Perth Airport | New Runway Project

New Runway Project

FINAL
MAJOR DEVELOPMENT PLAN

EXECUTIVE SUMMARY
FEBRUARY 2021

New Runway Project

FINAL
MAJOR DEVELOPMENT PLAN

EXECUTIVE SUMMARY

The Major Development Plan for the New Runway Project is presented in four volumes:

- Executive Summary – this volume
- Volume A: Background and Need (Sections 1-7)
- Volume B: Environment, Heritage and Traffic Assessment (Sections 8-18)
- Volume C: Airspace Management Plan (Sections 19-26)

This Major Development Plan for the New Runway Project has been prepared by Perth Airport Pty Ltd (Perth Airport) (ABN 24 077 153 130) to satisfy the requirements of the *Airports Act 1996* (Cth).

While all care has been taken in the preparation of this Major Development Plan for the New Runway Project:

- it is based on certain forecasts and assumptions, and Perth Airport makes no claim as to the accuracy or completeness of any of the information or the likelihood of any future matter,
- it should not be relied upon by any other party for any purpose,
- it does not commit Perth Airport to any particular development, and
- Perth Airport accepts no liability whatsoever to any person who in anyway relies on any information in this Major Development Plan for the New Runway Project (including making any decision about development or any other activity on or off Perth Airport).

ACKNOWLEDGEMENT OF COUNTRY

Hello, this is Whadjuk Country! Perth Airport operates on the traditional lands of the Whadjuk people of the Noongar Nation. We respect their ongoing cultural connection to this region. We value the insights and guidance of the Noongar signatories to the Perth Airport Partnership Agreement, as we work together to preserve and honour this connection.

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Safe, reliable, convenient and affordable air services are vital to the economic, cultural and social development of Western Australia. Perth Airport operates 24 hours a day, seven days a week, and is one of the most important infrastructure facilities in the State, with over 90 per cent of visitors entering or departing Western Australia through Perth Airport.

Perth Airport is operated by Perth Airport Pty Ltd. In 1997, the operation and management of Perth Airport was transferred from the Commonwealth of Australia to Westralia Airports Corporation under a 50-year lease with a 49-year option for extension. In 2011, Westralia Airports Corporation changed its trading name to Perth Airport Pty Ltd. A breakdown of the shareholder representation highlights that superannuation funds make up over 50 per cent of the ownership.

With this ownership structure it means that Perth Airport privately funds infrastructure development and maintenance investment through a mix of equity and debt from banks and capital markets.

In May 2008, Perth Airport released its 'Vision for the Future' which, through a staged major redevelopment, would see all commercial air services consolidated into new facilities around the site of the existing T1 International terminal within the Airport Central Precinct. Perth Airport fully committed to the first stage of consolidation with a privately funded investment program worth more than $1 billion, including 92 projects each valued over $5 million.

Included in this program of works was significant airfield infrastructure projects. $250 million was invested in new taxiways, taxiway widening, enhanced lighting and approach equipment as well as runway overlays.

Perth Airport is currently preparing for a $2.5 billion investment program over the next decade to support consolidation. Key projects include:

- expansion of international facilities via the International Terminal Upgrade Project,
- consolidation of the Qantas Group to Airport Central, and
- construction of the new runway.

This Major Development Plan (MDP) outlines the case for the construction and operation of a new runway, referred to as the New Runway Project (NRP), at Perth Airport. The MDP is presented in accordance with the requirements for a MDP as prescribed by the Commonwealth *Airports Act 1996* (Airports Act) and subsequent assessment of the on-ground environmental impacts under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The MDP has also been prepared to meet the requirements for aviation airspace-management changes under the EPBC Act.

The New Runway Project (NRP) includes:

- construction, including clearing and site preparation, of a new runway up to 3,000 metres long with associated infrastructure, and
- development of an airspace management plan that will cater for the changes to current airspace and flight paths to accommodate operations of the new runway.

To meet future capacity demand, the new runway is expected to be operational between 2023 and 2028, subject to actual demand and a commercial agreement with airlines being reached. To meet this timeframe, Perth Airport is seeking to complete the approvals process for the new runway by 2019 to be ready for the construction and commissioning phase to begin.

