical miles
NMP	Noise Management Plan
NSW	New South Wales
OAR	Office of Airspace Regulation
PSA	Public Safety Area
QNH	Query Nautical Height
RFS	Rural Fire Service
RWY	Runway
SEPP	State Environmental Planning Policy
TAG	The Airport Group
VMC	Visual Meteorological Conditions

1. Introduction

Introduction

1.

1. INTRODUCTION

The Airport Group (TAG) has been engaged by Kempsey Shire Council (KSC) to prepare a Noise Management Plan (NMP) and Fly Neighbourly Advice (formerly "Fly Neighbourly Agreement") (FNA) for Kempsey Airport (IATA: **KPS**; ICAO: YKMP).

In order to produce the NMP, noise monitoring was conducted at 17 locations surrounding KPS over an eight-week period. The sampling occurred in two, four-week stages. In the first stage, four locations were monitored. In the second stage, monitoring was continuous at one location close to the runway centre (source). Additionally, three alternative locations were sampled per week for the four-week period. A program of stakeholder engagement with KSC, airport users, and community representatives was undertaken. This process has created a robust understanding of the airport operating context and understanding of how noise currently impacts the areas surrounding the Airport.

The NMP has been developed based on the collation of objective data for a specific period of time at Kempsey Airport. This has been considered in the context of industry standard noise metrics and aviation and land use planning considerations. Broader considerations, such as the social, health, and environment impacts of noise are not included within this NMP.

1.1. Purpose of this study

The Airport has seen an increase of flight activity over the past few years, primarily due to aviation flight training operations. This has seen an increase of manoeuvres such as touch and gos (including circuits) and practice approaches being performed at KPS in addition to take offs and landings.

The purpose of the NMP and FNA is to provide guidance for the management of potential environmental impacts (in particular noise impacts) associated with the ongoing use and development of KPS. To do this, this Final NMP and FNA identifies several aviation and non-aviation related noise management strategies for KSC.

1.2. Objectives of this Plan

The objectives of this report are to:

- Provide an overview of the outcomes of the noise monitoring period that was undertaken at various locations surrounding KPS;
- Review of noise events and decibel (dB(A)) recordings of noise based on the day which experienced the highest and maximum number of noise events;
- Review noise events in the context of Australian Standards;
- Review the noise impacts and identify noise management strategies; and
- Produce a Noise Management Plan and Fly Neighbourly Advice for KPS.

1.3. Methodology

The following methodology has been used to produce the report for KPS:

- Project inception engagement with KSC and the Kempsey Airport Reference Group (KARG);
- Noise monitoring at 17 logger locations for a period of eight weeks;
- Analysis of the data collected during the noise monitoring period to identify the day in each period with the maximum number of noise events and correlate with recorded aircraft movements to confirm if noise event was aircraft noise;
- Review of noise levels (decibel (dB(A)) for comparison to Australian Standard 2021 – 2015 parameters;
- Stakeholder engagement with key airport users, leaseholders and operators, Council and the KARG;
- Review of the airport and flying operations;
- Production of Noise Management Strategies for KPS; and
- Production of proposed standard document for KSC to introduce an FNA.

1.4. Limitations

There are a number of limitations that have been identified in relation to the outcomes of the noise monitoring, and development of noise management strategies at KPS.

- Noise monitoring has been undertaken during the months of August – September and may not be representative of the year around operations of the Airport and the directionality of runway operations.
- Monitoring of noise management strategies and abatement procedures at KPS may be difficult as it is not an air traffic-controlled airport.
- There are delays between the actual movement occurring and the transcription of the movement onto the Avdata portal for KPS.
- There are limited opportunities to change traffic flow due to current wind direction dictating what runway is used and that this airport is used mainly for pilot training.
- En Route Supplement Australia (ERSA) principles with regard to unsafe flying are enforceable by the Civil Aviation Safety Authority (CASA) not the local authority or airport operator, and as such items need to be referred to CASA for review.
- The Local Traffic Regulations listed in the ERSA must be in accordance with aviation safety and operational regulations and should be followed by all aircraft operations at the designated airport. If a local authority wishes to amend or list a new operating procedure in the Local Traffic Regulations, it should be referred to CASA and Airservices Australia (AsA) for review.
- Both the NMP and FNA are not enforceable under aviation law and is a manner of goodwill between airport users, the community and the airport operator which endeavors to find a balance for stakeholders with regard to impacts on the environment from aviation operations.

1.5. Additional considerations

All information outlined in this report should be considered as recommendations, or potential strategies only. The scale to which KSC implement any or all of these strategies should be determined at the discretion of KSC.

Prior to implementation any strategies and recommendations for noise management, it is recommended that KSC consult/notify with CASA and AsA.

With regard to any future proposed changes from the standard procedures at the Airport (e.g AIP-ERSA) it is recommended that Council conduct a risk assessment with operational stakeholders (e.g regulatory and airport operational stakeholders) before implementing changes to operational procedures. This is particularly relevant where it involves changes to operational procedures at Airports with flight training as this adds to the complexity for students which may impact on safety in aerodrome operations during transition. A consultation document overviewing the proposed changes should be issued to relevant operational stakeholders inviting aviation parties to participate in the risk assessment before implementing. This should be done prior to the implementation of any of the strategies outlined in Section 1 and Recommendations in Section 7.

Overview

2. Kempsey Airport and Local Environment

2.

2. KEMPSEY AIRPORT AND LOCAL ENVIRONMENT

2.1. Airport site

Kempsey Airport (KPS) is a regional, general aviation (GA) centric airport located approximately 6km west of the Kempsey township. The Airport is located on the mid-north coast of New South Wales and was constructed in 1930 and officially opened in 1936. The Airport site is approximately 114ha. The indicative site boundary can be seen in Figure 1, below.

Figure 1: Site boundary of KPS (provided by KSC)

2.2. Infrastructure

2.2.1. Airport infrastructure

KPS is 54ft above mean sea level (AMSL) and has two runways. The main runway is Runway 04/22 and a there is a secondary cross runway, named Runway 16/34. The characteristics of the runways are outlined in Table 1, below.

Table 1: Overview of runway characteristics at KPS

Characteristic	Runway 04/22	Runway 16/34
Runway Length	1,643m (5,400ft)	614m (2,000ft)
Runway Width	30m	18m
Runway Surface	Asphalt or bitumen	Grass brown sand clay
Pavement Classification Number (PCN)	14	Unrated
Flight Strip width	90m	60m
Lighting	Low Intensity Runway Lighting (LIRL) – Pilot Activated (PAL)	N/A

The GA apron areas are not available to aircraft with a Maximum Take Off Weight (MTOW) in excess of 5,700kg or wingspan greater than 15m.

The Airport apron is connected to the main Runway 04/22 by a single taxiway, identified as A. There is also a network of minor taxiways connecting to Taxiway A. Taxiway C, C1, D and E are not available for aircraft above 5,700kg MTOW or with a wingspan greater than 15m. Airfield layout diagram for KPS is shown in Figure 2 as published in the Aeronautical Information Package (AIP) ERSA.

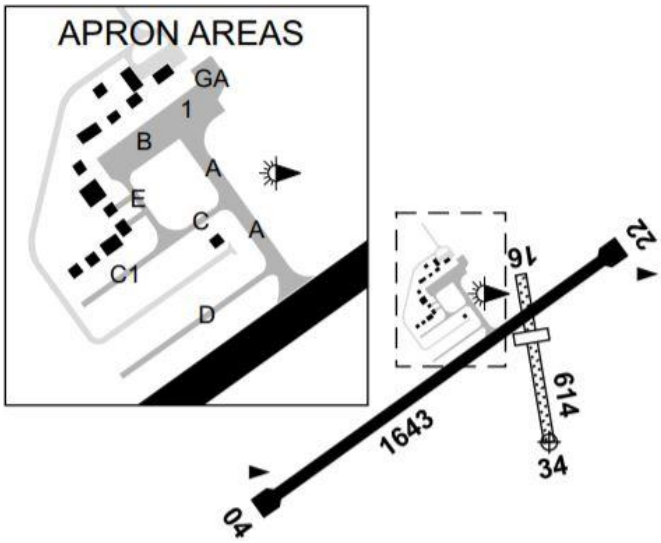


Figure 2: KPS Airfield Layout Diagram (AsA, 2018)

A Bureau of Meteorology (BOM) Automatic Weather Information System (AWIS) is also located at the Airport. A new automated fuel system and supply has recently been constructed at KPS. The system collocates and supplies both Jet A1 and Avgas to aircraft at the Airport.

2.2.2. Landside infrastructure

KPS is accessible via Airport Road. The Airport has a small terminal area with amenities and vehicle parking.

The ongoing development at KPS is expected to be accommodated within the Aviation Business Park, which is planned to have fully serviced hangar sites which opened in 2015 as part of the Mid North Coast Regional Aviation Plan.

2.3. Surrounding areas

The land surrounding the Airport is primarily RU 2 – Rural Landscape and RU 5 – Large Lot Residential (refer to Appendix A: Kempsey Shire Council LEP land Zoning Map). Surrounding communities include the suburbs of Aldavilla, Dondingalong, Greenhill, and Yarravel. The Airport is relatively close to the township of Kempsey and suburb of West Kempsey. The indicative location of these localities is identified in Figure 3 below. The boundaries and positioning of the locality markers presented have been determined using mapping data available from NSW Spatial Services called NSW Globe available online for Google Earth[1].

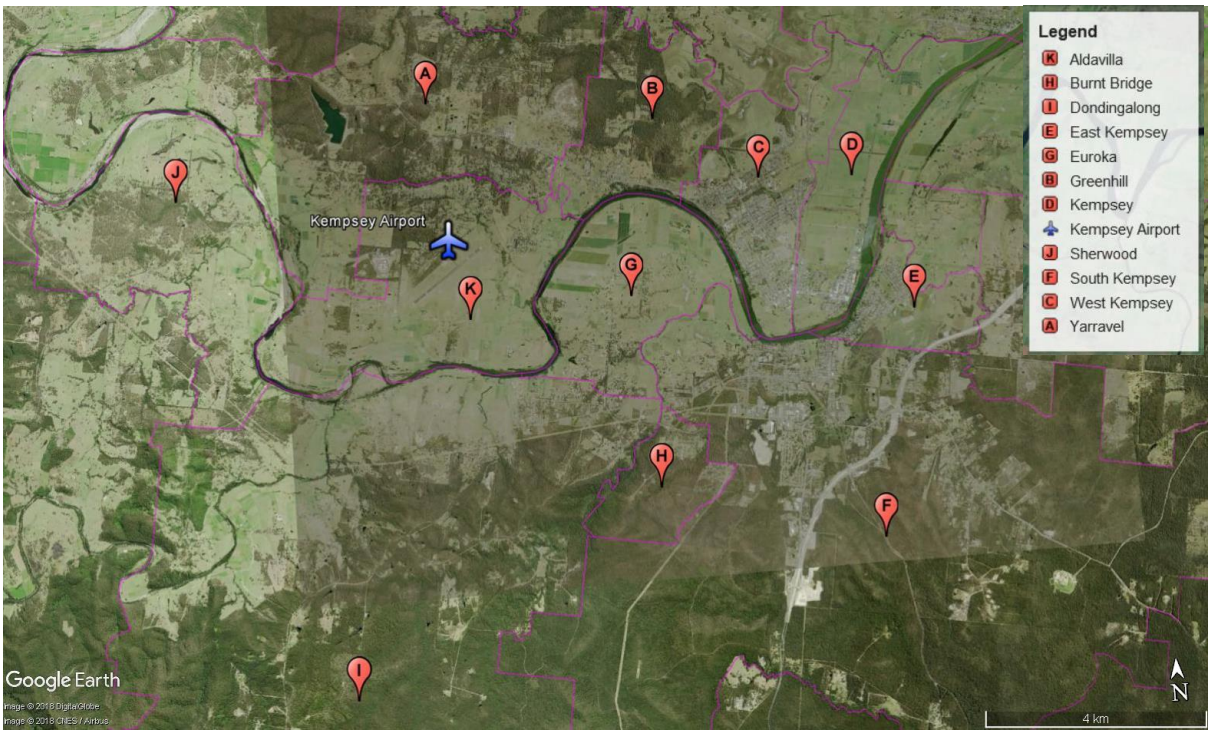


Figure 3: Location of Kempsey Airport relative to surrounding suburbs

2.4. Airport operations

The Airport is home to a number of aviation related business and private aircraft operators who have facilities or hangars based at the site. The primary use for the airport is for flight training, with the satellite operation of the Australian International Aviation College (AIAC) being based there. The Airport is also home to the Kempsey Flying Club, Coffs City Sky Divers and Macleay Aircraft Maintenance. On a regular basis, KPS also hosts model jet aircraft flying days, drawing visitors from around the region and Australia.

The Airport supports a number of emergency services operations. Aeromedical emergency service operators include the Royal Flying Doctor Service, LifeFlight, and the Helicopter Rescue Service operate out of KPS. The New South Wales Rural Fire Service (RFS) have permanent facilities based at the Airport and use the aerodrome as required during peak fire season and other emergencies such as floods, storms and search and rescue situations.

2.4.1. Aircraft movements

The number of aircraft movements at KPS has grown in recent years, primarily as a result of the ongoing growth and development in the flight training operations at the Airport.

The aircraft movements represented in the graphs in this section represent several types of operations, including practice approaches, touch and go's and other training operations.

'Training operations' as presented here only relate to touch and go, stop and go and other dedicated training movements, as recorded and defined by Avdata (the aircraft movement recording service). In this report, each training movement performed has been counted as two movements to reflect that each circuit involves a take-off and a landing. In addition, the recorded landings have been doubled to estimate the number of take offs and landings.

In Financial Year (FY) 2017/18 the airport experienced approximately 31,134 movements. This was a 130% increase on FY2016/17 in which 13,528 movements were experienced at the Airport.

An overview of the year on year growth of movements split by take offs and landings and training movements at the Airport since FY2012/13 can be seen in Figure 4 below.

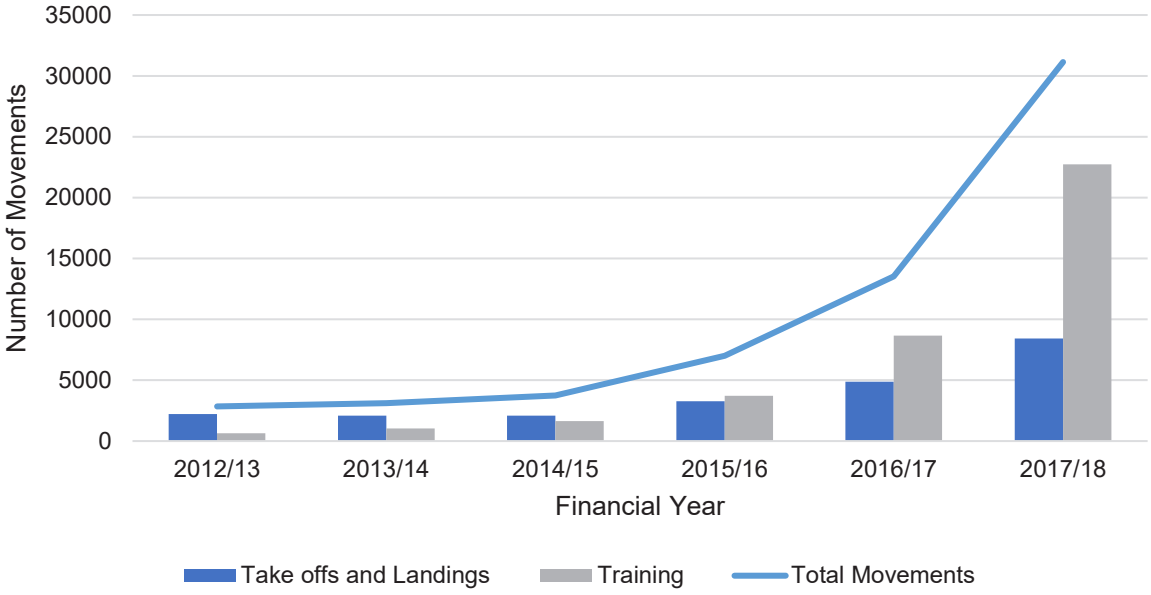


Figure 4: Historical aircraft movements at KPS by financial year (2013 to 2018)

The month by month aircraft movements experienced at KPS are outlined in Figure 5. This figure is broken down into landings and take offs and training movements for the period from March 2017 to October 2018.

It should be noted that from 1 July 2018, Avdata started transcribing take offs as part of their aircraft movement recording service. For the compilation of the monthly movement overview for the months prior to 1 July 2018, the number of landings transcribed by Avdata has been doubled to estimate the number of take off movements. The months since 1 July 2018 have been calculated using the separate transcribed number of movements for both landing and take offs.

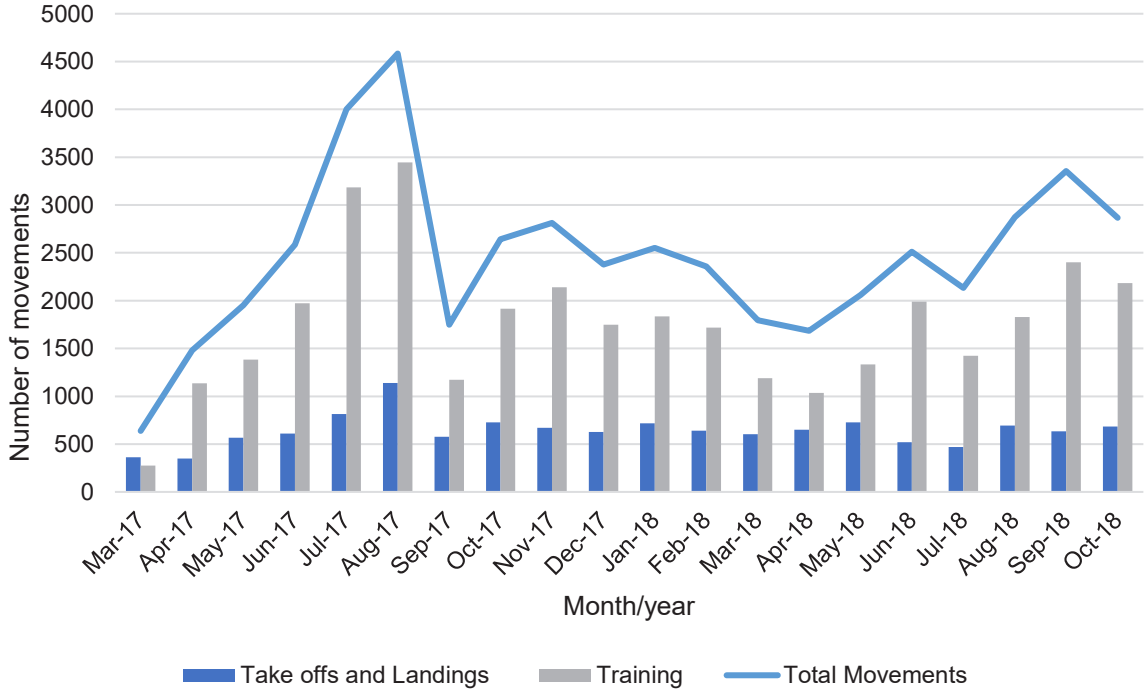


Figure 5: Monthly aircraft movements at KPS

2.4.2. Typical aircraft operations at KPS

KPS has two instrument approaches, enabling aircraft to conduct an approach to land on either RWY 04 or RWY 22 during poor weather conditions. Aircraft may also fly these approaches in any weather for testing and pilot training requirements. These approach procedures require an instrument rated pilot to be in command of the aircraft. Instrument landings require the aircraft to be tracking on the extended runway centreline at 10.8 nautical miles (nm) from threshold for an approach to RWY 04 and 10.3nm from threshold for an approach to RWY 22. An aircraft may elect to cancel the approach if visual conditions apply and it is necessary to manoeuvre for another runway. This is called circling and aircraft conducting a circling approach must do so at a minimum height of 940 feet.

The table below lists the published instrument approaches for RWY 04 and RWY 22 at KPS.

Table 2: Kempsey Airport published instrument approaches minima[2]

Instrument Approach Minima	Runway 04	Runway 22
Straight in Approach	680ft	690ft
Circling Approach	940ft	940ft

For the majority of arrivals at KPS, aircraft are in training operations or are operating to Visual Flight Rules. This generally requires that aircraft approach the airport and join the circuit at 1000 feet. Within the circuit, a decision as to which runway to use is made, considering factors such as wind direction, traffic or other operational matters.

The Departure and Approach Procedures (DAP) published by AsA as part of the AIP outlines the instrument approach procedures for KPS.

Circuit operations

As outlined by AsA *"circuit training is the first stage of practical pilot training focused on take-offs and landings. It involves the pilot making approaches to the runway, touching down and then applying power to take off again".*

A typical left-hand circuit as presented by AsA can be seen in Figure 6.

2 http://www.airservicesaustralia.com/aip/current/dap/AeroProcChartsTOC.htm#K

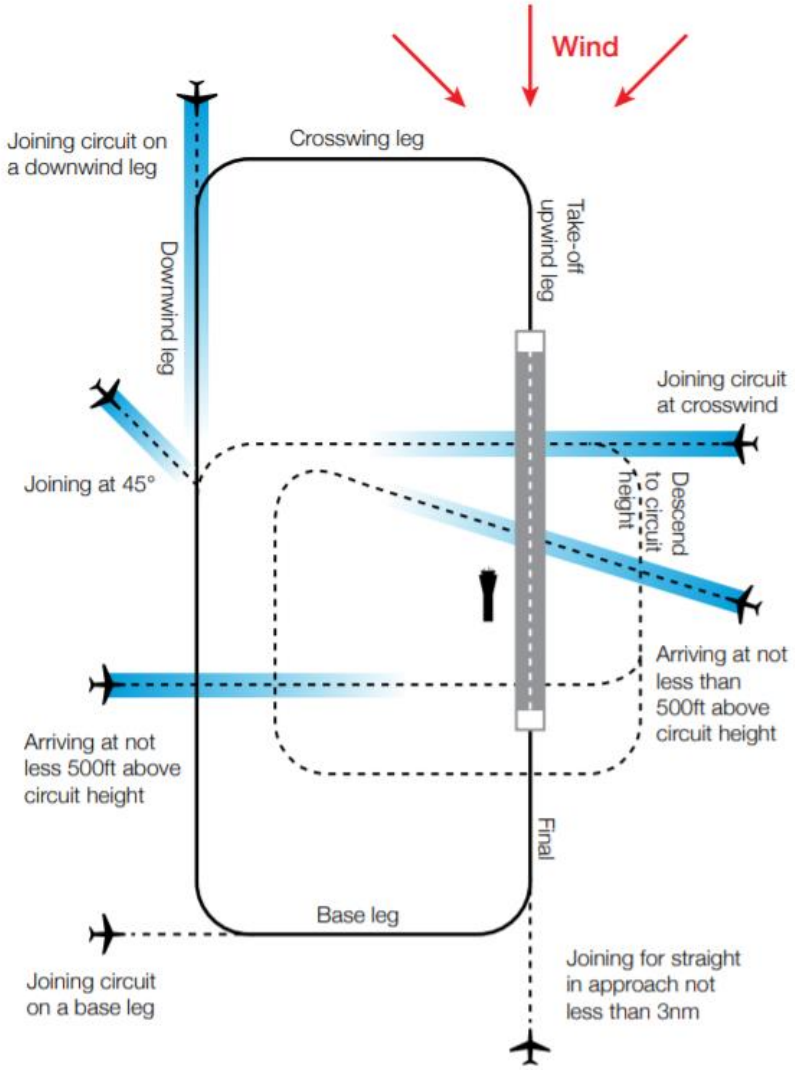


Figure 6: Typical left-hand circuit diagram (AsA)

Legislative Review

3.

3. Legislative Review

3. LEGISLATIVE REVIEW

As part of this project, TAG has reviewed legislation pertaining to noise and land uses at a Commonwealth, State and Local level. High-level overviews of particularly pertinent legislation and their relevance to KPS are described in this section.

This study has been prepared whilst taking into consideration the legislative context including the following documentation:

- National Airports Safeguarding Framework;
- Australian Standard - AS 2021:2015;
- Civil Aviation Safety Authority (CASA) Fly Neighbourly Agreement Voluntary code of practice;
- Air Navigation (Aircraft Noise) Regulations 2018;
- New South Wales State Environmental Planning Policy (Infrastructure) 2007;
- Kempsey Local Environmental Plan; and
- Kempsey Local Growth Management Strategy (LGMS) Rural Residential Component.

3.1. Aviation noise

This section provides an overview of the legislation pertaining directly to noise emissions by Aircraft at a federal level, which are administered by various bodies including CASA and the Department of Infrastructure, Regional Development and Cities.

3.1.1. National Airports Safeguarding Framework (NASF)

The National Airports Safeguarding Framework (NASF) is a national land use planning framework that aims to:

- *Improve community amenity by minimising aircraft noise-sensitive developments near airports;*
- *Improve safety outcomes by ensuring aviation safety requirements are recognised in land use planning decisions through guidelines being adopted by jurisdictions on various safety related issues.*

The Framework consists of Guidelines A-H which cover a range of topics relating to the safeguarding of Airports, including aircraft noise[3]. It is recognised that the NASF is a Federal Government guideline, and the implementation of the Framework is dependent on each State. Nonetheless, it is widely referred to within the aviation industry and is considered an appropriate Framework for consideration in this NMP.

Guideline A: Measures for Managing Impacts of Aircraft Noise

The purpose of Guideline A is to: *"provide guidance to Commonwealth, State, Territory and Local Government decision makers to manage the impacts of noise around airports including assessing the suitability of developments".* The guideline outlines that existing and future development need to be considered differently and describes that *"Where there is no major existing or approved development, there is scope to plan ahead to take account of potential noise disturbance and in particular to minimise the zoning of noise exposed land for residential development".*

The Guideline provides direction for planning officials when considering: rezoning of greenfield and brownfield areas to permit noise sensitive uses, as well as the assessment of new development applications for noise sensitive uses within existing residential areas.

ANEF is a useful tool for non-federally leased aerodromes to assist in identifying areas where noise sensitive development should be controlled, and to help to ensure the long-term sustainability of operations. However, AsA describes that as outlined in Appendix B1 of the AS 2012:2015, an ANEF is not compulsory for KPS as it is not a federally leased Airport[4].

For those airports which an ANEF is not required, which includes KPS, Section 30 of the Guideline outlines that, *"whether or not an ANEF is prepared for these airports, land use planning should take into*

3 https://infrastructure.gov.au/aviation/environmental/airport_safeguarding/nasf/nasf_principles_guidelines.aspx

4 http://www.airservicesaustralia.com/services/anef-and-anei/

account, flight paths, the nature of activity on airports and/or 'number above' contours if available". KPS does not currently have an ANEF in place for the Airport.

In situations where an ANEF is not in place at an airport, the Guideline describes that *"a 'zone of influence' around airports could be taken into account, depending on the amount of traffic at the airport".* The Guideline indicates (as guidelines only) that for *"any other type of aerodrome for which an ANEF chart is unavailable"* (which KPS would be categorised as) an approximate 5km zone of influence might be appropriate. The Guideline does not clearly stipulate how this 5km zone should be applied.

3.1.2. Air Navigation (Aircraft Noise) Regulations 2018

Air Navigation (Aircraft Noise) Regulations 2018 ("the Regulations") require all civil aircraft operating in Australia to comply with noise standards and recommended practices introduced under the convention on Civil Aviation. This is regardless of size, purpose or ownership.

There are a number of aircraft which are exempt from the regulations including State aircraft, hot air balloons and propeller driven aircraft that are specifically designed and used for aerobatic purposes, firefighting purposes, agricultural purposes and environmental operations.

The Regulations also provide for some exceptional circumstances where there are dispensations to enable limited operation of non-compliant aircraft may be applied for. Dispensations will include conditions that are intended to mitigate the impact of aircraft noise of the community.

All aircraft operating at KPS should be compliant with the Regulations. The owner/operator of the aircraft is responsible for regulatory compliance tests to ensure their aircraft meets the regulations, if required. Additionally, as outlined in the Regulations, *"The operator of an aircraft for which a noise certificate is in force must ensure that the noise certificate (whether consisting of a separate document or not) is carried on board the aircraft at all times".*

Based on the type of aircraft in operation, some aircraft are automatically deemed to be certified based upon advice from their manufacturer. If the aircraft's flight manual contains a statement that the aircraft complies with the relevant Australian noise laws or regulations then there is no need for a further assessment. If your aircraft is not certified by its manufacturer then you must obtain a certificate by showing that the aircraft complies with the noise standards[5].

3.1.3. Australian Standard (AS) 2021:2015

Australian Standards are *"voluntary documents that set out specifications, procedures and guidelines that aim to ensure products, services, and systems are safe, consistent, and reliable"*. Standards Australia describes that *"On their own, standards are voluntary. There is no requirement for the public to comply with standards. However, State and Commonwealth governments often refer to Australian Standards® (AS) or joint Australian/New Zealand Standards (AS/NZS) in their legislation"*[6].

The *Australian Standard 2021:2015 -'Acoustics – Aircraft noise intrusion – Building siting and construction'* (AS 2021:2015) was *"developed to assist in building construction and land use planning in the vicinity of airports".* The AS 2021:2015 has been considered when assessing the noise impact from an aircraft movement associated with KPS on surrounding residential receivers. The AS 2021:2015 is a key guidance document for the NASF as overviewed in Section 3.1.1. As outlined in the AS 2021:2015:

Aircraft noise intrusion within a building depends substantially on:

- *The location, orientation and elevation of the site relative to aircraft flight paths;*
- *The types and frequency of aircraft operating from the aerodrome;*
- *Meteorological conditions;*
- *Types of activity (including sleep) to be, or being, accommodated at that location;*
- *The type of layout, construction and ventilation used; and*
- *The internal acoustic environment.*

5 https://ablis.business.gov.au/service/ag/aircraft-noise-certificate/96

6 https://www.standards.org.au/standards-development/what-is-standard

The AS 2021:2015 is intended to assist in building construction and land use planning in the vicinity of airports. A major consideration for noise impacts at an airport include the scope of aircraft types currently operating at the aerodrome, and aircraft that may operate at the aerodrome in the future.

As per the AS 2021:2015, it is generally preferable for an aerodrome to have an ANEF chart in place to determine aircraft noise exposure at a site. Despite this, there are some processes that can be undertaken for aerodromes without ANEF charts. The procedure specified in Appendix E of AS 2021:2015 sets the acceptability of a building site for a particular building type that is exposed to the aircraft noise.

Whilst AS 2021:2015 defines land uses for future development, it is considered an appropriate benchmark to assessing potential noise impacts from aircraft movements on existing properties. The principles of the AS 2021:2015 noise goals to minimise intrusiveness are applicable to both future and existing sensitive uses.

An overview of how the AS 2021:2015 has been adopted for the noise monitoring undertaken at KPS can be found in Section 4.5

3.1.4. Fly Neighbourly Advice

Fly Neighbourly Advice (formerly "Fly Neighbourly Agreement") (FNA) are described by Australia's Civil Aviation Safety Authority (CASA) in the Airspace Risk and Safety Management Manual (2017)[7] as *"a voluntary code of practice established between aircraft operators and communities or authorities that have an interest in reducing the disturbance caused by aircraft within a particular area".*

The FNA wording is a matter for the participants involved. However, it must be consistent with the *Civil Aviation Safety Regulations 1998*, *Civil Aviation Regulations 1988* and any other air traffic management procedures applicable at the Airport. Mandatory aviation operating and safety procedures, in conjunction with any aviation requirements relevant to the area have precedence over an FNA. An FNA should also acknowledge the necessity for emergency services (including police, fire, search and rescue) and infrastructure monitoring organisations to have access to low level airspace when required.

There are a number of opportunities or alterations that can be implemented or made to operations in order to minimise noise impacts by airport management which are outlined in the Manual. These include:

- The number of operations;
- The heights of operations;
- Flight tracks used, including the avoidance of sensitive areas and the repetitive use of particular tracks;
- The origins and destinations of operations;
- Times of operations;
- Operating procedures available to the type of aircraft in use; and
- Changing the type of aircraft used.

Airport users, operators, and pilots have the opportunity to employ FNA piloting techniques and principles which include:

- Avoiding noise sensitive areas:
  - Follow high ambient noise routes (i.e. highways etc); and
  - Follow unpopulated routes (i.e. waterways, etc).
- When operating near noise sensitive areas:
  - Maintain an appropriate fly-over altitude;
  - Maintain an appropriate hover/circling altitude;
  - Speed reduction;
  - Low noise speed/descent settings;
  - Route variation; and
  - Use high take-off/descent profiles.

