13

Aircraft Noise

13.1. Introduction

The Airports Act requires a master plan to specify the following noise-related matters:

- An Australian Noise Exposure Forecast (ANEF) for the areas surrounding Adelaide Airport
- Flight paths at Adelaide Airport
- Adelaide Airport's plans (developed following consultation with the airlines that use the airport and Local Government bodies in the vicinity of the airport) for managing aircraft-noise intrusion in areas forecast to be subject to exposure above the significant ANEF levels (i.e. 30 ANEF levels)

Additional information is provided to ensure stakeholders are informed about aircraft-noise management.

13.2. Overview

- A curfew currently operates at Adelaide Airport between 11:00pm and 6:00am. Some aircraft are permitted to operate during curfew hours (mainly for medical emergency flights and delivery of freight and mail).
- A new Australian Noise Exposure Forecast has been technically endorsed by Airservices.
- Adelaide Airport has a broad range of programs in place to manage aircraft noise exposure around the airport. These include:
  - Working with stakeholders to observe the existing curfew arrangements
  - Consulting and engaging with the local community
  - Working closely with the Commonwealth, State and Local Governments
  - Consulting with the airlines that use the airport
  - Investing in airport infrastructure to support new-generation quieter aircraft
  - Noise abatement procedures

13.3. Aircraft Noise Management

Aircraft noise is an unavoidable impact of aircraft operations.

Roles and responsibilities regarding aircraft-noise management vary across a range of organisations, as shown in Table 13-1.

Management

ORGANISATION	RESPONSIBILITY
Airlines	Airlines purchase particular types of aircraft which are suitable for the routes they wish to fly or are currently flying.
International Civil Aviation Organization	ICAO is responsible for setting noise standards for manufacturers of new aircraft.
Civil Aviation Safety Authority	CASA is responsible for regulation and ensuring safe operation of civil aviation in Australia. CASA is responsible for approving the use of new aircraft types in Australia.
Airservices Australia	Airservices manages the airspace around Australia to maintain control over the movement of aircraft into, and out of, airports in Australia. Airservices also designs and manages the flight paths and manages aircraft-noise complaints and enquiries through its Noise Complaints and Information Service (NCIS).
Aircraft Noise Ombudsman	The Aircraft Noise Ombudsman oversees the handling of aircraft-noise enquiries and complaints by Airservices and the Commonwealth Department of Defence.
Department of Infrastructure, Transport, Regional Development and Communications (DITRDC)	The Commonwealth Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) develops and enforces the policy and regulatory framework for airports and the aviation industry and administers the Airports Act. DITRDC also administers the Adelaide Airport curfew, including dispensations and regulators matters for quiet aircraft to operate during the curfew period.
Adelaide Airport Limited (AAL)	AAL is responsible for providing and maintaining aviation infrastructure at a high standard for aircraft movements and passenger moments at the airport. AAL does not control aircraft noise. However, through direct engagement and through the Adelaide Airport Consultative Committee and the Technical Working Group sub-committee, it implements aircraft noise-management activities. AAL actively manages ground-based noise at the airport.
Adelaide Airport Technical Working Group	The Adelaide Airport Technical Working Group sub-committee discusses aircraft-noise management and improvement opportunities.
South Australian Government	The State Government is responsible for developing land-use planning frameworks, implemented by Local Governments, to prevent inappropriate (noise-sensitive) developments in the vicinity of the airport.

Table 13-1: *Responsibilities for Aircraft Noise*

13.3.1. Aircraft Noise Mitigation

There are a broad range of programs in place to manage aircraft-noise exposure around the airport. These include:

- Working with stakeholders to observe curfew arrangements
- Noise abatement procedures
- Consulting and engaging with the local community
- Working closely with the Commonwealth, State and Local Governments to ensure a consistent approach, management and implementation of noise-mitigation measures
- Consulting with the airlines that use the airport
- Investing in airport infrastructure to support new-generation quieter aircraft
- Quieter aircraft technology

13.3.1.1. Current Curfew Arrangements

Adelaide Airport currently operates under a legislated curfew *(Adelaide Airport Curfew Act 2000)* to limit noise exposure from aircraft at night. During curfew hours (11:00pm to 6:00am), take-offs and landings at the airport are restricted to specific types of aircraft and operations. For departing flights to meet the curfew they must be given taxi clearance by Airservices Air Traffic Control after 6:00am and before 11:00pm.

Some aircraft can operate during the curfew if they meet certain low-noise criteria and observe noise-abatement procedures. These aircraft movements include:

- A maximum of 15 take-offs and 25 landings each week during the curfew by low-noise heavy freight aircraft that meet the noise level requirements set out in the *Adelaide Airport Curfew Act 2000*
- Prescribed types of low-noise heavy freight aircraft that may operate during the curfew
- Aircraft that are listed as specified types of jet aircraft, of a maximum take-off weight of 34,000 kilograms or less, that comply with the Air Navigation (Aircraft Noise) Regulations 1998
- Medical emergency flights, such as Royal Flying Doctor Service flights, by turbo-propeller aircraft and small jets that comply with the Air Navigation (Aircraft Noise) Regulations 1998
- Medevac helicopters are permitted to use the airport during curfew hours

The Secretary of the Commonwealth Department of Infrastructure, Transport, Regional Development and Communications has the power to grant a dispensation that allows an aircraft to operate during a curfew period. In practice, a dispensation is granted by the Minister where there are exceptional circumstances to justify the flight. Dispensations must be granted before a flight operates into, or out of, Adelaide Airport and can be granted for certain situations such as:

- Search and rescue or medical emergencies
- A declared flight emergency landing or resumption of that flight
- A low-fuel emergency
- For safety or security emergencies

During the curfew period, aircraft take-off and land over Gulf St Vincent using the main runway (Runway 05 for arrivals and Runway 23 for departures). Under Section 15 of the Adelaide Airport Curfew Act 2000, Runway 23 can be used for arrivals only when Runway 05 is declared by Airservices to be not operationally acceptable for arrivals.

The Adelaide Airport Curfew Regulations 2000 provide for international passenger movements between 11:00pm and midnight and between 5:00am and 6:00am (the curfew shoulder periods) subject to:

- Jet aircraft meeting the strictest ICAO noise standards
- No more than eight arrivals per week and no departures

13.3.1.2. Noise Abatement Procedures

Noise abatement procedures are implemented at all major airports, including Adelaide Airport, to reduce the impact of aircraft noise on the community. The use of noise abatement procedures, which include preferred runway use and preferred flight paths, are applied by Airservices air traffic control subject to weather conditions and aircraft requirements. (Adelaide's seasonal wind patterns primarily influence the use of runways as aircraft take-off and land into the wind for safety and performance reasons).

The noise abatement procedures for Adelaide Airport set out the preferred runway use during specific periods of the day. Currently, between 6.00am and 11.00pm the most preferred runway is main Runway 23 (arrivals over the suburbs and departures over the water), followed by main Runway 05 (arrivals over the water and departures over the suburbs) as a second preference. If the main Runway is not available, the preferred runway is cross Runway 30 and the second preference is cross Runway 12.

Airservices conducts regular reviews to check the effectiveness of noise abatement procedures and to seek improvements.

13.3.1.3. Commonwealth Noise Insulation Scheme

In 2000, the Commonwealth Government introduced and operated a noise insulation program for buildings in areas of high aircraft noise exposure. Residential properties in the ANEI 30 contour and public buildings (schools, places of worship, day care centres and hospitals) in the ANEI 25 contour were eligible for assistance under the programs.

The noise insulation scheme was funded by a Commonwealth levy on passengers that was in place until 2010. Insulation works on some houses and public buildings continued until 2012.

The Commonwealth Government closed the noise insulation scheme in 2012.

13.3.1.4. Consultation with Local Communities

AAL continues to engage with local communities surrounding the airport through a range of committees and forums. Principally, the Adelaide Airport Consultative Committee, which includes local community representatives, is a forum where any issue relating to the operations of the airport and potential effects on the local community can be raised. This includes issues such as aircraft ground-based noise, car parking, flood mitigation, landscaping, bike path access and commercial developments.

Management of the curfew and the reporting of dispensations and levels of allowable night-time flights are regularly reviewed. Master planning (including the formulation of ANEFs) and aircraft flight path improvements are regularly discussed, including presentations from airlines and Airservices.

Information about aircraft noise and curfew arrangements is published on the Adelaide Airport website.

Airservices has developed an online WebTrak system, available at airservicesaustralia.com, which provides information about individual flights and allows users to submit noise inquiries and complaints.

13.3.1.5. Consultation with Commonwealth, State and Local Governments

Representatives of the Commonwealth, State and Local Governments participate in the Adelaide Airport Consultative Committee and the Adelaide Airport Planning Coordination Forum.

These regular meetings consider off-airport land-use planning including
land-use development suitability, aircraft noise and airspace protection.