The new runway will occupy 293-hectares and will be located parallel to the existing main runway with a two-kilometre separation so that both runways can be used independently.

The need for the new runway was first identified in the 1970's, when a joint Commonwealth and State Government Committee investigated the future aviation requirements for the Perth region. The Committee evaluated options based on the ability of the aerodromes to be a single primary airport site, capable of development to accommodate two widely spaced parallel runways and handed down its final report in 1979.

Following extensive review of the current and proposed airports in the Perth area, the Committee found that after weighing economic and environmental considerations, the existing Perth Airport should continue as the sole primary airport for the Perth Region and plan for a widely spaced parallel runway.

When the preferred new runway location was being considered, land use to the north and south of the airport was primarily agricultural farming land or low-density housing. At the time, this area was more sparsely populated and provided the opportunity for more appropriate development with sympathetic planning. The area immediately to the east of the estate was primarily agricultural land and provided the opportunity to be purchased for the long-term use of the airport.

The preferred location running north/south was first published in the Perth Airport Master Plan 1985 supported by the development of the first Australian Noise Exposure Forecast (ANEF) for Perth Airport. The ANEF set up the planning protection for the new runway to ensure that developments, including residential, considered the aircraft noise exposure of current and future runway usage.

Between 2008 and 2012, Perth Airport saw dramatic and unforecast growth in the number of aircraft arriving and departing at the airport. $250 million was invested up to 2012 in airfield infrastructure to cater for the demand. However, this was not enough to meet the demand and Perth Airport brought forward a comprehensive review of the timing of the planned parallel runway.

In 2013, UK NATS (the UK's air navigation service provider) were engaged by Perth Airport to support Perth Airport and Airservices in developing a Concept of Operations (CONOPS) for a parallel runway system.

The CONOPS study provided a high-level view of the optimal operation of Perth Airport in terms of ground movements and airspace design, focusing on the handling of arrivals, departures and missed approach scenarios. The CONOPS considered the particulars of operations at Perth Airport including fleet mix, destination and origins, and apron locations to maximise efficiency and capacity.

The Master Plan 2014 proposed the construction of the new runway as the preferred option to increase the capacity of Perth Airport and proposed that the new runway was required in the short term.

Following approval of the Master Plan 2014, the Perth Airport Board of Directors approved a $45 million investment in pre-construction activities, including environmental and other approvals, preliminary airspace design and public consultation. In September 2015, Perth Airport appointed a joint venture between Aurecon and AECOM to undertake a preliminary design of the new runway and taxiway infrastructure.

The new runway and associated infrastructure has been designed to minimise or avoid effects on environment and heritage on the airport estate, where reasonably practicable. Extensive technical studies have been undertaken to design, assess and mitigate the effects of the NRP on geology, wetlands and hydrology, flora and fauna, ground-based noise, air quality, visual impact, and aircraft operations. These assessments are outlined in the MDP. The MDP is consistent with the regulatory requirements and is presented as the Major Development Plan for the New Runway Project at Perth Airport.

The development of the NRP will impact some areas of environmental significance. Perth Airport understands and recognises the importance for the new runway development to achieve positive environmental outcomes. However, in developing the NRP site, it is unavoidable that some areas of environmental significance will be affected, mostly through the clearing of land. The specific impacts include clearing of:

- Banksia Woodlands of the Swan Coastal Plain threatened ecological community,
- *Macarthuria keigheryi*,
- *Conospermum undulatum*, and
- Black Cockatoo habitat.

To mitigate these impacts, Perth Airport continues to work with the State Department of Biodiversity, Conservation and Attractions (DBCA), and the Commonwealth Department of Agriculture, Water and Environment (DAWE) to identify suitable offsets, consistent with the Commonwealth's Environmental Offsets Policy (2012).

Munday Swamp is also an important Aboriginal heritage site. Therefore, as part of the planning for the new runway, in 1999 the length of the new runway was shortened and moved further south. More recently the taxiways and associated infrastructure, such as fencing, has also been altered to minimise the impact to the area, although a small part of the swamp will still be unavoidably affected by the new runway.