7 https://www.casa.gov.au/publications-and-resources/publication/airspace-risk-and-safety-management-manual

The CASA Airspace Risk and Safety Management Manual states that *"once an FNA is drafted, it should be referred to the OAR for consideration in regard to related aviation issues. The OAR will also consult with AsA as part of this process".*

FNA in the context of KPS is presented in Section 8.

3.2. State and Local planning regulations

3.2.1. State Environmental Planning Policy (Infrastructure) 2007

The State Environmental Planning Policy (SEPP) (Infrastructure) 2007 outlines *that development for the purpose of an airport may be carried out by or on behalf of a public authority without consent on land in various land use zones.* This includes RU 2 – Rural Landscape.

The SEPP does not have any provisions relating to aircraft noise.

3.2.2. State Environmental Planning Policy (Exempt and Complying Development Codes) 2008

The State Environmental Planning Policy (SEPP) (Exempt and Complying Development Codes) 2008 is a statewide policy except as defined in the Policy. The Policy provides for streamlined assessment processes for development that complies with specific development standards. Clauses of relevance to KPS are described in this section.

Clause 1.18 – General Requirements for complying development under this Policy in 1.18(2) provides for:

> *The erection of a new dwelling house or an addition to a dwelling house on land in the 20-25 ANEF contours is complying development for this Policy, if the development is constructed in accordance with AS 2021—2000,* Acoustics—Aircraft noise intrusion—Building siting and construction.

Clause 1.19 of the SEPP for Exempt and Complying Development Codes 2008 outlines specific land on which complying development may not be carried out and is relevant to KPS, as outlined below.

> *Clause 1.19 (1) Specific land exemptions for Housing Code, Inland Code, Low Rise Medium Density Housing Code, Rural Housing Code and Greenfield Housing Code.*
>
> *To be complying development specific for the Housing Code, the Low Rise Medium Density Housing Code, the Rural Housing Code, the Rural Housing Code or the Greenfield Housing Code, the development must not be carried out on:*
>
> *…..*
>
> *(h) land that is in the 25 ANEF contour or a higher ANEF contour, unless the development is only for:*
>
> *(i) the erection of ancillary development, attached development or detached development, or*
>
> *(ii) the alteration of, or an addition to, ancillary development, attached development or detached development.*

The SEPP refers to the use of ANEF Contours in the assessment and designation of compliant and non-complying development in NSW when looking into the effect of aircraft noise on land uses.

3.2.3. Kempsey Local Environmental Plan

The lot in which KPS is located is zoned as RU2 – Rural Landscape in the Kempsey Shire Council LEP 2011. As per the LEP, the use of land for air transport facilities and airstrips is permitted with consent within this zone.

Part 7 of the KSC LEP for additional local provisions includes development in areas subject to aircraft noise. Part 7.8, Development in areas subject to aircraft noise, is presented here.

(1) The objectives of this clause are as follows:

(a) to prevent certain noise sensitive developments from being located near the Kempsey Airport and its flight paths,
(b) to assist in minimising the impact of aircraft noise from that airport and its flight paths by requiring appropriate noise attenuation measures in noise sensitive buildings,
(c) to ensure that land use and development in the vicinity of that airport do not hinder or have any other adverse impacts on the ongoing, safe and efficient operation of that airport.

(2) This clause applies to development that:
(a) is on land that:
(i) is near the Kempsey Airport, and
(ii) is in an ANEF contour of 20 or greater, and
(b) the consent authority considers is likely to be adversely affected by aircraft noise.

(3) Before determining a development application for development to which this clause applies, the consent authority:
(a) must consider whether the development will result in an increase in the number of dwellings or people affected by aircraft noise, and
(b) must consider the location of the development in relation to the criteria set out in Table 2.1 (Building Site Acceptability Based on ANEF Zones) in AS 2021—2000, and
(c) must be satisfied the development will meet the indoor design sound levels shown in Table 3.3 (Indoor Design Sound Levels for Determination of Aircraft Noise Reduction) in AS 2021—2000.

(4) In this clause:
ANEF contour means a noise exposure contour shown as an ANEF contour on the Noise Exposure Forecast Contour Map for the Kempsey Airport prepared by the Department of the Commonwealth responsible for airports.
AS 2021—2000 means AS 2021—2000, Acoustics—Aircraft noise intrusion—Building siting and construction.

3.2.4. Kempsey Local Growth Management Strategy (LGMS) Rural Residential Component

The Kempsey Local Growth Management Strategy (LGMS) Rural Residential component is the outcome of a review of Council's Rural Residential Land Release Strategy 1990 and forms part of Council's Local Growth Management Strategy. The strategy is intended to meet Council's obligations to manage population and housing growth, consistent with relevant regional policies including state strategic planning documents for the region.

A number of the key investigation areas for rural residential land are in close proximity to KPS. Additional releases of rural residential land are likely to increase the number of developments within the proximity of the Airport which may to be affected by aircraft noise. Areas close to the airport include, Aldavilla and Yarravel, and Dondingalong.

Noise Monitoring

4. Noise Monitoring & Assessment

4.

4. NOISE MONITORING AND ASSESSMENT

To understand the nature and extent of disturbance caused by aircraft noise, monitoring has been undertaken at KPS as the source as well as numerous locations surrounding the Airport. This monitoring process was conducted by Air Noise Environment (ANE) and an overview of the methodology and outcomes of the noise assessment period are summarised in this section. The complete ANE report can be found in Appendix F: ANE Noise Monitoring Report. Appendix A of the ANE report provides a glossary of terms adopted throughout this Section.

4.1. Noise monitoring overview

The noise monitoring for this project occurred between 4 August 2018 and 30 September 2018. This section provides an overview of the Airport context as well as operations during this period.

4.1.1. Noise monitoring geographic context

The noise monitoring context of KPS is primarily rural and residential land uses, as can be seen in Figure 7, below.

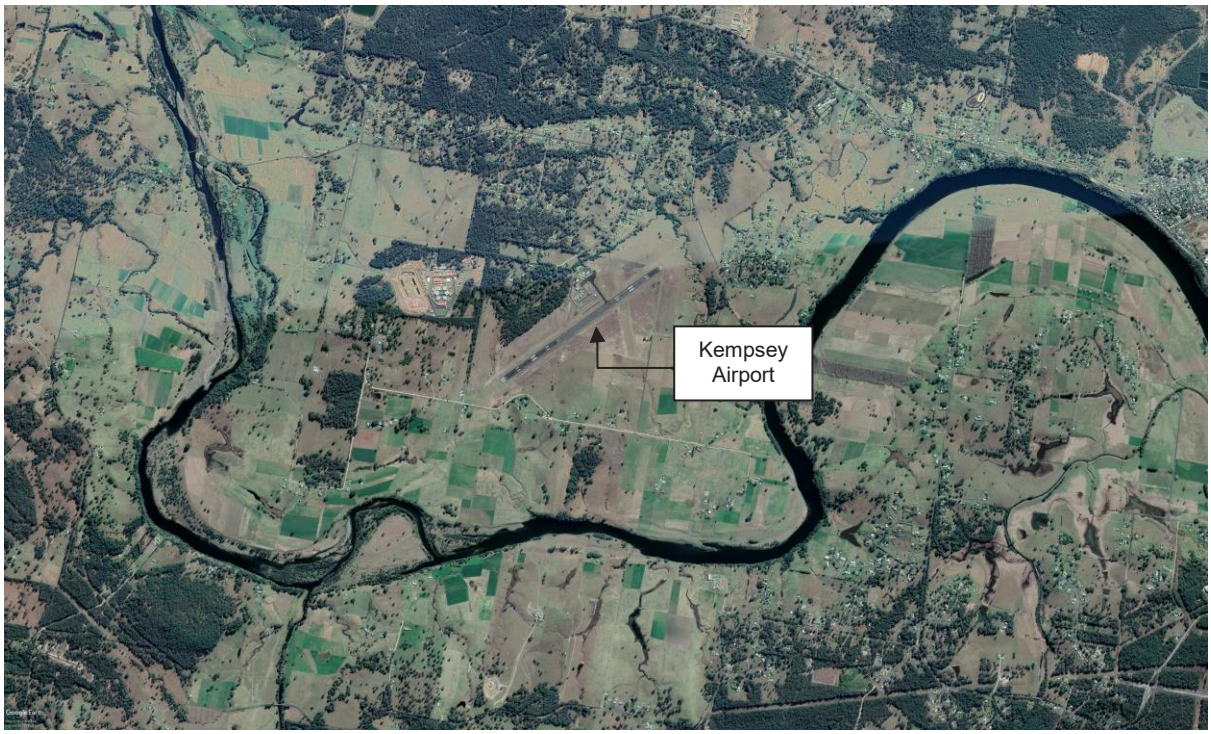


Figure 7: Kempsey Airport context aerial image (Google Earth, 2018)

4.1.2. Summary of movements during noise monitoring period

During the period 4 August 2018 to 30 September 2018, a total of 5,209 movements occurred at KPS, including 27 movements recorded during the evening (see Figure 8). This figure adopts the assumptions outlined in Section 2.4.1 (i.e. training operations counted as two movements each to reflect that each circuit involves a take-off and a landing).

During this period, there was a total of 27 operations conducted between the hours of 19:00 and 07:00, representing 0.004% of all aircraft movements. Of the night time movements, 22 (81%) were for the purposes of emergency services with a majority being operated by aeromedical operators. The remainder of the operations were take-offs performed between 06:30 and 07:00 in addition to two occurrences of touch and go training aircraft movements also between 06:30 and 07:00.

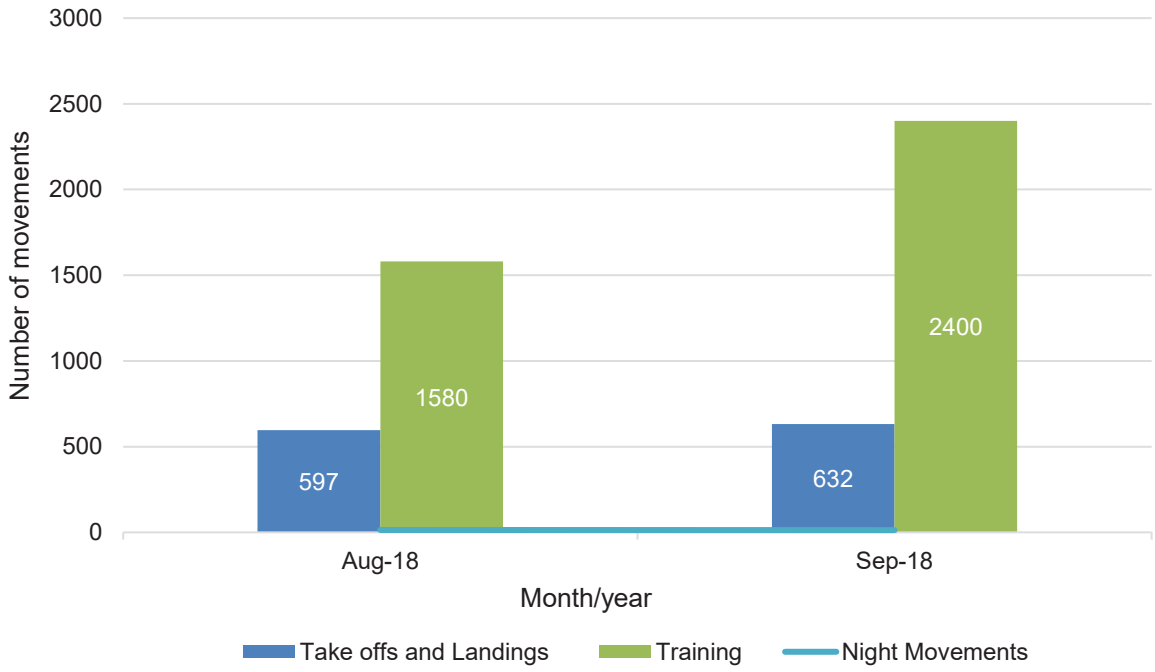


Figure 8: Aircraft movements at KPS during noise monitoring period

The purpose of this section is to provide an 'extrapolated' overview of all the operations that occurred at KPS during the noise monitoring period. It is not representative of the noise events that were recorded during this period.

An overview of noise events which occurred during each day the monitoring was recording is presented in Section 4.1.3 following. For clarity, a reconciliation of raw and extrapolated Avdata movements, including an overview of movements that were not captured during the noise monitoring period (for reasons outlined in Section 4.1) can be viewed in Appendix B: Reconciled aircraft movement data.

4.1.3. Summary of Avdata from noise monitoring period

Figure 9, below, provides a summary of the Avdata transcriptions for the noise monitoring period and for the dates the noise loggers were recording (as defined in Section 4.2). This data represents movements as recorded by Avdata, with no extrapolation assumptions applied (see Appendix B: Reconciled aircraft movement data for further explanation). This data was utilised by ANE when assessing the noise events recorded and discussed in Section 4.6. The total number of movements over this period is 2,061.

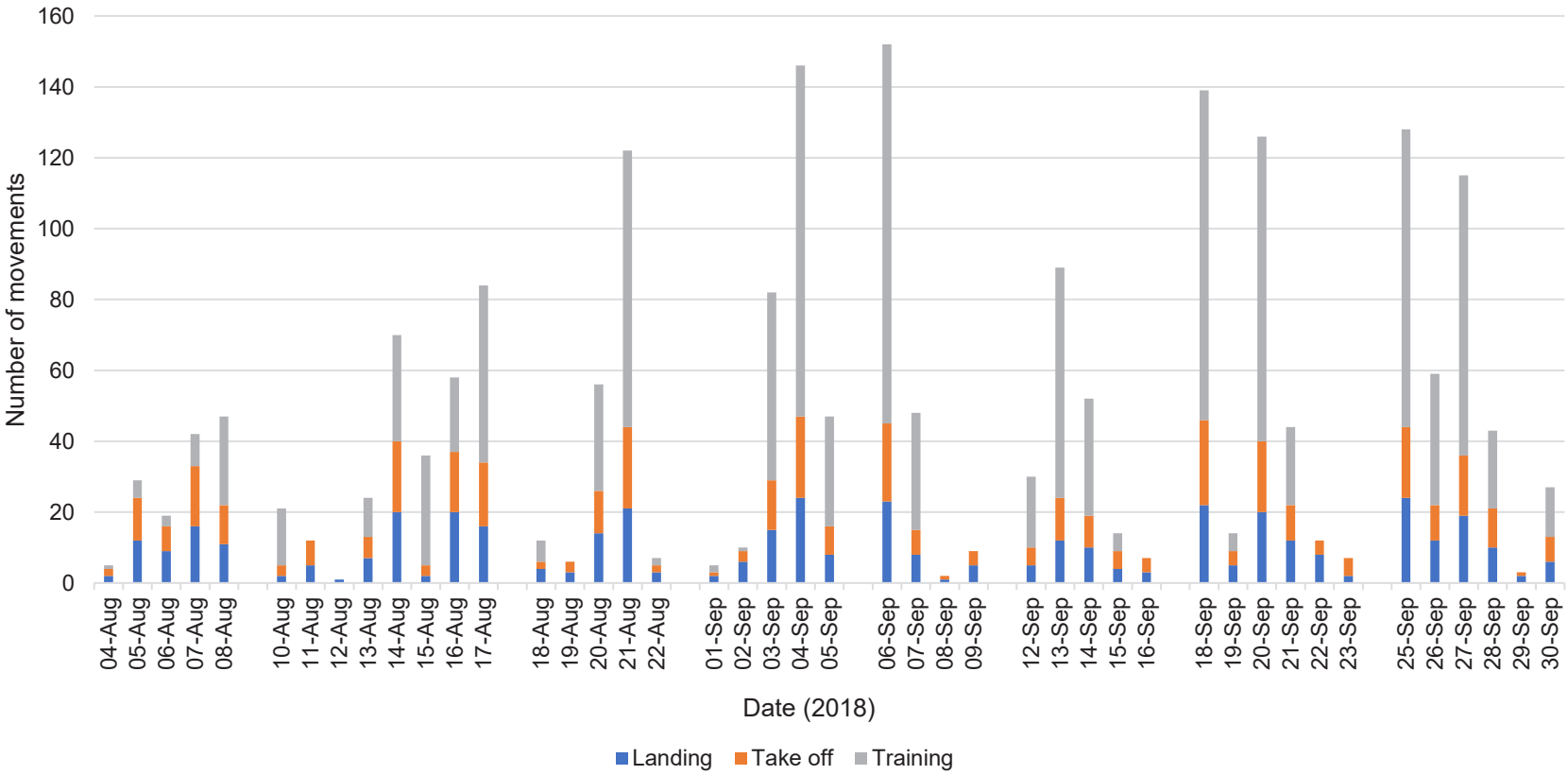


Figure 9: Day by day breakdown of Avdata movements

4.2. Noise monitoring data collection

Noise monitoring was conducted for a period of eight weeks between 4 August 2018 and 30 September 2018 at 17 different locations. There was one source location and the additional 16 monitoring locations were within the surrounding areas. These areas were determined based on a review of the typical approach and departure paths for KPS, a 'typical' circuit pattern, as well as a review of areas where complaint data for KPS was received from. An additional noise logger was installed near the Airport runway for weeks five to eight as the source location.

An overview of the locations, timing, and recording periods for the noise loggers is listed in Table 3. Items to be considered when reviewing this information are outlined below:

- A loss of data from technical difficulties with two of the loggers occurred between Saturday 18th August and Wednesday 23rd August 2018;
- No noise monitoring was conducted between Friday 24th August and Friday 31st August 2018 due to a flat battery;
- On Thursday 16th August 2018 the loggers located at Area 15 and 16 only recorded data until 10:30am;
- On Friday 17th August 2018 there was no data recorded at Area 15 and 16;
- On Monday 3rd September 2018, the noise loggers located at Area 13, 14 and 16 commenced recording from 3:00pm local time;
- On Tuesday 4th September 2018 there was no data recorded at Areas 14 and 15;
- On Thursday 6th September 2018 the noise loggers at Area 9 and Area 1 commenced noise monitoring from 11:00am local time; and
- Data analysis has not been undertaken on the days where the loggers were recharged and relocated between monitoring locations, these days are excluded from each monitoring period and are outlined in Table 3, below.

Table 3: Overview of noise monitoring data collection

Monitoring area	Noise monitoring date	Monitoring period	Note
Area 13, 14, 15 & 16	Saturday, 4th August to Wednesday, 8th August 2018	Week 1	Monitoring in Progress.
	Thursday, 9th August 2018		No noise monitoring data recorded on this day due to maintenance of equipment.
	Friday 10th August 2018 to Friday, 17th August 2018	Week 2	Monitoring in Progress. On 16th August 2018, the noise monitor located at Area 15 and Area 16 recorded data until 10:30am. No data was recorded on 17th August 2018 by noise loggers located at Area 15 and Area 16.
	Saturday, 18th August 2018 to Wednesday, 22nd August 2018	Week 3	No data recorded by noise logger located at Area 15 and Area 16.
	Thursday, 23rd August 2018 to Friday, 31st August 2018		No noise monitoring data recorded due to flat battery.
	Saturday, 1st September 2018 to Wednesday, 5th September 2018	Week 4	Monitoring in Progress. On 3rd September 2018, the noise loggers at Area 13, Area 14 and Area 16 commenced recording from 3:00 pm. No data was recorded on 4th September 2018 by noise loggers located at Area 14 and Area 15.
Area 1, 5 & 9	Thursday, 6th September 2018 to Sunday, 9th September 2018	Week 5	Monitoring in Progress. On 6th September 2018, the noise logger at Area 9 and Area 1 commenced noise monitoring from 11:00am.
	Monday, 10th September 2018 to Tuesday, 11th September 2018		No noise monitoring recorded during this period. Recharged/changed battery, and relocation of loggers to Area 2, Area 6 and Area 10.
Area 2, 6 & 10	Wednesday, 12th September 2018 to Sunday, 16th September 2018	Week 6	Monitoring in Progress.
	Monday 17th September 2018		No noise monitoring recorded during this period. Recharged/change battery and relocation to Area 3, 7 and 11.
Area 3, 7 & 11	Tuesday, 18th September 2018 to Sunday, 23rd September 2018	Week 7	Monitoring in Progress.

	Monday, 24th September 2018		No noise monitoring recorded during this period. Recharged/change battery, removal of noise loggers and relocation to area 4, 8 & 12
Area 4, 8 & 12	Tuesday, 25th September 2018 to Sunday, 30th September 2018	Week 8	Monitoring in Progress
Total number of days where noise event recording was in progress: 44 days			

Monitoring has also been performed on the Airport as the source location to underpin the comparison of the data review. Figure 10, below, identifies the noise monitoring locations.

The unattended noise monitors located in each Area were configured with the following settings to measure noise levels:

- 'A' weighting;
- Measurement descriptors L_{Amax}, L_{Aeq}, L_{A10}, L_{A90}; and
- Both 1 minute and 15-minute statistical interval.

All monitoring was conducted in accordance with *Australian Standard AS1055.1-1997 Acoustics – Description and measurement of environmental noise*.

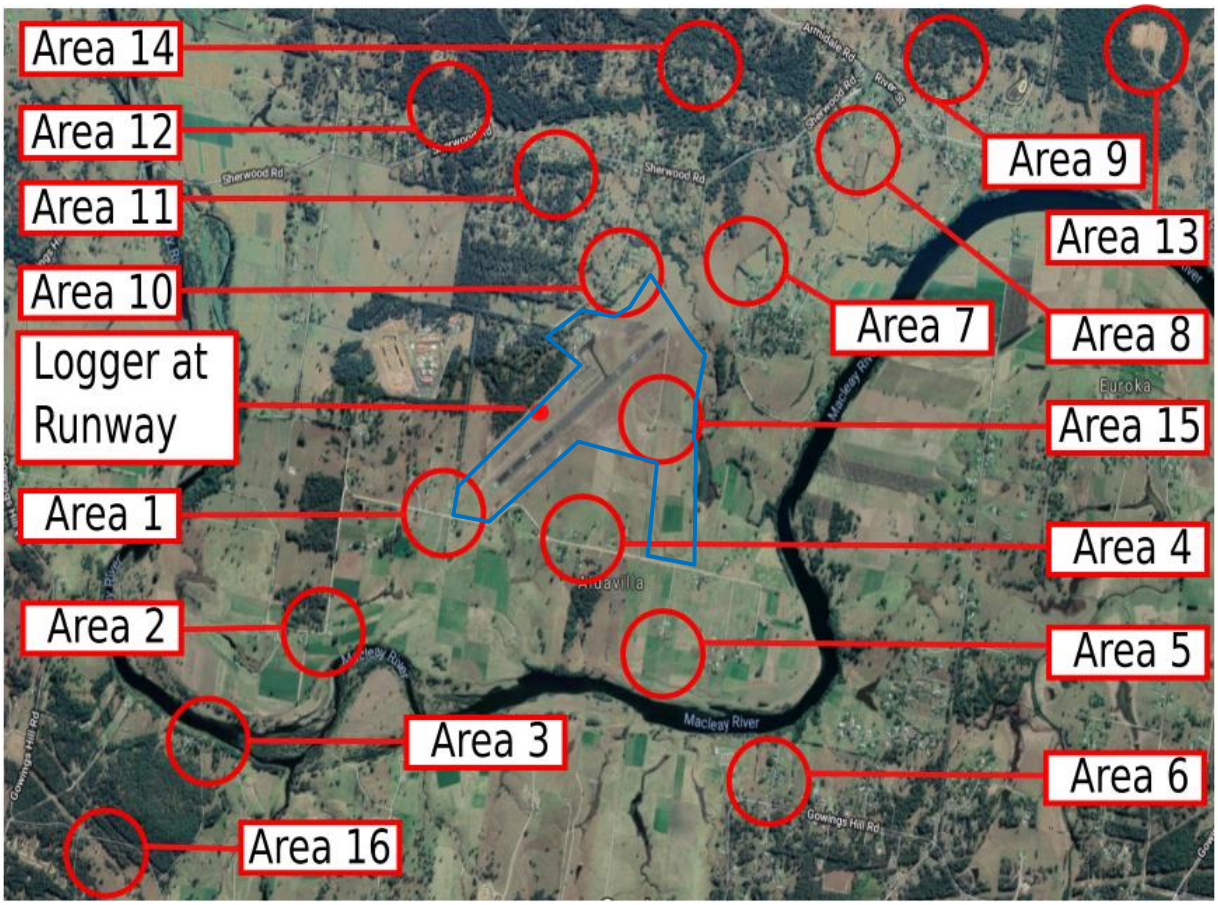


Figure 10: Noise monitoring logger locations

4.2.1. Data considerations

Items to be considered when reviewing this information are outlined below:

- During the noise monitoring period there were some technical difficulties experienced and data was unable to be recorded on certain times and days, these are outlined earlier in Table 3;
- The days in which the noise loggers were moved between locations have been excluded from the study (as per Table 3);
- The source location adjacent to the runway was only monitored for weeks five to eight;
- The noise assessment has identified the day within each monitoring week that experienced the greatest number of aircraft related noise events, which may not represent an "standard" day of operations at KPS; and
- Each data collection period consisted of a different combination of days of the week.

4.3. Noise Criteria and Guidelines

For the purpose of assessing the existing noise impact from KPS associated aircraft movement on to the surrounding residential receivers, the following documents were reviewed by ANE:

- Australian Standard AS2021:2015, 'Acoustics – Aircraft noise intrusion – Building sitting and construction;
- Aircraft Noise in Australia: A Survey of Community Reaction prepared by National Acoustic Laboratories, Commonwealth Department of Health, N.A.L Report No. 88, dated February 1982;
- *Expanding Ways to Describe and Assess Aircraft Noise (Expanding Ways)* discussion paper prepared by Sydney Environment Section in the Airports Operations area of the Department, Commonwealth of Australia 2000;
- Guidance Material for Selecting and Providing Aircraft Noise Information published jointly by the Commonwealth Department of the Environment and Heritage and the Commonwealth Department of Transport and Regional Services in 2003; and
- Going Beyond Noise Contours – Local Approaches to Land Use Planning Around Smaller Australia Airports, Discussion Paper, October 2003 prepared by the Aviation Environment Policy Section of the Department's Aviation Operations Branch.

Relevant sections from the applicable documents list is included throughout this Section.

4.3.1. Australian Standard 2021:2015

Relevant sections from the Australian Standard (AS) 2021:2015 is presented in Section 4.3.2 and Section 4.3.3 following.

4.3.2. Australian Standards 2021:2015 – Aerodrome without ANEF Charts

Australian Noise Exposure Forecast (ANEF) is a single number index for predicting the cumulative exposure to aircraft noise in communities near aerodromes during a specified time period (normally one year). The computation of this index includes:

- Measurements of aircraft noise (expressed in Effective Perceived Noise Decibels, EPNdB), which take account of the spectral, temporal and spatial aspects of the noise;
- Estimates and generalisations of aircraft type groups and mix, number of operations, runway utilisation, flight paths and operational procedure, and
- Time of day, i.e. whether daytime (07:00 hours to 19:00 hours) or night-time (19:00 hours to 07:00 hours).

The single number index is useful for rating the compatibility of various land uses with respect to aircraft noise. For this purpose, equivalent ANEF values at individual positions around an aerodrome are combined on a map to form ANEF contours.

The ANEF system takes account of noise levels, frequency and time of day of aircraft noise events. Therefore, it is always preferable to use an ANEF chart to predict aircraft noise exposure at a site. As specified in section 2.1.2 of AS 2021:2015, where aerodrome usage is confined to a small number of civil, non-jet aircraft movements the production of an ANEF chart may not be justified and is unlikely to occur. In these cases, procedure specified in Appendix E of AS 2021:2015 should be followed.

As no ANEF chart for the Kempsey Airport is available at this stage, the procedure specified in Appendix E of AS2021 has been adopted and is discussed below. Appendix E of AS 2021:2015 sets the acceptability of a building site for a particular building type that is exposed the aircraft noise from light general aviation aerodromes without ANEF charts.

Table 4, below, is taken from Appendix E (Table E1) of AS 2021:2015, which presents the Building Site Acceptability based on number of aircraft flights per day and calculated or measured noise levels. The adoption of Appendix E from AS 2021:2015 in relation to the noise monitoring data collected at KPS is outlined in Section 4.3.

Table 4: Building Site Acceptability Based on Aircraft Noise Levels (AS 2021:2015)

Number of flights per day	Aircraft noise level expected at building site, dB(A)		
	Acceptability	Conditionally acceptable	Unacceptable
House, home unit, flat, caravan park, school, university, hospital, nursing home			
>30	<70	70-75	>75
15-30	<80	80-85	>85
<15	<90	90-95	>95
Hotel, motel, hostel, public building			
>30	<75	75-80	>80
15-30	<85	85-90	>90
<15	<95	95-100	>100
Commercial building			
>30	<80	80-85	>85
15-30	<90	90-95	>95
<15	<100	100-105	>105

Note: as specified in AS2012:2015, each night-time flight between 19:00 hours and 07:00 hours is to count as four operations.

4.3.3. AS 2021:2015 – Indoor Design Noise Criteria

AS 2021:2015 (Table 3.3) also sets out the noise criteria for internal sound levels (in terms of maximum A-weighted noise levels, L_{amax}) within buildings depending on the type/use of different rooms. Applicable indoor noise criteria for this project are provided below in Table 5. AS 2021:2015 indoor sound levels and relationship to the data collected during the noise monitoring conducted at KPS is outlined in Section 4.6.2.

Table 5: Aircraft Noise Indoor Design Sound Level (AS 2021:2015)

Building Type and Activity	L_{Amax}, Indoor Design Sound Level
House, home units, flats, caravan parks	
Sleeping areas, dedicated lounge	50
Other habitable spaces	55
Bathrooms, toilets, laundries	60
Hotels, motels, hostels	
Relaxing, sleeping	55
Social activities	70
Service activities	75
Schools, universities	
Libraries, study areas	50
Teaching areas, assembly areas	55
Workshops, gymnasia	75
Hospitals, nursing homes	
Wards, theatres, treatment and consulting rooms	50
Laboratories	65
Service areas	75
Public Building	
Churches, religious activities	50
Theatres, cinemas, recording studios	40
Court houses, libraries, galleries	50

Commercial buildings, offices and shops	
Private offices, conference rooms	55
Drafting, open offices	65
Typing, data processing	70
Shops, supermarkets, showrooms	75
Industrial	
Inspection, analysis, precision work	75
Light machinery, assembly, bench work	80

4.3.4. 'Going Beyond Noise Contours' Discussion Paper

Relevant extracts from the 'Going Beyond Noise Contours' discussion paper[8] published by the Aviation Environment Policy Section of the Departments Aviation Operations Branch are presented in the ANE report attached in Appendix F: ANE Noise Monitoring Report.

In summary, the Discussion Paper describes that the most commonly adopted metric of noise in Australia is the N70 (noise events louder than 70 dB(A)). The Paper further discusses that while adoption of the N70 has been commonly used for reporting noise at major jet airports, for GA airports a metric of N60 (the number of events louder than 60 dB(A) is more likely to be more indicative of the noise regime.

This recommendation has been considered within this Final NMP and based on the completed noise monitoring, N70 and N60 events recorded on a worst affected day during the monitoring period for each monitoring area are presented in Section 4.6.2.

4.3.5. 'Expanding Ways' Discussion Paper

Relevant extracts from the 'Expanding Ways' discussion paper is presented in the ANE report attached in Appendix F: ANE Noise Monitoring Report.

In summary, this Discussion Paper outlines the evolution of the Australian Noise Exposure (ANEF) system and the evolution of the 'Number Above' representation of noise events. These contour maps in effect combine information on single noise levels with aircraft movement numbers. This Paper further outlines that an external single event noise will be attenuated by approximately 10 dB(A) by the fabric of a house with open windows. An internal noise level of 60 dB(A) is the sound pressure level of a noise event that is likely to interfere with conversation or with listening to the radio or the television.

It has been noted that the indoor design noise for a habitable space is specified as L_{Amax} 55 in the current AS 2021.2015. As such, in addition to N70, number of events louder than 65 dB(A) (N65) has been adopted in order to consider the difference in impact between indoor and outdoor noise levels. This has been adopted in this assessment, as outlined in Section 4.5 and Section 4.6.

4.4. Noise monitoring summary

The number of aircraft movements that occurred at the same time a noise event was logged has been determined for each period of the noise monitoring. This was determined based on the review of the provided Avdata for aircraft movements and from the completed noise monitoring results. The total number of aircraft movement noise events from each day during the monitoring period is listed in Table 6 to Table 13, following.

The tables also outline the individual number of noise events recorded by Avdata on each day of the noise monitoring which correlate to the raw data described in Section 4.1.3. As can be seen, on three days during this period, there were some discrepancies between Avdata recorded events and noise events recorded as outlined in Section 4.2. As such, the noise events recorded were 1,931 (compared to Avdata recorded movements of 2,061).