AAL continues to work with State and Local Governments to formalise the long-term land-use planning of land surrounding the airport. The South Australian Government has committed that the new Planning, Development and Infrastructure Act and the associated Planning and Design Code will include planning policy for the implementation of the National Airports Safeguarding Framework (NASF). This includes taking into consideration the location of noise-sensitive development and building-height limitations to ensure the ongoing operations of the airport.

13.3.1.6. Consultation with Airlines and Airservices Australia

AAL conducts regular consultative meetings with the airport operators and Airservices to review the operation and efficiency of the airport and airfield infrastructure and discuss opportunities for aircraft noise improvements. Airline and general aviation representatives are represented on the Adelaide Airport Consultative Committee.

The views of the Adelaide Airport Consultative Committee are noted in formal applications to the Commonwealth Minister for permission to operate low-noise freighter aircraft in the curfew period.

Airservices participates in consultative meetings and reports on aircraft noise complaint trends and any investigations associated with the complaints.

13.3.1.7. Investing in Airport Infrastructure

AAL regularly consults with airlines to encourage use of the ground power and pre-conditioned and compressed air facilities provided at Terminal 1, which reduces noise associated with the use of auxiliary power units and early engine start-ups.

Additionally, AAL has implemented an Engine Ground Running Policy and guidelines for the ground running of aircraft engines.

AAL is also planning for infrastructure that supports new generation quieter aircraft such as the Boeing B787 Dreamliner, B737 MAX , B777X and Airbus neo aircraft types.

Further information on the management of ground-based noise is provided in Chapter 14.

13.3.1.8. Quiter Aircraft Technology

Technological advancement in aircraft technology have reduced aircraft fuel consumption, air pollution, and noise emissions, significantly over the last 30 years and this is expected to continue in the future. Technology is also expected to evolve to change how people travel and how aviation transport and connections are delivered. Changes in the next 20 years could include the use of sustainable biofuel, electro-powered aircraft, supersonic aircraft, the introduction of air taxis, and growth in aircraft drones.

The aircraft industry has been designing and building quieter aircraft that now operate in Australia. This reduces aircraft noise exposure for residents under flight paths. Many passenger aircraft, both domestic and international, are using required navigation procedures combined with continuous descent procedures, which allow the design of flight paths that minimise aircraft noise exposure for residential areas.

AAL will continue to consult with the aircraft industry with a mutual goal to reduce aircraft noise.

13.4. Understanding Aircraft Noise

Under the Airports Act, Adelaide Airport is not responsible for the noise generated from aircraft while landing, taking-off or taxiing. However, AAL does recognise the need for the airport to assist in managing aircraft noise for the surrounding communities by working closely with the airlines (the generators of the noise) and Airservices (the airspace manager).

The most effective means for reducing the impact of aircraft noise is through the effective long-term planning of land use for areas adjacent to the airport site. Other means include a combination of land use with alternative runway allocations and/or adopted flight path procedures; restrictions of aircraft movements by aircraft type; and the implementation of aircraft operational procedures aimed at achieving desired noise-abatement objectives. The current trend in renewing airline fleets also has the advantage that newer aircraft types are generally quieter than existing or older aircraft.

The Airports Act requires a Master Plan to include forecasts of noise levels resulting from the operation of the airport. The Commonwealth Government has specified the use of the computer-based Integrated Noise Model (INM) which produces the Australian Noise Exposure Forecast (ANEF) for an airport. The ANEF is applied by State and Local Government planning authorities to determine the suitability of land-use and proposed developments around an airport.

To inform the community of current and future noise exposure, Number-Above contours are prepared to identify the frequency of aircraft noise events above a specified decibel threshold. N70 contours are included in this Master Plan to show the average number of daily noise events above 70 decibels (dB) caused by over-flying aircraft.

13.4.1. Describing Aircraft Noise

Aircraft noise is generated both by the aircraft's engines and by air passing over its airframe. Different models and sizes of aircraft produce different types and loudness of noise. These characteristics depend on the type of engine (propeller or jet), aerodynamic noise (affected by how modern the aerodynamic design is) and how the aircraft is flying (its speed and weight characteristics; how it takes off and lands).

Aircraft noise is different to other forms of noise in that it occurs sporadically and from an elevated source. Other forms of noise such as background urban transport noise occur more frequently, with morning and evening peaks and at ground level.

Although aircraft noise is sporadic, it can occur at regular or frequent intervals, depending on airline schedules. The noise from aircraft increases closer to airports when aircraft descend prior to landing. At low levels, aircraft noise can be very loud but only for a short period of time. This makes traditional methods of measuring and reporting aircraft noise (such as average sound levels) unsuitable.

To address this, aircraft noise is measured and analysed in terms of frequency of occurrence, peak noise levels during an overflight, loudness levels, and duration of the noise event. These characteristics are integrated over longer periods of time to describe the aircraft noise exposure at locations around airports.

13.4.2. Noise Plots

The Commonwealth Government has adopted a system for modelling current and forecast aircraft noise exposure around airports.

There are a range of different types of plots that display noise exposure, including:

- ANEI (Australian Noise Exposure Index): An ANEI is a plot of defined noise exposure based on the actual historical operations of the airport and uses an analysis of actual aircraft types and movements over a 12-month period (usually a calendar year). An ANEI is primarily used to establish a base case from which an ANEF can be developed
- ANEF (Australian Noise Exposure Forecast): An ANEF is a plot of estimated noise exposure based on a forecast of aircraft movements and fleet mix for a defined future horizon. The ANEF provides an indication of the change in noise exposure over time and is used to determine appropriate land-use zoning in areas surrounding the airport. An ANEF is a chart endorsed by Airservices for technical accuracy. An airport can only have one endorsed ANEF at any one time
- Number-Above contours are a frequency-based metric that shows the number of aircraft noise events greater than a specified decibel level that can be expected on an average day. N70 modelling provides maps of areas that are likely to experience a predicted number of average daily noise events above 70 decibels (dB) from aircraft flying overhead. An outdoor noise level of 70 dB is approximately 60 dB indoors, with windows open to a normal extent, which is the approximate noise level that could interfere with normal conversation or with listening to television

13.5. The Australian Noise Exposure Forecast (ANEF) System

The ANEF system is the aircraft noise exposure forecasting system currently adopted in Australia. The aircraft Noise Exposure Forecast (NEF) modelling was developed in the United States of America in the late 1960s and recognised internationally. It was modified in Australia to the ANEF in 1982.

The ANEF system provides a scientific measure of noise exposure from aircraft operations around airports. It provides guidance for land-use planning near the airport. Table 13-2 shows the land-use compatibility as recommended by Standards Australia: Australian Standard AS2021-2015 *Acoustics – Aircraft noise intrusion – Building, siting and construction* in relation to the specific ANEF contours.

The ANEF computation is based on forecasts of traffic movements on an average day. Allocations of the forecast movements to runways and flight paths are on an average basis over a year and take into account the existing and forecast air-traffic-control procedures at the airport because they nominate preferred runways and preferred flight paths for noise-abatement purposes.

The following factors are considered 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 (7:00am to 7:00pm) and night time (7:00pm to 7:00am) hours
- The topography of the area surrounding the airport

13.5.1. Calculation of the Australian Noise Exposure Forecast

The ANEF system combines noise level and frequency of operations to calculate the average noise level at any point along, and to the side of, the flight path using the following reasonably simple mathematical procedure.

Partial ANEFs are calculated for the frequency of night-time and day-time operations of each aircraft type and flight path. These calculations use a value of Effective Perceived Noise Level (EPNL) for each aircraft and take into account all known annoying aspects in the temporal, frequency spectrum and spatial domains. The EPNL is obtained by the algebraic addition of the maximum perceived noise level at any instant corrected by noise tonal and duration factors. The EPNL unit is also used for the international certification of new aircraft.

These partial ANEFs are computed for each significant type of noise intrusion. The total ANEF at any point on the ground around the airport is composed of all individual noise exposures (summed logarithmically) produced by each aircraft type operating on each path over the period of one day. These calculated values do not take account of any background noise levels such as road or rail activities which, particularly in ground transport corridors, could be much higher than aircraft noise.

13.5.2. Noise Threshold Levels

In the area outside the 20 ANEF contour, noise exposure may be of concern for some individuals. Within the area between the 20 to 25 ANEF contour, levels of noise are generally accepted to emerge as an environmental problem, and within the 25 ANEF contour the noise exposure becomes progressively more severe. It should be noted that the actual location of the 20 ANEF contour is difficult to accurately define. This is because variations in actual flight paths, operating techniques of pilots, meteorological conditions and topography all have a largely unpredictable effect on the position of the 20 ANEF contour for any given day.

Aircraft noise elicits a wide range of individual responses and the reasons for the differences between individuals are largely socially based and complex to quantify. Research has indicated however, that community response to noise exposure is more predictable than an individual's response.