A draft Airspace Management Plan has also been developed in consultation with Airservices, airlines and the Commonwealth Department of Defence. The draft Airspace Management Plan outlines the indicative flight corridors and airspace architecture required for safe and efficient operations of a parallel runway system. When the new runway opens, exposure to aircraft noise will be unchanged for most metropolitan residents. For some, there will be a reduction while for others there will be new or an increase. Over time, the number of flights will grow over all areas.

The MDP has been prepared to address the various legislative approvals required for a new runway at Perth Airport and provides a combined approvals document to ensure a whole of project is represented.

The NRP MDP is presented in four volumes:

- Executive Summary (this volume)
- Volume A: Background and Need
- Volume B: Environment, Heritage and Traffic Assessment
- Volume C: Airspace Management Plan

This Executive Summary should be read in conjunction with Volume A: Background and Need, Volume B: Environment, Heritage and Traffic Assessment, and Volume C: Airspace Management Plan

Table ES-1 provides details of the content and scope of each of the volume of the MDP.

In accordance with the requirements of a major development plan, under the Airports Act Perth Airport released a Preliminary Draft MDP for 60 business days of public consultation. The public comment period ran from 31 May 2018 to 5pm (WST) 24 August 2018.

Further information on the consultation process is provided in Section 7.

This executive summary document provides an overview of the key findings from the MDP for Perth Airport's NRP.

Detailed information on the impacts and key findings can be found within the relevant Volumes and Sections of the MDP.

Section	Description	Scope
Executive Summary		
Volume A: Background and Need		
01	Introduction	Volume A sets the scene for the project. It describes the background and need for the new runway, alternative options that have been considered, as well as provides a description of the NRP and how it will be constructed.
02	Need for additional capacity	
03	Options and alternatives	
04	Benefits of the New Runway Project at Perth Airport	
05	Consistency with State and Local government planning	
06	Project description and construction	
07	Consultation	
Volume B: Environment, Heritage and Traffic Assessment		
08	Environment, Heritage and Ground Transport Introduction	Volume B describes the initial conditions, impacts and mitigation strategies associated with the on-ground construction and operation activities of the NRP. It also provides details for environment, heritage and traffic management for the project.
09	Geology and soils	
10	Wetlands and hydrology	
11	Flora and vegetation	
12	Fauna	
13	Ground-based noise	
14	Air quality and greenhouse gas (ground)	
15	Landscape and visual	
16	Heritage	
17	Environment and heritage management	
18	Ground transport	
Volume C: Airspace Management Plan		
19	Airspace management plan introduction	Volume C outlines the plan for airspace management. It also describes the impacts and mitigation strategies proposed as a result of the operation of the new runway.
20	Background and existing airspace management	
21	Airspace management plan	
22	Aircraft noise	
23	Air quality and greenhouse gas (air based)	
24	Health	
25	Social	
26	Hazards and risks to airport operations	

Table ES-1 Content and scope of the New Runway Project Major Development Plan
Source: Perth Airport
MDP Reference: Table 1-1


Arrivals
Coral
VOLUNTEER


154
154

A
Background and Need Overview

Volume A of the MDP describes the background and need for the New Runway Project (NRP). It provides a history of Perth Airport and context for the NRP. It outlines the case for requiring additional runway capacity, gives an overview of the legislative framework, alternative options that have been considered, as well as a detailed description of the NRP and how it will be constructed. The volume also outlines the community engagement process undertaken during the public comment period.

Section 1 - Introduction

The Introduction Section introduces Perth Airport and provides an overview of the NRP which will see the construction and operation of a new runway at Perth Airport.

Project Overview

The NRP includes:

- construction, including clearing and site preparation, of a new runway up to 3,000 metres long with associated infrastructure as shown in Figure ES-1, and
- development of an airspace management plan that will cater for the changes to current airspace and flight paths to accommodate operations of the new runway.