8 Going Beyond Noise Contours – Local Approaches to Land Use Planning Around Smaller Australian Airports, Discussion Paper Prepared by Aviation Environment Policy Section of the Department's Aviation Operations Branch, October 2003.

Table 6: Total number of aircraft movement events recorded during Week 1 noise monitoring

Week 1				
Day	**Date (2018)**	**Number of Aircraft Movement Noise Event Recorded**	**Noise monitoring in progress (Y/N)**	**Avdata recorded aircraft movements**
Saturday	4-August	5	Y	5
Sunday	5-August	29	Y	29
Monday	6-August	19	Y	19
Tuesday	7-August	42	Y	42
Wednesday	8-August	47	Y	47
Thursday	9-August	0	N	-

Table 7: Total number of aircraft movement events recorded during Week 2 noise monitoring

Week 2				
Day	**Date (2018)**	**Number of Aircraft Movement Noise Event Recorded**	**Noise monitoring in progress (Y/N)**	**Avdata recorded aircraft movements**
Friday	10-August	21	Y	21
Saturday	11-August	12	Y	12
Sunday	12-August	1	Y	1
Monday	13-August	24	Y	24
Tuesday	14-August	70	Y	70
Wednesday	15-August	36	Y	36
Thursday	16-August	58	Y	58
Friday	17-August	84	Y	84

Table 8: Total number of aircraft movement events recorded during Week 3 noise monitoring

Week 3				
Day	**Date (2018)**	**Number of Aircraft Movement Noise Event Recorded**	**Noise monitoring in progress (Y/N)**	**Avdata recorded aircraft movements**
Saturday	18-August	12	Y	12
Sunday	19-August	6	Y	6
Monday	20-August	56	Y	56
Tuesday	21-August	122	Y	122
Wednesday	22-August	7	Y	7
Thursday	23-August	0	N	-

Table 9: Total number of aircraft movement events recorded during Week 4 noise monitoring

Week 4				
Day	**Date (2018)**	**Number of Aircraft Movement Noise Event Recorded**	**Noise monitoring in progress (Y/N)**	**Avdata recorded aircraft movements**
Thursday	29-August	0	N	-
Friday	30-August	0	N	-
Saturday	1-September	5	Y	5
Sunday	2-September	10	Y	10
Monday	3-September	17	Y	82

Tuesday	4-September	138	Y	146
Wednesday	5-September	47	Y	47

Table 10: Total number of aircraft movement events recorded during Week 5 noise monitoring

Week 5				
Day	**Date (2018)**	**Number of Aircraft Movement Noise Event Recorded**	**Noise monitoring in progress (Y/N)**	**Avdata recorded aircraft movements**
Thursday	6-September	95	Y	152
Friday	7-September	48	Y	48
Saturday	8-September	2	Y	2
Sunday	9-September	9	Y	9
Monday	10-September	0	N	-
Tuesday	11-September	0	N	-

Table 11: Total number of aircraft movement events recorded during Week 6 noise monitoring

Week 6				
Day	**Date (2018)**	**Number of Aircraft Movement Noise Event Recorded**	**Noise monitoring in progress (Y/N)**	**Avdata recorded aircraft movements**
Wednesday	12-September	30	Y	30
Thursday	13-September	89	Y	89
Friday	14-September	52	Y	52
Saturday	15-September	14	Y	14
Sunday	16-September	7	Y	7
Monday	17-September	0	N	-

Table 12: Total number of aircraft movement events recorded during Week 7 noise monitoring

Week 7				
Day	**Date (2018)**	**Number of Aircraft Movement Noise Event Recorded**	**Noise monitoring in progress (Y/N)**	**Avdata recorded aircraft movements**
Tuesday	18-September	139	Y	139
Wednesday	19-September	14	Y	14
Thursday	20-September	125	Y	125
Friday	21-September	43	Y	43
Saturday	22-September	11	Y	11
Sunday	23-September	6	Y	6
Monday	24-September	0	N	-

Table 13: Total number of aircraft movement events recorded during Week 8 noise monitoring

Week 8				
Day	**Date (2018)**	**Number of Aircraft Movement Noise Event Recorded**	**Noise monitoring in progress (Y/N)**	**Avdata recorded aircraft movements**
Tuesday	25-September	127	Y	127
Wednesday	26-September	59	Y	59
Thursday	27-September	115	Y	115
Friday	28-September	43	Y	43

Saturday	29-September	3	Y	3
Sunday	30-September	27	Y	27

4.5. Adopted noise criteria

The following section outlines the noise criteria adopted by ANE in this Final NMP.

This section provides an overview of the Number of Events contour and the relevance to this Final NMP. In addition, the various means of noise criteria adopted for this Final NMP are outlined.

There are two key means of noise criteria that have been adopted for the assessment of the noise monitoring results at KPS. The first relates to the Building Site Acceptability, as defined by AS 2021:2015. The standard was developed to assist in building construction and land use planning in the vicinity of Airports. The Standard defines levels of noise 'acceptability' for different types of land uses, which can be used for future development or new buildings. The Standard describes that *"land use planning by necessity must use a long-term horizon and the building siting acceptability recommendations in this Standard are based on the reactions of noise accustomed communities".* The AS 2021:2015 criteria is discussed further in Section 4.5.2.

The second key noise criteria used for this project considers the levels of noise experienced by residents currently. The purpose of this criteria is to establish an understanding of the current impact of noise for existing residents in the areas surrounding KPS. This criteria is discussed further in Section 4.5.3.

4.5.1. Number of Events (N)

As per the *'Expanding Ways'* discussion paper (Section 4.3.5), the following listed 'number of events (N)' contour can be used to assess the noise impact from the existing Kempsey Airport flight movement onto the surrounding existing residential receivers:

- N70 (the number of events above 70 dB(A) for the period 7am to 7pm) – should be applied to outside of a normal domestic area that are used to carry out activities such normal conversation, watching TV, etc;
- N65 (the number of events above 65 dB(A) for the period 7pm to 10pm) – should be applied to outside of an indoor space that are used for relaxing activities such as reading, studying, etc;
- N60 (the number of events above 60 dB(A) for the period 10pm to 7am) – should be applied to outside of a sleeping area.

Current AS2021:2015 standard specifies the indoor design levels as L_{Amax} 50 dB(A) for sleeping and dedicated lounge areas and L_{Amax} 55 for other habitable spaces. Indoor design sound level of L_{Amax} 60 dB(A) has been specified for a bathrooms, toilets and laundries. As such, ANE recommend that the following listed 'number of events (N)' contours are used to assess the aircraft movement noise impact onto residential dwellings:

- N65 (the number of events above 65 dB(A)) – should be applied to outside of a habitable space;
- N60 (the number of events above 60 dB(A)) – should be applied to outside of a sleeping area.

The N65 and N60 values are typically referenced for the 7pm to 10pm and 10pm to 7am period. For the purpose of analysing the noise monitoring data, N60 and N65 have been considered during all periods of the day (including 7am to 7pm).

4.5.2. Adopted Building Site Acceptability Noise Levels

As shown in Table 6 to Table 13, generally more than 30 events of aircraft movements occur during weekdays and less than 30 events during weekends.

Based on the number of aircraft movement and the noise criteria presented in Section 4.3 and Section 4.5, the adopted project specific noise criteria (as specified in Table E1 of AS 2021:2015) to assess the Building Site Acceptability for the surrounding residential area at KPS is presented below in Table 14. The noise criteria presented here refers to *'House, home unit, flat, caravan park, school, university,*

historical, and nursing home' land uses as determined the most appropriated for uses surrounding KPS and those with the lowest threshold for noise.

Table 14: Building Site Acceptability Based on Aircraft Noise Levels (AS 2021:2015)

Number of flights per day	Aircraft noise level expected at building site, dB(A)		
	Acceptability	Conditionally acceptable	Unacceptable
>30	<70	70-75	>75

4.5.3. Indoor Design Noise Limits

The surrounding nearest sensitive receivers are identified as residential dwellings. Table 14 presents the relevant section of Table 3.3. of the AS 2021:2015 noise criteria to assess whether a building is located within an acceptable site or not; however, a building located within an 'acceptable' building site does not necessarily mean that residents located within these areas will not find the levels of noise experienced to be acceptable to them.

In considering this, an additional level of consideration has been given to the data in order to assess the noise impact from an aircraft movement to a habitable space of the existing residential receivers. As such, it is recommended that the noise criteria listed below in Table 15 are considered (based on AS 2021:2015 internal design sound levels).

Table 15: Proposed Indoor and Outdoor Noise Limits, dB(A) (AS 2021:2015)

Building type and activity	AS 2021:2015 L_{Amax}, indoor design sound level	Proposed outdoor L_{Amax}, noise limits*
Sleeping areas, dedicated lounge	50	60
Other habitable spaces	55	65

** Outdoor limit based on indoor design sound level and assuming a 10dB facade attenuation (partially opened window).*

4.5.4. Adopted project specific noise criteria

As outlined earlier, there are two means of noise criteria that have been adopted for the assessment of the noise monitoring results at KPS. The way in which these have been adopted within the specific context of this Final NMP is outlined here.

Building Site Acceptability

The AS 2021:2015 is concerned with land use planning and building treatments in the vicinity of an airport. The objective is to provide guidance to regional and local authorities, organisations, communities and others associated with the urban and regional planning and building development on the sitting and construction of new buildings against aircraft noise intrusion and on the acoustical adequacy of existing buildings in the areas near aerodromes. As shown in Table 14, if a building site is likely to be exposed to more than 30 aircraft movements then each of those events must not be greater than L_{Amax} 70 dB(A).

As shown in in Table 15 previously, the proposed outdoor noise limits for a habitable space is L_{Amax} 65. Therefore, in order to assess the Building Site Acceptability for existing residential dwellings surrounding KPS, the proposed building site acceptability noise levels for this particular project is listed below in Table 16.

Table 16: Project Specific Noise Criteria for Existing Building Site (AS 2021:2015)

Number of flights per day	Aircraft noise level expected at building site, dB(A)		
	Acceptability	Conditionally acceptable	Unacceptable
>30	65-70	70-75	>75

The assessment of the noise data collected during the monitoring period against the criteria established here is presented in Table 18, following.

Number of Events (N)
In order to assess the noise impact from the existing flight movement operations, residential areas that are affected by N70, N65 and N60 events have been identified and included in this report (this assessment is presented in Section 4.6.2). 'Guideline A: Managing Aircraft Noise' of the NASF suggests to avoid any noise sensitive development where 20 or more daily events greater than 70 dB(A) are predicted.

As specified in the *'Expanding Ways'* discussion paper, an internal noise level of 60 dB(A) is the sound pressure level of a noise event that is likely to interfere with conversation or with listening to the radio or the television. An external single event noise will be attenuated by approximately 10 dB(A) by the fabric of a house with open windows.

It is recognised that the indoor design noise for a habitable space is specified as L_{Amax} 55 in the current AS 2021:2015. As such, in addition to N70, number of events louder than 65 dB(A) (N65) has also been adopted to identify the noise affected area for this particular project.

4.6. Monitoring results and discussion

In order to identify the worst noise affected day for each monitoring area, 15-minute intervals of noise data for the monitoring period and the Avdata movement information provided each day was first reviewed. The worst affected day for each noise monitoring Area has been identified, as presented below in Table 17.

Table 17: List of worst affected day from each monitoring period

Monitoring Area	Day with highest number of aircraft events and noise levels	Monitoring period
Area 13,14,15 & 16	Wednesday, 8th August 2018	Week 1 to Week 4
Area 1, 5 & 9	Thursday, 6th September 2018	Week 5
Area 2, 6 & 10	Thursday, 13th September 2018	Week 6
Area 3, 7 & 11	Tuesday, 18th September 2018	Week 7
Area 4, 8 & 12	Tuesday, 25th September 2018	Week 8

In order to determine if noise levels were from an aircraft movement, 1-minute interval noise data measured at each location during the monitoring was analysed. 1-minute interval data has been reviewed for these days as presented in the attached ANE report (Appendix F: ANE Noise Monitoring Report). Table 5.2 to Table 5.6 of the ANE report presents results from the noise monitoring completed at each location on the worst affected day of each monitoring period.

As outlined in Section 4.3, there are two key means of noise criteria that have been adopted for the assessment of the noise monitoring results at KPS. The first relates to the Building Site Acceptability, and the second component of the analysis presents a summary of the existing noise levels experienced in the locations surrounding KPS.

The following discussion is presented based on the results of the noise monitoring with regard to both aspects of noise criteria adopted.

4.6.1. Building Site Acceptability

AS 2021:2015 outlines 'Building Site Acceptability' based on maximum aircraft noise levels experienced and the number of flights per day for aerodromes without an ANEF chart (previously described in Section 4.5.2).

The project specific noise criteria are outlined earlier in Section 4.5.4. The number of noise events which occurred in each area on the worst day have been reviewed in relation to each of the acceptable,

conditionally acceptable, and unacceptable number of events for number of events which occur within ranges of 65-70 dB(A), 70-75 dB(A), and >75 dB(A). These results are summarised in Table 18 below.

Table 18: Number of aircraft events on the worst day and AS2021:2015 Acceptability

Noise monitoring location	No. of events within L_{Amax} 65-70 dB(A)	Acceptable?	No. of events within L_{Amax} 70-75 dB(A)	Conditionally acceptable?	No. of events greater than L_{Amax} 75 dB(A)	Un-acceptable?
Area 1	15	Y	4	N	2	N
Area 2	0	Y	0	N	0	N
Area 3	1	Y	0	N	0	N
Area 4	5	Y	1	N	0	N
Area 5	9	Y	4	N	2	N
Area 6	26	Y	8	N	2	N
Area 7	26	Y	1	N	0	N
Area 8	**30**	**N**	**6**	**Y**	5	N
Area 9	4	Y	1	N	0	N
Area 10	5	Y	0	N	0	N
Area 11	13	Y	0	N	0	N
Area 12	22	Y	0	N	2	N
Area 13	0	Y	0	N	0	N
Area 14	2	Y	1	N	2	N
Area 15	6	Y	1	N	1	N
Area 16	0	Y	0	N	0	N

As shown in Table 18, when considering Building Site Acceptability, all surrounding Areas monitored experienced 'acceptable' levels of noise, except Area 8, which has been identified to experience 'conditionally acceptable' levels of noise. No Areas monitored experienced 'unacceptable' levels of noise during the monitoring period.

As per AS 2021:2015, if a building site is classified as 'acceptable', then "*there is usually no need for the building construction to provide protection specifically against aircraft noise*". If the building site is classified as 'conditionally acceptable', the required noise reduction and the required proposed building construction should be determined in accordance with the method specified in AS 2021:2015.

4.6.2. Noise impact on existing residential receivers

A building located within an 'acceptable' building site does not necessarily means that residents located within these areas will not find the levels of noise experienced to be acceptable to them. As such, an additional level of consideration has been given to the data in order to assess the noise impact from an aircraft movement to a habitable space.

The measured noise levels were assessed against the indoor design noise levels for habitable space specified in Table 3.3 of the AS 2021:2015. The standards for indoor noise levels and proposed outdoor noise levels for this study are outlined in Table 5 (Section 4.5.3) which includes a 10dB(A) adjustment factor for attenuation between outdoor and indoor.

Table 19, and Figure 11 to Figure 13 following, present the percentage of total events recorded each monitoring area on the worst affected day that were louder than L_{Amax} 70, L_{Amax} 65 and L_{Amax} 60. The percentage of noise levels experienced in each location are relative to the total number of events

recorded at that monitoring Area. This total number of events for the identified worst affected days from the noise monitoring week 1 to week 8, as well as the total number of events that occurred from each day that noise monitoring was being undertaken, is presented earlier in Section 4.4.

Table 19, below, presents the percentage of total events recorded that are louder than the identified L_{Amax} value, to identify the worst affected areas on the worst day for each area. The worst day for each area was presented previously in Table 17.

Table 19: Overview of noise events recorded on the worst day and percentages of events louder than identified L_{Amax} value[9]

Noise monitoring location	Number of events recorded	Percentage of total events >60 dB(A)	Percentage of events >65 dB(A)	Percentage of events >70 dB(A)
Area 1	95	25%	18%	6%
Area 2	89	0%	0%	0%
Area 3	139	4%	1%	0%
Area 4	127	27%	4%	1%
Area 5	95	25%	18%	6%
Area 6	89	66%	31%	11%
Area 7	139	47%	19%	1%
Area 8	127	57%	28%	9%
Area 9	95	13%	4%	1%
Area 10	89	6%	6%	0%
Area 11	139	14%	9%	0%
Area 12	127	35%	20%	2%
Area 13	47	0%	0%	0%
Area 14	47	30%	9%	6%
Area 15	47	30%	15%	4%
Area 16	47	0%	0%	0%

4.6.3. Number of events > L_{Amax} 60 dB(A)

The number of events represented in percentage form for each Area on the worst day within the monitoring period is overviewed in Figure 11. From this Figure, the following observations can be made:

- An L_{Amax} 60 dB(A) event measured outside a bedroom (sleeping area) will generally be experienced as an L_{Amax} 50 dB(A) inside a residence with the windows open. As specified in Table 5, AS 2021:2015 specifies L_{Amax} 50 dB(A) as indoor design sound level for a bedroom (sleeping area).
    - Based on the noise monitoring results presented in this report, residential dwellings located within and around the noise monitoring Areas 1, 4, 5, 6, 7, 8, 12, 14 and 15 experienced a higher number of N60 events (number of events > L_{Amax} 60 dB(A)).
    - The completed noise monitoring results shows that a number of existing residential dwellings are likely to experience a higher number N60 events. As such, consideration

9 Each column of data presented in Table 19 is independent. The 'Number Above' events should be interpreted as individual percentages for each dB(A) category. They are not cumulative and do not total a whole.

has been given to the definition of 'daytime and night-time' as per the AS 2021:2015 in developing the strategies and recommendations outlined the following sections.

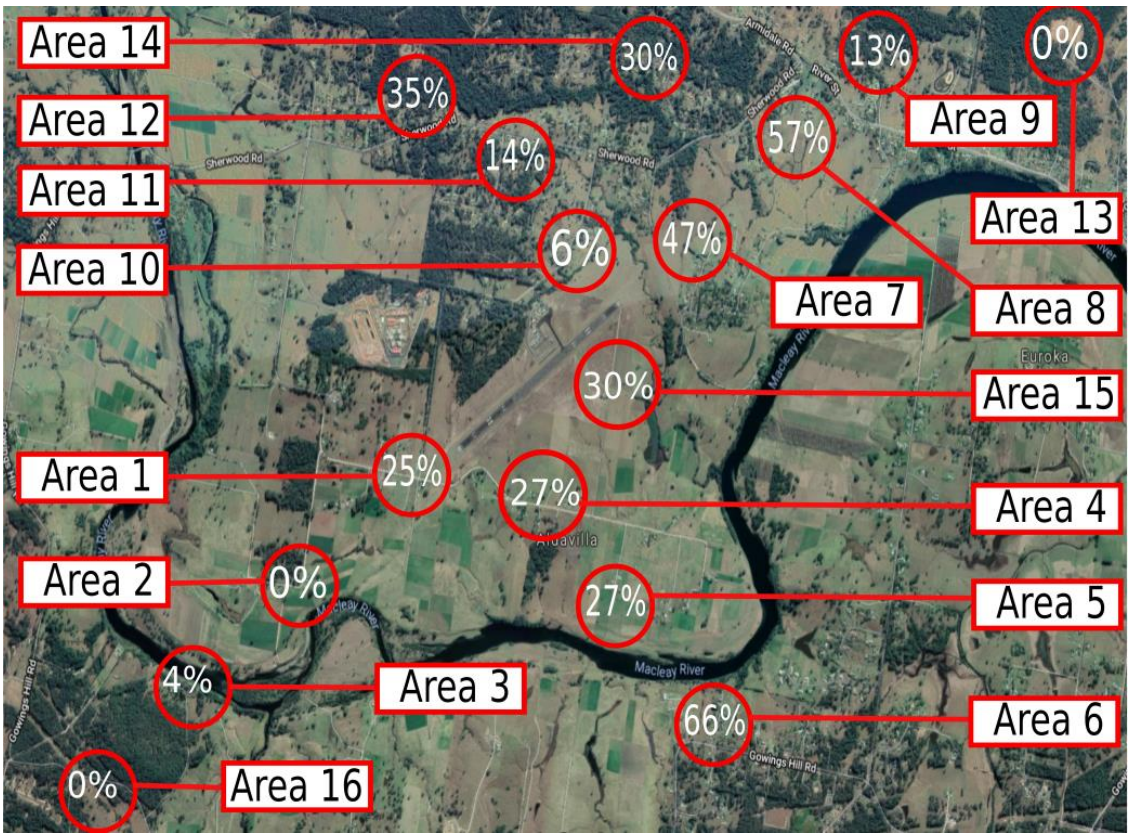


Figure 11: Number of events > L_{Amax} 60 dB(A) affected area (in percentage)

4.6.4. Number of events> L_{Amax} 65 dB(A)

The number of events represented in percentage form for each Area on the worst day within the monitoring period is overviewed in Figure 12. From this Figure, the following observations can be made:

- An L_{Amax} 65 dB(A) event measured outside a habitable area will generally be experienced as an L_{Amax} 55 dB(A) inside a residence with the windows open. As outlined in Table 5, AS 2021:2015 specifies L_{Amax} 55 dB(A) as indoor design sound level for habitable space. Additionally, the existing acoustic environment of the surrounding KPS is rural in nature and as such residents are likely to experience relatively lower background levels. As such, the recorded L_{Amax} level over 65 dB(A) are likely to be considered as excessive or intrusive by residents in the surrounding area.
    - Based on the noise monitoring results presented in this report, residential dwellings located within and around the noise monitoring Areas 6, 8, and 12 experienced higher numbers of N65 (number of events > L_{Amax} 65 dB(A)). Upon investigation of the noise data, in correlation with aircraft movement data provide by Avdata, it was found that the majority of these higher noise events were recorded during the touch and go training operation by Diamond DA40 type aircraft.
    - It is understood that eliminating the aircraft noise events greater L_{Amax} 65 dB(A) may not be a feasible option due to the nature of airport operations, however, appropriate mitigation measures should be adopted to reduce N65 to an acceptable/reasonable level.

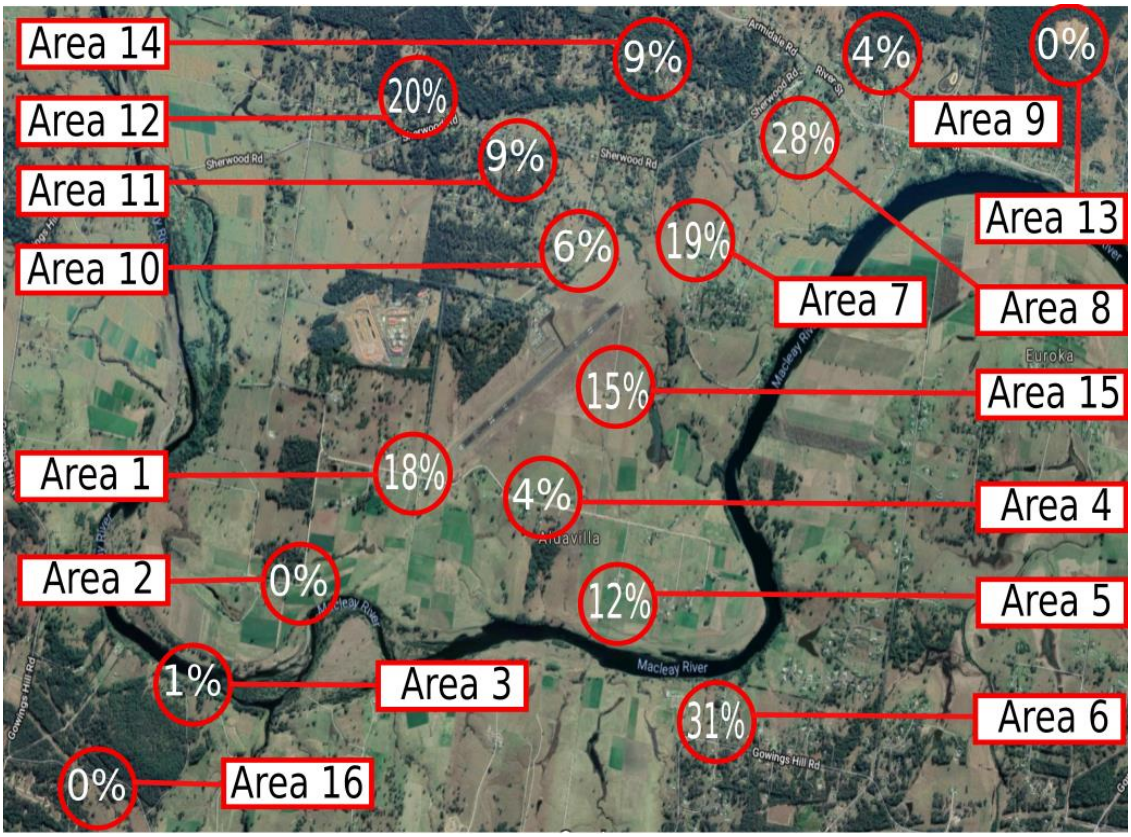


Figure 12: Number of events > L_{Amax} 65 dB(A) affected area (in percentage)

4.6.5. Number of events > L_{Amax} 70 dB(A)

The number of events represented in percentage form for each Area on the worst day within the monitoring period is overviewed in Figure 13. From this Figure, the following observations can be made

- The number of events > L_{Amax} 70 dB(A) (N70) measures is the most commonly used frequency-based aircraft noise measure because an L_{Amax} 70 dB(A) event measured outside a habitable area will generally be experienced as an L_{Amax} 60 dB(A) event inside a residence with the windows open. 60 dB(A) is the sound level that will disturb a normal conversation or activities such as watching television.
    - As shown in Table 19, Area 6 is identified as the worst affected area when considering this threshold, as 11% of the recorded events were measured above L_{Amax} 70 dB(A).

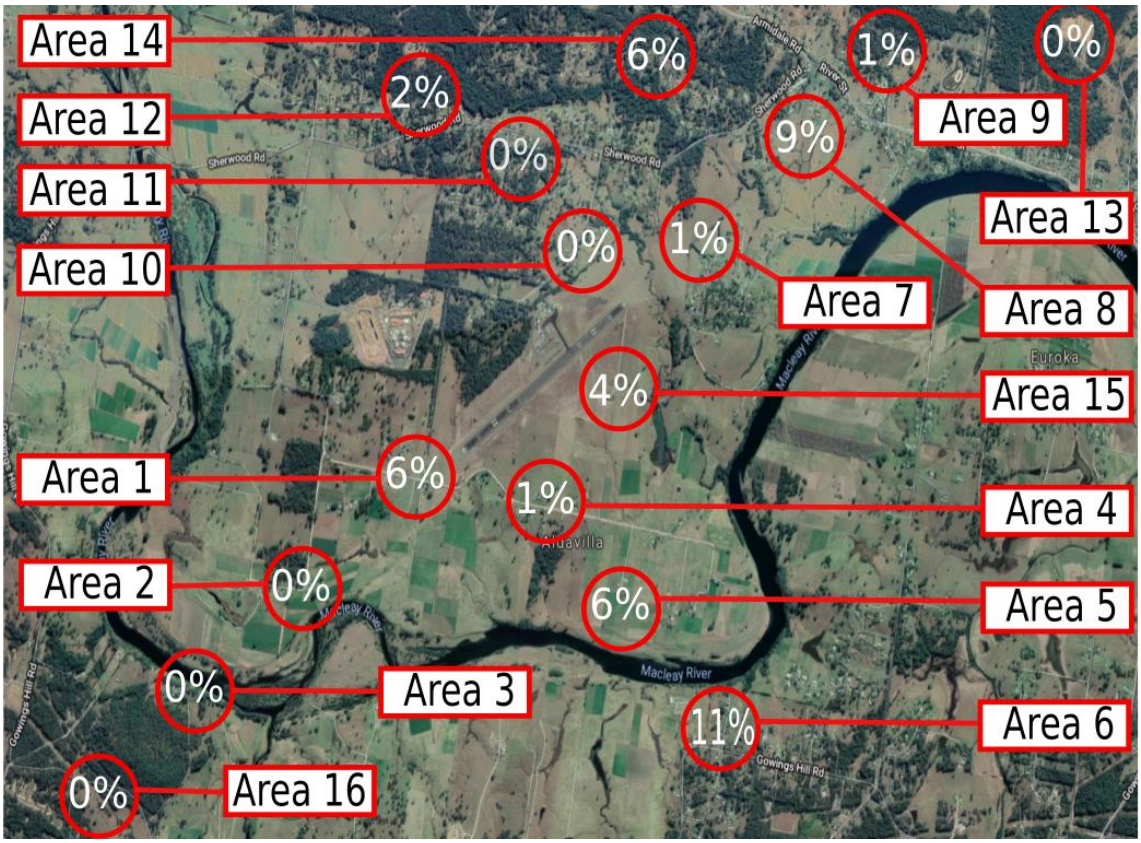


Figure 13: Number of events > L_{Amax} 70 dB(A) affected area (in percentage)

These results and recommendations from the ANE report are considered in Section 1 and Section 7. The full report for the noise assessment can be found in Appendix F: ANE Noise Monitoring Report.

5. Noise Management Strategies

Noise Management

5.

5. NOISE MANAGEMENT STRATEGIES

The section describes proposed Noise Management strategies identified for consideration by KSC for KPS operations. The Strategies in this Final NMP are categorised between aviation and non-aviation related and are supported by recommendations in Section 7.

It should be noted that emergency services and similar operations at KPS should be exempt from the strategies and recommendations of the NMP. Nonetheless, it is advised that emergency operators adopt the best practicable noise mitigation strategies for their operations at KPS where possible.

5.1. Aviation related

Aviation related strategies for minimising noise disturbances at KPS are discussed in this section. Any reference to time should be considered in the local time of Kempsey.

5.1.1. Hours of operation

In developing the recommended hours of operation for KPS, several considerations have been made and are outlined here. Generally, operations between 19:00 and 07:00 should be conducted with regard to best practicable noise mitigation strategies for their operations at KPS where possible (e.g. altitude, flight tracks).

Definition of daytime and night time

The AS 2021:2015 defines a category of day and night-time for the purposes of noise modelling. This distinction is predominately used in the development of ANEF for airports and reflects consideration of the sensitivity of people to noise during night-time as compared to the daytime. Daytime is considered to be 07:00 to 19:00 and night-time is considered to be 19:00 to 07:00. Importantly, this distinction by AS 2021:2015 only relates to the sensitivity of people to noise and does not define operational standards.

Existing hours of operation

During the noise monitoring period, there were minimal aircraft movements which occurred at KPS between 19:00 and 07:00 (as defined as 'night time' in the AS 2021:2015). It is important to note that the noise monitoring occurred during a period without daylight savings time. As such, a review of historical movements at KPS was undertaken in order to understand the operations which occur between 19:00 and 07:00 during periods of daylight savings (assumed October to March).

This analysis has been undertaken from FY2013/14 to FY2017/18 and has shown some operations to occur during these hours, as outlined in Figure 14, below. The graph presents only movements which occurred during 'night-time hours' (as defined above) in October to March for each FY. The percentage of total identified refers to the percentage of movements which occurred during the 'night-time' in proportion to the total number of movements at KPS during the period of October to March in that FY.