BUILDING TYPE	ACCEPTABLE	CONDITIONALLY ACCEPTABLE	UNACCEPTABLE
House, home unit, flat, Caravan Park	Less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 2)	Greater than 25 ANEF
Hotel, motel, hostel	Less than 25 ANEF	25-30 ANEF	Greater than 30 ANEF
School, university	Less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 2)	Greater than 25 ANEF
Hospital, nursing home	Less than 20 ANEF (Note 1)	20-25 ANEF	Greater than 25 ANEF
Public building	Less than 20 ANEF (Note 1)	20-30 ANEF	Greater than 30 ANEF
Commercial building	Less than 25 ANEF	25-35 ANEF	Greater than 35 ANEF
Light industrial	Less than 30 ANEF	30-40 ANEF	Greater than 40 ANEF
Other industrial	Acceptable in all ANEF zones		

Table 13-2: *AS2021 Table of Building Site Acceptability Based on ANEF Zones*

Notes:

- (1) The actual location of the 20 ANEF contour is difficult to define accurately, mainly because of variation in aircraft flight paths. Because of this, the procedure of Clause 2.3.2 in AS2021: 2015 may be followed for building sites outside but near to the 20 ANEF contour
- (2) Within 20 ANEF to 25 ANEF, some people may find that the land is not compatible with residential or educational uses. Land-use authorities may consider that the incorporation of noise-control features in the construction of residences or schools is appropriate (see also Figure A1 of Appendix A in AS2021: 2015)
- There will be cases where a building of a particular type will contain spaces used for activities which would generally be found in a different type of building (e.g. an office in an industrial building). In these cases, Table 12-1 should be used to determine site acceptability but internal design noise levels within the specific spaces should be determined by Table 3.3 in AS2021: 2015
- This Standard does not recommend development in unacceptable areas. However, where the relevant planning authority determines that any development may be necessary within existing built-up areas designated as unacceptable, it is recommended that such development should achieve the required aircraft-noise reduction determined according to Clause 3.2 in AS2021: 2015. For residences, schools etc., the effect of aircraft noise on outdoor areas associated with the building should be considered
- In no case should new development take place in greenfield sites deemed unacceptable because such development may impact airport operations

13.6. Noise Modelling

Modelling of aircraft noise exposure was carried out using the United States Federal Aviation Administration (FAA) approved Integrated Noise Model (INM Version 7.0d). This internationally-recognised, computer-based noise simulation model calculates contours from an analysis of the contribution the various defined aircraft and their operations have on the overall noise emissions from the airport.

The resulting noise footprint can then be used to assess the relative noise exposure that different aircraft fleets and/or operational procedures have on the surrounding environs. The INM model contains a database of civil passenger and military aircraft along with their performance and typical noise characteristics.

The preparation of ANEFs is transitioning from INM to the Aviation Environmental Design Tool (AEDT) software, which is also developed by the US Federal Aviation Administration. The ANEF prepared for the next Adelaide Airport Master Plan will be prepared using AEDT.

AIRCRAFT CATEGORY	AIRCRAFT TYPE (FLEET MIX)	ULTIMATE CAPACITY TOTAL MOVEMENTS ANEF
Large Jets	Boeing 777-300 ER	17,643
	Boeing 787-8	18,473
	Airbus 350 - 900	3,727
Medium Jets	Boeing 717-200	3,575
	Airbus 330 Neo	12,553
	Boeing 737-8 MAX	68,387
	Fokker 100	2,049
	British Aerospace 146	1,352
	Airbus 320 Neo	29,126
	FA18 Hornet Fighter Jet	28
Small Turbo Prop and General Aviation	Bombardier Dash 8	25,700
	SAAB 340 B	9,733
	Cessna 208	4,704
	Cessna 441	17,221
	Beech Baron EC58P	3,458
	Single engine variable pitch propeller and/or turbine aircraft	15,267
Helicopters	Eurocopter EC130B4	1,184
	Bell 430	5,582
TOTAL MOVEMENTS		***239,762***

Table 13-3: Aircraft Movement Numbers Used in Noise Modelling

13.6.1. Methodology

Aircraft noise exposure was modelled for two scenarios:

- 2018 actual movements (ANEI)
- Ultimate capacity of existing runway system (ANEF)

Based on the forecast movement numbers provided in Chapter 6, it is estimated that the practical capacity of the existing runway system would be reached well beyond the 20-year planning horizon of this Master Plan and relies on no changes to current air traffic control procedures or other air traffic management practices or satellite-based technologies that could extend this estimate. Hence the estimate for when the airport will reach existing runway capacity is considered a conservative one.

13.6.2. Flight Movements

The forecast number of flights operating from Adelaide Airport in the future is outlined in Chapter 6. The number of flights used in the aircraft noise modelling was based on the central forecast scenario. The estimated aircraft movement numbers for each aircraft type are provided in Table 13-3.

13.6.3. Fleet Mix

The fleet mix of aircraft operating from Adelaide Airport 20 years or more into the future cannot be defined accurately. At best, the mix of aircraft using the airport in the future can be inferred from current fleet mixes and discussions on the intentions of major airlines regarding future purchases and operational arrangements. Major manufacturers of aircraft also provide notification of new aircraft likely to enter the world's fleet in the next 20 years.

The expected fleet mix for international, domestic, regional and general aviation that was used for the modelling is provided in Table 13-3, and generally reflects the current fleet mix types. However, the modelling has included newer aircraft types that do not presently fly into Adelaide on a regular basis. These include the Airbus A320 Neo and the Boeing B787 which have commenced service in Australia.

The proposed fleet mix also includes aircraft types such as the Airbus A350 (which has recently commenced regular flights to Adelaide by two airlines); new-generation variations of the Boeing B737 type aircraft that have recently entered service; and some future aircraft anticipated to enter service in the next decade (these include the Boeing B777X and the Boeing B797 type aircraft).

The inclusion of these newer aircraft into the aircraft noise modelling will see a more conservative noise contour in the shorter term.

13.6.4. Runway Utilisation

The choice of runway can also be influenced by aircraft type, as the larger aircraft can only use the main runway while smaller aircraft have more options available. Operational rules may also be imposed to limit the number of flights on runways that have greater impacts on noise (as a standard noise-abatement procedure).

Runway usage for the noise modelling was based on analysis of the 2018 Adelaide radar data provided by Airservices. The allocations were made onto the existing runway layout.

Runway allocations were also made recognising the existing curfew requirements and the existing noise-abatement procedures.

13.6.5. Flight Paths

The Airports Act requires a Master Plan to include the current and future flight paths for an airport.

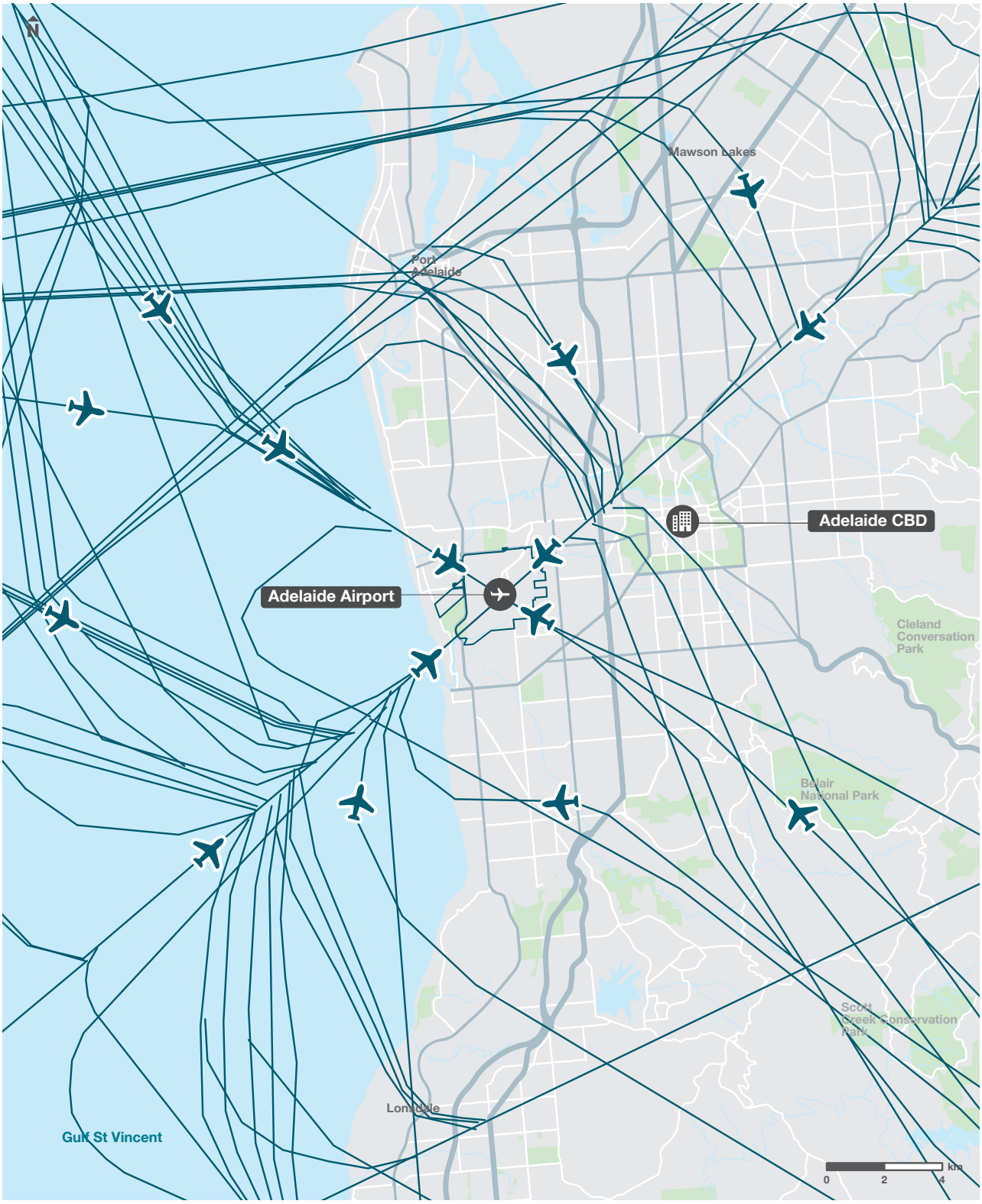
Aircraft generally fly along flight paths following navigational procedures which have been designed to guide the aircraft between waypoints either away from, or towards, an airport.