Regulatory Framework

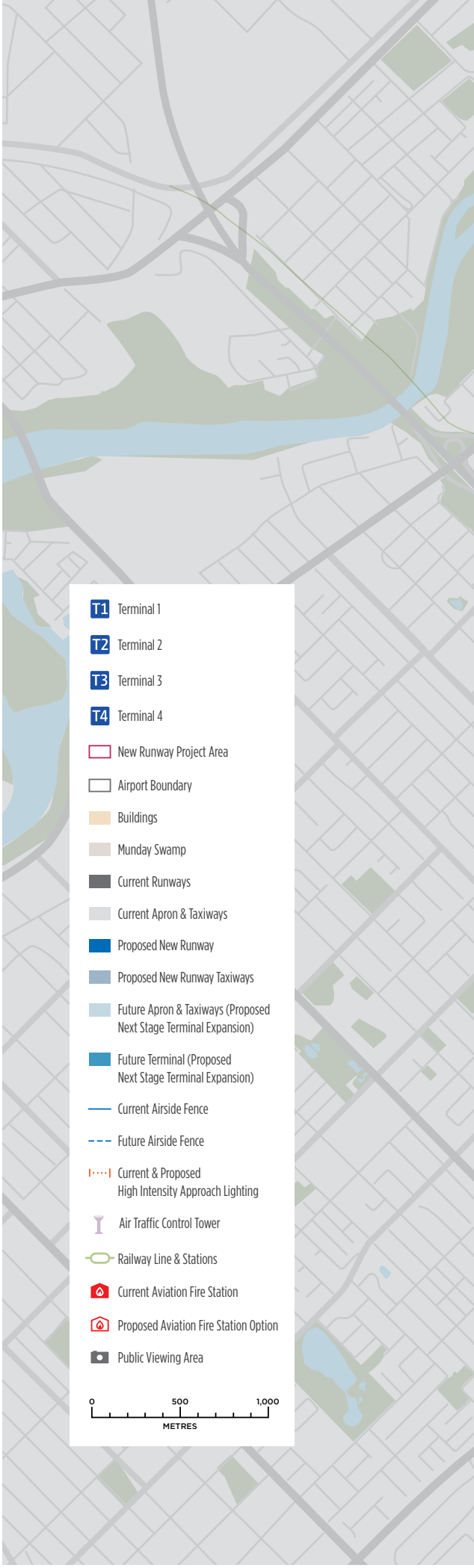
Perth Airport is located on land owned by the Commonwealth of Australia and, although the day to-day management of Perth Airport was privatised in 1997, the Commonwealth Government continues to play an important regulatory and oversight role through the Airports Act and associated regulations. This statutory regime ensures that the public interest is protected.

Perth Airport is governed by Commonwealth legislation and the key legislation applicable to planning, land use, and development of the NRP comprises the:

- *Aboriginal and Torres Strait Islander Heritage Protection Act 1984*,
- *Airports Act 1996* (Airports Act),
- Airports Regulations 1997,
- Airports (Building Control) Regulations 1996,
- Airports (Protection of Airspace) Regulations 1996,
- Airports (Environment Protection) Regulations 1997,
- *Airspace Act 2007*,
- *Aviation Transport Security Act 2004*,
- *Civil Aviation Act 1988*,
- Civil Aviation Regulations 1988,
- Civil Aviation Safety Regulations 1998,
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act),
- Environment Protection and Biodiversity Conservation Regulations 2000, and
- *Native Title Act 1993*.

Although Perth Airport is located on Commonwealth land, State legislation may apply under the provisions of the *Commonwealth Places (Application of Laws) Act 1970*. This is typically for activities for which Commonwealth legislation does not exist, such as for bushfire and Aboriginal heritage management. Where State and Commonwealth legislation conflict, Commonwealth legislation takes precedence. The State legislation relevant to the NRP is the:

- *Aboriginal Heritage Act 1972* (AH Act),
- *Bush Fires Act 1954*, and
- *Dampier to Bunbury Pipeline Act 1997*.