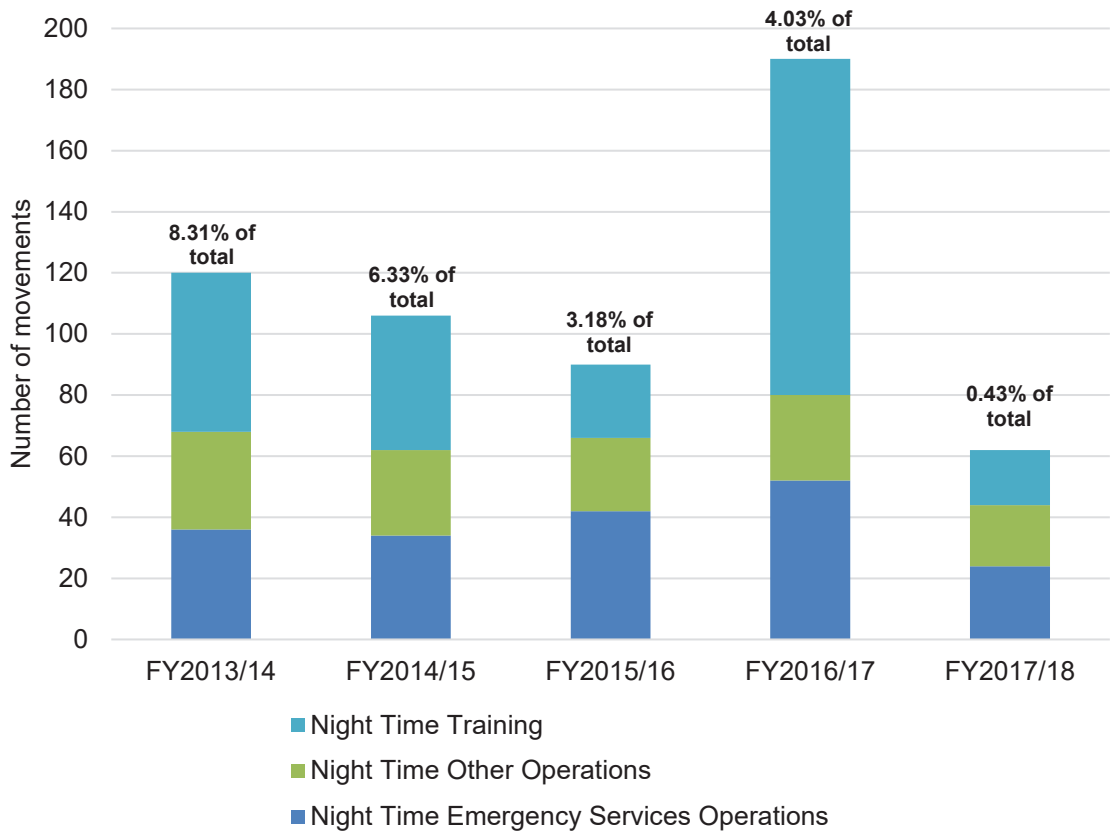


Figure 14: Historical night time operations at KPS relative to percentage of total movements during day light savings time (October to March of Financial Year)

Benchmarking of other Australian airports

A review of the ERSA's and operating procedures of other GA and RPT airports, has been undertaken to understand any prescribed hours of operations for the Airport or in particular, training operations. A summary of the Airports reviewed in this process can be found in Appendix C: Benchmarking of Australian Airport ERSAs Operating Times[10]. It is worth noting that a considerable number of Airports around Australia operate without prescribed hours of operations, including training operations. Prescribed hours vary with regard to both regular and training operations.

In addition to this, the AsA fact sheet regarding circuit training describes that *"there are no regulated hours for circuit training, but most airports have their own limitations which prohibit circuits during the late night to early morning, typically 10pm to 7am"*[11].

Training requirements

It is important to also recognise the requirement for night circuit operations within a flight training syllabus and relevant legislative requirements.

5.1.1.1. Circuit training operation hours

The proposed operational hours for circuit training movements during week days outlined below is based on the AS 2021:2015 which indicates that daytime is defined as 07:00-19:00 hours and night time is defined as 19:00-07:00 hours.

10 This information has been compiled from the Airport ERSA's released on 08 November 2018 available at https://www.airservicesaustralia.com/aip/aip.asp?pg=40&vdate=28FEB2019&ver=2

11 http://www.airservicesaustralia.com/wp-content/uploads/16-086FAC_NCIS-Circuit-training_WEB.pdf

As outlined above, a review of other Airports has also been conducted and this benchmarking exercise has been considered in developing the proposed circuit training hours below for weekends and public holiday operations.

The following operating times for circuit training operations would be reasonable for implementation at KPS.

- **Monday to Friday:**
  - 07:00 – 19:00 during *Australian Eastern Standard Time*; and
  - 07:00 – 22:00 during *Australian Eastern Daylight Time*.
- **Saturday:** 08:00 – 19:00 all year round.
- **Sunday:** 09:00 – 18:00 all year round.
- **NSW Public Holidays:**
  - 09:00 – 18:00, with the exception of:
    - Christmas Day – no circuit training.

A person's sensitivity to aircraft noise is increased during the evening or night time hours and aircraft operations during this period should be minimised where possible. Sensitivity to aircraft noise events is also likely to be experienced on weekends as well when ambient or background noise is lower. Nonetheless, this should be balanced with the feasibility and reality of training operations at an airport.

Given the practices adopted at airports around Australia with regard to the allowance of circuit training operations; the limited number of training operations which have occurred at KPS historically; and the requirement for night operations in flight training processes, it is not unreasonable that hours of circuit training operations would be allowed until 22:00 during daylight savings time for both visiting and local operators.

5.1.2. Circuit training operations

Circuit operations are one of the earlier stages of practical pilot training focused on take-offs and landings. This involves the pilot making approaches to the runway, touching down and then applying power to take off again. There are three types of circuit training performed during a student's training:

Normal circuit

Normal circuit operations occur at 1,000 feet above an airport elevation.

Glide circuit

A glide circuit occurs at 1,500 feet above an airport. In this exercise, from late downwind the engine is almost at idle, simulating the last part of an engine failure during a cross country flight. The aircraft then would glide to a suitable landing area (in this case using the runway to land).

Low level circuit

A low level circuit engine failure occurs at 500 feet above an airport. The purpose is to simulate poor weather and during this type of circuit the aircraft will avoid flying over built-up areas.

These circuits are required by the CASA syllabus of training. CASA also regulates aviation activities and publishes the regulations and standards to be applied. These are published so pilots learn how to fly a standard circuit and to ensure safety.

There may also be ultralight aircraft and helicopters at KPS which fly at different heights and slightly different distances from the runway (lower and closer). Larger aircraft will fly a standard 1,500ft circuit. All arriving aircraft may enter the circuit using a standard procedure of their choice.

Circuit direction

As outlined in Section 4.6, the noise monitoring assessment indicates that areas on the north and north west of the Airport experience higher levels of noise in comparison to other noise monitoring locations, however areas to the south and east of the airport also experience noise. This distribution of movements may be due to meteorological conditions at the time of recording.

A change of circuit direction from one runway end would likely create a more disproportionate unequal distribution of noise on areas surrounding KPS. In addition, there are potential risks associated with changing circuit direction. Using a non-standard circuit pattern means that pilots would not see other aircraft where expected, or a pilot may not be aware of the change (such as a visiting aircraft). Both scenarios would increase the possibility of a near-miss occurring.

As such, it is recommended that circuit operations at KPS should follow the standard left-hand circuit directions as recommended by AsA and CASA, subject to meteorological and operational conditions.

Number of aircraft in circuit
At some airports around Australia, a limit on the number of aircraft in the circuit at any one time is applied. By way of example, Ballarat Airport has limits to six (6) aircraft at any time, while Parafield Airport is limited to five (5) aircraft outside tower operational hours[12].

It is recommended that KSC review the Avdata when published to investigate the number of aircraft and/or circuits being performed at any one time, in conjunction with noise complaint data gathered from the proposed noise complaint register. In future, KSC may consider investigating the requirement to limit the number of aircraft in the circuit at one time.

It is worth noting that restrictions to the number of aircraft operating in a circuit may prolong the number of operational hours during the day, in order for a training facility to accommodate the required training hours for students. This should be considered prior to implementing any restrictions.

Simulated engine failure practice
There are two types of simulated engine failure practices that are performed during training operations. Each has different requirements, which are outlined below:

Glide circuit
As part of a glide circuit manoeuvre, the engine is throttled back to almost idle power from late downwind in the circuit pattern. The engine will only be powered up if a glide landing is not able to be safely performed.

Engine Failure After Take-Off
The practice Engine Failure After Take-Off (EFATO) is an essential part of a pilots training and is only carried out with an instructor. The practice EFATO happens relatively quickly during the climb after take-off, and once the immediate actions are complete the aircraft applies normal climb power and continues in the circuit or departure. While the aircraft does descend for a short time, the manoeuvre is only conducted for a short time during training, and the noise increase is only going to be for a short period and not likely to be significantly different to a normal circuit.

The noise impacts of practice EFATOs are likely a result of the sudden increase in noise, as the aircraft goes from an almost idle power setting to a climb power setting (nearly full power) in a short time.

It is recommended that, where practicable, EFATOs should not be performed over Noise Sensitive Areas (refer 5.1.7 following).

5.1.3. Runway usage
To identify runway end (RWY) usage at KPS for RWY 04 and RWY 22, wind rose plots were obtained from the Bureau of Meteorology (BOM) data services. The wind rose plots provide indications of average wind direction and speed for each month of the year and for the full year that was recorded between 9:00am and 3:00pm.

The wind rose plots for the BOM weather station at the KPS (Site No. 059007) were prepared using records for the period of February 2001 to August 2018. The 9:00am and 3:00pm annual wind rose

12 http://aircraftnoiseinfo.bksv.com/parafield/wp-content/uploads/sites/24/2018/05/Investigation-Report-Circuit-training-at-Parafield-Airport.pdf

plots are shown in Figure 15. This Figure shows the average annual difference in wind direction and speed at 9:00am and 3:00pm.

These BOM wind rose plots depict that, based on typical wind direction at that time of day, at 9:00am the majority of operations should be on RWY 22 and at 3:00pm the majority of operations should be on RWY 04.

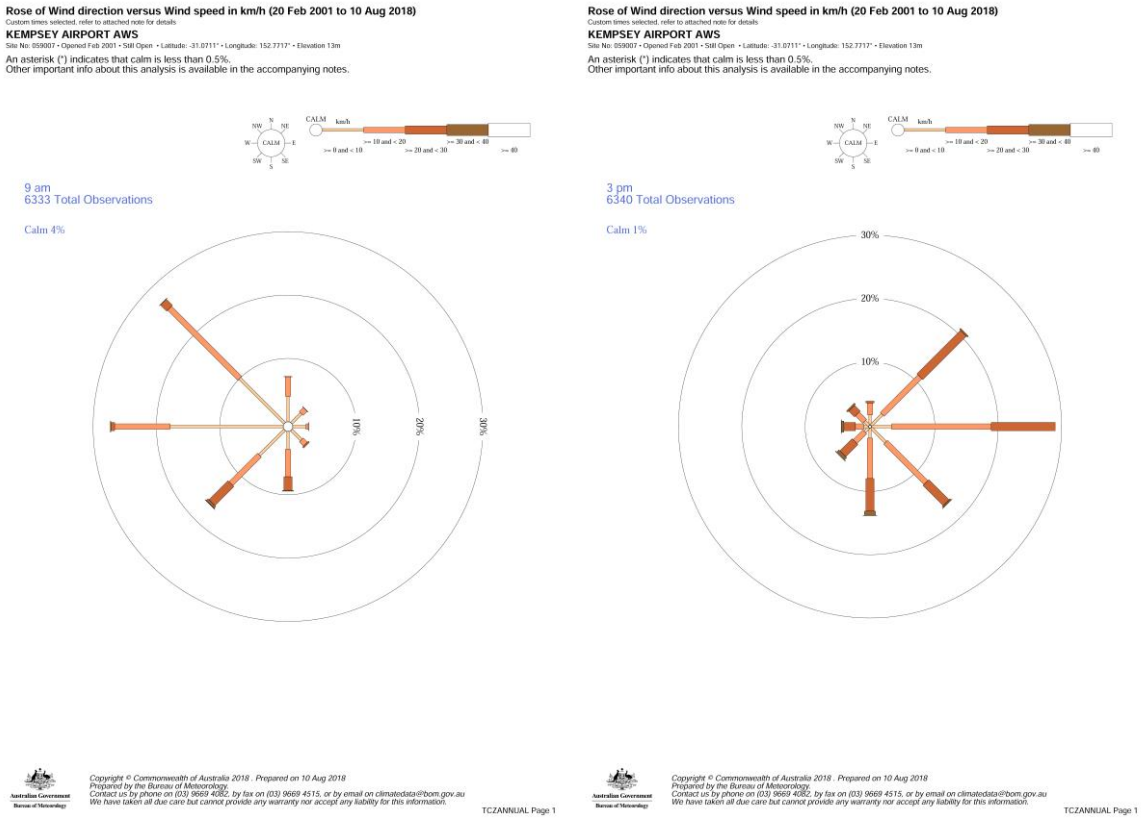


Figure 15: BOM Wind Rose data for 9:00am and 3:00pm at KPS (BOM Site No 059007)

Analysis of these plots indicates annual runway usage at KPS should be split by approximately 50% on RWY 04 and 50% on RWY 22. This analysis has not taken into account runway usage for RWY 16 and RWY 34, which is understood to be rarely used as the short runway (614m) and the surface being grass preventing operations for many aircraft types.

5.1.4. Altitude of operations

The *Civil Aviation Regulations (1988)*[13] requires:

(1) The pilot in command of an aircraft must not fly the aircraft over:
(a) any city, town or populous area at a height lower than 1,000 feet; or
(b) any other area at a height lower than 500 feet.

The height specified is:

"The height above the highest point of the terrain, and any object on it, within a radius of:
(a) in the case of an aircraft other than a helicopter—600 metres; or
(b) in the case of a helicopter—300 metres;
from a point on the terrain vertically below the aircraft.

13 https://www.legislation.gov.au/Details/F2018C00826/Html/Volume_3#_Toc530043134

There are several exceptions to this outlined in the Regulation, including (but not limited to) an exception for when *"the aircraft is flying in the course of actually taking-off or landing at an aerodrome".*

With regard to height of operations for circuit training, the AsA fact sheet for circuit training outlines 1,000 feet as the 'standard' height for the downwind leg of a circuit (based on medium performance aircraft).' Aircraft are required to climb to 500 feet above the aerodrome elevation prior to making the turn into the circuit.

Aircraft operating at KPS should comply with these Regulations and documentation outlined wherever practicable (e.g. subject to meteorological conditions).

Model jet aircraft
Model jet aircraft operating at KPS should maintain operations in conjunction with their CASA Instrument of Approval and operate at altitudes of less than 1,000 feet.

5.1.5. Aircraft engine ground running

There are two primary types of ground running. One is a series of last-minute checks performed by a pilot prior to take-off, and the other is to test aircraft engines and diagnose engine problems. Both of these are regulated by CASA.

Aircraft engine ground runs are carried out when the safe, full or partial correct operation of an aircraft needs to be proven before being returned to service, for the purposes of aircraft maintenance or engine testing. Part or routine engine ground run-ups are the maintenance tests performed for extended periods of time generating continuous elevated noise levels[14]. Engine running at KPS should only be conducted during the hours of 08:00 and 17:00 all year around, with a minimum 1-hour break between each engine test run being conducted.

Other engine ground run requirements with regard to the safe operation of aircraft may be conducted at any time when required, such as prior to the operation of aircraft during last minute checks[15]. As such, the above conditions are not intended to limit immediate preflight engine checks, normal start, taxi and shutdown procedures.

To minimise noise impacts, engine ground runs and run-ups should be kept to the minimum time operationally required.

5.1.6. Flight tracks

Flight tracks are the plan view of where an aircraft fly. These flight tracks may include published and non-published approach and departure flight tracks as well as training and helicopter tracks. However, due to the majority of flights to and from KPS are by general aviation aircraft, the majority of their flight paths may not be along published routes, with the exception for the final approach to a runway during a landing.

Aircraft operating in close proximity to KPS should maintain altitudes as outlined in the *Civil Aviation Regulations (1988)*[16] as outlined in Section 5.1.4.

5.1.7. Noise Sensitive Areas

There are three facilities near Kempsey Airport that may be considered Noise Sensitive Areas due to their uses and location relative to the noise assessment logger results. These facilities are the Aldavilla Primary School, the Greenhill School, and Booroongen Djugun Aged Care Facility.

It is important to note that these Noise Sensitive Areas are located north-east of Runway 04/22. These areas are under the runway centreline approach to runway 22 and as such cannot be avoided in their entirety. As per CASA regulations, aircraft must be aligned with the runway centreline by at least 500 feet above the airport elevation. When considering a standard flight path, with an aircraft approaching

14 https://www.darwinairport.com.au/node/656/attachment

15 http://www.airservicesaustralia.com/wp-content/uploads/Ground-running-factsheet-WEB.pdf

16 https://www.legislation.gov.au/Details/F2018C00826/Html/Volume_3#_Toc530043134

at approximately 300 feet per nautical mile, this equates to approximately 1.7 nautical miles. At this distance, aircraft will be inherently overflying these Noise Sensitive Areas.

Nonetheless, unnecessary flight training exercises should not be conducted over these areas, for example practise EFATO (as mentioned earlier). Further, pilots should use the minimum power necessary on approach to minimize noise over these areas.

5.1.8. Aircraft noise standards

All civil aircraft operating in Australia are required to comply with the *Air Navigation (Aircraft Noise) Regulations 2018*, regardless of size, purpose and ownership. The owner/operator of the aircraft should have a copy of the aircraft registration which should state compliance with the Air Navigation (Aircraft Noise) Regulations 2018 and is responsible for regulatory compliance tests to ensure their aircraft meets the regulations, if required. Aircraft that do not comply with the Regulations and noise standards are not permitted to operate in Australia, therefore should not operate at KPS.

5.1.9. Operating Procedures

All aircraft operating from KPS should operate in accordance with aircraft manufacturing requirements, CASA regulations, and company Standard Operating Procedures (SOPs). Private or leisure operators without SOPs, operating from KPS should operate in accordance with aircraft manufacturing requirements and CASA regulations.

5.1.10. Noise Abatement Benchmarking

In addition to the benchmarking undertaken with regard to restrictions on timing of operations and circuit training at Australian Airports (Section 5.1.1), a similar exercise has been conducted to identify if there are any restrictions on flying activities which may be used to manage the noise that impacts on the community's amenity. The information included within the published ERSA documentation reviewed includes guidance on preferred runways, circuit direction, and operating altitudes for aircraft. This information has been collated in Appendix D: Benchmarking of Australian Airports operating restrictions in ERSA[17].

In addition to the information published in the ERSAs, some Airports have developed documents with more specific guidance relating to noise abatement procedures. For example, Moorabin Airport and Evans Head Memorial Airport. Moorabin Airport Noise Information Pack (2013)[18] and Evans Head Memorial Aerodrome Noise Abatement Procedures[19] include guidance on the conducting of flight operations to minimise noise on the community. These documents are available online and can be accessed at the links provided in the footnote.

5.2. Non-aviation related

Proposed non-aviation related strategies for minimising noise impacts at KPS are discussed in this section.

5.2.1. Engagement with the community

Aircraft noise is one of the most prominent environmental issues for people living and working within close proximity to an Airport. Ongoing open and transparent engagement with the community with regard to noise management at KPS is an opportunity to provide education and increase awareness of the Airport and its role in the community.

The Attachment for Guideline A of the NASF Guidelines recommends that the use of ANEF as a tool for providing information to the public on the noise exposure patterns surrounding Airports as well as the other metrics of the N60 and N70 contour. This is further discussed in Section 3.2.

Another means of community engagement is to offer a noise complaint register, which is discussed following.

17 This information has been compiled from the Airport ERSA's released on 08 November 2018 available at https://www.airservicesaustralia.com/aip/aip.asp?pg=40&vdate=28FEB2019&ver=2

18 http://www.airservicesaustralia.com/wp-content/uploads/Moorabbin-Airport-Noise-Information-Pack.pdf

19 http://www.richmondvalley.nsw.gov.au/content/Document/CommunityServices/Aerodromes/NoiseAbatementProceduresEHAerodrome.pdf

5.2.2. Development of a noise complaint register

It is recommended that KSC implement a thorough noise complaint register and process for appropriately managing complaints related to aircraft noise disturbances at KPS. This process is independent to existing AsA noise complaint services and should be considered an additional avenue for the community.

A noise complaint register will provide KSC with a holistic understanding of the situation. An internal staff member should be appointed to oversee the implementation and practice of the noise complaint register as the nominated KPS representative. This will provide a point of contact for referral for the complainant, or KSC staff member initially processing the complaint.

The nominated KPS representative should forward all complaint data to CASA for safety related concerns and AsA for noise related complaints on a monthly basis, as suggested in Section 7.4. An overview of how a complaint register framework may be applied in practice is outlined in Figure 11.

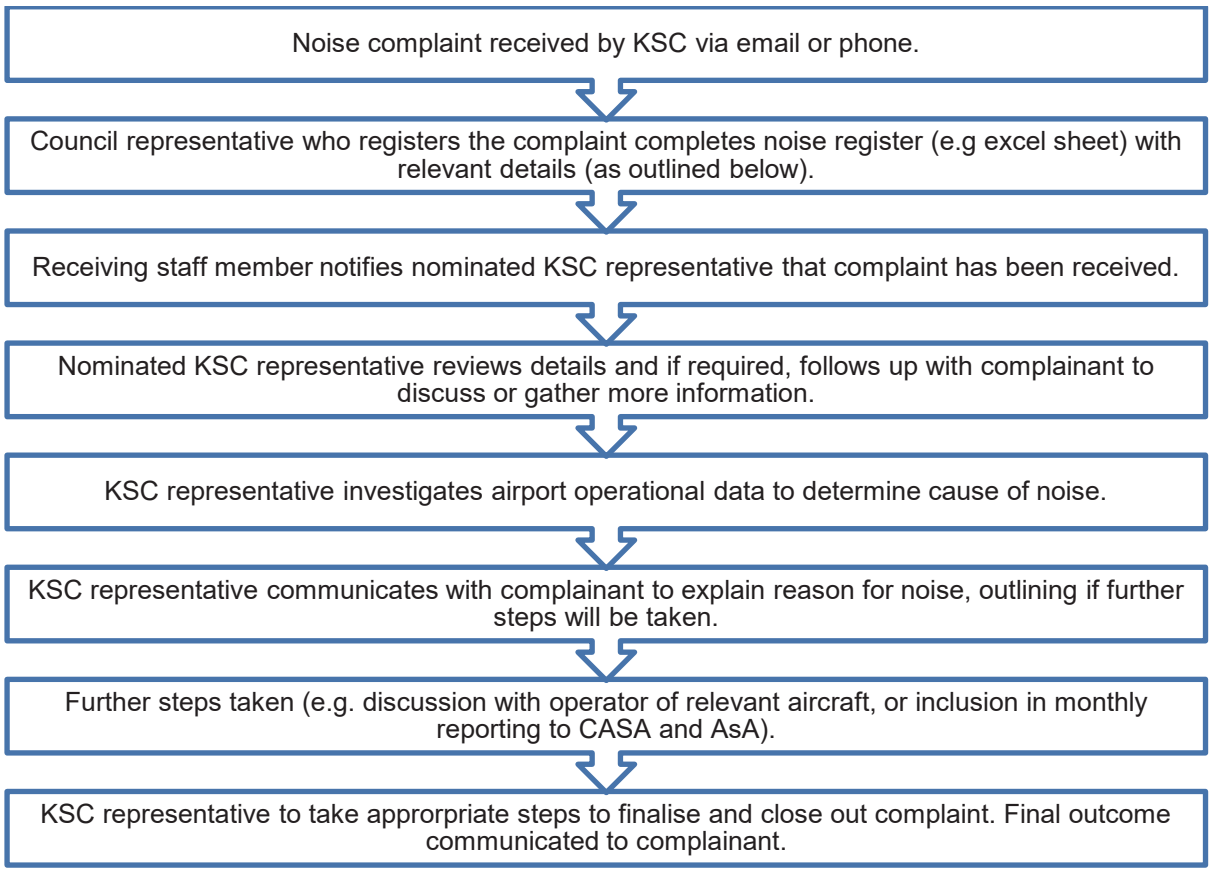


Figure 16: Proposed Noise Complaint review process

Suggested noise complaint register details

The information that may be collated for the KPS noise complaint register includes:

- Date;
- Time;
- Receiving person/department;
- Name and details of complainant;
- Address;
- Phone Number;
- Nature/description of complaint (with as much detail as possible);
- Identify if further contact required – if yes, forward to KPS Representative:
- Action taken and response overview;
- KSC representative completed;

- Method of advice/feedback;
- Indication of whether complaint has, or will be, forwarded to CASA or AsA;
- Date complaint actioned (if required);
- Timing for follow up (if required); and
- Outlining how complaint was finalised.

An example of how this process may be adopted is outlined in the example spreadsheet in Appendix E: Example Noise Complaint Register.

The purpose of the noise complaint register is to provide KSC with a succinct means to understand the noise impact of the airport operations in the community, as well as to ensure that the actions taken are appropriate for the complaint received. It is also envisaged that this approach will aid transparency in communications as well as understanding of the aviation operations at KPS.

At the discretion of Council, noise complaint data may be reported to the community on a regular basis. Any noise register complaint process should be developed in alignment with the existing Council Complaints Management Policy.

5.2.3. Land use planning

Land use planning is a tool that can be used to effectively manage the current and future impacts of noise on communities near KPS. Nearby activities should be planned in a manner that remains compatible with the aviation operations at the Airport.

It is important to note that land use planning should take a balanced view and decision-making should recognise that aircraft noise does not immediately stop at a line on a map. In addition, it is not the intention of this Section to apply retrospectively and recommendations should be considered with regard to future proposed development only.

It is recommended that any future developments located within the noise affected areas, or likely to be affected by aircraft noise, be designed to meet the AS 2021:2015 through land use planning mechanisms which are described in this section and reiterated through the recommendations in Section 7.

5.2.3.1. Strategic planning

KSC's strategic planning strategies may be reviewed with a particular focus on the proposed future development of areas immediately surrounding the Airport, and areas that experience higher levels of noise and environmental disturbances as identified in the noise assessment of this study, as outlined in Section 4.

Existing strategies such as the Kempsey Local Growth Management Strategy (LGMS) Rural Residential Component should be reviewed with consideration of the influences on noise as a result of the noise assessment (and if developed in the future, ANEF contours for KPS). Future strategies produced or implemented by KSC should endeavor to reduce the designation of areas impacted by aircraft noise for rural living character or residential use.

5.2.3.2. Land use planning

Statutory planning policies should provide for the inclusion of appropriate noise management techniques and parameters in codes for development assessment, which will consequently influence the design of any future buildings and residences. This may include the use of tools such as ANEF to understand the areas which may be exposed to aircraft noise.

The AS 2021:2015 provides an assessment of potential aircraft noise exposure around airports based on the ANEF system and is widely referred to in guiding strategic land use planning in the vicinity of airports. As outlined in Section 3.2.3, there is an existing Clause within the current LEP for *'Development in areas subject to aircraft noise'*. In addition, the SEPP for Exempt and Complying Development Codes (2008) references an ANEF in the designated compliant and non-complaint development provisions in this Policy as overviewed in Section 3.2.2. However, there is not a current ANEF for Kempsey Airport. An overview of ANEF is described below.

Australian Noise Exposure Forecast
An ANEF is based on forecast future aircraft movements for a planning period (typically 20 years) and the types of aircraft that are likely to be operated at that point in time and on an average day. The allocations of the forecast movements to runways and flight paths are on an average basis and take into account the existing and forecast air traffic control procedures at the Airport which nominate preferred runways and preferred flight paths for noise abatement purposes.

The following factors of aircraft noise are taken into account in calculating the ANEF:

- The intensity, duration, tonal content and spectrum of audible frequencies of the noise of aircraft take-offs, landings and reverse thrust after landing (the noise generated on the Airport from ground running of aircraft engines or taxiing movements is not included for practical reasons);
- The forecast frequency of aircraft types and movements on the various flight paths;
- The average daily distribution of aircraft take-offs and landing movements in both daytime and night time; and
- The topography of the area surrounding the Airport.

The ANEF has the ability to guide future land use planning decisions for KSC as it will outline areas that will be influenced by aircraft noise in future. The ANEF should include the contours referenced within the relevant planning legislation as outlined in Section 3 (ANEF 20 and 25 and greater). Once the ANEF has been completed, it is recommended that a technical review of the ANEF be undertaken. This review would be completed by AsA as a component of their endorsement process. This process can take up to a period of three to six months to be finalised and includes consultation with relevant State and Local Government planning authorities.

After the completion of the endorsement process with AsA, it is recommended that KSC incorporate the ANEF into the KSC LEP, supporting the existing Clause 7.8 of the LEP, as applicable to future development.

Number Above Contours
The Number Above contours are supplementary metrics of the ANEF system and provide a different way of identifying the impact of forecast changes to aircraft operations that may occur for residents and community that surround an airport or are below aircraft flight tracks. As described in the *NASF Guideline A attachment 1 – Supplementary aircraft noise metrics.* These metrics are often described as the 'Number Above' noise metric, where 'N70' is the number of noise events louder than 70dB(A). The N70 is the most commonly used aircraft noise measure to date as this dB will generally be experienced as a 60dB(A) noise event inside a residence. In order to account for indoor sound levels for habitable and sleeping areas, as well as the outdoor sound levels, it is recommended that N60, N65 and N70 contours are often produced for KPS.

5.2.3.3. Context specific noise criteria
'Guideline A: Managing Aircraft Noise' of the NASF suggests to avoid any noise sensitive development where 20 or more daily events greater than 70 dB(A) are predicted. As specified in the *'Expanding Ways'* discussion paper, an internal noise level of 60 dB(A) is the sound pressure level of a noise event that is likely to interfere with conversation or with listening to the radio or the television. An external single event noise will be attenuated by approximately 10 dB(A) by the fabric of a house with open windows.

It is recognised that the indoor design noise for a habitable space is specified as L_{Amax} 55 in the current AS 2021:2015. As such, in addition to N70, number of events louder than 65 dB(A) (N65) has also been adopted to identify the noise affected area for this particular project. In order to be consistent with the proposed Building Site Acceptability noise levels, it is recommended by ANE that the number of N65 events (number of events > L_{Amax} 65 per day) are limited to 30 at any surrounding residential receiver. The number of N70 (number of events > L_{Amax} 70 per day) should be limited to 20. This relates to Number Above events experienced by residents and does not relate to levels of acceptability with regard to Building Site. This Final NMP acknowledges that existing residents are affected by noise (as summarised in Section 4.6), however in order to account potential future operations at the airport, these recommendations are outlined in consideration of this.

5.2.3.4. Context specific future considerations

Based on the outcomes of the noise monitoring, particular consideration should be given to the future development within and around noise monitoring Area 1, 4, 5, 6, 7, 8, 12, and 14.

5.2.3.5. Proposed residential development acoustic testing

Consideration should be given to the implementation of a noise or acoustics assessment as part of the planning scheme and for the assessment of future Development Applications (DA) submitted to KSC. This would be a condition for residential or noise sensitive development in areas at most risk of noise and environmental influences within the vicinity of KPS. These areas may be drawn from the outcomes of the noise assessment in Section 4 and should be developed in collaboration with KSC planning representatives.

The purpose of the acoustic assessment is to review the indoor and outdoor noise impacts that may be experienced at the location in comparison to the background noise and relative to AS 2021:2015 for construction and building acoustics. This process has the ability to ensure that appropriate measures are included in the design and construction of buildings to demonstrate compliance with the provisions of the planning scheme.

The policy required to implement this may be incorporated in the form of a KSC Development Control Plan (DCP). The requirement to conduct an onsite acoustic test would be the responsibility of the proponent for the DA.

5.2.3.6. Public Safety Areas (PSA)

The Australian Government Department of Infrastructure, Regional Development and Cities has released a Draft New Guideline I – Managing the Risk in Public Safety Areas (PSA) at the Ends of Runways (the Guideline) as part of the National Airports Safeguarding Framework (NASF) on 9 November 2018[20]. This provides land use planning controls for the areas which fall within the PSA.

As outlined in the Guideline:

A PSA is a designated area of land at the end of an airport runway within which development may be restricted in order to control the number of people on the ground at risk of injury or death in the event of an aircraft accident on take-off or landing.

It is not intended that this Guideline will be applied retrospectively to existing development. Rather, it is intended to ensure there is no increase in risk from new development. New or replacement development, changes of use of existing buildings and rezoning of land are discouraged if it results in increasing the number of people living, working or congregating within the PSA. The guideline applies to land both on and off airport.

20 https://infrastructure.gov.au/aviation/environmental/airport_safeguarding/nasf/files/NASF-Guideline-I-PSA.pdf

The Guideline does not prescribe how the local government may implement a PSA into their planning system but provides for the ability for the statutory body to elect how they can best address PSAs in their local context.

The United Kingdom and Queensland PSA approaches are of the most relevance to Australia amongst various other models which may be appropriate for Australia, pending the size and type of operations. As outlined in the Guideline, *"the reasons for adopting a particular approach should be clearly justified and articulated to explain why a particular model is best suited to an airport's circumstances".*

As an example, the Queensland State Planning Policy has adopted Public Safety Areas since 1992. This model applies a single defined trapezoid template to every runway which meets a certain in terms of aircraft movements. The PSA is 1,000m long and 350m wide closest to the runway end tapering to a width of 250m furthest from the runway (Figure 17).