The flight paths used for future noise modelling were developed through a detailed analysis of radar flight-track data provided by Airservices, which show the actual tracks that aircraft have flown. These flight paths were verified by Airservices.

There is always some variation in the actual tracks flown by aircraft. To account for this variation, flight paths are illustrated as an indication of the spread of flight tracks. The flight paths are densest in the centre, where most aircraft are expected to fly.

There have been very few changes to published flight paths since the Master Plan 2014. Airservices has introduced Required Navigational Procedures (RNP), which were specifically designed to align with existing flight paths, and there has also been a realignment of non-jet (i.e. turbo propeller aircraft) flight paths which were moved to align with the existing jet flight paths.

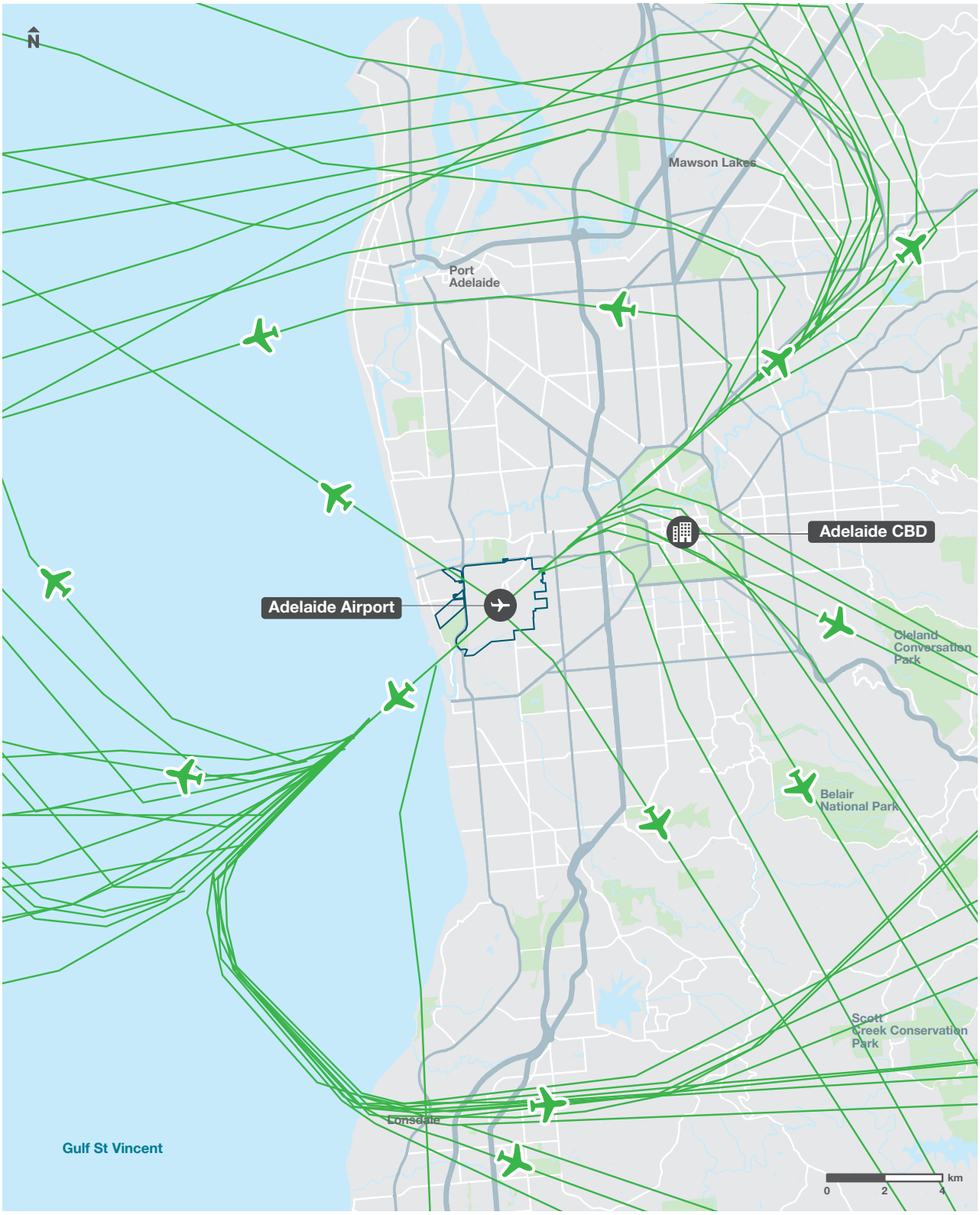
Maps showing the general placement of designed flight paths are shown in Figure 13-1 and Figure 13-2. Helicopter flight paths are shown in Figure 13-3. These flight paths reflect the current operating procedures designed by Airservices.



LEGEND

- Airport Boundary
- Parks, Forests and Reserves
- Watercourses
- Major Transport Routes
- Local Roads
- Direction of Aircraft Travel (Arrivals)
- Arrivals Flight Paths

Figure 13-1: Arrival Flight Paths



LEGEND

- Airport Boundary
- Parks, Forests and Reserves
- Watercourses
- Major Transport Routes
- Local Roads
- Direction of Aircraft Travel (Departures)
- Departure Flight Paths