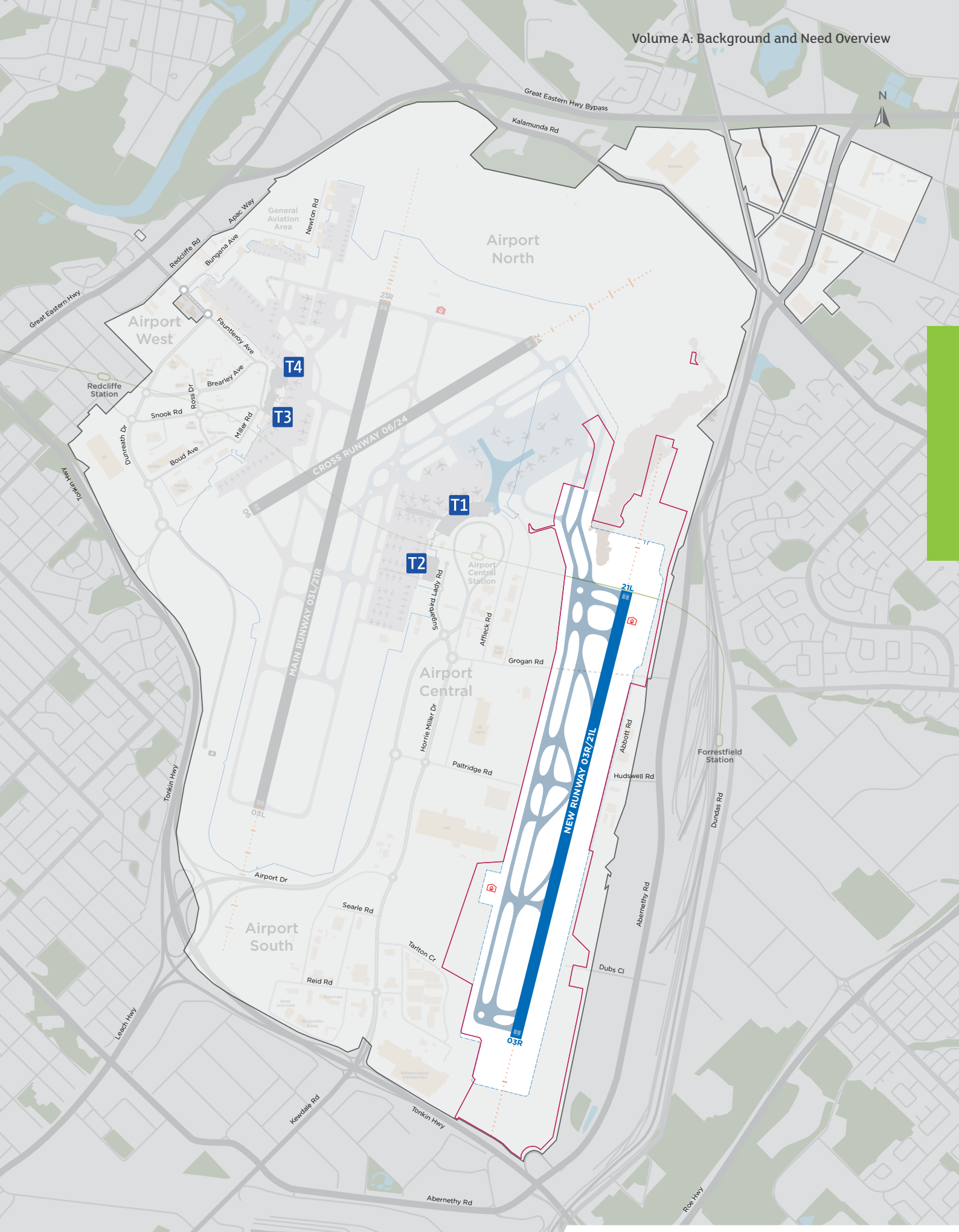


Figure ES-1 New Runway Project location plan
Source: Perth Airport (MDP Reference: Figure 1-1)

Major Development Plan

The MDP has been prepared to address the various legislative approvals required for a new runway at Perth Airport and provides a combined approvals document to ensure a whole of project is represented.

Section 90 of the Airports Act states that an airport-lessee company must not carry out a major airport development unless the development is in accordance with an approved MDP.

An MDP is required for the NRP as it meets criteria defined in Section 89(1)(a) of the Airports Act, being to construct a new runway.

Approval Process

The legislative approvals process for the NRP is shown in Figure ES-2.

A MDP is subject to community consultation, including a 60 business day public comment period and Ministerial approval. Section 91 of the Airports Act requires the major development plan to be consistent with the approved Master Plan.

This MDP details the development of a new runway of up to 3,000 metres in length, consistent with Master Plan 2014, Minor Variation to the Master Plan 2014 and the approved Master Plan 2020.