Figure 17: Indicative PSA from Queensland State Planning Policy

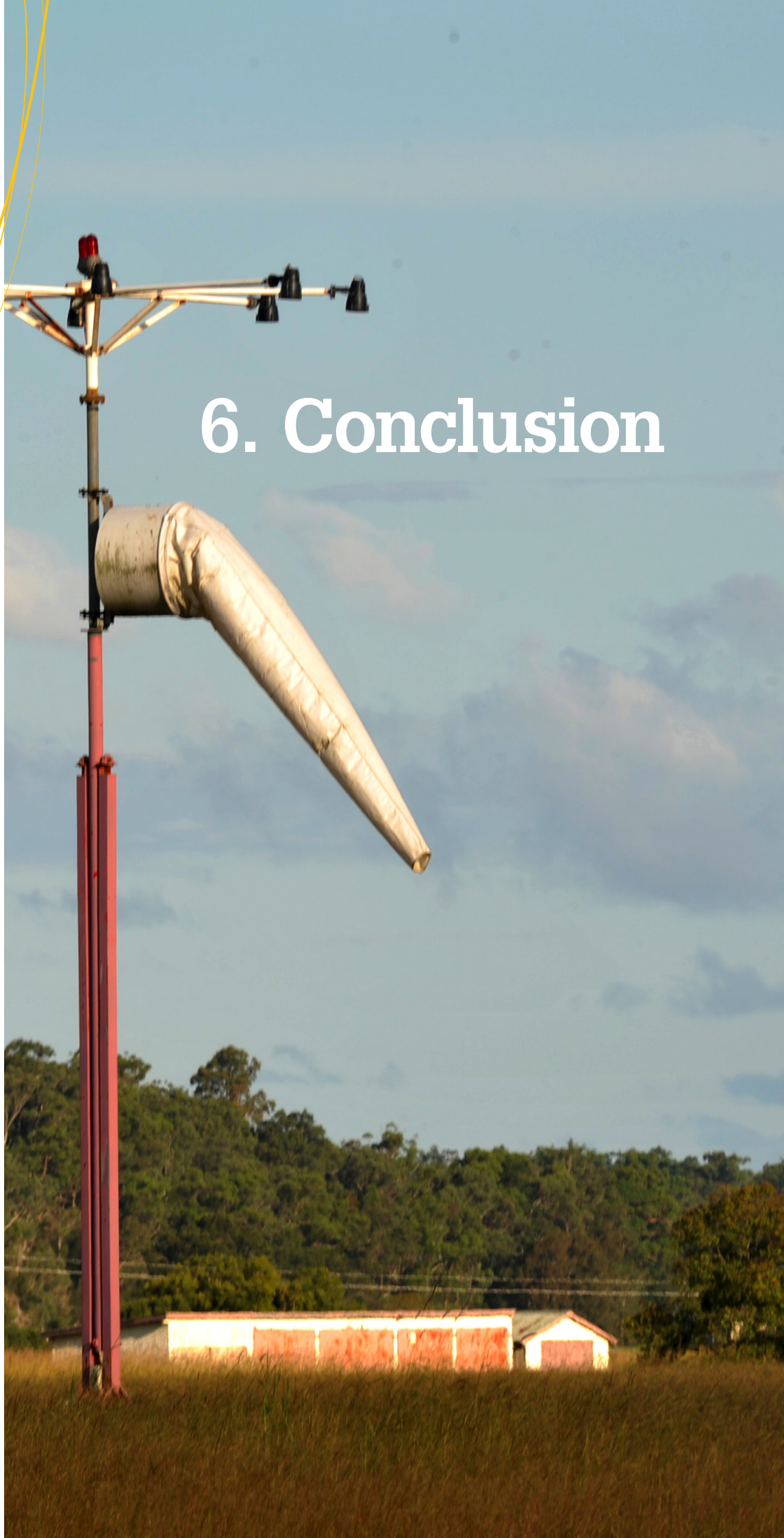
A PSA does not directly relate to aircraft noise, however can be used as a land use planning tool to limit development near the Airport in the future. The application and implementation of a PSA for KPS should be considered when conducting land use planning in the vicinity of KPS.

5.2.3.7. Non-aviation on airport noise

The strategies of managing on airport noise relating to non-aviation land uses may vary, depending on the type of development. There may also be specific legislation relating to different uses. For example, the NSW Government has produced a Noise Policy for Industry (2017)[21]. Investigation into non-aviation related land uses on airport is not within the scope of this Final NMP, however may be considered by KSC in the future to provide appropriately for development opportunities at the Airport.

21 https://www.epa.nsw.gov.au/your-environment/noise/industrial-noise/noise-policy-for-industry-(2017)

6. Conclusion



Conclusion

6.

6. CONCLUSION

KPS has experienced growth in aircraft movements over the past few years which has stimulated increases in disturbances from aircraft noise in the surrounding environment. The Final NMP has been prepared and included a detailed noise monitoring period with 17 locations, including a source location near the Airport runway, for a period of eight weeks. The production of the Final NMP also included stakeholder engagement with KSC, airport users, and community representatives.

This Final NMP has presented the outcomes of an eight-week period of noise monitoring for 17 locations surrounding KPS. Based on AS 2021:2015, two key noise criteria have been considered. The Building Site Acceptability has been discussed with regard to future development. This assessment identified all Areas monitored experienced 'acceptable' levels of noise, except Area 8, which has been identified to experience events that are 'conditionally acceptable'. No Areas monitored experienced 'unacceptable' levels of noise during the monitoring period.

The impact of noise events experienced by existing residents was also reviewed and analysed based on AS 2021:2015. This analysis identified the areas within the monitoring locations that are currently worst affected by aircraft noise. Within the threshold of events greater than 70 dB(A), Area 6 was identified as the worst affected area with 11% of the recorded events measuring above L_{Amax} 70 dB(A). With regard to events above 65 dB(A), residential dwellings located within and around the noise monitoring Areas 6, 8, and 12 experienced higher numbers of N65 (number of events > L_{Amax} 65 dB(A)). Based on the noise monitoring results presented in this report, residential dwellings located within and around the noise monitoring Areas 1, 4, 5, 6, 7, 8, 12, 14 and 15 experienced a higher number of N60 events (number of events > L_{Amax} 60 dB(A)).

Noise management strategies that pertain to aviation and non-aviation related options have been developed based on the outcomes of the noise monitoring as well as desktop legislative and existing operations review. The noise management strategies proposed in this Final NMP relate to hours of operation, circuit training operations, runway usage, altitude of operations, flight tracks, aircraft noise standards, and standard operating procedures. Non-aviation related strategies consider the communication of noise, development of a noise complaint register and both statutory and strategic land use planning.

The Strategies (Section 5) have been developed with consideration to the Recommendations (Section 7) following this chapter. The Recommendations provide guidance on next steps and implementation of noise management strategies at KPS.

With regard to any future proposed changes from the standard procedures at the Airport (e.g AIP-ERSA) it is recommended that Council conduct a risk assessment with operational stakeholders (e.g regulatory and airport operational stakeholders) before implementing changes to operational procedures. This is particularly relevant where it involves changes to operational procedures at Airports with flight training as this adds to the complexity for students which may impact on safety in aerodrome operations during transition. A consultation document overviewing the proposed changes should be issued to relevant operational stakeholders inviting aviation parties to participate in the risk assessment before implementing. This should be done prior to the implementation of any of the strategies outlined in Section 1 or recommendations in Section 7.

Recommendations

7. Recommendations

7.

7. RECOMMENDATIONS

The previous chapter provides an overview of strategies which may be used for managing and abating the noise impacts experienced at KPS. This chapter provides some recommendations for the implementation of these strategies and for incorporation into aerodrome operational documentation such as the AsA Aeronautical Information Packages (AIP) and En Route supplement Australia (ERSA) at the discretion of KSC.

The implementation of any strategies or recommendations for the management of noise should be with the intention to reduce the number of events occurring and/or limit the disturbance, particularly surrounding the areas identified in the Noise Assessment (Section 4). Eliminating noise events completely is not seen to be a practical solution at KPS, or any operating Airport.

A number of recommendations have been identified for KPS and the implementation of proposed noise management strategies. These are described in this section.

7.1. Industry engagement

The aviation industry in Australia is regulated by CASA. AsA is responsible for air traffic control in controlled airspace and the publication of Australian operational documentation. It is important to maintain ongoing engagement with nominated representatives from both organisations. They will also be able to provide advice on proposed amendments to the ERSA and it is worthwhile providing draft amendments to representatives prior to sending the formal request for change. Evidence of engagement will be required when submitting for changes to the ERSA.

In addition, the request for changes to the ERSA should include evidence of industry and stakeholder engagement to be submitted to support the proposed amendments. This may not just be limited to AsA and CASA but extend to the NSW Department of Planning and Environment and KSC representatives as required.

7.2. Risk assessment

With regard to any future proposed changes from the standard procedures at the airport (e.g AIP-ERSA) it is recommended that Council conduct a risk assessment with operational stakeholders (e.g regulatory and airport operational stakeholders) before implementing changes to operational procedures. This is particularly relevant where it involves changes to operational procedures at Airports with flight training as this adds to the complexity for students which may impact on safety in aerodrome operations during transition. A consultation document overviewing the proposed changes should be issued to relevant operational stakeholders inviting aviation parties to participate in the risk assessment before implementing. This should be done prior to the implementation of any of the strategies outlined in Section 1 and Recommendations in this Section.

7.3. Recommendations for AIP/ERSA

While an NMP and FNA are not legally enforceable, operational procedures and limitations for an airport can be included in the FAC section of the ERSA for Kempsey.

A “Local Traffic Regulations” entry in ERSA is the appropriate method to use if operational restrictions can be imposed at KSCs discretion from the NMP strategies outlined in Section 1.

Consideration should also be given to AsA’s suggestion of short-term trials to ‘road test’ proposed changes to flight paths or operating procedures, which should be considered in this instance to assess the influence they have on the scale of complaints regarding noise[22]. As such, amendments to the ERSA should be incorporated on a trial basis with a review to be undertaken at the end of a period of three (3) months to identify if there has been a reduction in the noise complaints received.

22 http://www.airservicesaustralia.com/aircraftnoise/aircraft-operations/noise-improvements/

Nonetheless, given the scale of training operations at KPS, it is advisable to ensure amendments to ERSA and operating procedures are sufficiently communicated to stakeholders. In addition, the risk of multiple changes or amendments to operating procedures should be reviewed in light of aviation safety requirements.

It should be noted that whilst ERSA is part of the AIP documentation published by AsA, which is a legal document, entries in the ERSA relating to noise abatement or FNA are a guide for pilots operating at KPS and are not enforceable. As such, TAG recommends that KSC identify priority or efficient amendments for the ERSA based on a risk assessment process as outlined in Section 7.2. In addition, prior to finalising any proposed amendments to the KPS ERSA entry, KSC should liaise with the CASA Sydney Region.

7.4. Actions taken with complaint data

If the detail in noise complaints process in the noise complaints register (outlined in Section 5.2.2) relates to operational safety, complaint information should be forwarded to CASA; whilst any concerns relating to aircraft noise should be forwarded to AsA. At the end of each month, KSC should discuss all the complaint data with the relevant operator. In addition, KSC should send a monthly report of all complaint data to CASA and AsA.

This complaint information should be sent to the CASA Sydney Region office and to the CASA Flight Operations Inspector for KPS. These monthly reports should, among other elements included in Section 5.2.2, detail the type of complaint, including the perceived reason for operational safety issues. When sending to CASA, KSC should seek feedback on the complaint reporting and discuss further with CASA when required or requested. As outlined on their website, CASA *"is obliged to act on safety related information they become aware of".*

7.5. Statutory and Strategic Planning

It is recommended that KSC review the planning related noise management strategies outlined in Section 5.2.3 and identify opportunities for inclusion into Council LEP and DCP documentation as well as any other relevant strategic planning documentation.

Particularly in relation to the specific monitoring Areas which were identified to experience higher levels of aircraft noise (Area 1, 4, 5, 6, 7, 8, 12, and 14) or suburbs which are the source of complaints in relation to aircraft noise. The planning documentation should provide guidance to ensure that future development in these areas should be designed to meet the AS2021:2015 indoor design noise levels specified in this report (Section 4.3.3). Overall, KSCs land use planning documentation and strategies should allow for a balanced, considered approach to appropriate developments near the Airport.

The NMP does not direct KSC development decisions. Any future development would require a Development Application and would follow all statutory processes and requirements.

7.6. Production of ANEF and N60, N65 and N70 Contours

To provide the most accurate of understanding of which areas will be affected by aircraft noise in the future, is it recommended that an ANEF study be undertaken, as well as the production of 'Number Above' N60, N65 and N70 contours for KPS. An overview of ANEF and Number Above Contours has previously been provided in Section 5.2.3.2.

The output of the ANEF study should be reviewed in conjunction with the Strategic and Statutory planning recommendations in Section 7.5.

7.7. Review of Noise Management outcomes

It is recommended that KSC review the outcomes of the strategies and recommendations adopted on a regular basis (e.g on an annual basis) to identify if there have been any changes in the number of complaints received in relation to aircraft noise and operations at KPS. In addition, future noise monitoring may be considered to identify if any amendments to the management strategies are required.

8. Fly Neighbourly Advice

Fly Neighbourly Advice

8.

8. FLY NEIGHBOURLY ADVICE

The FNA is described as *"a voluntary code of practice established between the airport, aircraft operators and communities or authorities that have an interest in reducing the disturbance caused by aircraft within a particular area".*

The Fly Neighbourly Advice (previously Fly Neighbourly Agreement) is not enforceable and is a measure of goodwill. It is in the intention that the FNA would assist with the minimisation of noise nuisance experienced by the Airport's neighbours.

It is important to note that on overriding provision of the Civil Aviation Safety Authority (CASA) Airspace Risk and Safety Management Manual (2017) is that *"all the above provisions or requests should be considered not applicable if, for any reason, their observance would jeopardise the safety of a flight or put a pilot in conflict with any provision of the Civil Aviation Regulations 1988".*

8.1. Proposed standard document

The structure of the FNA presented here is based upon the Civil Aviation Safety Authority (CASA) Airspace Risk and Safety Management Manual (2017)[23].

This proposed document is provided as initial guidance only and not a final FNA. This should be reviewed and updated upon implementation or adoption of any noise strategies and/or recommendations presented in this Final NMP.

A preamble that would set out the intent of the FNA

- The intent of the Fly Neighbourly Advice (FNA) is to manage the impact of noise on the communities surrounding Kempsey Airport. This agreement should form part of the lease agreement for on airport land and should be entered into with existing leaseholders. The FNA is a voluntary agreement which has been identified by KSC as a tool to manage the operations in the vicinity of KPS.

The proponents of the FNA

- Kempsey Shire Council, Residents of Kempsey, and Kempsey Airport Operators

The geographic area and coordinates of the area over which the FNA would apply to

- The geographic area of the FNA should be determined for a predefined area surrounding KPS, as determined.

The matters of concern to the stakeholders affected by aviation operations

- Noise and the ongoing effect on the regional environment (e.g. crops and livestock), as well as the health and wellbeing the community are key concerns to those that may be affected by aviation operations.

Matters of concern to the aviation operators

- The matters of concern to the aviation operators are the feasibility and viability of their ongoing operations, ensuring that their business or hobby is able to operate as required.

Undertakings by aircraft operators to reduce the disturbances or impacts of their operations.

The aviation operators are to:

- Abide by the operating procedures for KPS as per the ERSA [*dependent on those adopted*].
- Operate with consideration of the surrounding community.
- Emergency service providers are exempt from operational controls and are able to operate to KPS any time.

23 https://www.casa.gov.au/sites/g/files/net351/f/arasmm.pdf?v=1477006420

The means of monitoring the FNA, including the identification of indicators of the performance of operations in achieving the undertakings given

The monitoring of the acceptance and following of the FNA will be:

- Monthly review of Avdata movements to review timings of operations and identify any abnormalities.
- Monthly review of any external comments or complaints received by KSC.

The means by which failure to achieve the undertakings should be considered and remedied

- KSC should approach the operator by which is not upholding the terms of the ERSA or engaging in other operational practices not conducive to neighbourly operations to discuss the challenge and identify any solutions.

Undertakings by the aircraft operators to accept the FNA and adhere to it

- Aircraft operators should incorporate values into their SOPs which ensure that operations take into consideration best practicable noise abatement procedures in that operating situation, pending on meteorological conditions and other external influence.

Acknowledgements by the stakeholders that emergency services including police, fire, search and rescue and infrastructure monitoring operations may not always be able to adhere with the FNA

- This FNA and its proposed stakeholders acknowledge that emergency services including police, fire, search and rescue and infrastructure monitoring operations may not always be able to adhere with the operations guidance proposed in the FNA. It is understood that where possible, these operators will adopt fly neighbourly approaches, provided they do not interfere with the safety or key outcomes of their operations.

A process to review the FNA after a set period of time

- The FNA should be reviewed within 12 months of being adopted.

9. Appendices

Appendices

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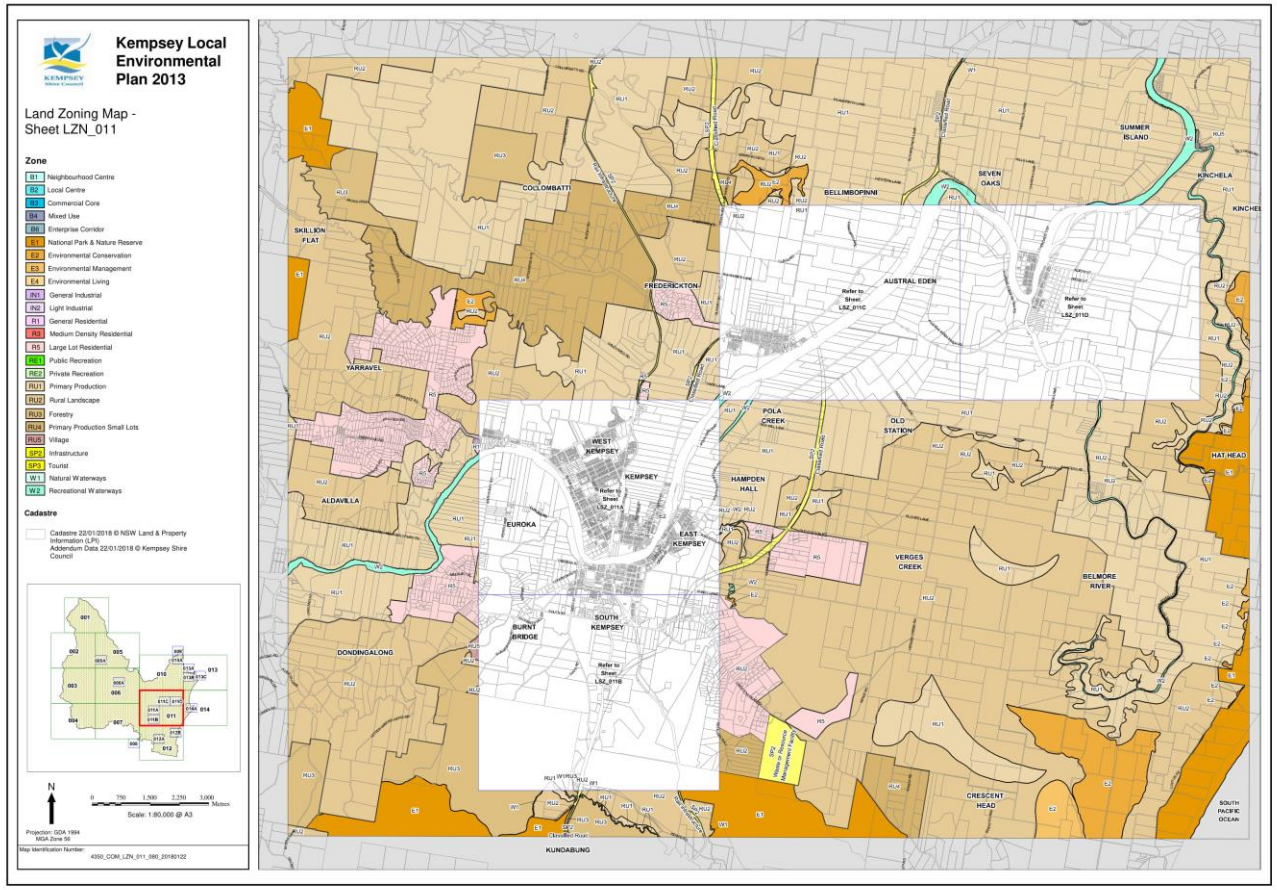
9. APPENDICES

Appendix A: Kempsey Shire Council LEP land Zoning Map



Appendix B: Reconciled aircraft movement data

Total Avdata movements 4 August to 30 September							
Period	**Landings (L)**	**Take offs (TO)**	**Combined take offs and landings (C) = (L + TO)**	**Training[24] (T)**	**Total Movements (R) = (C + T)**	**Extrapolated (E) = (T x 2)**	**Extrapolated Total Movements (C + E)**
August	301	296	597	790	1,387	1,580	2,177
September	324	308	632	1,200	1,832	2,400	3,032
TOTAL			**1,229**	**1,990**	**3,219**	**3,980**	**5,209**

Noise Monitoring Data (4 August to 30 September)							
Movements during periods with monitoring							
Period	**Landings (L)**	**Take offs (TO)**	**Combined take offs and landings (C) = (L + TO)**	**Training (T)**	**Total Movements (R) = (C + T)**	**Extrapolated (E) = (T x 2)**	**Extrapolated Total Movements (C + E)**
4 Aug - 30 Sep	436	416	852	1,209	2,061	2,418	3,270
Movements during periods with no monitoring							
Period	**Landings (L)**	**Take offs (TO)**	**Combined take offs and landings (C) = (L + TO)**	**Training (T)**	**Total Movements (R) = (C + T)**	**Extrapolated (E) = (T x 2)**	**Extrapolated Total Movements (C + E)**
4 Aug - 30 Sep	189	188	377	781	1,158	1,562	1,939
TOTAL			**1,229**	**1,990**	**3,219**	**3,980**	**5,209**

[24] Training refers to touch and go, stop and go, and practice approach movements as recorded by Avdata.

Appendix C: Benchmarking of Australian Airport ERSAs Operating Times

Airport	Airport or training timing restrictions
Albury NSW	• Training circuits not permitted Monday to Sunday 21:00-07:00, (1hr earlier in hours of daylight saving).
Archerfield QLD	• No restrictions on airport operating hours or types of operations at certain times.
Armidale NSW	• No restrictions on airport operating hours or types of operations at certain times.
Ballarat VIC	• Circuit training not permitted between 23:00-06:00 local.
Bankstown NSW	• Circuit training is only permitted 0600 and 2200 Monday to Friday. During hours of daylight saving it is permitted between 0600 and 2230. • Saturday and Sunday between 0700 and last light.
Bathurst NSW	• No training between 22:00 (local) and first light.
Bendigo VIC	• Circuit training not permitted between 22:00-07:00 local.
Bundaberg QLD	• Circuit training permitted 06:00-19:00 • Night training permitted for local operators only 19:00-22:00.
Busselton WA	• Circuit training restricted operations 19:00-07:00 (local).
Caboolture QLD	• No night operations between last light and first light. • Training circuits permitted between 07:00 (local) and last light.

Caloundra QLD	• Training circuits are permitted:
	  ○ Monday to Saturday between 06:00 (local) and last light. Sunday between 08:00 (local) and last light.
	  ○ Caloundra based operators – night training circuits are permitted Monday to Friday until 21:00 (local).

Camden NSW	• Circuit training is permitted between:
	  ○ 08:00 and 20:00 (local mean time) Monday to Friday (22:30pm during hours of day light saving).
	  ○ Between 07:00 and 20:00 local time Saturday and Sunday.

Cessnock NSW	• Circuit training restricted 08:00-22:00 local time.
Coffs Harbour NSW	• Circuit training only permitted between 07:00-22:00 (local time).
Deniliquin NSW	• No restrictions on airport operating hours or types of operations at certain times.
Dubbo NSW	• No restrictions on airport operating hours or types of operations at certain times.
Evans Head NSW	• No restrictions on airport operating hours or types of operations at certain times.
Goulburn NSW	• No restrictions on airport operating hours or types of operations at certain times.
Gympie QLD	• All operations prohibited between sunset and sunrise except for emergency services.
Horsham VIC	• No restrictions on airport operating hours or types of operations at certain times.
Kingaroy QLD	• No restrictions on airport operating hours or types of operations at certain times.

Lake Macquarie NSW	• No restrictions on airport operating hours or types of operations at certain times.
Launceston TAS	• No restrictions on airport operating hours or types of operations at certain times.
Lethbridge VIC	• No restrictions on airport operating hours or types of operations at certain times.
Longreach QLD	• No restrictions on airport operating hours or types of operations at certain times.
Lismore NSW	• No restrictions on airport operating hours or types of operations at certain times.
Maitland NSW	• September to April: 0600 to 2300 local time • May to August 0630 to 2300 local time • Aircraft are permitted to operate outside operational hours whilst engaged in emergency service operations as directed by emergency services organisation. **Circuit training:** • September to April 0700 to 2200 Local time • May to August 0700 to 2130 local time
Moorabbin VIC	• Circuit training permitted between the following hours: ○ 08:00-21:00 local time Monday to Friday. ○ 08:00-22:00 local time, Hours of Daylight Saving, Monday to Friday. ○ 09:00-18:00 local or last light (whichever sooner) on Saturdays, Sundays and public holidays. ○ 09:00-18:00 local or last light (whichever sooner, hours of daylight saving, Saturday, Sunday and public holidays.
Narrabri NSW	• No restrictions on airport operating hours or types of operations at certain times.
Orange NSW	• No restrictions on airport operating hours or types of operations at certain times.
Parafield SA	• Circuit training only permitted between: ○ Monday-Friday 07:00-23:00, local mean time. ○ Saturday 07:00-21:00, local mean time. ○ Sunday 08:30-21:00, local mean time. ○ Anzac Day: 09:00-23:00, local mean time. ○ Christmas Day – no circuit training. ○ New Years Day – no circuit training.
Port Macquarie, NSW	• No restrictions on airport operating hours or types of operations at certain times.
Redcliffe, QLD	• Operations not permitted between 2200-0600.
Roma, QLD	• No restrictions on airport operating hours or types of operations at certain times.
Toowoomba City QLD	• Aerodrome curfew from 23:00-05:00 local time (excluding emergency and military use).
Woollongong NSW	• Circuit training to be avoided before 0800 local time. • Night circuits not permitted after 2200 local time.

Appendix D: Benchmarking of Australian Airports operating restrictions in ERSA

The information provided in this Appendix relates to fixed wing aircraft operations only. The Appendix does not consider any directions within the ERSA to obtain supplementary noise abatement or management documentation available in other AIPs Council or Airport operator websites. TAG has determined which information has been included based on the potential to influence noise impacts of the Airport. The Table highlights the section of the ERSA in which the information has been obtained from.

The only section of the ERSA which provides information that is specifically with the intention of minimising noise is the Noise Abatement Procedures section. The Noise Abatement Procedures component of the ERSA should not affect a Pilot's responsibility to operate in accordance with Civil Aviation Safety Regulations and Procedures.

Airport	Applicable guidance on flying activities that may influence noise creation
Albury NSW	**Local Traffic Regulations** • Right hand circuits required when operating RWY 07 except as directed by ATC. • Simulation of engine failure after take off TWY 25 must only be initiated during sunrise to sunset and not below 1,500ft AMSL.

Archerfield QLD	**Local Traffic Regulations**
	• Circuit altitude: 1,000ft query nautical height (QNH)
	• Single engine aircraft require prior ATC approval to conduct simulated engine failure on take off. Recovery must be initiated prior to departure end of runway.
	• Low level circuits not permitted on RWY 04/22
	• Circuit directions during tower hours (unless otherwise instructed by ATC):
	  ○ Runway 04R sunrise to sunset – Right; Sunset to sunrise – not available.
	  ○ RWY 04L sunrise to sunset – Left, sunset to sunrise – not available
	  ○ RWY 22R sunrise to sunset – right, sunset to sunrise – not available
	  ○ RWY 22L sunrise to sunset – left, sunset to sunrise – not available
	  ○ RWY 10R sunrise to sunset – right, sunset to sunrise – not available
	  ○ RWY 10L – left.
	  ○ RWY 28R – right
	  ○ RWY 28L – sunrise to sunset – left – sunset to sunrise – not available.
	• Outside tower hours
	  ○ All circuit direction: Left Hand.
	  ○ Runway Available: 04R/22L sunrise to sunset only,. RWY 10L/28R continuous.
	  ○ Runway not available: RWY 04L/22R and RWY 10R/28L.
	
	Noise abatement procedures
	  ○ Outside tower hours when operational conditions permit, RWY 28 must be used for take off.

Armidale NSW	• No commentary around operating activities that may support the management of noise impacts.
Ballarat VIC	**Local Traffic Regulations** • Right hand circuits when operating on RWY 18 or RWY 13. • In nil wind conditions use RWY 18. • Training flights conducting NDB or GPS approach should add 1,000ft to the altitude prescribed in the approaches to reduce noise nuisance and interference with circuit traffic. Such flights should broadcast their intentions including altitude limit of operations when turning inbound. Instrument Meteorological conditions (IMC) flights shall remain as high as practical when encountering Visual Meteorological Conditions (VMC) and join the circuit in the standard manner.

	Additional information • Visiting aircraft are not to conduct circuit training at any time.

Bankstown NSW	**Flight Procedures**
	• Circuit altitude: 1,000ft QNH
	• Circuit operations are to be confined within a 2NM radius of the Aerodrome Reference Point.
	• Class D: Circuit Directions during Tower hours:
	  ○ RWY 11L Sunrise to Sunset – Left, sunset to sunrise - right (when RWY 11C not available)
	  ○ RWY 11R sunrise to sunset – left, sunset to sunrise – not available.
	  ○ RWY 11C sunrise to sunset – left, sunset to sunrise not available.
	  ○ RWY 29L sunrise to sunset – left, sunset to sunrise not available.
	  ○ RWY 29R, sunrise to sunset – right, sunset to sunrise – left (when RWY 29C not available)
	  ○ RWY 29C sunrise to sunset – right, sunset to sunrise – left.
	  ○ Operations on RWY 11C/29C shall confirm to the 11L/29R circuit direction unless otherwise advised by ATC.
	  ○ Practice instrument approaches must be advised by ATC.
	
	Noise Abatement Procedures
	• Preferred RWY direction is 29.
	• Operations between first light and 0700: operations in the 29 direction shall be confined to RWY 29L, except that RWY 29C may be used if operationally required.
	• Operations in the 11 direction shall be confined to RWY 11R, except that RWY 11C may be used is operationally required.
	• Between 1900 (or last light, if later) and 0700, circuits must be flown only on the southern side of the aerodrome. RWY 11: right circuit; RWY 29: left circuit.
	• Between W2130-2300 (E2030 -2300), aircraft departing RWY 11 (except circuit traffic) must turn left
	• Low level circuit training not available.

Bathurst NSW	**Local Traffic Regulations** • Right hand circuits required sunrise to sunset on RWY 35
Bendigo VIC	**Local Traffic Regulations** • Right hand circuits RWY 35.
Bundaberg QLD	**Noise Abatement Procedures** • Preferred RWY 32 for Arrivals, RWY 14 for Departures. • If departure RWY 32 required, full length of runway to be used.
Busselton WA	**Noise Abatement Procedures** • Training flight conducting NDB and GPS approach should add 1,000ft to altitude prescribed in approach to reduce noise nuisance and interference with circuit traffic. • Adopt rate of CMB/Decent which minimises noise over residential areas.
Caboolture QLD	**Local Traffic Regulations** • Right hand circuits required when operating RWY 30. • No take off RWY 24 except in emergency or when wind strength and direction preclude safe operations on other runways. • Circuit height 1,000 ft Above Ground Level (AGL) minimum. • Training circuits Caboolture based operators only. **Noise Abatement Procedures** • Sensitive Areas to the North, East and West to be avoided at all times. • Departures from RWY 24 required to make a 90 degree left turn at 500 ft AGL to avoid overflying the hospital and populated areas.

	• Departures from RWY 30 required to make a 90 degree right turn at 500ft AGL to avoid overflying populated areas. • Departures from RWY 24 and 30 required to commence ground roll at East extremity of RWY. • Max 5 aircraft conducting circuits at anyone time. • Training circuits for Caboolture based operators only.

Caloundra QLD	**Local Traffic Regulations**
	• Right hand circuits required when operating on RWY 12 and 23.
	
	Noise Abatement Procedures
	Preferred runway arrangements for arriving and departing aircraft (subject to weather or other operational constraints, following is the order of preference for RWY usage for arriving and departing aircraft)
	• Arrivals: RWY 05, RWY 12
	• Departures: RWY 23, RWY 12, RWY 05, RWY 30
	• Circuit operations:
	  ○ RWY 05 – Left hand circuits
	  ○ RWY 12 – Right hand circuits
	  ○ RWY 23 – Right hand circuits
	  ○ RWY 30 – left hand circuits
	• Subject to weather or other operational constraints following is the order of preference of RWY usage for training circuit operations: RWY 23, RWY 12, RWY 05 and RWY 30.
	• A maximum of five aircraft including helicopters are permitted in the circuit for training circuits at any one time.
	• All aircraft departures (other than touch and go operations) to commence take off roll from end of RWY to maximise height over residential areas after takeoff.
	• For single engine aircraft, simulated engine failure after takeoff preferred on WY 23 or RWY 12 and where possible aerodrome boundary.
	• Simulated asymmetric operations preferred on RWY 23 or RWY 12
	• Low level training circuits preferred on RWY 23 or RWY 12.