Figure 13-2: Departure Flight Paths

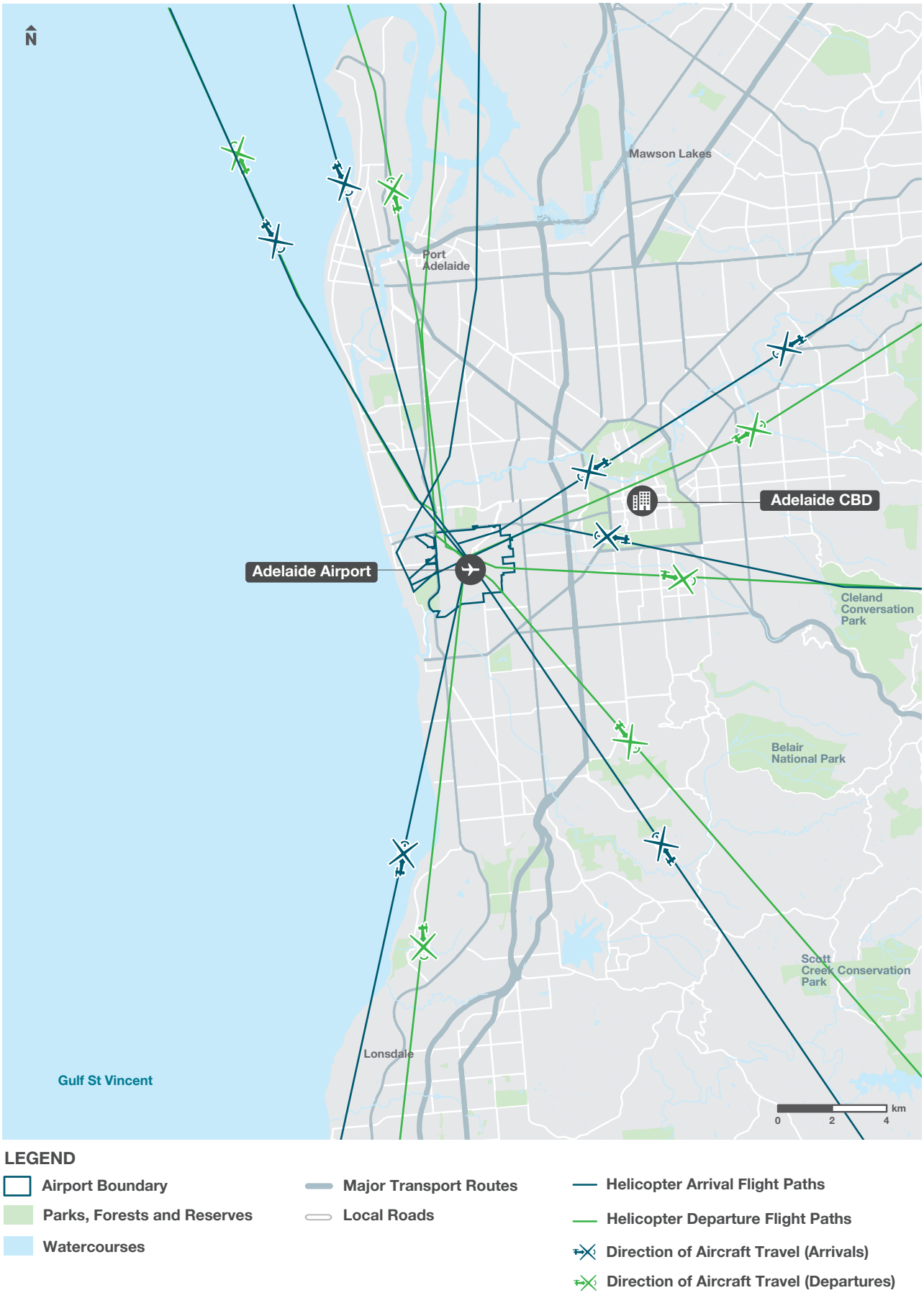


Figure 13-3: Helicopter Flight Paths

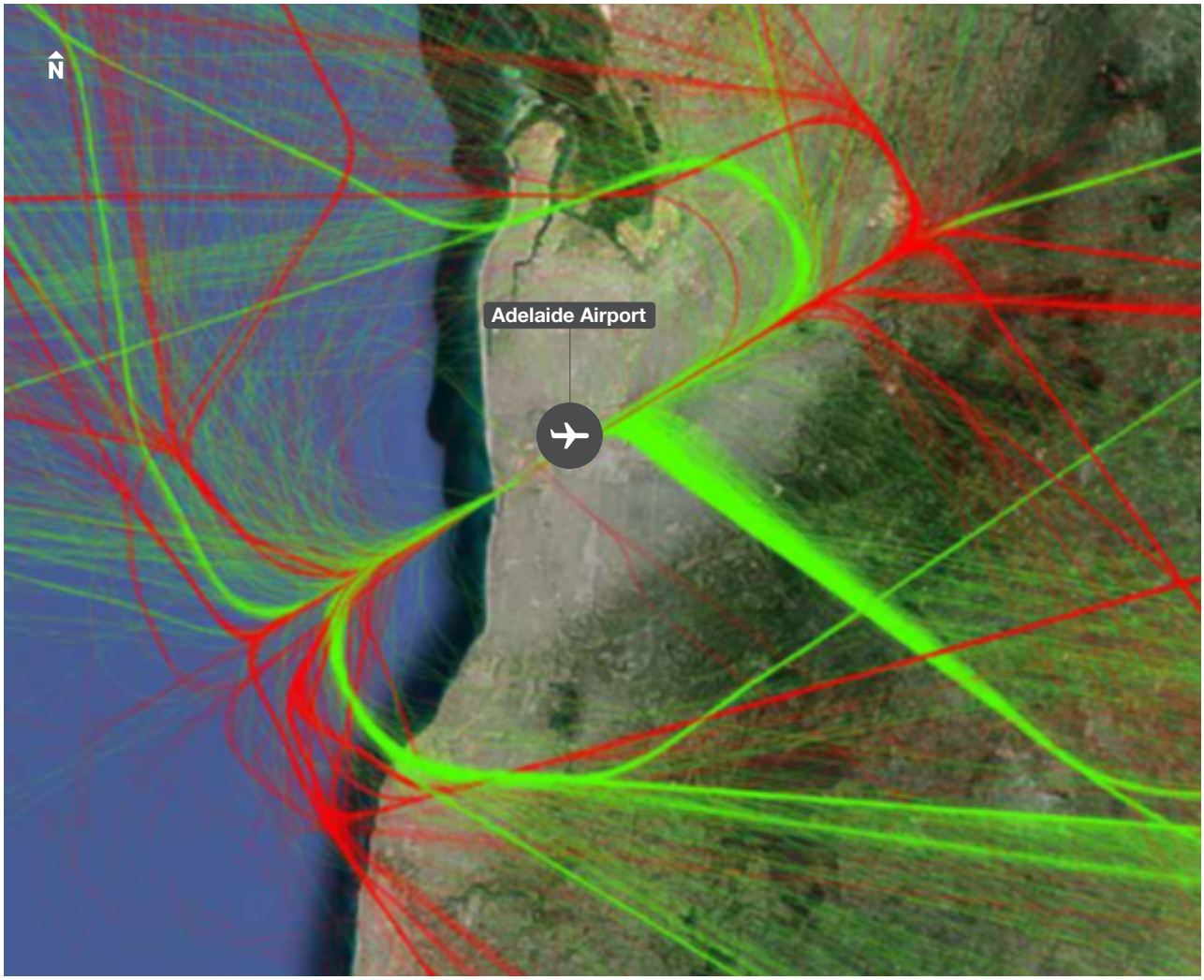


Figure 13-4: January 2018 Jet Aircraft Tracks Source: Airservices Australia

Flight tracks show the actual routes flown by aircraft. The flight tracks of all jet aircraft movements in January 2018, based on Airservices radar track data, is shown in Figure 13-5. (green represents departure tracks and red represents arrival tracks).

The actual flight tracks flown generally follow the designed flight paths. Non-jet tracks (turbo-propeller, piston-engine aircraft and helicopters) arrive and depart Adelaide Airport on more spread-out flight tracks. For safety and operational reasons, these aircraft may be directed by Airservices to operate outside of the published flight paths.

Weather conditions and seasonal shifts in prevailing wind directions will generally determine which runway end is being used for aircraft arrivals and departures, and therefore which flight paths are being used at a given time.

As an example, a comparison of departures in January 2018 and August 2018 is shown in Table 13-4 and identifies the difference in the main runway direction use. Figure 13-5 also shows a comparison of departures between January and August 2018.

Similarly, comparison of arrivals in January and August 2018 shows the variation in runway direction use (refer to Table 13-5 and Figure 13-6).

DEPARTURES	MAIN RUNWAY 23	MAIN RUNWAY 05
January 2018	33-40%	10%
August 2018	23%	28%

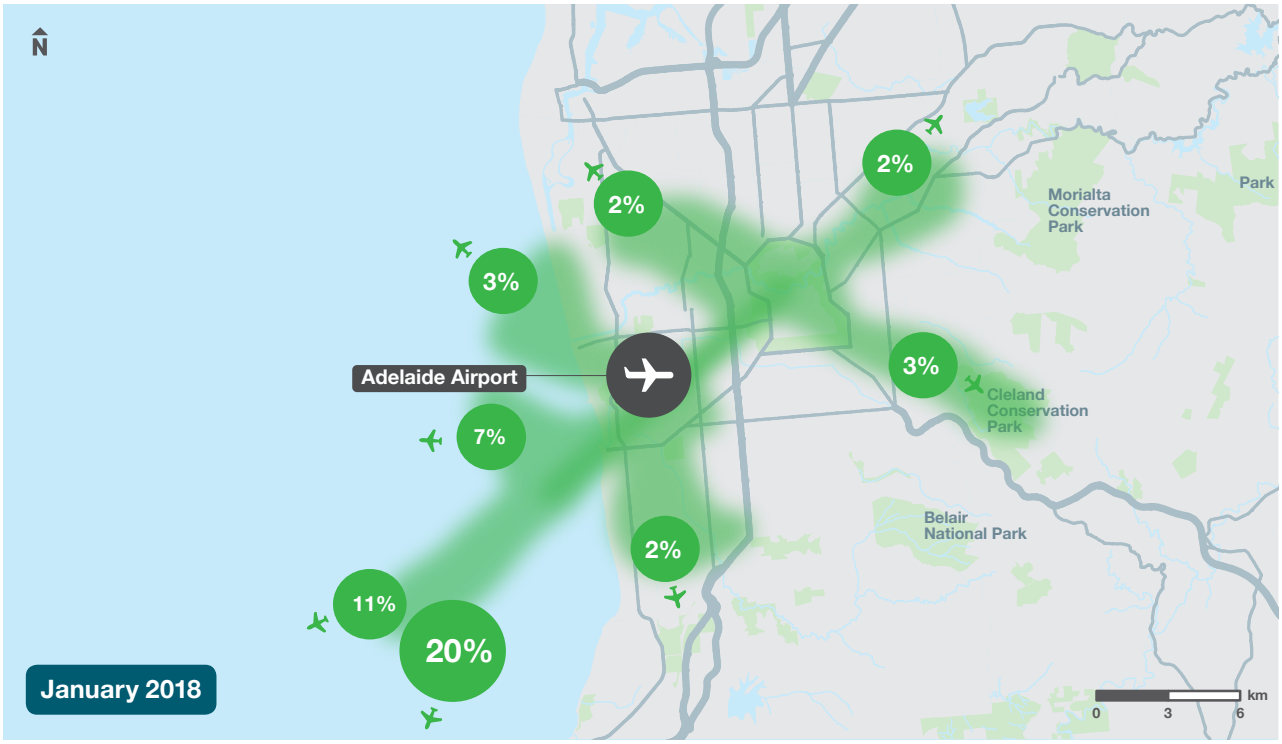
Table 13-4: Main Departure Runway Usage January and August 2018