Perth Airport is also required to obtain a permit under Part 13 of the EPBC Act. Perth Airport is seeking this permit parallel to the MDP process.

Under the AH Act the State Government gave Section 18 approval in May 2018.

Site Context

Perth Airport is the premier international and interstate hub to Western Australia and connects lives, businesses and communities to the world. It operates 24 hours a day, seven days a week, and is a vital public transport infrastructure facility. Perth Airport is located 12 kilometres east of the Perth's Central Business District (CBD) and integrates with other transport infrastructure including the Kewdale rail freight facility, major highway networks and, via these roads, the port of Fremantle.

The relative isolation of Perth as an Australian capital city and the vast distances between major population centres makes air travel and Perth Airport indispensable to the people of Western Australia and to the State's economic, social and cultural development. Perth Airport is both the primary airport in Western Australia and the hub through which nearly all regional aviation is serviced.

The new runway will occupy 293-hectares and will be located parallel to the existing main runway with a two-kilometre separation so that both runways can be used independently.

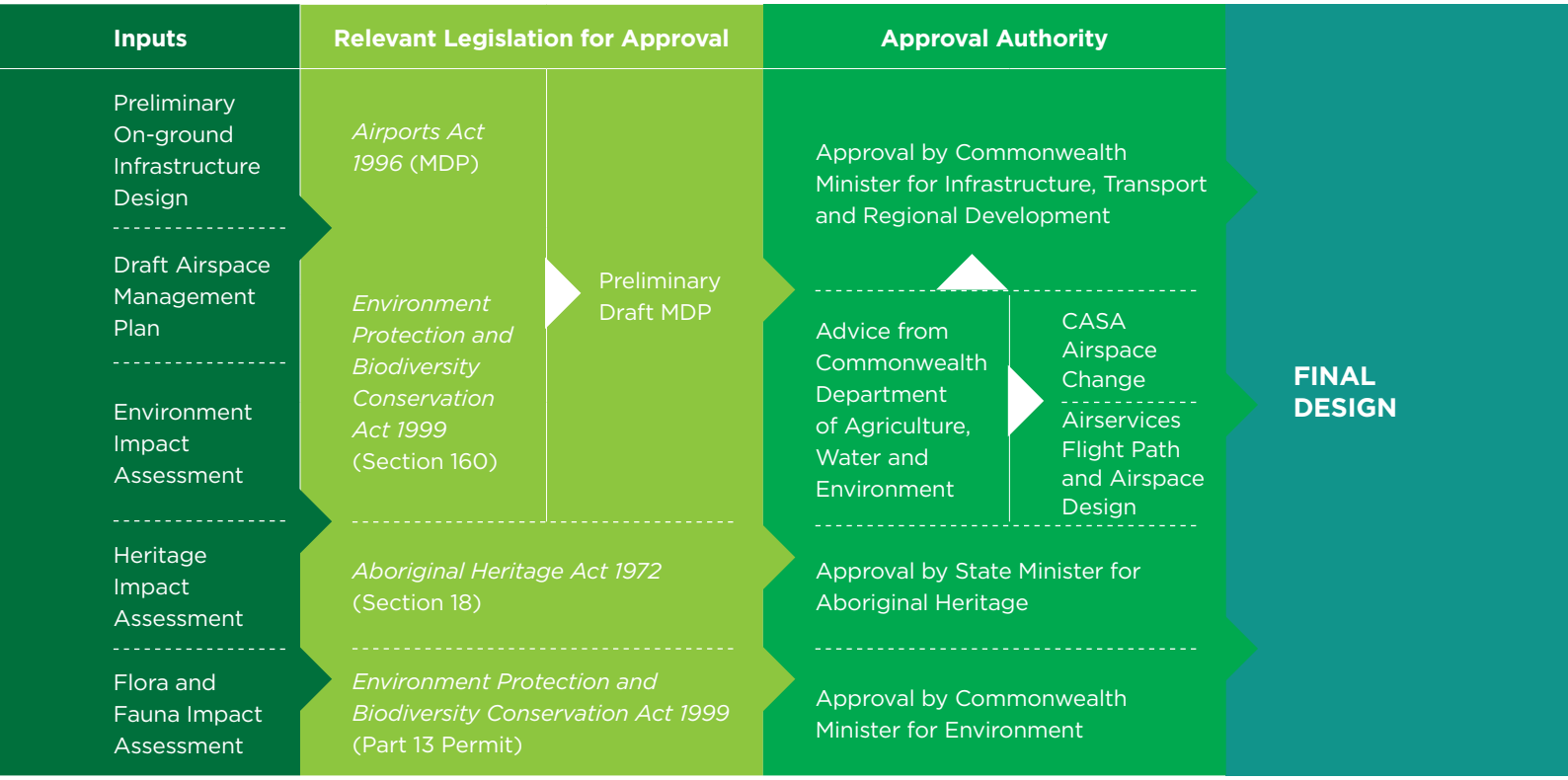


Figure ES-2 Legislative approvals process for the New Runway Project
Source: Perth Airport (MDP Reference: Figure 1-2)

Perth Airport Operations

The main responsibilities of Perth Airport, as the airport operator, are:

- to provide and maintain aerodrome infrastructure for safe and secure operations,
- to provide airfield, terminal and other asset management and maintenance, including infrastructure for power, water, sewerage, drainage and communications services,
- future planning, development and administration of the estate,
- commercial development, including retail tenancy management, and
- overall environmental management of the estate.