Camden NSW	**Flight Procedures** • Left hand circuits required for powered aircraft operating RWY 06 and RWY 10. • Right hand circuits required for powered aircraft operated Class D and Class G airspace RWY 24 and RWY 28. • Circuit operations altitude 1,000ft (Camden QNH) **Noise abatement procedures** • RWY 06 • Practice instrument approaches are not permitted on GPS PROC between 11pm and 6am LMT day.
Cessnock NSW	**Local Traffic Regulations** • Right hand circuits required RWY 35 sunset to sunrise (left hand circuits day light hours). • Preferred RWY 35 NIL or Light and Variable (L/V) wind or direct crosswind. • Straight in approaches are not permitted. • Circuit operations to be conducted WI 2NM Rad due to terrain and noise abatement. • Pilots should maintain the extended RWY centreline after take off until the aircraft is at least 500ft above terrain.
Coffs Harbour NSW	**Local Traffic Regulations** • Right hand circuits when operating on RWY 03, except as directed by ATC.
Deniliquin NSW	**Local Traffic Regulations** • All movements right hand circuit pattern on RWY 06 on landing or after take off. • Right hand circuit pattern RWY 12 on landing or after take off.

Dubbo NSW	• No commentary around operating activities that may support the management of noise impacts.
Evans Head NSW	**Local Traffic Regulations** • Right hand circuits required on RWY 18.
Goulburn NSW	• No commentary around operating activities that may support the management of noise impacts.
Gympie QLD	• No commentary around operating activities that may support the management of noise impacts.
Horsham VIC	• No commentary around operating activities that may support the management of noise impacts.
Kingaroy QLD	**Local traffic regulations** • Right hand circuits runway 34 24 hours. • All circuits left hand RWYs 05/23.
Lake Macquarie NSW	**Noise abatement procedures** • No circuit training. • No flight below 1,000ft AMSL. • Avoid all built up areas. • Avoid Golf Course to east.
Launceston TAS	• No commentary around operating activities that may support the management of noise impacts in the ERSA.
Lethbridge VIC	**Local Traffic Regulations** • Noise sensitive area, no flights over houses within 1km of the airfield boundary. • In NIL weather conditions preferred RWY 28 or 34. **Additional information** • To assist with noise minimisation, pilots are encouraged to climb to altitude as quickly as possible after take off & if possible operate at a reduced engine revolutions per minute within the circuit area. • Avoid overflying Lethbridge township at less than 2,500ft AMSL.
Longreach QLD	No commentary around operating activities that may support the management of noise impacts.
Lismore NSW	No commentary around operating activities that may support the management of noise impacts.
Maitland NSW	**Local traffic regulations** • Right hand circuits for night operations RWY 05 • Preferred RWY 23 NIL or L/V wind • Circuit training before 0800 local restricted to single-engine aeroplanes less than 1,900kgs MTOW. **Noise Abatement Procedures** • Noise sensitive areas at Windella (immediately west of AD) and Rutherford (1-2NM east of Aerodrome)

Moorabbin VIC	**Flight procedures – circuit procedures**
	• Circuit altitude: 1,000ft (QNH)
	• Simulated engine failure in single engine aircraft after take off not permitted.
	• Circuit directions during tower hours
	  ○ RWY 04 sunrise to sunset – right, sunset to sunrise – not available.
	  ○ RWY 22 sunrise to sunset – left, sunset to sunrise – not available
	  ○ RWY 13R sunrise to sunset – right, sunset to sunrise – not available.
	  ○ RWY 13L sunset to sunrise – left, sunset to sunrise – left.
	  ○ RWY 31R sunrise to sunset – right, sunset to sunrise – right.
	  ○ RWY 31L sunrise to sunset – left, sunset to sunrise -not available.
	  ○ RWY 17R, sunrise to sunset – right, sunset to sunrise – not available.
	  ○ RWY 17L sunrise to sunset – left, sunset to sunrise – left.
	  ○ RWY 35R sunrise to sunset – right, sunset to sunrise – right.
	  ○ RWY35L sunrise to sunset – left, sunset to sunrise not available.

	Outside tower hours
	• Right hand circuits required on RWYs 04, 31R and 35R.
	• RWYS 17R, 35L, 13R 31L not available.
	• Maximum of 5 aircraft permitted in the circuit.
	• Night operations:
	  ○ Preferred runway for departures north is RWY 35R
	  ○ Preferred runway for departures south is RWY 13L
	  ○ After 2200 departure must maintain runway heading until 1,000ft
	
	Noise Abatement Procedures
	• Preferred runways
	  ○ RWY 35, then 17, 13 and 31.
	  ○ RWY 04/22 not available unless operationally required and touch and go circuits not permitted.
	• RWY 17R
	  ○ Departure not permitted before 0900 local and 0900 in daylight savings.
	  ○ Departure from 17R maintain upwind leg until south of Woodlands Golf Course.
	  ○ 17R Jet Aircraft not permitted
	• RWY 31L
	  ○ Departures from RWY31L maintain upwind leg until over Kingston centre.
	  ○ C180, C185, C206, C210, BE35/36 with two bladed prop, C336/337 and Warbirds fitted with constant speed props are not permitted to use RWY 17R or RWY 31L for take off unless no other RWY available.

Narrabri NSW	• No commentary around operating activities that may support the management of noise impacts.
Orange NSW	• No commentary around operating activities that may support the management of noise impacts.

Parafield SA	**CTAF- AFRU**
	• RWY 03L/21R – 24 hours, RWY 08R/26L sunrise to sunset only.
	• Maximum of 5 aircraft are permitted in the circuit at any one time outside tower hours.
	
	Circuit procedures
	• Circuit altitude: 1,000ft
	• Simulated engine failure in single engine aircraft after take off not permitted.
	• Circuit directions during tower hours:
	  ○ RWY 03R sunrise to sunset – right, sunset to sunrise – not available.
	  ○ RWY 03L sunrise to sunset – left, sunset to sunrise – left.
	  ○ RWY 21R sunrise to sunset – right, sunset to sunrise – right
	  ○ RWY 21L sunrise to sunset – left, sunset to sunrise – not available.
	  ○ RWY 08R sunrise to sunset – right, sunset to sunrise not available
	  ○ RWY 26R sunrise to sunset – right. Sunset to sunrise, not available
	  ○ RWY 26L sunrise to sunset – left, sunset to sunrise – not available.
	
	Noise Abatement Procedures
	• Outside tower hours preferred RWY 03L/21R
	• Circuit training operations sunset to sunrise: RWY 03L Left hand circuits
	• RWY 21R – right hand circuits.

Port Macquarie, NSW	• No commentary around operating activities that may support the management of noise impacts.
Redcliffe, QLD	**Noise Abatement Procedures** • Residential areas to be avoided at all times.

	• Circuits for YRED resident aircraft permitted between 0600 and 2030 local Monday to Friday and 0700 and 1800 local Saturday and Sunday • Circuits for non resident aircraft only with prior permission from the aerodrome operator between 0700-1800 local • Turns after take off should be made as soon as practical • No straight in approaches permitted • Take off on RWY 07 except when operationally unacceptable. • Right hand circuits required on RWY 2
Roma, QLD	• No commentary around operating activities that may support the management of noise impacts.

Toowoomba City QLD	**Local traffic regulations**
	• Subject to weather conditions or operational constraints, the following are preferred:
	  ○ Departures preferred RWYs – RWY 29 and RWY 24
	  ○ Arrivals – preferred RWY's – RWY 11 and RWY 06
	  ○ Weather permitting, take off from RWY 06 to be avoided due to noise abatement.
	Noise abatement procedures
	• Noise sensitive areas north of the aerodrome (housing estates), pilots are requested to avoid the area if possible, circuits or transit not below 1000ft AGL.
	• Aircraft arriving YTWB 5NM straight in approach preferred.
	• Aircraft departing RWY 11 or to the south or southwest recommended right turn at 3NM or 1500 ft AGL.
	• Simulated engine failure after take off in single engine aircraft preferred on RWY 29 or other inside aerodrome boundary.
	• For RWY 29 departure, when practicable enter at TWY a2 and backtrack.

Woollongong NSW	**Local Traffic Regulations**
	• RWY 08:
	  ○ Simulated engine failure EFATO not permitted.
	  ○ Use full runway length for take off.
	• Right hand circuits RWY 26 and 34.
	
	Noise Abatement Procedures
	• RWY 34:
	  ○ Avoid flight over houses on base.
	  ○ Position crosswind to avoid overflying houses.
	• RWY 16:
	  ○ Turn onto crosswind below 700 to be avoided
	  ○ Position base to avoid overflying houses.
	• Avoid take off RWY 08 and landing RWY 26 unless operationally necessary.
	• Night operations RWY 16, avoid take off unless operational necessary.

Appendix E: Example Noise Complaint Register

Kempsey Airport Contact (Complaint) Register
November 2018 - date

Date	Time	Name of Receiving Staff Member/Team	Name/Details of Complainant	Address	Phone Number	Further Contact Required	Passed on to nominated KSC KPS representative	Nature of Complaint	Action Taken (if required)	KSC KPS representative completed	Method of Advice	Sent to CASA (Y/N)	Date sent to CASA	Timing for follow up (if required)
1/11/2018	10:00:00 AM	Bill Brown	Jane Doe	12 Wood Road, Kempsey	1234 6789	Y	Y	Complainant rang to advise Council that she was awoken during the night (3am) due to aircraft noise operating near her home.	Team member reviewed Avdata movements when available and confirmed that this flight was operated by a RFDS aircraft.		Telephone	Y		N/A
5/12/2018	11:30:00 AM	Jill Black	Jack Jones	10 Bird Crescent, Kempsey		Y	Y	Low flying noisy aircraft passing over complainants house at around midday.				N		N/A

Appendix F: ANE Noise Monitoring Report

Prepared by Air Noise Environment

Air

- Ambient Monitoring
- Auditing
- Computational Modelling
- Control Solutions
- Emission Inventories
- Expert Evidence
- Dust Assessment and Management
- Occupational Monitoring and Assessment
- Odour Monitoring and Assessment
- Research and Policy Studies
- Source Emission Monitoring

Noise

- Acoustic Design and Certification
- Computational Acoustic / Noise Modelling
- Entertainment Noise Modelling and Control
- Acoustic / Noise Control Solutions
- Acoustic Expert Evidence
- Liquor Licence Assessments
- Acoustic / Noise Monitoring
- Occupational Noise Monitoring and Control
- Acoustic / Noise Research and Policy studies
- Road Traffic and Transport Noise Studies
- Vibration Monitoring and Assessment
- Acoustic Calibrations

Environment

- Environmental Audits,
- Environmental Impact Statements,
- Environmental Management Plans and Systems,
- Environmental Policy and Compliance,
- Greenhouse Gas Emissions Inventories and Testing,
- National Pollutant Inventory, and
- National Greenhouse and Energy Reports.

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Where site inspections, testing or fieldwork have taken place, the report is based on the information made available by the client or their nominees during the visit, visual observations and any subsequent discussions with regulatory authorities. It is further assumed that normal activities were being undertaken at the site on the day of the site visit(s).

The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to Air Noise Environment Pty Ltd for the purposes of this project is both complete and accurate.

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1 Introduction

1.1 Background

Kempsey Airport is a regional general aviation airport located approximately 6 km west of the town of Kempsey, New South Wales. The airport is home to a variety of general aviation users ranging from the local flying club to a satellite operation of the Australian International Aviation College (AIAC). There are also several private users that are based at the airport. Other key tenants and/or users of the airport include Kempsey Flying Club, Macleay Aircraft Maintenance, SES, NSW Rural Fire Service, NSW Ambulance Services/Kempsey Hospital and itinerant aviation users.

The airport services the larger community of Kempsey Shire Council located approximately midway between Sydney and Brisbane on the NSW Mid North Coast. The resident population in the airport's catchment is approximately 25,000 based on an analysis of ABS Census data.

Kempsey Airport has seen significant investment in recent years with a $2.5 million-dollar upgrade at Kempsey Airport completed in 2015 and a new automated fuel system in September 2017. The upgrade included a new Aviation Business Park with significant improvements to key facilities and infrastructure.

During a meeting held on 18 April 2017, Council resolved to endorse a procedure for preparing a Noise Management Plan (NMP) to underpin a Fly Neighbourly Agreement (FNA) between Council and current airport users, with the aim of effectively managing the noise and potential disturbance associated with the use of Kempsey Airport. The NMP and FNA will be used to guide future activity at Kempsey Airport.

In order to investigate existing noise complaints and identify existing aircraft noise levels, ANE have conducted unattended noise monitoring at various location over an 8-week monitoring period between August and September 2018. The purpose of this report is to summarise the findings of the monitoring results. On the basis of the monitoring outcomes, potential noise management measures have also been identified.

1.2 Purpose of This Report

The purpose of this report is to present the completed noise monitoring summary, to identify the worst noise affected area and to assess the building site acceptability for any future development.

2 Unattended Noise Monitoring

2.1 Equipment

The equipment listed in Table 2.1 was used to measure the noise levels at each monitoring area listed in Table 2.2.

Calibration checks of the noise instrument was carried out at the commencement and completion of the monitoring, and it was noted that the maximum variation was +0.5 dB(A) (within the allowable 1 dB variation for a Type 1 instrument). All instruments used to conduct the noise monitoring for this project carry traceable calibration certificates (NATA). The serial numbers and calibration information are presented in Table 2.1.

Table 2.1 - Noise Instrument Calibration Information

Position	Instrument/ Serial No.	NATA Calibration Current to:
Area 3, 6, 9 & 13	Norsonic 1/ 1404621	02/06/2019
Area 14 & Runway Location	Norsonic 2/ 1405306	13/07/2019
Area 12	Norsonic 4/ 1405257	20/02/2020
Area 11 & 8	Norsonic 7/ 1405261	08/06/2019
Area 1, 2, & 15	Norsonic 8/ 1405552	17/07/2019
Area 4, 5, 7, 10 & 16	Norsonic 9/ 1405551	10/07/2019
Field Calibrator	Pulsar 105/ 62686	16/11/2018

2.2 Noise Monitoring Periods and Locations

Noise monitoring was conducted for a period of 8 weeks between August and September 2018 at 17 different locations. 16 monitoring locations were selected from the surrounding residential area and 1 noise logger was installed near the airport runway. Figure 2.1 presents the unattended noise monitoring locations. The monitoring period of each location is presented below in Table 2.2. Based on the review of the existing flight path, noise monitoring locations were selected to represent areas that are likely to be affected by the aircraft movement along the existing flight path.

Table 2.2 - Noise Monitoring Area and Monitoring Period

Monitoring Area	Noise Monitoring Date (2018)	Monitoring Period	Note
Area 13, 14, 15 & 16	Saturday, 4th August to Wednesday, 8th August	Week 1	Monitoring in Progress
	Thursday, 9th August	-	No noise monitoring data recorded on 9th August due to maintenance of the equipment
	Friday, 10th August to Friday, 17th August	Week 2	Monitoring in Progress. On 16th August, the noise monitor located

Monitoring Area	Noise Monitoring Date (2018)	Monitoring Period	Note
			at Area 15 and Area 16 recorded data until 10:30am. No data was recorded on 17th August by noise loggers located at Area 15 and Area 16
	Saturday, 18th August to Wednesday, 22nd August	Week 3	No data recorded by noise logger located at Area 15 and Area 16
	Thursday, 23rd August to Friday, 31st August	-	No noise monitoring data recorded due to flat battery.
	Saturday, 1st September to Wednesday, 5th September	Week 4	Monitoring in Progress. On 3rd September, the noise logger at Area 13, Area 14 and Area 16 commenced recording from 3:00 pm. No data was recorded on 4th September by noise loggers located at Area 14 and Area 15
Area 1, 5 & 9	Thursday, 6th September to Sunday, 9th September	Week 5	Monitoring in Progress. On 6th September, the noise logger at Area 9 and Area 1 commenced noise monitoring from 11am.
	Monday, 10th September to Tuesday, 11th September	-	No noise monitoring recorded during this period. Recharged/changed battery, and relocation to Area 2, Area 6 & Area 10
Area 2, 6 & 10	Wednesday, 12th September to Sunday, 16th September	Week 6	Monitoring in Progress
	Monday, 17th September	-	No noise monitoring recorded during this period. Recharged/change battery and relocation to area Area 3, Area 7 & Area 11
Area 3, 7 & 11	Tuesday, 18th September to Sunday, 23rd September	Week 7	Monitoring in Progress
-	Monday, 24th September 2018	-	No noise monitoring recorded during this period. Recharged/change battery, removal of noise loggers and relocation to Area 4, Area 8 & Area 12
Area 4, 8 & 12	Tuesday, 25th September to Sunday, 30th September	Week 8	Monitoring in Progress
			Total number of days where noise event recording was in progress - 44 days

The unattended noise monitors were configured to measure noise levels as follows:

- 'A' weighting
- Measurement descriptors L_{Amax}, L_{Aeq}, L_{A10}, L_{A90}
- Both 1 minute and 15 minute statistical intervals

All monitoring was conducted in accordance with Australian Standard AS 1055.1-1997 *Acoustics – Description and measurement of environmental noise.*

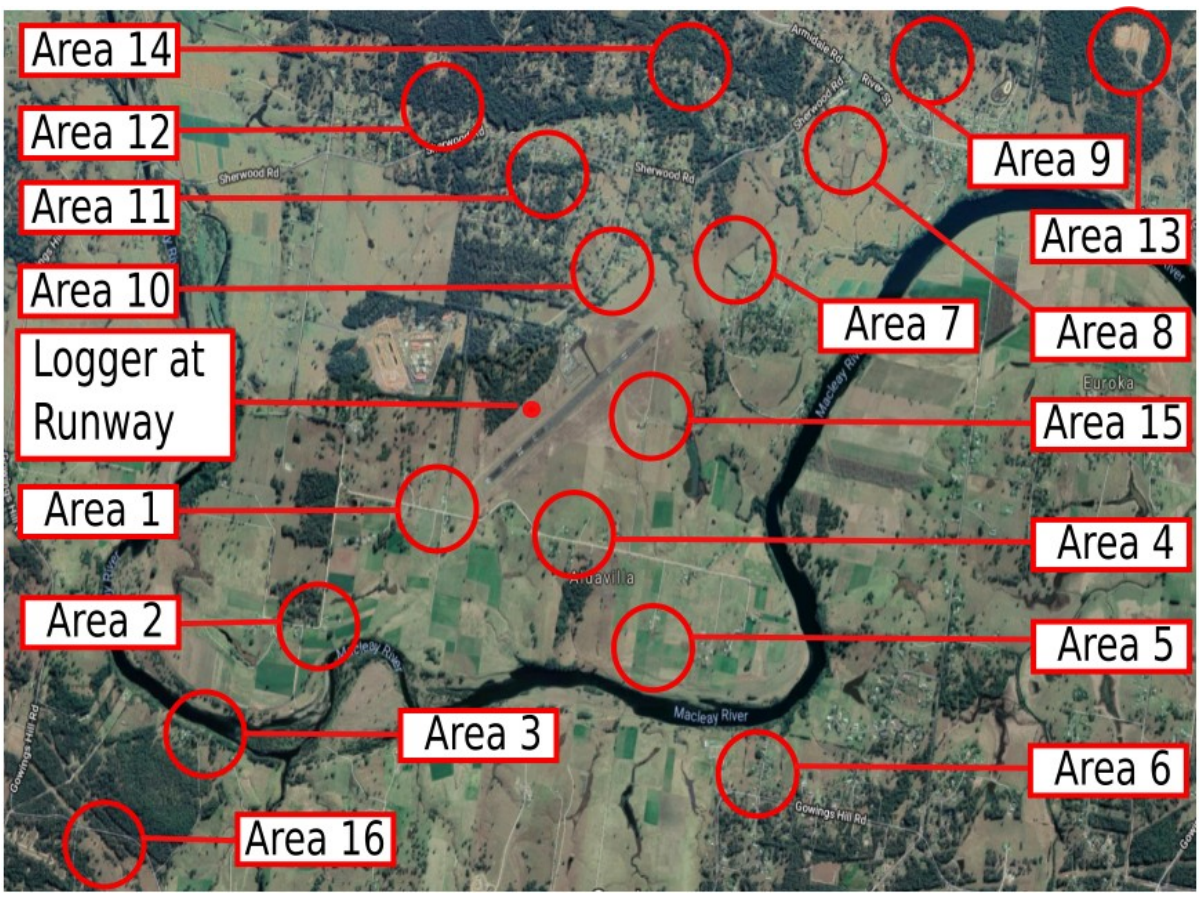

Figure 2.1 - Unattended Noise Monitoring Locations

3 Noise Criteria and Guidelines

3.1 Overview

For the purpose of assessing the existing noise impact from the Kempsey Airport associated aircraft movement on to the surrounding residential receivers, the following listed document has been reviewed:

- Australian Standard AS 2021:2015, 'Acoustics – Aircraft noise intrusion – Building sitting and construction;
- Aircraft Noise in Australia: A Survey of Community Reaction prepared by National Acoustic Laboratories, Commonwealth Department of Health, N.A.L Report No. 88, dated February 1982;
- *'Expanding Ways to Describe and Assess Aircraft Noise (Expanding Ways)'* discussion paper prepared by Sydney Environment Section in the Airports Operations area of the Department, Commonwealth of Australia 2000;
- Guidance Material for Selecting and Providing Aircraft Noise Information published jointly by the Commonwealth Department of the Environment and Heritage and the Commonwealth Department of Transport and Regional Services in 2003;
- Going Beyond Noise Contours – Local Approaches to Land Use Planning Around Smaller Australia Airports, Discussion Paper, October 2003 prepared by the Aviation Environment Policy Section of the Department's Aviation Operations Branch.

Relevant section from the applicable document listed above is presented in Section 3.2 to Section 3.4.

3.2 Australian Standard AS 2021

Relevant section from AS 2021 is presented in Section 3.2.1 and 3.2.2.

3.2.1 Aerodrome without ANEF Charts

Australian Noise Exposure Forecast (ANEF) is a single number index for predicting the cumulative exposure to aircraft noise in communities near aerodromes during a specified time period (normally one year). The computation of this index includes:

- measurements of aircraft noise (expressed in Effective Perceived Noise Decibels, EPNdB), which take account of the spectral, temporal and spatial aspects of the noise;
- estimates and generalisations of aircraft type groups and mix, number of operations, runway utilisation, flight paths and operational procedure, and
- time of day, i.e. whether daytime (0700 hours to 1900 hours) or night-time (1900 hours to 0700 hours).

The single number index is useful for rating the compatibility of various land uses with respect to aircraft noise. For this purpose, equivalent ANEF values at individual positions around an aerodrome are combined on a map to form ANEF contours.

The ANEF system takes account of noise levels, frequency and time of day of aircraft noise events. Therefore it is always preferable to use an ANEF chart to predict aircraft noise exposure at a site. As specified in section 2.1.2 of AS 2021, where aerodrome usage is confined to a small number of civil, non-jet aircraft movements the production of an ANEF chart may not be justified and is unlikely to occur. In these cases procedure specified in Appendix E of AS 2021 should be followed.

As no ANEF chart for the Kempsey Airport is available at this stage, the procedure specified in Appendix E of AS 2021 has been adopted and is discussed below. Appendix E of AS 2021 sets the acceptability of a building site for a particular building type that is exposed the aircraft noise from light general aviation aerodromes without ANEF charts.

Table 3.1 - Building Site Acceptability Based on Aircraft Noise Levels

Number of flights per day	Aircraft noise level expected at building site, dB(A)		
	Acceptability	Conditionally acceptable	Unacceptable
House, home unit, flat, caravan park, school, university, hospital, nursing home			
>30	<70	70-75	>75
15-30	<80	80-85	>85
<15	<90	90-95	>95
Hotel, motel, hostel, public building			
>30	<75	75-80	>80
15-30	<85	85-90	>90
<15	<95	95-100	>100
Commercial building			
>30	>80	80-85	>85
15-30	<90	90-95	>95
<15	<100	100-105	>105
Note: As specified in AS 2021, each night-time flight between 1900 hours and 0700 hours is to count as four operations.			

3.2.2 AS 2021 – Indoor Design Noise Criteria

AS 2021 also sets the noise criteria for internal sound levels (in terms of maximum A-weighted noise levels, L_{Amax}) within buildings depending on the type/use of different rooms. Applicable indoor noise criteria for this project are provided below in Table 3.2.

Table 3.2 - Aircraft Noise Indoor Design Sound Level

Building type and activity	L_{Amax}, Indoor Design Sound Level
House, home units, flats, caravan parks	
Sleeping areas, dedicated lounge	50
Other habitable spaces	55
Bathrooms, toilets, laundries	60
Hotels, motels, hostels	
Hotels, motels, hostels	
Relaxing, sleeping	55
Social activities	70
Service activities	75
Schools, universities	
Libraries, study areas	50
Teaching areas, assembly areas	55
Workshops, gymnasia	75
Hospitals, nursing homes	
Wards, theatres, treatment and consulting rooms	50
Laboratories	65
Service areas	75
Public Building	
Churches, religious activities	50
Theatres, cinemas, recording studios	40
Court houses, libraries, galleries	50
Commercial buildings, offices and shops	
Private offices, conference rooms	55
Drafting, open offices	65
Typing, data processing	70
Shops, supermarkets, showrooms	75
Industrial	
Inspection, analysis, precision work	75
Light machinery, assembly, bench work	80

3.3 'Going Beyond Noise Contours' Discussion Paper

Relevant extract from the 'Going Beyond Noise Contours' discussion paper[1] published by the Aviation Environment Policy Section of the Department's Aviation Operations Branch is presented below:

Australian Standard 2021-2000 Acoustics-Aircraft Noise Intrusion – Building sitting and construction

1 Going Beyond Noise Contours – Local Approaches to Land Use Planning Around Smaller Australian Airports, Discussion Paper Prepared by Aviation Environment Policy Section of the Department's Aviation Operations Branch, October 2003

(AS2021) provides guidance on the acceptability of specified land uses in the vicinity of aerodromes based on ANEF zones. The Standard's land use compatibility advice has been incorporated into the planning legislation of a number of States and is widely used by planning authorities as the basis for land use planning decisions around airports.

Over the recent years there has been increasing evidence that the number of noise events is a key determinant of the extent to which a person may be annoyed by aircraft noise. When ANEF was being developed more than 20 years ago, the NAL study found that even though at that time there were relatively few aircraft overflights compared to today, a number of events based noise metric - the N70, could provide useful information. Two major public inquiries in recent years have found that logarithm contours (e.g. the ANEF) do not give sufficient weight to the number of aircraft noise events[2, 3]. These findings are supported by examination of complaints about aircraft noise from residents living around general aviation (GA) and other airports. The issues of concern is primarily the very high number of overflight per day. Therefore there would appear to be strong arguments for suggesting the noise metrics based on number of noise events could be of value in land use planning decisions. In particular, these metrics could be useful when considering the issue of land use planning to cater for training circuits at smaller airports.

These number of events based metrics, commonly called the N70 (noise events louder than 70 dB(A)) in Australia, have recently been introduced as a tool for providing aircraft noise information around major jet airports. A sound pressure level of 70 dB(A) is considered to be a useful 'trigger level' since an external noise of this magnitude equate to approximately 60 dB(A) inside a house with open windows[4]. 60 dB(A) is the sound pressure level at which noise events may become intrusive to speech and hence may interfere with activities like telephone conversations and watching the TV.

While 70 dB(A) is commonly used as the reporting level for major jet airports, for GA airports where the number of noise events per day is often very significantly higher than for a person living around an regional Regular Public Transport (RPT) airport, lower noise levels metrics such as the N60 (the number of events louder than 60 dB(A)) are likely to be more indicative of the noise regime. This is because the small aircraft involved in performing training circuits normally generate outdoor sound pressure level at houses which are around 60 dB(A).

Based on the completed noise monitoring, N70 and N60 events recorded on a worst affected day during the monitoring period for each monitoring area are presented in Section 5.3.2.

3.4 'Expanding Ways' Discussion Paper

Relevant extract from the 'Expanding Ways' discussion paper is presented below:

2 Falling on Deaf Ears?, Report of the Senate Select Committee on Aircraft Noise in Sydney, Commonwealth of Australia, Canberra, 1995

3 The Heathrow Terminal Five and Associated Public Inquires, Summary Report, Office of the UK Deputy Prime Minister, November 2001

4 Going Beyond Noise Contours – Local Approaches to Land Use Planning Around Smaller Australian Airports, Discussion Paper Prepared by Aviation Environment Policy Section of the Department's Aviation Operations Branch, October 2003

In Australia the conventional approach to providing information on aircraft noise has been to publish Australian Noise Exposure Forecast (ANEF) contours. These contours show the amount of total noise energy received by locations on the ground near an airport on an annual average day. Australian Standard AS 2021 'Aircraft noise intrusion – building sitting and construction' uses ANEF values to determine land use compatibility. The production of ANEFs is required at leased Commonwealth airports as part of the airport master planning process established under the Airports Act 1996.

The ANEF system was developed and adopted in the early 1980s. Over a period of years the use of ANEF contours as an aircraft noise information tool grew to the point where these contours effectively excluded all other ways of describing aircraft noise exposure patterns. This is despite the fact that ANEF contours were not developed, or initially intended to be used, as a way to describe noise impacts to the non-expert. The ANEF system is primarily a land use planning system.

During the development of the Sydney Airport Long Term Operating Plan (LTOP) extended debate took place with community representatives on ways to provide information on aircraft noise levels (as distinct from the number of movements) in a way that could be easily understood. Interests was initially focused on provided information on the dB(A) level of single aircraft movements as this is most basic way to report the noise. Single event contours superimposed on flight path enable a person to readily see the noise level in the vicinity of their home for a single event for a certain aircraft type. The contours allow the person to readily compare the noise levels generated by different aircraft types and activities (say landings versus take-offs).

A large number of single event contours were produced for a range of flight paths and aircraft types and were provided to the community as part of the LTOP consultation process. However, single event maps by themselves can be misleading because they do not contain information on the number of times the noise events will occur. In order to overcome these problems 'Number Above' contours began to be produced by the Department. These contour maps in effect combine information on single event noise levels with aircraft movement numbers.

During the development of LTOP, contour maps showing the number of events louder than 70 dB(A) have been adopted as the normal presentation. As specified in the 'Expanding Ways' discussion paper[5], level of 70 dB(A) has been chosen because this is equivalent to the single event level of 60 dB(A) specified in Australian Standard AS 2021 as the indoor design sound level for normal domestic areas in dwellings. As specified in this document, an external single event noise will be attenuated by approximately 10 dB(A) by the fabric of a house with open windows. An internal noise level of 60 dB(A) is the sound pressure level of a noise event that is likely to interfere with conversation or with listening to the radio or the television.

We note that the indoor design noise for a habitable space is specified as L_{Amax} 55 in the current AS 2021. As such, in addition to N70, number of events louder than 65 dB(A) (N65) has been adopted to identify the noise affected area for this particular project.

5 Discussion Paper, Expanding Ways to Describe and Assess Aircraft Noise published by the Department of Transport and Regional Services, Commonwealth of Australia 2000

4 Adopted Noise Criteria

4.1 Number of Events (N)

As per the *'Expanding Ways' discussion paper*[6]*, t*he following listed 'number of events (N)' contour can be used to assess the noise impact from the existing Kempsey Airport flight movement onto the surrounding existing residential receivers:

- N70 (the number of events above 70 dB(A) for the period 7am to 7pm) – should be applied to outside of a normal domestic area that are used to carry out activities such normal conversation, watching TV, etc;
- N65 (the number of events above 65 dB(A) for the period 7pm to 10pm) – should be applied to outside of an indoor space that are used for relaxing activities such as reading, studying, etc;
- N60 (the number of events above 60 dB(A) for the period 10pm to 7am) – should be applied to outside of a sleeping area

The current AS 2021 standard specifies the indoor design levels as L_{Amax} 50 dB(A) for sleeping and dedicated lounge areas and L_{Amax} 55 for other habitable spaces. Indoor design sound level of L_{Amax} 60 dB(A) has been specified for a bathrooms, toilets and laundries. As such, we recommend that the following listed 'number of events (N)' contours are used to assess the aircraft movement noise impact onto a residential dwellings:

- N65 (the number of events above 65 dB(A)) – should be applied to outside of a habitable space;
- N60 (the number of events above 60 dB(A)) – should be applied to outside of a sleeping area

The N65 and N60 values are typically referenced for the 7 pm to 10 pm and 10 pm to 7 am period. For the purpose of analysing the noise monitoring data, N60 and N65 have been considered during all periods of the day (including 7 am to 7 pm).