Source: Airservices Australia

ARRIVALS	MAIN RUNWAY 23	MAIN RUNWAY 05
January 2018	40%	8%
August 2018	23-29%	21%

Table 13-5: Arrivals Runway Usage January and August 2018

Source: Airservices Australia



LEGEND

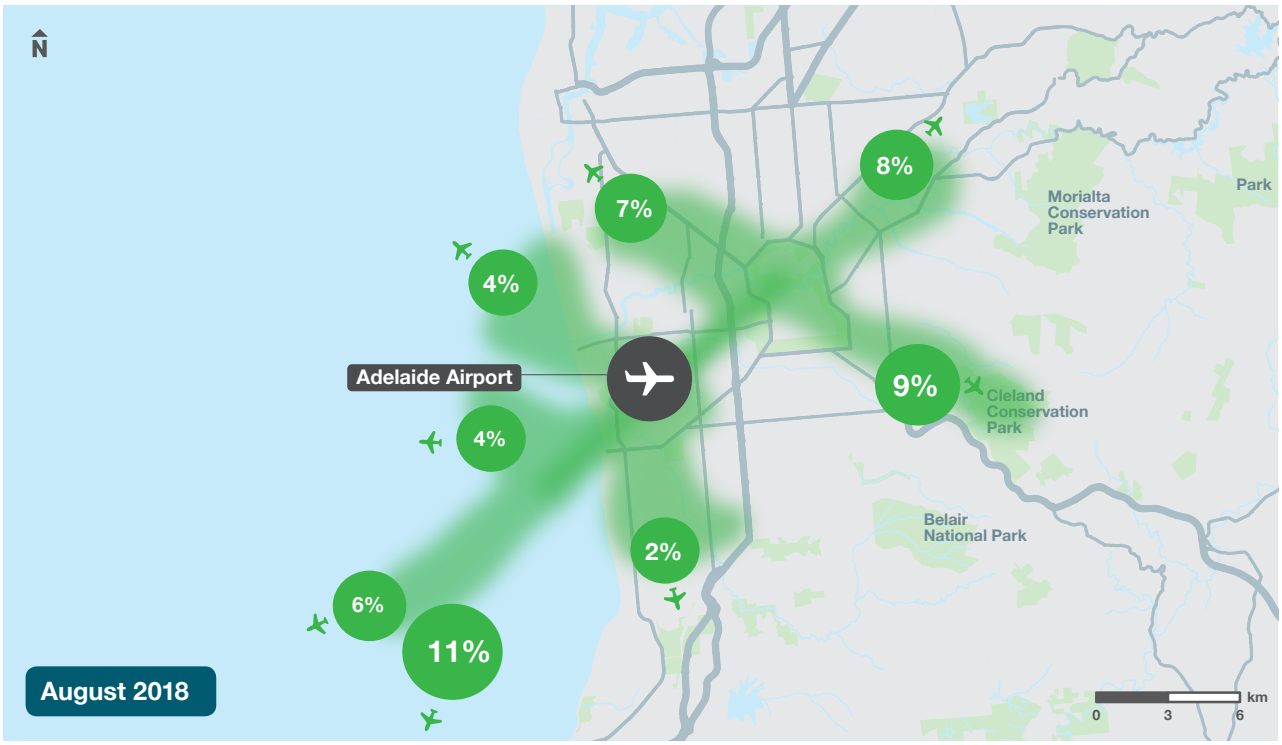
Runways

Major Transport Routes

Parks, Forests and Reserves

Watercourses

Departures



LEGEND

Runways

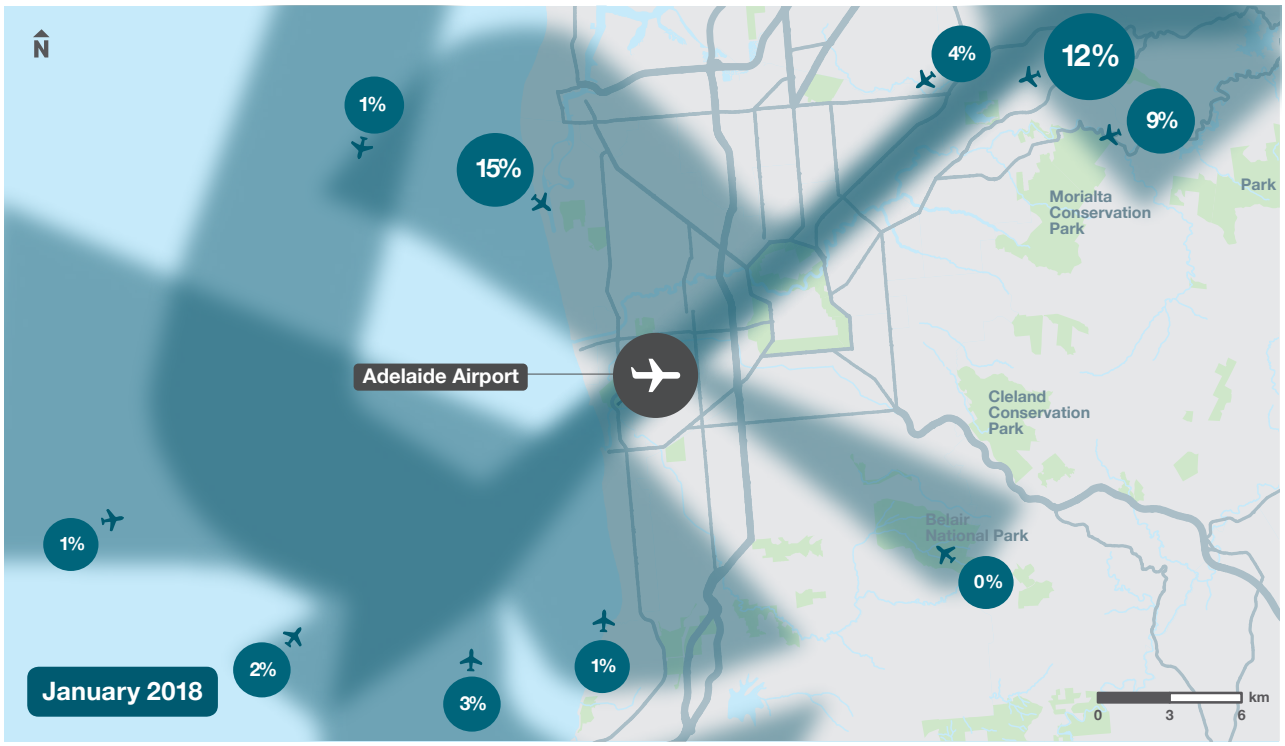
Major Transport Routes

Parks, Forests and Reserves

Watercourses

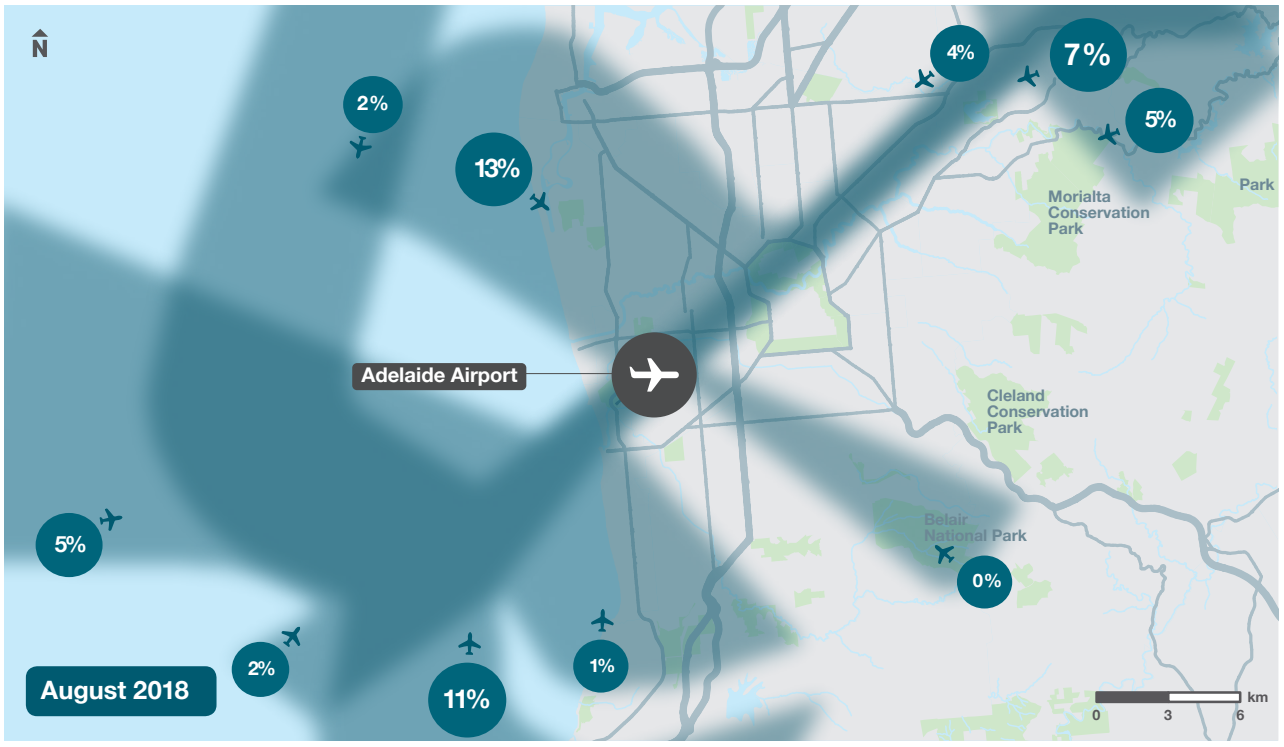
Departures

Figure 13-5: Comparison of Flight Path Usage for Departures Between January and August 2018



LEGEND

Runways
Major Transport Routes
Parks, Forests and Reserves
Watercourses
Arrivals



LEGEND

Runways
Major Transport Routes
Parks, Forests and Reserves
Watercourses
Arrivals

Figure 13-6: *Comparison of Flight Path Usage for Arrivals Between January and August 2018*

13.7. Noise Modelling Outputs

13.7.1. Australian Noise Exposure Index (ANEI)

The ANEI for 2018 is shown in Figure 13-8. This is based on the actual numbers and types of aircraft that flew into and out of Adelaide Airport in calendar year 2018. The ANEI includes some newer more advanced aircraft types that have recently entered service (both in Adelaide and the rest of the world) such as the Airbus A350 and the Boeing 787.

13.7.2. Existing Runway Capacity Australian Noise Exposure Forecast (ANEF)

The ANEF is modelled for a point in time when the existing airfield infrastructure approaches a theoretical capacity. This is currently estimated to occur when annual movements near 240,000 aircraft movements per year and is shown in Figure 13-9. It is based on a scaling of the forecast numbers and types of aircraft used. This also includes the more advanced aircraft types either just entering service in Australia and the rest of the world; or known future aircraft types that are likely to fly into or out of Adelaide.

The following sections provide detail of the relevant inputs used when developing the ANEI and ANEF. Airservices has formally endorsed the ANEF for technical accuracy.

13.7.3. Frequency-Based Noise Charts

The ANEF system in conjunction with *Australian Standard AS 2021-2015 Acoustics – Aircraft Noise Intrusion – Building Siting and Construction (AS2021)* is used by Local and State governments for land-use planning purposes around airports, particularly in relation to development suitability and sound-insulation requirements.