The estate covers an area of approximately 2,105 hectares and currently comprises four terminals (T1, T2, T3 and T4) as well as a general aviation area. These terminals are supported by two intersecting runways and associated infrastructure. The main runway (03L/21R) is 3,444 metres long with a north-south orientation. The cross runway (06/24) is 2,163 metres long with a northeast-southwest orientation.

As shown in Figure ES-3, Perth Airport operates 24 hours, seven days a week, providing an essential link for business and leisure travel, and meeting the needs of:

- regional communities and the resource sector,
- interstate domestic travel,
- international access to multiple global destinations, and
- freight, including express and time critical supplies.

Maintaining operational flexibility is critical to supporting Western Australia's economy. Perth Airport is part of a national and global aviation network and, as such, flight times and schedules are not determined locally. The viability of many of Perth's international air services depend on linking with connecting networks through hub airports, such as Dubai and Singapore. Any restrictions on the operations of Perth Airport would lead to a significant loss of air services, which may result in a reduction of service levels and a likely increase in the cost of flying for community members and businesses.

A study completed in 2015, found that without operational restrictions between the hours of 11.00 pm and 6.00 am over a 25-year horizon, Perth Airport operations would account for $43.4 billion in Gross Domestic Product (GDP), and approximately 19,000 jobs in Perth and 26,900 jobs across Western Australia.

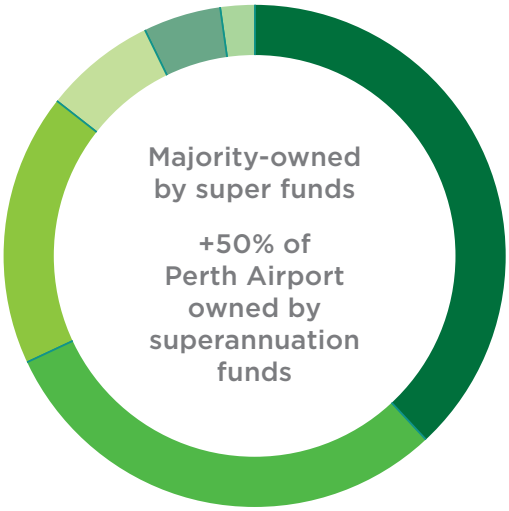
Perth Airport acknowledges that there are communities which are affected by the 24-hour operation of the airport; however, this impact is balanced against the broader community and economic benefits that arises from providing safe and critical operations.