4.2 Building Site Acceptability

Based on the review of the provided Avdata for aircraft movement and from the completed noise monitoring results, the total number of aircraft movements from each day during the monitoring period is listed below in Table 4.1 to Table 4.8.

6 Discussion Paper, Expanding Ways to Describe and Assess Aircraft Noise published by the Department of Transport and Regional Services, Commonwealth of Australia 2000

Table 4.1 - Total Number of Aircraft Movement Events During Noise Monitoring Week 1

Noise Monitoring Week 1				Avdata Provided Aircraft Movement Number
Day	Date (2018)	Number of Aircraft Movement Noise Event Recorded[7]	Noise Monitoring in Progress (Y/N)	
Saturday	4-August	5	Y	5
Sunday	5-August	29	Y	29
Monday	6-August	19	Y	19
Tuesday	7-August	42	Y	42
Wednesday	8-August	47	Y	47
Thursday	9-August	0	N	-

Table 4.2 - Total Number of Aircraft Movement Events During Noise Monitoring Week 2

Monitoring Week 2				Avdata Provided Aircraft Movement Number
Day	Date (2018)	Number of Aircraft Movement Noise Event Recorded[7]	Noise Monitoring in Progress (Y/N)	
Friday	10-August	21	Y	21
Saturday	11-August	12	Y	12
Sunday	12-August	1	Y	1
Monday	13-August	24	Y	24
Tuesday	14-August	70	Y	70
Wednesday	15-August	36	Y	36
Thursday	16-August	58	Y	58
Friday	17-August	84	Y	84

Table 4.3 - Total Number of Aircraft Movement Events During Noise Monitoring Week 3

Monitoring Week 3				Avdata Provided Aircraft Movement Number
Day	Date (2018)	Number of Aircraft Movement Noise Event Recorded[7]	Noise Monitoring in Progress (Y/N)	
Saturday	18-August	12	Y	12
Sunday	19-August	6	Y	6
Monday	20-August	56	Y	56
Tuesday	21-August	122	Y	122
Wednesday	22-August	7	Y	7
Thursday	23-August	0	N	-

7 Number of noise events represent the aircraft movements that occurred when noise monitoring was in operation

Table 4.4 - Total Number of Aircraft Movement Events During Noise Monitoring Week 4

Monitoring Week 4				Avdata Provided Aircraft Movement Number
Day	Date (2018)	Number of Aircraft Movement Noise Event Recorded [7]	Noise Monitoring in Progress (Y/N)	
Thursday	29-August	0	N	-
Friday	30-August	0	N	-
Saturday	1-September	5	Y	5
Sunday	2-September	10	Y	10
Monday	3-September	17	Y	82
Tuesday	4-September	138	Y	146
Wednesday	5-September	47	Y	47

Table 4.5 - Total Number of Aircraft Movement Events During Noise Monitoring Week 5

Monitoring Week 5				Avdata Provided Aircraft Movement Number
Day	Date (2018)	Number of Aircraft Movement Noise Event Recorded[7]	Noise Monitoring in Progress (Y/N)	
Thursday	6-September	95	Y	152
Friday	7-September	48	Y	48
Saturday	8-September	2	Y	2
Sunday	9-September	9	Y	9
Monday	10-September	0	N	-
Tuesday	11-September	0	N	-

Table 4.6 - Total Number of Aircraft Movement Events During Noise Monitoring Week 6

Monitoring Week 6				Avdata Provided Aircraft Movement Number
Day	Date (2018)	Number of Aircraft Movement Noise Event Recorded[7]	Noise Monitoring in Progress (Y/N)	
Wednesday	12-September	30	Y	30
Thursday	13-September	89	Y	89
Friday	14-September	52	Y	52
Saturday	15-September	14	Y	14
Sunday	16-September	7	Y	7
Monday	17-September	0	N	-

Table 4.7 - Total Number of Aircraft Movement Events During Noise Monitoring Week 7

Monitoring Week 7				Avdata Provided Aircraft Movement Number
Day	Date (2018)	Number of Aircraft Movement Noise Event Recorded[7]	Noise Monitoring in Progress (Y/N)	
Tuesday	18-September	139	Y	139
Wednesday	19-September	14	Y	14
Thursday	20-September	126	Y	126
Friday	21-September	44	Y	44
Saturday	22-September	12	Y	12
Sunday	23-September	7	Y	7
Monday	24-September	0	N	-

Table 4.8 - Total Number of Aircraft Movement Events During Noise Monitoring Week 8

Monitoring Week 8				Avdata Provided Aircraft Movement Number
Day	Date (2018)	Number of Aircraft Movement Noise Event Recorded[7]	Noise Monitoring in Progress (Y/N)	
Tuesday	25-September	128	Y	128
Wednesday	26-September	59	Y	59
Thursday	27-September	115	Y	115
Friday	28-September	43	Y	43
Saturday	29-September	3	Y	3
Sunday	30-September	27	Y	27

As shown in Table 4.1 to Table 4.8, generally more than 30 events of aircraft movement associated with the Kempsey Airport occur during weekdays and less than 30 events during weekends. Based on the number of aircraft movement and the noise criteria presented in Section 3 and 4, the adopted project specific noise criteria (as specified in Table E1 of AS 2021) to assess the building site acceptability for the surrounding residential area are presented below in Table 4.9.

Table 4.9 - Building Site Acceptability Based on Aircraft Noise Levels

Number of flights per day	Aircraft noise level expected at building site, dB(A)		
	Acceptability	Conditionally acceptable	Unacceptable
>30	<70	70-75	>75

4.3 Indoor Design Noise Limits

The surrounding nearest sensitive receivers are identified as residential dwellings. Table 4.9 presents the noise criteria to assess whether a building is located within an acceptable site or not; however, is not applicable to assess the community annoyance from an aircraft event. In order to assess the noise impacts from an aircraft event on to the habitable space of the existing residential receivers, we recommend that the noise criteria listed below in Table 4.10 are considered (based on AS 2021 internal design sound levels).

Table 4.10 - Proposed Outdoor Noise Limits, dB(A)

Residential Building Area/Space	AS 2021 L_{Amax}, Indoor Design Sound Level	Proposed Outdoor L_{Amax}, Noise Limits[8]
Sleeping areas, dedicated lounge	50	60
Other habitable spaces	55	65
[1] Outdoor limit based on indoor design sound level and assuming a 10 dB facade attenuation (partially opened window)		

4.4 Adopted Project Specific Noise Criteria

4.4.1 Building Site Acceptability

The AS 2021 standard is concerned with land use planning and building treatments in the vicinity of an airport. The objective is to provide guidance to regional and local authorities, organisations, communities and others associated with the urban and regional planning and building development on the sitting and construction of new buildings against aircraft noise intrusion and on the acoustical adequacy of existing buildings in the areas near aerodromes. As shown in Table 4.9, if a building site is likely to be exposed to more than 30 aircraft movements then each of those events must not be greater than L_{Amax} 70 dB(A). As shown in Table 4.10, our proposed outdoor noise limits for a habitable space is L_{Amax} 65. Therefore, in order to assess the acceptability of the existing residential dwellings, our proposed building site acceptability noise levels for this particular project is listed below in Table 4.11.

Table 4.11 - Building Site Acceptability Based on Aircraft Noise Levels

Number of flights per day	Aircraft noise level expected at building site, dB(A)		
	Acceptability	Conditionally acceptable	Unacceptable
>30	65-70	70-75	>75

4.4.2 Number of Events (N)

In order to assess the noise impact from the existing flight movement operations, residential areas that are affected by N70, N65 and N60 events have been identified and included in this report. 'Guideline A: Managing Aircraft Noise' of the National Airport Safeguarding Framework (NASF) document[9] suggests to avoid any noise sensitive development where 20 or more daily events greater than 70 dB(A) are predicted.

8 Based -10 dB outdoor to indoor attenuation correction factor

9 Guideline A: Measures for Managing Impacts of Aircraft Noise

As specified in the 'Expanding Ways' discussion paper[10], an internal noise level of 60 dB(A) is the sound pressure level of a noise event that is likely to interfere with conversation or with listening to the radio or the television. An external single event noise will be attenuated by approximately 10 dB(A) by the fabric of a house with open windows.

We note that the indoor design noise for a habitable space is specified as L_{Amax} 55 in the current AS 2021. As such, in addition to N70, number of events louder than 65 dB(A) (N65) has also been adopted to identify the noise affected area for this particular project. In order to be consistent with the proposed building site acceptability noise levels, we recommend that the number of N65 events (number of events > L_{Amax} 65 per day) are limited to 30 at any surrounding residential receiver. The number of N70 events should be limited to 20.

4.4.3 Noise Limits for Future Development

Any future development located within the aircraft noise affected area will need to be designed to meet the indoor noise levels presented in Table 3.2.

10 Discussion Paper, Expanding Ways to Describe and Assess Aircraft Noise published by the Department of Transport and Regional Services, Commonwealth of Australia 2000

5 Monitoring Results and Discussion

5.1 Overview

In order to identify the worst noise affected day for each monitoring area, the 15-minutes interval noise data for the 8-weeks monitoring period and the Avdata provided aircraft movement for each day was reviewed. For the purpose of this task, days when all noise loggers were working simultaneously were considered and period. Based on the review, the worst affected day for each noise monitoring area has been identified as presented below in Table 5.1. In order to identify noise levels from an aircraft movement, 1-minute interval noise data measured at each location for the worst-affected day was analysed. 1-minute interval data has been subsequently reviewed for these days as presented in Table 5.2 to Table 5.6. The L_{Amax} noise levels from 1-minute interval data were then correlated with the aircraft movement time table provided by the Avdata. It is unlikely that a noise event other than an aircraft movement will trigger the L_{Amax} noise levels at all four monitoring locations during a time when a aircraft movement occurred. from the

Table 5.1 - List of Worst Affected Day from Each Monitoring Period

Monitoring Area	Day with Highest Number of Aircraft Events & Noise Levels	Monitoring Period
Area 13,14,15 & 16	Wednesday, 8th August 2018	Week 1 to Week 4
Area 1, 5 & 9	Thursday, 6th September 2018	Week 5
Area 2, 6 & 10	Thursday, 13th September 2018	Week 6
Area 3, 7 & 11	Tuesday, 18th September 2018	Week 7
Area 4, 8 & 12	Tuesday, 25th September	Week 8

5.2 Monitoring Results

Table 5.2 to Table 5.6 presents results from the noise monitoring completed at each location on the worst affected day of each monitoring period.

Table 5.2 - Measured Noise Levels at Area 13, 14, 15 and 16 on 8th August 2018 (Week 1 to Week 4 Monitoring Period)

Date/Time	Aircraft Type	Usage Type	Measured Levels $L_{Amax,1\ min}$ Noise Levels, dB(A)			
			Area 13	Area 14	Area 15	Area 16
08-08-18 8:27	DA40	LA	51	51	46	54
08-08-18 8:55	DA40	TO	51	69	51	54
08-08-18 9:03	DA40	TO	47	61	48	54
08-08-18 9:12	P28A	LA	44	61	66	56
08-08-18 9:16	DA40	SG	40	60	42	58
08-08-18 9:23	DA40	SG	42	95	59	53
08-08-18 9:32	DA40	SG	43	53	55	52

Date/Time	Aircraft Type	Usage Type	Measured Levels $L_{Amax,1\ min}$ Noise Levels, dB(A)			
			Area 13	Area 14	Area 15	Area 16
08-08-18 9:37	DA40	LA	55	61	48	63
08-08-18 9:39	DA40	**SG**	39	62	**74**	**65**
08-08-18 9:47	DA40	LA	39	45	45	60
08-08-18 9:59	DA40	TG	50	62	56	50
08-08-18 10:04	DA40	TG	35	57	55	53
08-08-18 10:11	DA40	TO	41	62	45	52
08-08-18 10:18	DA40	TG	44	64	52	53
08-08-18 10:18	DA40	LA	44	71	43	51
08-08-18 10:24	DA40	TG	40	51	62	54
08-08-18 10:29	DA40	TO	38	57	55	59
08-08-18 10:30	DA40	TG	36	59	52	58
08-08-18 10:39	DA40	LA	35	52	57	47
08-08-18 10:39	DA40	TG	34	53	43	50
08-08-18 10:46	DA40	TG	42	52	35	56
08-08-18 10:51	DA40	TG	37	50	52	48
08-08-18 10:56	DA40	TO	35	49	49	56
08-08-18 10:57	DA40	**PA**	43	45	**67**	45
08-08-18 11:05	DA40	SG	41	48	43	50
08-08-18 11:10	DA40	**TG**	34	86	**65**	55
08-08-18 11:43	DA40	LA	39	48	52	55
08-08-18 11:56	DA40	LA	38	50	49	48
08-08-18 12:31	DA40	**TO**	42	61	**79**	48
08-08-18 12:39	DA40	**TG**	43	58	**67**	56
08-08-18 12:44	DA40	**TG**	44	55	**69**	53
08-08-18 12:47	DA40	**TO**	41	52	**66**	54
08-08-18 12:50	DA40	**TG**	42	56	**65**	36
08-08-18 12:56	DA40	TG	44	55	63	53
08-08-18 13:01	DA40	TG	45	61	64	60
08-08-18 13:09	DA40	PA	42	51	53	**65**
08-08-18 13:12	DA40	**TG**	41	49	**65**	56
08-08-18 13:21	DA40	LA	44	47	60	60
08-08-18 13:21	DA40	TO	47	47	58	63
08-08-18 13:34	DA40	LA	43	46	58	56
08-08-18 13:56	P28A	TO	41	49	51	56
08-08-18 14:00	DA40	TO	44	50	51	57
08-08-18 14:51	DA40	LA	39	59	49	55
08-08-18 14:56	DA40	PA	38	53	43	50
08-08-18 14:58	DA40	PA	38	55	45	59
08-08-18 15:19	DA42	TG	48	45	46	55
08-08-18 15:22	DA40	TO	43	56	38	40

Table 5.3 - Measured Noise Levels at Area 9, near the runway, Area 1 and Area 5 on 6th September 2018 (Week 5 Monitoring Period)

Date/Time	Aircraft Type	Usage Type	Measured Levels $L_{Amax,1\ min}$ Noise Levels, dB(A)			
			Area 9	Near Runway	Area 1	Area 5
06-09-18 11:14	DA40	TG	52	63	38	44
06-09-18 11:21	DA40	LA	52	43	44	48
06-09-18 11:25	DA40	TG	49	69	43	54
06-09-18 11:32	DA40	**TG**	55	63	**66**	55
06-09-18 11:37	DA40	TO	45	50	38	43
06-09-18 11:37	DA40	TG	50	65	38	44
06-09-18 11:43	DA40	TG	46	63	43	56
06-09-18 11:44	DA40	TO	49	63	42	61
06-09-18 11:47	DA40	TG	51	67	45	50
06-09-18 11:48	DA40	TG	47	66	43	46
06-09-18 11:51	DA40	TG	51	68	47	48
06-09-18 11:53	DA40	**TG**	60	62	**79**	46
06-09-18 11:56	DA40	PA	58	64	46	44
06-09-18 11:57	DA40	TG	51	54	48	50
06-09-18 12:00	DA40	TG	52	62	50	56
06-09-18 12:01	DA40	TO	54	58	47	47
06-09-18 12:02	DA40	LA	64	58	46	59
06-09-18 12:04	DA40	**TG**	53	54	**72**	47
06-09-18 12:05	DA40	TG	52	65	47	46
06-09-18 12:09	DA40	TG	58	67	**81**	48
06-09-18 12:11	DA40	**TG**	52	65	**75**	51
06-09-18 12:14	DA40	TG	50	64	45	53
06-09-18 12:17	DA40	**TG**	57	61	50	**82**
06-09-18 12:19	DA40	**TG**	55	46	47	**76**
06-09-18 12:23	DA40	TO	50	61	48	53
06-09-18 12:25	DA40	TG	64	57	50	46
06-09-18 12:26	DA40	LA	46	51	59	43
06-09-18 12:29	DA40	TG	49	46	46	55
06-09-18 12:40	DA40	LA	52	64	47	63
06-09-18 12:48	DA40	**TG**	54	61	44	**66**
06-09-18 12:55	DA40	**TG**	50	43	**67**	52
06-09-18 12:58	DA40	TG	44	51	48	54
06-09-18 12:59	DA40	TG	51	44	42	48
06-09-18 13:00	DA40	**TG**	50	59	**68**	50
06-09-18 13:02	C182	**TO**	53	69	**61**	52
06-09-18 13:06	DA40	LA	48	69	50	51

Date/Time	Aircraft Type	Usage Type	Measured Levels $L_{Amax,1\ min}$ Noise Levels, dB(A)			
			Area 9	Near Runway	Area 1	Area 5
06-09-18 13:07	DA40	**PA**	50	49	**65**	52
06-09-18 13:08	DA40	**PA**	55	40	**68**	51
06-09-18 13:11	DA40	TG	58	47	47	52
06-09-18 13:11	DA40	**TO**	**66**	43	**69**	**73**
06-09-18 13:15	DA40	LA	58	62	60	58
06-09-18 13:19	DA40	LA	46	65	49	47
06-09-18 13:22	DA40	**TG**	54	64	**70**	53
06-09-18 13:23	DA40	TO	45	52	45	62
06-09-18 13:27	DA40	**TG**	48	84	**72**	51
06-09-18 13:33	DA40	TG	58	62	61	57
06-09-18 13:38	DA40	TG	61	69	45	59
06-09-18 13:41	DA40	TG	55	64	41	64
06-09-18 13:42	DA40	**TG**	52	44	45	**71**
06-09-18 13:48	DA40	TG	62	68	60	55
06-09-18 13:49	DA40	**TG**	**74**	66	51	**71**
06-09-18 13:49	DA40	TO	60	50	44	**69**
06-09-18 13:53	DA40	TG	53	65	44	62
06-09-18 13:55	DA40	**TG**	61	58	**65**	51
06-09-18 14:02	DA40	LA	45	66	47	50
06-09-18 14:04	DA40	LA	59	64	50	49
06-09-18 14:07	DA40	**LA**	47	65	59	**72**
06-09-18 14:23	DA40	**TO**	52	49	**61**	54
06-09-18 14:28	DA40	TO	54	44	50	49
06-09-18 14:30	DA40	TG	52	50	46	55
06-09-18 14:36	DA40	TG	47	50	49	62
06-09-18 14:39	DA40	PA	56	46	45	63
06-09-18 14:42	DA40	**TO**	61	43	**64**	55
06-09-18 14:42	DA40	TG	55	46	42	61
06-09-18 14:42	DA40	TG	53	53	48	62
06-09-18 14:49	DA40	**SG**	49	69	40	**65**
06-09-18 14:50	DA40	TG	58	51	37	60
06-09-18 14:52	DA40	TG	47	64	36	50
06-09-18 14:57	DA40	**SG**	**65**	68	51	56
06-09-18 14:58	DA40	**TG**	63	71	**66**	58
06-09-18 15:00	DA40	**TG**	52	66	**62**	52
06-09-18 15:02	DA40	LA	50	70	51	54
06-09-18 15:03	P68	**LA**	53	61	**67**	61
06-09-18 15:04	DA40	**TG**	50	59	39	**70**
06-09-18 15:05	DA40	**TG**	48	61	51	**69**
06-09-18 15:10	DA40	TG	52	63	45	54
06-09-18 15:12	DA40	TG	53	65	49	57
06-09-18 15:15	DA40	**TO**	48	63	**70**	48

Date/Time	Aircraft Type	Usage Type	Measured Levels $L_{Amax,1\ min}$ Noise Levels, dB(A)			
			Area 9	Near Runway	Area 1	Area 5
06-09-18 15:18	DA40	TG	51	66	60	50
06-09-18 15:24	DA40	TG	55	56	51	56
06-09-18 15:25	DA40	TG	50	65	44	54
06-09-18 15:27	DA40	LA	52	72	49	51
06-09-18 15:29	DA40	TG	55	65	53	56
06-09-18 15:31	DA40	TG	57	59	51	58
06-09-18 15:32	DA40	TG	58	65	52	54
06-09-18 15:35	DA40	**TG**	55	66	52	**65**
06-09-18 15:37	DA40	**TG**	51	70	61	**66**
06-09-18 15:41	DA40	TG	54	69	59	52
06-09-18 15:41	DA40	LA	53	56	53	60
06-09-18 15:46	DA40	LA	61	64	50	48
06-09-18 15:47	DA40	TO	49	71	41	60
06-09-18 15:47	DA40	**PA**	51	43	**68**	62
06-09-18 15:49	DA40	**TG**	52	61	**68**	54
06-09-18 15:55	DA40	**TG**	**66**	65	47	57
06-09-18 16:58	P68	TO	43	40	32	51

Table 5.4 - Measured Noise Levels at Area 6, near the runway, Area 2 and Area 10 on 13th September 2018 (Week 6 Monitoring Period)

Date/Time	Aircraft Type	Usage Type	Measured Levels $L_{Amax,1\ min}$ Noise Levels, dB(A)			
			Area 6	Near Runway	Area 2	Area 10
13-09-18 8:35	DA40	**TO**	**72**	44	51	58
13-09-18 8:42	DA40	TG	54	68	54	66
13-09-18 8:48	DA40	**TG**	**70**	63	41	51
13-09-18 8:50	DA40	TO	64	50	42	48
13-09-18 8:53	DA40	TG	63	62	44	48
13-09-18 8:57	DA40	TG	64	67	43	51
13-09-18 8:58	DA40	**TG**	**73**	60	46	51
13-09-18 9:04	DA40	**TG**	**66**	61	34	49
13-09-18 9:06	DA40	TG	54	46	35	54
13-09-18 9:10	DA40	**LA**	**73**	64	50	49
13-09-18 9:10	DA40	TO	62	63	37	54
13-09-18 9:11	DA40	**TO**	**66**	65	38	54
13-09-18 9:12	DA40	**TG**	**66**	62	36	48
13-09-18 9:17	DA40	**TG**	**67**	61	36	48
13-09-18 9:23	DA40	**TG**	**69**	66	35	53
13-09-18 9:25	DA40	**TG**	**65**	49	35	48
13-09-18 9:25	DA40	TO	64	63	34	**69**
13-09-18 9:29	DA40	TG	56	63	34	49

Date/Time	Aircraft Type	Usage Type	Measured Levels $L_{Amax,1\ min}$ Noise Levels, dB(A)			
			Area 6	Near Runway	Area 2	Area 10
13-09-18 9:33	DA40	LA	62	73	34	46
13-09-18 9:35	DA40	**TG**	**65**	64	52	43
13-09-18 9:41	DA40	TG	58	64	34	52
13-09-18 9:47	DA40	**TG**	**75**	63	38	59
13-09-18 9:49	DA40	**TG**	**65**	53	38	46
13-09-18 9:52	DA40	**PA**	**66**	51	37	47
13-09-18 9:52	DA40	TG	59	46	40	52
13-09-18 9:58	DA40	**TG**	**67**	60	34	52
13-09-18 9:58	DA40	PA	63	62	36	55
13-09-18 10:00	DA40	TO	69	62	36	45
13-09-18 10:04	DA40	PA	47	64	39	46
13-09-18 10:05	DA40	TG	47	67	36	66
13-09-18 10:07	DA40	TG	53	59	36	58
13-09-18 10:10	DA40	TG	51	64	41	55
13-09-18 10:11	DA40	LA	55	45	40	57
13-09-18 10:12	DA40	**TG**	**66**	64	43	52
13-09-18 10:16	DA40	TG	61	64	40	44
13-09-18 10:18	DA40	TG	61	43	35	47
13-09-18 10:25	DA40	TG	60	42	43	52
13-09-18 10:26	DA40	LA	46	40	39	43
13-09-18 10:29	DA40	TG	64	42	42	54
13-09-18 10:35	DA40	TG	45	61	54	48
13-09-18 10:40	DA40	**TG**	**67**	60	41	45
13-09-18 10:49	DA40	LA	74	46	32	46
13-09-18 11:28	DA40	TO	65	47	34	59
13-09-18 11:41	DA40	LA	60	66	33	46
13-09-18 11:41	DA40	**TG**	**67**	45	34	44
13-09-18 11:47	DA40	TG	63	55	33	44
13-09-18 11:54	DA40	TG	47	42	38	45
13-09-18 12:00	DA40	TG	62	44	41	48
13-09-18 12:07	DA40	PA	62	54	37	47
13-09-18 12:08	DA40	TO	46	56	39	49
13-09-18 12:11	DA40	**TG**	**72**	61	49	48
13-09-18 12:15	DA40	TG	42	61	36	53
13-09-18 12:15	DA40	TG	45	62	32	56
13-09-18 12:18	DA40	TG	63	43	31	44
13-09-18 12:21	DA40	TG	40	44	34	48
13-09-18 12:25	DA40	LA	43	64	31	54
13-09-18 12:25	DA40	TG	55	46	31	54
13-09-18 12:40	DA40	TG	61	49	34	40
13-09-18 12:45	DA40	TG	64	49	32	44
13-09-18 12:52	DA40	TG	63	49	33	56

Date/Time	Aircraft Type	Usage Type	Measured Levels $L_{Amax,1\ min}$ Noise Levels, dB(A)			
			Area 6	Near Runway	Area 2	Area 10
13-09-18 12:56	DA40	**TO**	**66**	47	33	59
13-09-18 12:56	DA40	TG	63	63	34	53
13-09-18 13:06	DA40	LA	60	70	34	68
13-09-18 13:06	DA40	TO	46	74	32	45
13-09-18 13:16	DA40	PA	46	50	36	46
13-09-18 13:18	DA40	**TG**	**64**	42	35	60
13-09-18 13:24	DA40	TG	62	64	32	50
13-09-18 13:31	DA40	**TG**	**80**	64	41	47
13-09-18 13:39	DA40	PA	57	46	33	37
13-09-18 13:41	DA40	**TG**	**68**	63	34	59
13-09-18 13:49	DA40	TG	47	64	38	42
13-09-18 13:54	DA40	**LA**	**73**	37	37	44
13-09-18 14:27	DA40	TO	64	64	45	41
13-09-18 14:31	DA40	TO	61	47	40	60
13-09-18 14:35	DA40	TG	61	64	34	54
13-09-18 14:39	DA40	TG	55	40	36	48
13-09-18 14:44	DA40	TG	46	66	34	58
13-09-18 14:47	DA40	**PA**	**67**	49	38	42
13-09-18 14:51	DA40	TG	66	63	28	43
13-09-18 14:58	DA40	PA	65	61	36	56
13-09-18 14:58	DA40	TG	60	49	37	58
13-09-18 14:59	DA40	TG	42	57	34	45
13-09-18 15:04	DA40	**TG**	**67**	65	No Data	60
13-09-18 15:06	DA40	TG	61	58	No Data	47
13-09-18 15:11	DA40	TG	72	54	No Data	47
13-09-18 15:12	DA40	LA	65	41	No Data	43
13-09-18 15:19	DA40	TG	55	39	No Data	42
13-09-18 15:23	DA40	LA	60	53	No Data	**65**
13-09-18 15:25	DA40	**LA**	**67**	47	No Data	47

Table 5.5 - Measured Noise Levels at Area 3, near the runway, Area 11 and Area 7 on 18th September 2018 (Week 7 Monitoring Period)

Date/Time	Aircraft Type	Usage Type	Measured Levels $L_{Amax,1\ min}$ Noise Levels, dB(A)			
			Area 3	Near Runway	Area 11	Area 7
18-09-18 8:06	DA40	LA	58	51	51	54
18-09-18 8:31	DA40	TO	54	62	54	46
18-09-18 8:38	DA40	TG	53	57	60	62
18-09-18 8:39	DA40	TO	56	68	60	49
18-09-18 8:43	DA40	TG	59	59	54	47
18-09-18 8:47	DA40	TG	52	68	47	49

Date/Time	Aircraft Type	Usage Type	Measured Levels $L_{Amax,1\ min}$ Noise Levels, dB(A)			
			Area 3	Near Runway	Area 11	Area 7
18-09-18 8:48	DA40	TG	55	60	45	51
18-09-18 8:53	DA40	TG	66	65	50	58
18-09-18 8:54	DA40	TG	56	54	49	47
18-09-18 8:58	DA40	TG	52	57	59	45
18-09-18 8:58	DA40	TO	61	58	49	45
18-09-18 9:00	DA40	TG	56	66	60	47
18-09-18 9:00	DA40	**TG**	53	59	**65**	55
18-09-18 9:04	DA40	TG	47	53	54	49
18-09-18 9:05	DA40	PA	59	61	55	45
18-09-18 9:08	DA40	**TG**	49	51	61	**67**
18-09-18 9:08	DA40	**TG**	42	59	54	**66**
18-09-18 9:12	DA40	TG	40	55	56	49
18-09-18 9:13	DA40	TG	55	51	48	44
18-09-18 9:15	DA40	TG	49	46	50	49
18-09-18 9:17	DA40	TG	52	46	48	44
18-09-18 9:21	DA40	LA	53	44	56	45
18-09-18 9:23	DA40	**TG**	49	61	57	**67**
18-09-18 9:24	DA40	LA	48	56	55	59
18-09-18 9:26	DA40	TO	46	46	53	51
18-09-18 9:28	DA40	LA	48	58	56	49
18-09-18 9:50	DA40	TO	47	61	47	42
18-09-18 10:01	DA40	**LA**	45	66	57	**66**
18-09-18 10:01	DA40	TO	40	48	48	44
18-09-18 10:02	DA40	TO	46	48	50	45
18-09-18 10:09	DA40	TG	43	66	58	64
18-09-18 10:16	DA40	TG	54	52	49	42
18-09-18 10:21	DA40	TG	44	52	53	68
18-09-18 10:28	DA40	TG	55	56	46	44
18-09-18 10:34	DA40	TG	52	48	50	44
18-09-18 10:40	DA40	**TG**	51	63	52	**68**
18-09-18 10:46	DA40	**TG**	46	63	55	**66**
18-09-18 10:48	DA40	LA	54	48	50	46
18-09-18 10:52	DA40	**TO**	50	48	51	**66**
18-09-18 10:52	DA40	TG	43	62	56	63
18-09-18 10:57	B350	LA	44	58	54	46
18-09-18 10:58	DA40	LA	42	54	52	46
18-09-18 11:00	DA40	TG	53	66	55	66
18-09-18 11:06	DA40	TG	46	52	55	50
18-09-18 11:12	DA40	TG	45	58	55	51
18-09-18 11:13	DA40	TG	44	49	50	47
18-09-18 11:18	DA40	TG	46	61	55	58
18-09-18 11:18	DA40	TG	44	63	56	66

Date/Time	Aircraft Type	Usage Type	Measured Levels $L_{Amax,1\ min}$ Noise Levels, dB(A)			
			Area 3	Near Runway	Area 11	Area 7
18-09-18 11:22	C182	TO	48	58	53	69
18-09-18 11:23	DA40	TG	51	64	54	64
18-09-18 11:23	DA40	LA	47	57	52	51
18-09-18 11:27	DA40	LA	52	55	54	68
18-09-18 11:28	DA40	PA	47	49	52	48
18-09-18 11:28	DA40	TO	46	50	48	42
18-09-18 11:29	YSSY	TO	50	52	49	43
18-09-18 11:35	DA40	TG	52	58	58	48
18-09-18 11:35	DA40	**LA**	44	54	**63**	**72**
18-09-18 11:42	DA40	**PA**	44	47	**67**	51
18-09-18 11:45	DA40	**TG**	47	59	**67**	51
18-09-18 11:50	DA40	**TG**	40	41	**69**	44
18-09-18 11:51	DA40	**TO**	42	46	**66**	59
18-09-18 11:58	DA40	SG	42	50	47	64
18-09-18 11:59	DA40	TG	42	66	58	62
18-09-18 12:01	DA40	**TG**	51	66	**68**	63
18-09-18 12:03	DA40	TG	46	61	53	61
18-09-18 12:05	DA40	TG	44	56	58	67
18-09-18 12:10	DA40	TG	47	61	57	67
18-09-18 12:14	DA40	LA	46	46	49	52
18-09-18 12:16	DA40	**TG**	49	65	**67**	64
18-09-18 12:17	DA40	**TO**	43	65	**67**	59
18-09-18 12:22	DA40	LA	46	43	51	47
18-09-18 12:28	DA40	PA	47	43	63	44
18-09-18 12:31	DA40	**TG**	52	66	58	**65**
18-09-18 12:37	DA40	**TG**	43	56	**67**	**66**
18-09-18 12:46	DA40	TO	40	52	60	48
18-09-18 12:46	DA40	TO	49	62	57	**68**
18-09-18 12:47	DA40	PA	48	50	51	49
18-09-18 12:50	DA40	TG	48	51	61	62
18-09-18 12:51	DA40	TO	48	55	52	54
18-09-18 12:54	DA40	TG	46	57	59	60
18-09-18 12:54	DA40	TG	47	67	57	62
18-09-18 12:59	DA40	TG	43	60	58	63
18-09-18 13:02	DA40	**PA**	55	66	**67**	62
18-09-18 13:03	DA40	**TG**	42	60	**66**	63
18-09-18 13:04	DA40	**TG**	44	63	**66**	63
18-09-18 13:08	DA40	LA	51	61	57	64
18-09-18 13:08	DA40	TG	52	63	55	63
18-09-18 13:11	DA40	PA	61	57	58	50
18-09-18 13:11	DA40	TO	50	55	59	54
18-09-18 13:15	DA40	TG	50	64	58	64