The Commonwealth Government has recognised the limitations of the ANEF system for communicating aircraft noise exposure to the community and recommended additional metrics to describe current and future aircraft noise exposure.

A widely-used metric is the numbers above modelling. This displays the number of aircraft noise events greater than a specified decibel level that can be expected on an average day.

N70 modelling provides maps of areas that are likely to experience a predicted number of average daily noise events above 70 decibels (dB) from aircraft flying overhead. An aircraft noise level of 70 dB outdoors is expected to be attenuated by 10 dB in a house with open windows (in accordance with AS2021). A noise event of 60 dB inside a house could interfere with a normal conversation or with listening to television.

Two to three decibels is the minimum change in sound level that most people can detect, while every 10 dB decrease in sound level is perceived as a halving of loudness.

Typical noise levels are shown in Figure 13-7.

An N70 map for the area around Adelaide Airport in 2018 is shown in Figure 13-10. Additionally, an N70 map for when the existing runway system reaches capacity is shown in Figure 13-11.

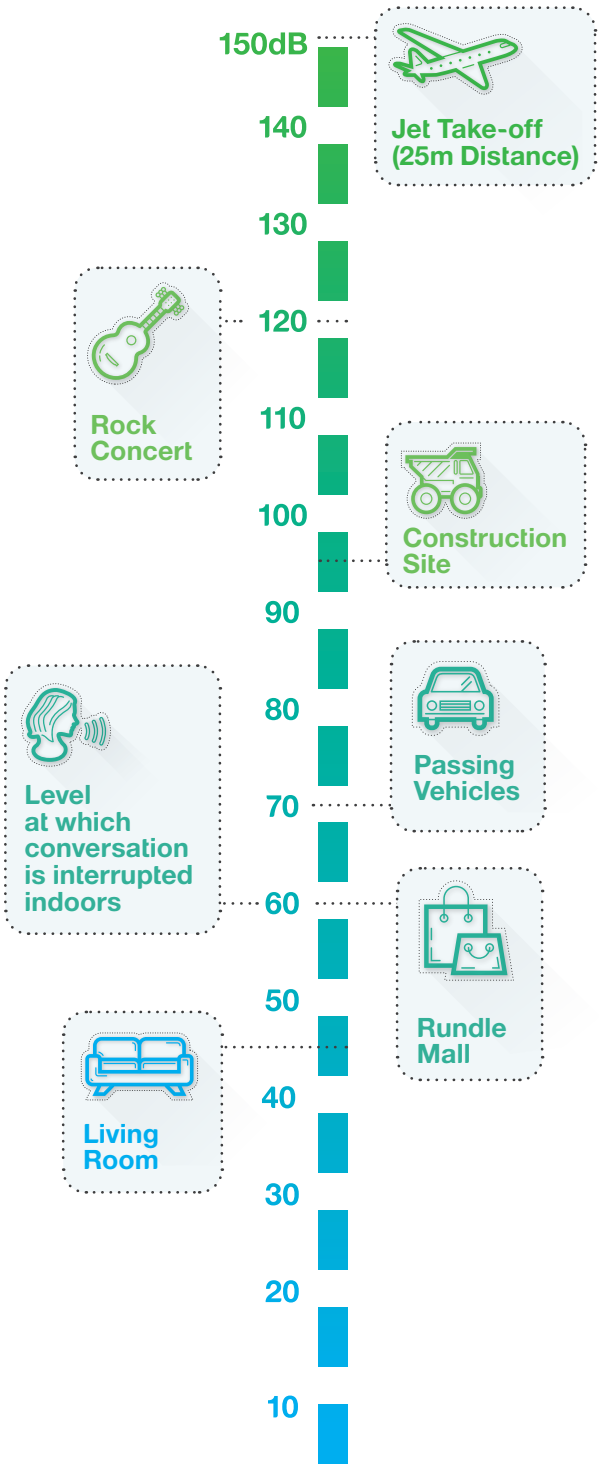


Figure 13-7: Example Noise Levels (in decibels)

Source: Airservices Australia and Australian Airports Association

13.7.4. Assessment of Changes

The ANEI chart shown in Figure 13-7 provides an estimate of the current position of the noise contours around the airport. These contours can be used as a baseline guide in the assessment of future proposed changes to the noise contours in the ANEF chart.

The ANEF, indicate an extension in the area of the contours along the main runway ends (Runways 05 and 23) compared to their present position in the ANEI. The reasons for the extensions are mainly due to two factors. Firstly, since the last Master Plan in 2014, Airservices has ceased using 'land and hold short operations' (LAHSO) on the cross runway 12/30. This change has resulted in a large number of cross runway operations being transferred to the main runway 05/23. Secondly, there has been an increase in the forecast numbers of international and domestic movements of larger types of aircraft using the main runways. The forecast increases in domestic and international passengers, coupled with the trend for airlines to service routes with larger and more fuel-efficient aircraft, mean that the number of movements will not increase significantly but the number of larger and slightly noisier aircraft will increase.