Date/Time	Aircraft Type	Usage Type	Measured Levels $L_{Amax,1\ min}$ Noise Levels, dB(A)			
			Area 3	Near Runway	Area 11	Area 7
18-09-18 13:19	DA40	TG	51	68	57	63
18-09-18 13:21	DA40	TG	52	61	58	59
18-09-18 13:22	DA40	**TG**	49	63	59	**65**
18-09-18 13:27	DA40	TG	48	61	56	66
18-09-18 13:28	DA40	**PA**	54	64	**68**	63
18-09-18 13:31	DA40	TG	50	68	59	64
18-09-18 13:35	DA40	TG	49	61	56	56
18-09-18 13:36	DA40	LA	49	63	58	**65**
18-09-18 13:40	DA40	TO	54	62	62	51
18-09-18 13:44	DA40	LA	54	59	58	55
18-09-18 13:52	DA40	TG	61	67	58	63
18-09-18 13:58	DA40	TG	52	63	55	63
18-09-18 14:04	DA40	**TG**	54	64	57	**66**
18-09-18 14:11	DA40	**TG**	53	62	55	**65**
18-09-18 14:17	DA40	TG	54	66	57	58
18-09-18 14:22	DA40	TG	49	64	56	65
18-09-18 14:28	DA40	TG	50	65	57	63
18-09-18 14:38	DA40	LA	51	65	57	65
18-09-18 14:44	DA40	TO	55	65	51	54
18-09-18 14:56	DA40	PA	48	53	65	54
18-09-18 14:58	DA40	TG	55	65	55	64
18-09-18 15:05	DA40	**TO**	51	62	59	**67**
18-09-18 15:05	DA40	TG	49	51	55	55
18-09-18 15:11	DA40	TG	54	48	51	51
18-09-18 15:13	DA40	TO	53	47	51	48
18-09-18 15:17	DA40	PA	51	68	59	62
18-09-18 15:17	DA40	SG	54	50	53	52
18-09-18 15:23	DA40	TG	55	55	50	60
18-09-18 15:24	DA40	TG	57	65	59	64
18-09-18 15:27	DA40	TG	48	59	57	62
18-09-18 15:29	DA40	TG	57	45	50	52
18-09-18 15:29	DA40	TG	60	48	51	56
18-09-18 15:33	DA40	TG	56	64	59	65
18-09-18 15:34	DA40	TG	49	61	56	56
18-09-18 15:34	DA40	LA	49	63	58	65
18-09-18 15:35	DA40	PA	56	61	55	65
18-09-18 15:37	DA40	TG	61	67	58	59
18-09-18 15:39	DA40	**PA**	55	62	57	**66**
18-09-18 15:41	DA40	TG	51	53	49	50
18-09-18 15:43	DA40	**LA**	54	65	57	**65**
18-09-18 15:44	DA40	**PA**	55	62	54	**65**
18-09-18 15:48	DA40	**LA**	56	63	56	**65**

Date/Time	Aircraft Type	Usage Type	Measured Levels $L_{Amax,1\ min}$ Noise Levels, dB(A)			
			Area 3	Near Runway	Area 11	Area 7
18-09-18 15:50	DA40	**TG**	52	63	56	**66**
18-09-18 15:59	DA40	LA	53	51	47	51
18-09-18 16:34	DA40	TO	52	57	52	50
18-09-18 17:05	DA40	TO	63	64	61	50
18-09-18 17:11	DA40	TG	49	47	53	60
18-09-18 17:17	C182	**LA**	57	63	54	**68**
18-09-18 18:57	DA40	TO	32	42	40	49

Table 5.6 - Measured Noise Levels at Area 12, near the runway, Area 8 and Area 4 on 25th September 2018 (Week 8 Monitoring Period)

Date/Time	Aircraft Type	Usage Type	Measured Levels $L_{Amax,1\ min}$ Noise Levels, dB(A)			
			Area 12	Near Runway	Area 8	Area 4
25-09-18 8:34	M20P	**LA**	58	73	**71**	56
25-09-18 8:35	DA40	**TO**	57	56	**68**	48
25-09-18 8:41	DA40	**LA**	**68**	70	**68**	62
25-09-18 8:42	DA40	TG	59	72	**69**	64
25-09-18 8:42	DA40	LA	56	71	56	45
25-09-18 8:47	DA40	TG	63	68	52	54
25-09-18 8:48	DA40	**TO**	56	71	**75**	47
25-09-18 8:51	M20P	TO	60	73	52	56
25-09-18 8:52	DA40	TG	46	74	54	44
25-09-18 8:55	DA40	**TG**	**69**	71	64	56
25-09-18 8:57	DA40	**TG**	**69**	54	**65**	**67**
25-09-18 9:01	DA40	TG	59	58	62	45
25-09-18 9:05	DA40	TG	39	73	60	62
25-09-18 9:07	DA40	TG	61	71	52	63
25-09-18 9:09	DA40	TG	54	69	53	48
25-09-18 9:13	DA40	TG	61	71	53	62
25-09-18 9:15	DA40	TG	47	70	48	55
25-09-18 9:19	DA40	**TG**	**65**	60	54	60
25-09-18 9:24	DA40	LA	60	72	63	61
25-09-18 9:24	DA40	TO	57	72	54	41
25-09-18 9:24	DA40	TG	52	63	49	46
25-09-18 9:32	DA40	TG	68	73	69	51
25-09-18 9:33	DA40	LA	52	67	62	47
25-09-18 9:37	DA40	PA	62	69	49	61
25-09-18 9:38	DA40	TG	57	72	52	44
25-09-18 9:40	DA40	**TG**	**76**	70	49	**70**
25-09-18 9:43	DA40	TG	60	75	**67**	60
25-09-18 9:46	DA40	TG	58	73	55	50

Date/Time	Aircraft Type	Usage Type	Measured Levels $L_{Amax,1\ min}$ Noise Levels, dB(A)			
			Area 12	Near Runway	Area 8	Area 4
25-09-18 9:48	DA40	TG	60	72	59	51
25-09-18 9:52	DA40	TG	53	73	75	50
25-09-18 9:53	DA40	**TG**	**65**	72	**74**	61
25-09-18 9:59	DA40	**TG**	**65**	72	56	47
25-09-18 10:01	DA40	**LA**	54	70	**77**	44
25-09-18 10:07	DA40	TO	53	72	59	44
25-09-18 10:08	DA40	LA	50	72	61	57
25-09-18 10:10	DA40	TO	44	74	48	41
25-09-18 10:13	DA40	TO	47	72	55	53
25-09-18 10:17	DA40	**TG**	55	71	**69**	46
25-09-18 10:19	DA40	**TG**	**68**	72	**75**	50
25-09-18 10:23	DA40	**TG**	61	70	**72**	50
25-09-18 10:25	DA40	**LA**	60	54	**72**	52
25-09-18 10:25	DA40	TG	48	73	59	45
25-09-18 10:32	DA40	TG	50	78	48	47
25-09-18 10:32	DA40	PA	51	59	45	40
25-09-18 10:36	DA40	TG	55	56	63	58
25-09-18 10:40	DA40	PA	40	65	62	54
25-09-18 10:44	DA40	**TG**	**69**	54	62	49
25-09-18 10:45	DA40	LA	47	72	54	51
25-09-18 10:50	PA31	**LA**	59	62	**79**	52
25-09-18 10:50	DA40	TG	50	71	52	45
25-09-18 10:55	DA40	TO	55	72	58	63
25-09-18 11:00	DA40	LA	42	61	52	55
25-09-18 11:01	DA40	**TG**	**69**	71	64	61
25-09-18 11:01	DA40	TO	60	64	57	62
25-09-18 11:06	DA40	TG	66	67	47	61
25-09-18 11:11	DA40	**PA**	**66**	55	64	61
25-09-18 11:15	DA40	TG	51	58	63	52
25-09-18 11:15	DA40	LA	46	63	60	56
25-09-18 11:21	DA40	TG	45	70	51	48
25-09-18 11:27	DA40	TG	49	74	52	45
25-09-18 11:33	DA40	TG	46	70	47	50
25-09-18 11:39	DA40	TG	64	72	58	52
25-09-18 11:49	DA40	LA	46	71	65	54
25-09-18 12:14	DA40	**TO**	53	73	**76**	45
25-09-18 12:15	DA40	TO	53	69	55	49
25-09-18 12:21	DA40	TG	49	67	64	57
25-09-18 12:26	DA40	**TO**	**68**	62	64	61
25-09-18 12:28	DA40	TG	49	74	58	52
25-09-18 12:30	DA40	TG	49	74	64	56
25-09-18 12:32	DA40	**TG**	**67**	74	63	50

Date/Time	Aircraft Type	Usage Type	Measured Levels $L_{Amax,1\ min}$ Noise Levels, dB(A)			
			Area 12	Near Runway	Area 8	Area 4
25-09-18 12:34	DA40	TG	52	70	66	49
25-09-18 12:36	DA40	**TG**	62	57	**67**	44
25-09-18 12:40	DA40	TG	55	69	64	43
25-09-18 12:42	DA40	TG	61	74	67	64
25-09-18 12:43	DA40	TG	41	74	61	60
25-09-18 12:49	DA40	TG	51	71	69	60
25-09-18 12:50	DA40	TG	46	74	57	47
25-09-18 12:50	DA40	LA	64	66	64	60
25-09-18 12:54	DA40	LA	62	63	64	43
25-09-18 12:57	DA40	LA	52	75	52	55
25-09-18 13:33	DA40	TO	56	77	63	53
25-09-18 13:45	DA40	**TO**	48	73	**70**	43
25-09-18 13:46	M20P	**LA**	46	79	**80**	59
25-09-18 13:58	DA40	**TG**	**67**	69	63	49
25-09-18 14:04	DA40	TG	42	61	68	56
25-09-18 14:09	DA40	TG	63	55	63	46
25-09-18 14:13	DA40	TO	52	57	51	44
25-09-18 14:18	DA40	PA	44	58	46	45
25-09-18 14:19	DA40	TO	49	66	54	61
25-09-18 14:25	DA40	LA	52	64	56	57
25-09-18 14:25	DA40	TG	52	64	56	57
25-09-18 14:26	DA40	**TG**	**66**	75	64	56
25-09-18 14:32	DA40	LA	56	55	57	62
25-09-18 14:33	DA40	**TG**	**65**	68	**65**	61
25-09-18 14:39	DA40	TG	47	72	61	61
25-09-18 14:44	DA40	TG	65	71	62	65
25-09-18 14:52	DA40	**TG**	**65**	66	**70**	41
25-09-18 14:53	DA40	TG	50	72	59	63
25-09-18 14:57	DA40	TG	52	70	60	63
25-09-18 14:59	DA40	**PA**	**65**	69	57	48
25-09-18 15:02	DA40	**TG**	55	77	**68**	57
25-09-18 15:03	DA40	**TG**	**68**	74	**66**	43
25-09-18 15:08	DA40	TG	45	57	62	55
25-09-18 15:09	DA40	**TG**	**65**	74	**66**	**68**
25-09-18 15:15	DA40	**TO**	**75**	75	**65**	55
25-09-18 15:17	DA40	LA	39	72	56	58
25-09-18 15:17	DA40	PA	44	73	62	44
25-09-18 15:21	DA40	PA	44	73	62	44
25-09-18 15:24	DA40	TG	42	76	62	64
25-09-18 15:25	DA40	SG	67	70	63	61
25-09-18 15:29	DA40	TO	54	73	58	47
25-09-18 15:29	DA40	TG	62	75	50	53

Date/Time	Aircraft Type	Usage Type	Measured Levels $L_{Amax,1\ min}$ Noise Levels, dB(A)			
			Area 12	Near Runway	Area 8	Area 4
25-09-18 15:31	DA40	**TG**	**65**	54	57	46
25-09-18 15:35	DA40	**TG**	48	72	**69**	42
25-09-18 15:37	PA31	**TO**	47	78	58	**65**
25-09-18 15:39	DA40	LA	47	57	66	46
25-09-18 15:40	DA40	TG	66	71	58	51
25-09-18 15:41	DA40	TG	49	76	64	40
25-09-18 15:47	DA40	**TG**	60	48	65	**67**
25-09-18 15:51	DA40	SG	40	78	45	64
25-09-18 15:53	DA40	TG	55	69	66	62
25-09-18 15:57	DA40	**TG**	**66**	69	**71**	49
25-09-18 15:59	DA40	**TG**	58	71	**68**	39
25-09-18 16:03	DA40	TG	44	76	50	46
25-09-18 16:03	DA40	LA	52	72	62	47
25-09-18 16:12	DA40	**LA**	47	71	**70**	58
25-09-18 16:57	DA40	TO	47	71	56	42

5.3 Analysis and Discussion

5.3.1 Building Site Acceptability

As shown in Table 5.7, all surrounding existing residential receiver buildings are located within the 'acceptable' building site location except area 8. As per AS 2021, if a building site is classified as 'acceptable', then there is usually no need for the building construction to provide protection specifically against aircraft noise. If the building site is classified as 'conditionally acceptable', the required noise reduction and the required building construction should be determined in accordance with the method specified in AS 2021.

Table 5.7 - Number of Aircraft Events and AS 2021 Acceptability

Noise Monitoring Location	Number of Events within L_{Amax} 65 – 70 dB(A)	Acceptable?	Number of Events within L_{Amax} 70 – 75 dB(A)	Conditionally acceptable?	Number of Events greater than L_{Amax} 75 dB(A)	Unacceptable?
Area 1	15	Y	4	N	2	N
Area 2	0	Y	0	N	0	N
Area 3	1	Y	0	N	0	N
Area 4	5	Y	1	N	0	N
Area 5	9	Y	4	N	2	N
Area 6	26	Y	8	N	2	N
Area 7	26	Y	1	N	0	N
Area 8	**30**	**N**	**6**	**Y**	5	N
Area 9	4	Y	1	N	0	N

Noise Monitoring Location	Number of Events within L_{Amax} 65 – 70 dB(A)	Acceptable?	Number of Events within L_{Amax} 70 – 75 dB(A)	Conditionally acceptable?	Number of Events greater than L_{Amax} 75 dB(A)	Unacceptable?
Area 10	5	Y	0	N	0	N
Area 11	13	Y	0	N	0	N
Area 12	22	Y	0	N	2	N
Area 13	0	Y	0	N	0	N
Area 14	2	Y	1	N	2	N
Area 15	6	Y	1	N	1	N
Area 16	0	Y	0	N	0	N

5.3.2 Noise Impact on the Existing Residential Receivers

A building located within an acceptable building site does not necessarily means that residences located within these areas will not find the levels of noise experienced to be acceptable. In order to assess the noise impact from an aircraft movement to a habitable space, measured noise levels were assessed against the indoor design noise levels for habitable space (living and sleeping area) specified in AS 2021 and are discussed in the following section.

Table 5.8 and Figure 5.1 to Figure 5.3 presents the percentage of events that are louder than L_{Amax} 70 dB(A), L_{Amax} 65 dB(A) and L_{Amax} 60 dB(A) at each monitoring area on the worst affected day. Refer to Table 5.1 for the identified worst affected days from the noise monitoring week 1 to week 8. Note that Table 5.8 presents the percentage of events that are louder than the selected L_{Amax} value to identify the worst affected noise area.

Table 5.8 - Number of Aircraft Events Above L_{AMax} 60 dB(A), 65 dB(A) and 70 dB(A)

Noise Monitoring Location	Total Number of Events	Percentage of Total Events > 60 dB(A)	Percentage of Total Events > 65 dB(A)	Percentage of Total Events > 70 dB(A)
Area 1	95	25%	18%	6%
Area 2	89	0%	0%	0%
Area 3	139	4%	1%	0%
Area 4	127	27%	4%	1%
Area 5	95	27%	12%	6%
Area 6	89	66%	31%	11%
Area 7	139	47%	19%	1%
Area 8	127	57%	28%	9%
Area 9	95	13%	4%	1%
Area 10	89	6%	6%	0%
Area 11	139	14%	9%	0%
Area 12	127	35%	20%	2%
Area 13	47	0%	0%	0%
Area 14	47	30%	9%	6%
Area 15	47	30%	15%	4%

Noise Monitoring Location	Total Number of Events	Percentage of Total Events > 60 dB(A)	Percentage of Total Events > 65 dB(A)	Percentage of Total Events > 70 dB(A)
Area 16	47	0%	0%	0%

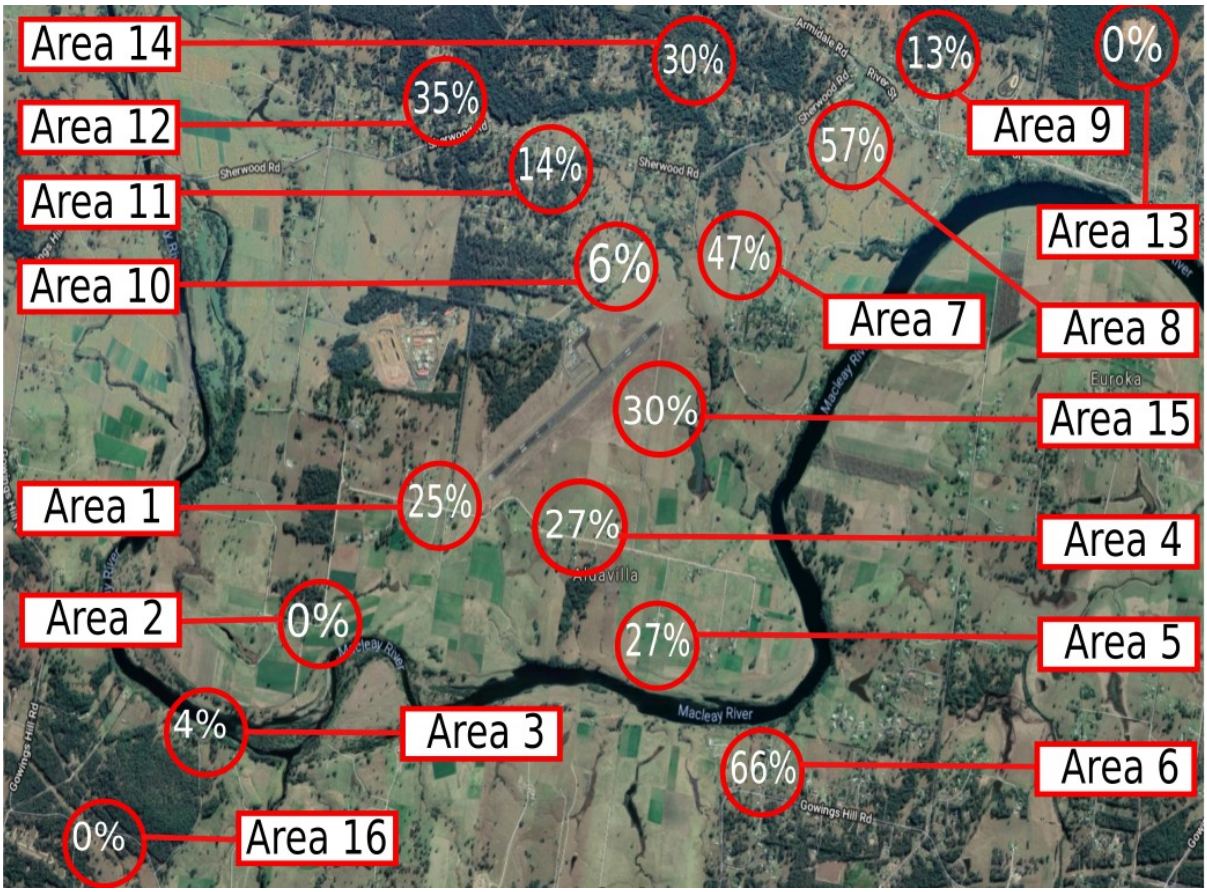

Figure 5.1 - Number of Events > L_{AMax} 60 dB(A) Affected Area (in Percentage)

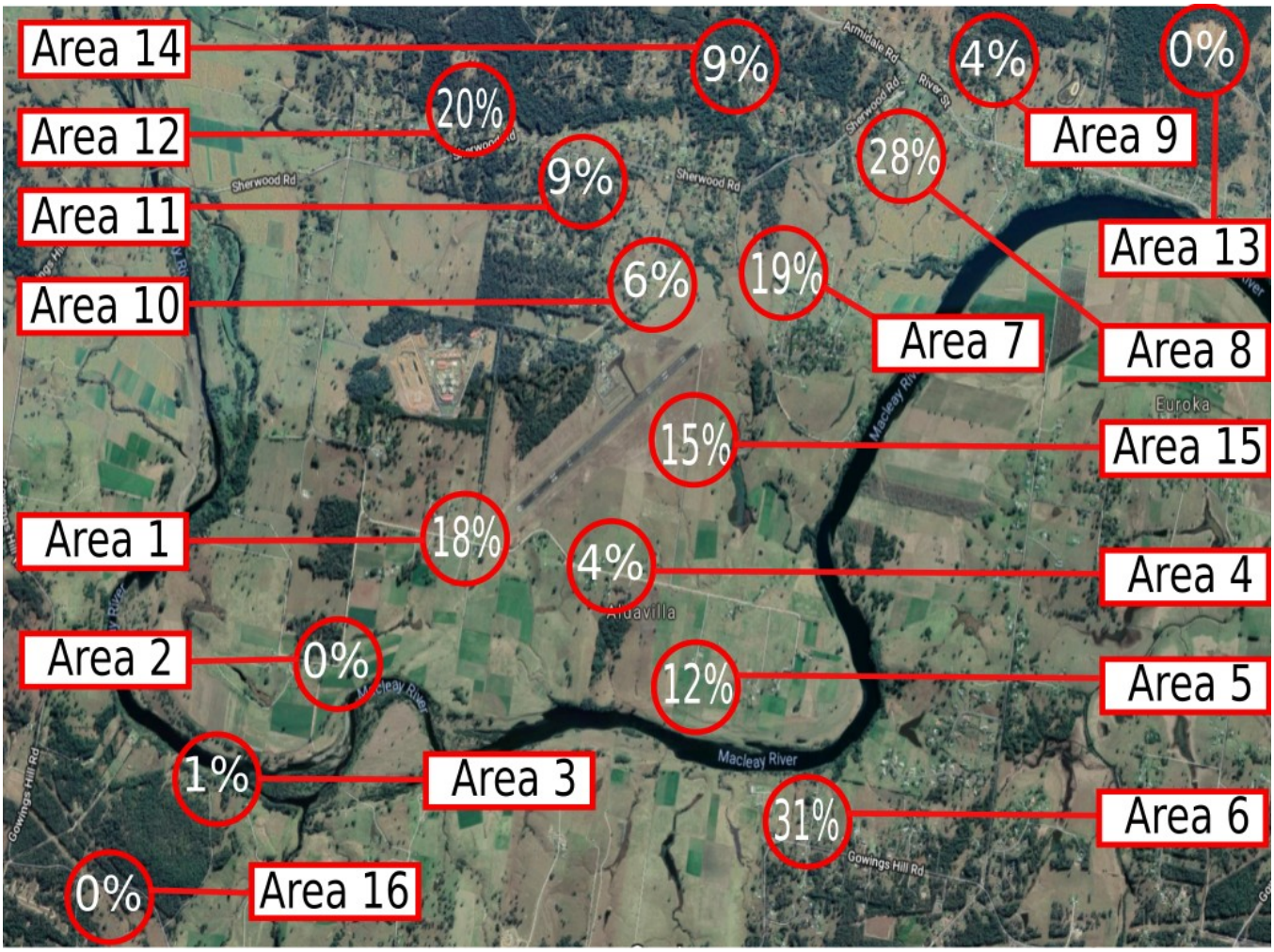

Figure 5.2 - Number of Events > L_{AMax} 65 dB(A) Affected Area (in Percentage)

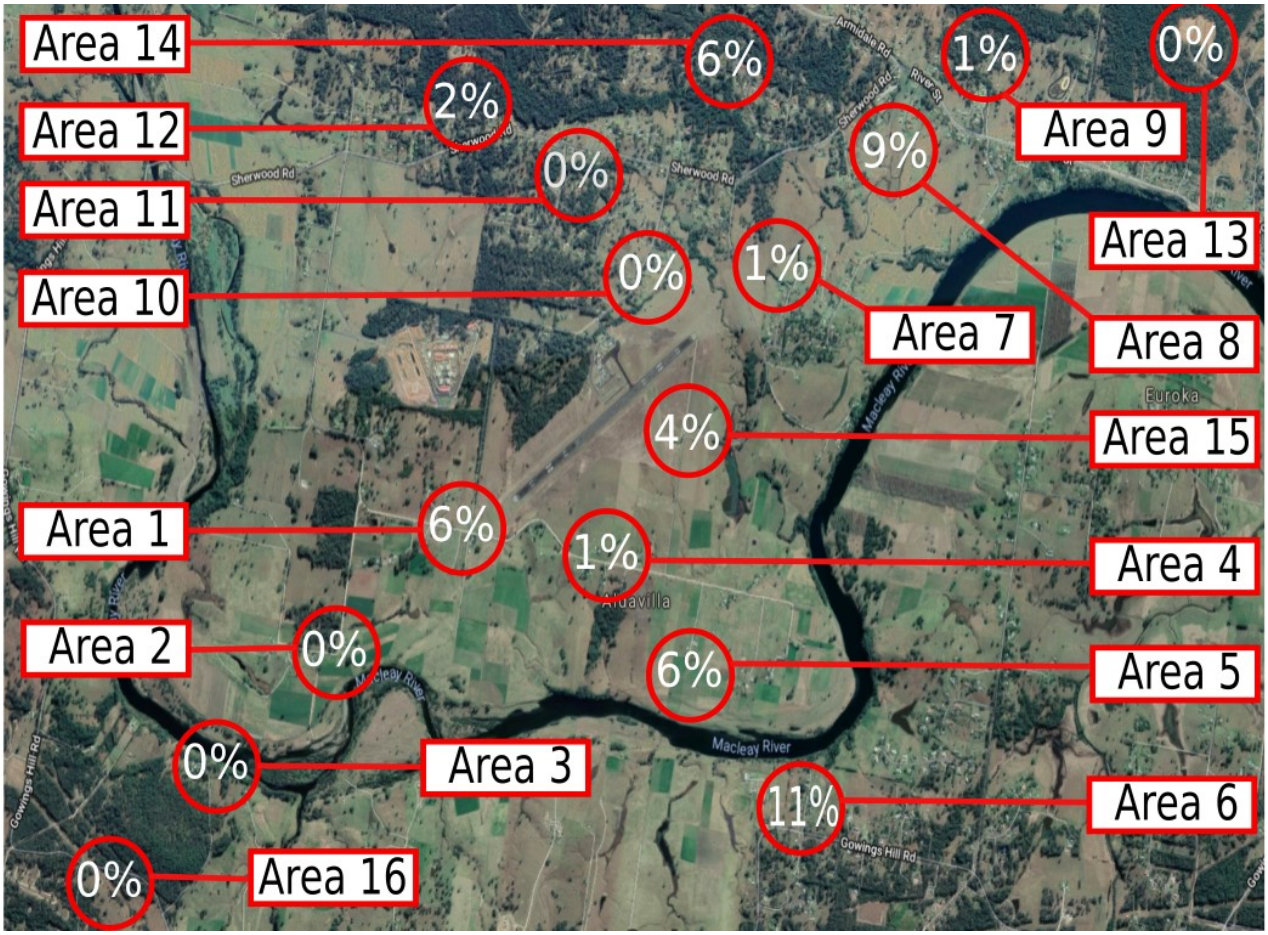

Figure 5.3 - Number of Events > L_{AMax} 70 dB(A) Affected Area (in Percentage)

Based on the completed assessment, we make the following comments:

- The number of events > L_{Amax} 70 dB(A) (N70) measures has been the most commonly used frequency based aircraft noise measure because an L_{Amax} 70 dB(A) event measured outside a habitable area will generally be experienced as an L_{Amax} 60 dB(A) event inside a residence with the windows open. L_{Amax} 60 dB(A) is the sound level that will disturb a normal conversation or activities such as watching television. As shown in Figure 5.3, Area 6 is identified as the worst affected area where 11% of the recorded events were measured above L_{Amax} 70 dB(A).
- An L_{Amax} 65 dB(A) event measured outside a habitable area will generally be experienced as an

L_{Amax} 55 dB(A) inside a residence with the windows open. As specified in Table 3.2, AS 2021 standard specifies L_{Amax} 55 dB(A) as indoor design sound level for habitable space. Additionally, the existing acoustic environment of the surrounding residential receivers are rural in nature and are likely to experience relatively lower background levels. As such, the recorded L_{Amax} level over 65 dB(A) are likely to be considered as excessive or intrusive by residents in the surrounding area. Based on the noise monitoring results presented in this report, residential dwelling located within and around the noise monitoring area 6, 8 and 12 are expected to experience a higher number of N65 events. The majority of these higher noise events were recorded during the touch and go (TG) training operation by DA40 type aircraft.

- We understand that eliminating the aircraft noise events greater than L_{Amax} 65 dB(A) may not be a feasible option, however, appropriate mitigation management plan should be adopted to reduce N65 to an acceptable/reasonable level.
- An L_{Amax} 60 dB(A) event measured outside a bedroom (sleeping area) will generally be experienced as an L_{Amax} 50 dB(A) inside a residence with the windows open. As specified in Table 3.2, AS 2021 specifies L_{Amax} 50 dB(A) as indoor design sound level for bedroom (sleeping area). Based on the noise monitoring results presented in this report, residential dwelling located within and around the noise monitoring area 1, 4, 5, 6, 7, 8, 12, 14 and 15 are expected to experience higher number of N60 events (number of events > L_{Amax} 60 dB(A)). The completed noise monitoring results shows that a number of existing residential dwellings are likely to experience a higher number N60 events. As such, we recommend that circuit training operation hours are limited to the day-time period only (7am to 7pm).

Section 6 presents potential noise management measures that can be incorporated into a Noise Management Plan.

6 Noise Management Measures

Based on the noise monitoring results, we recommend the following noise management measures:

- In order to reduce the aircraft noise exposure in a bedroom (sleeping areas) of the existing residential receivers, we recommend that the circuit training operating hours is restricted between the daytime period only (0700 hours to 1900 hours) during weekdays;
- More residences are expected to use the outdoor area during the weekend period. In order to reduce the aircraft noise exposure to the outdoor area of a residence, circuit training operating hours over the weekend should be reduced;
- 'We recommend that the number of N65 events (number of events > L_{Amax} 65 dB(A) per day) are limited to 30 and that number of N70 events (number of events > L_{Amax} 70 dB(A) per day) are limited to 20;
- Any future residential development located within and around noise monitoring Area 1, 4, 5, 6, 7, 8, 12, 14 and 15 are to be designed to meet the indoor design noise levels specified in this report.

APPENDIX A: GLOSSARY OF ACOUSTIC TERMINOLOGY	
A-Weighting	A response provided by an electronic circuit which modifies sound in such a way that the resulting level is similar to that perceived by the human ear.
dB (decibel)	This is the scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and the reference pressure (0.00002N/m^2).
dB(A)	This is a measure of the overall noise level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Facade Noise Level	Refers to a sound pressure level determined at a point close to an acoustically reflective surface (in addition to the ground). Typically a distance of 1 metre is used.
Free Field	Refers to a sound pressure level determined at a point away from reflective surfaces other than the ground with no significant contribution due to sound from other reflective surfaces; generally as measured outside and away from buildings.
Hertz (Hz)	A measure of the frequency of sound. It measures the number of pressure peaks per second passing a point when a pure tone is present.
L_{Aeq} Equivalent Continuous Sound Level	This is the equivalent steady sound level in dB(A) containing the same acoustic energy as the actual fluctuating sound level over the given period. For a steady sound with small fluctuations, its value is close to the average sound pressure level.
$L_{A90,T}$	This is the dB(A) level exceeded 90% of the time, T.
$L_{A10,T}$	This is the dB(A) level exceeded 10% of the time, T.
$L_{A50, T}$	This is the dB(A) level exceeded 50% of the time, T.
L_{WA}	The A-weighted sound power level in dB.

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