In terms of ANEF contours, the 35-ANEF contour extends outside the airport boundaries and just crosses Marion Road. The 30-ANEF contour extends further to the north-east and just reaches Henley Beach Road. The 25-ANEF contour extends north-east and extends across Wellington Square in North Adelaide. To the south-west, the 25-ANEF contour extends over an area of residential land in North Glenelg and the 30 ANEF contour also passes over some residential properties in this area. The 35-ANEF contour is generally restricted to airport land, public open space and the Glenelg Sewage Treatment Plan.

Adelaide Airport continues to work with all levels of Government, airlines and community to effectively manage aircraft noise exposure with particular focus on houses within the 30 contour.

LEGEND

- Airport Boundary
- Freehold Land
- Existing Runway
- Helipad West
- Parks and Reserves
- Watercourses
- Major Transport Routes
- Local Roads
- ANEI 40
- ANEI 35
- ANEI 30
- ANEI 25
- ANEI 20

Figure 13-8: Australian Noise Exposure Index 2018

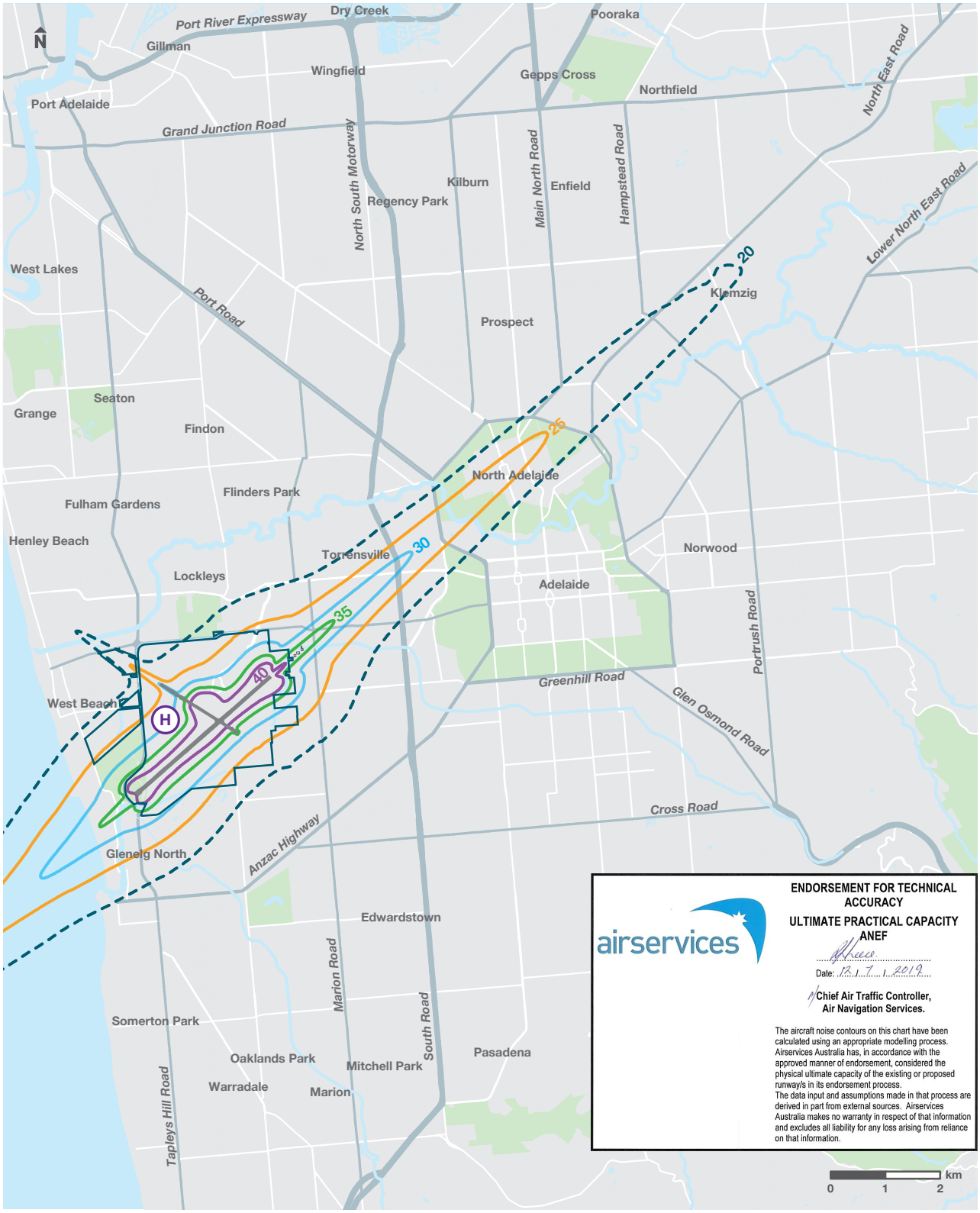


Figure 13-9: *Adelaide Airport Australian Noise Exposure Forecast*

Figure 13-10: *N70 Contours for 2018*

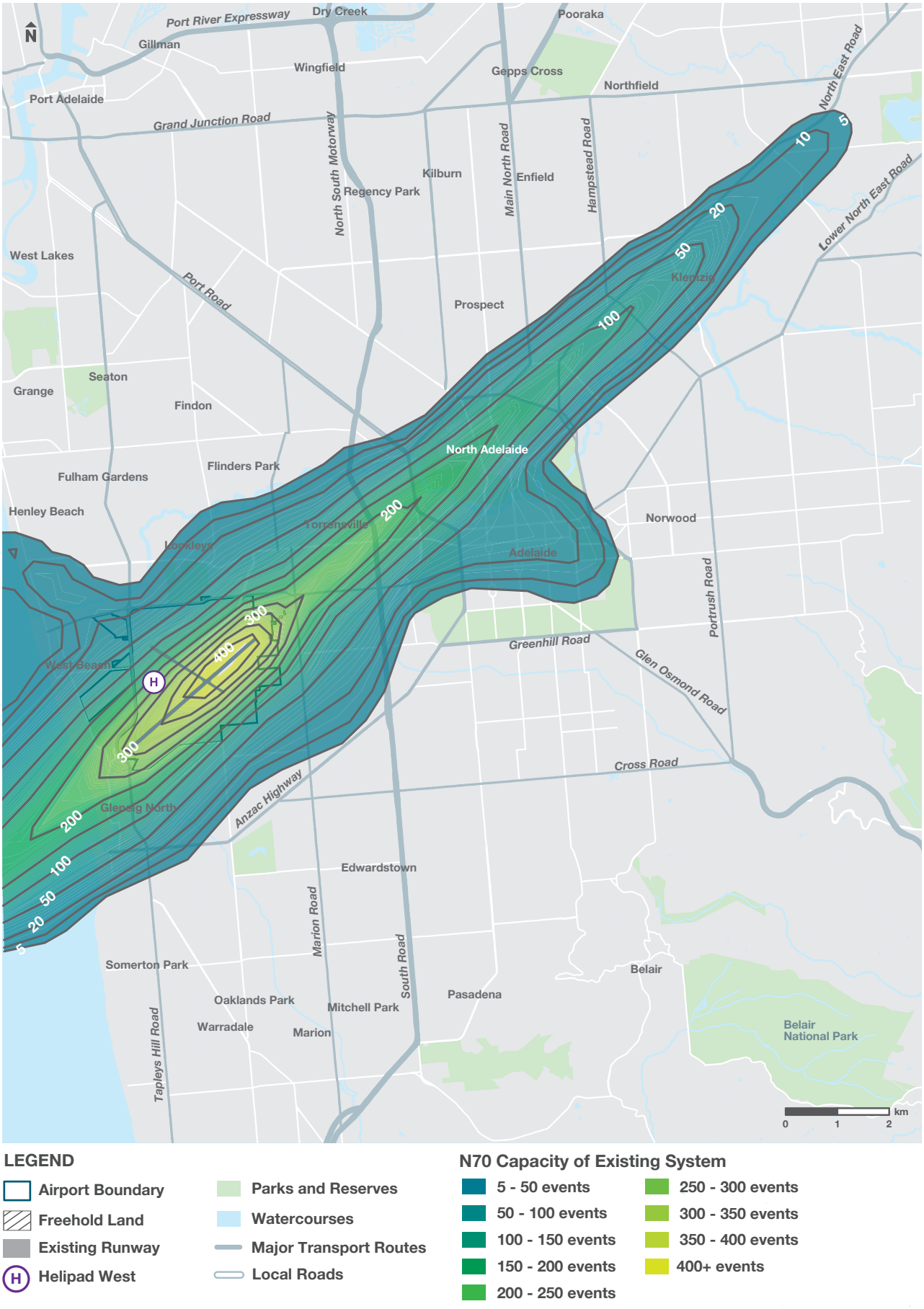


Figure 13-11: *N70 Contours – Maximum Capacity of the Existing Runway System*

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