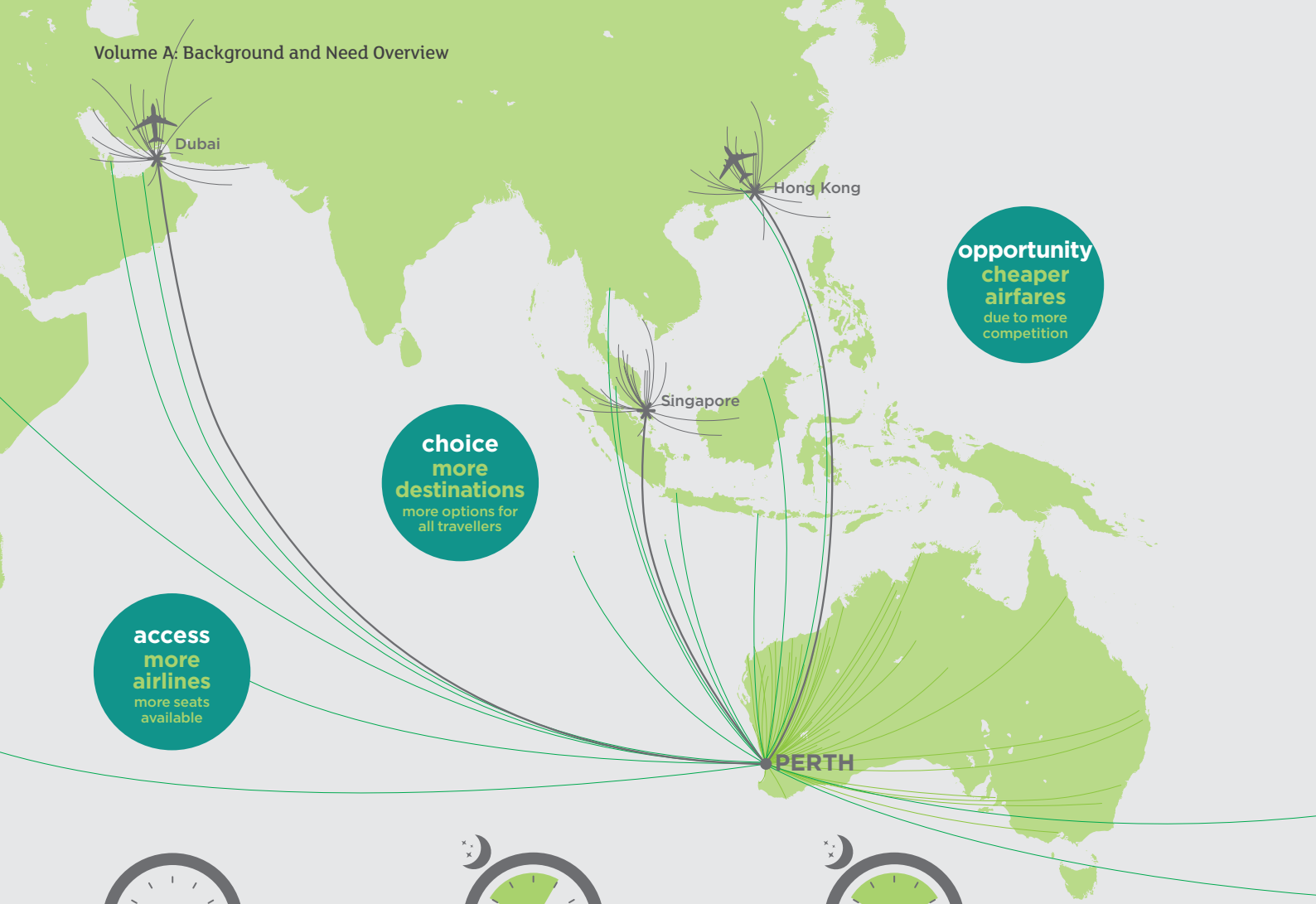
Ownership and Funding

Perth Airport is located on approximately 2,105 hectares of land owned by the Commonwealth of Australia. In 1997, the operation and management of Perth Airport was transferred from the Commonwealth of Australia to Westralia Airports Corporation under a 50-year lease with a 49-year option for extension. In 2011, Westralia Airports Corporation changed its trading name to Perth Airport Pty Ltd. A breakdown of the shareholder representation highlights that superannuation funds make up over 50 per cent of the ownership.

Perth Airport funds infrastructure development and maintenance investment through a mix of equity and debt from banks and capital markets.

Therefore, no Commonwealth or State funding is required for the construction of the new runway.





4.30am – 7.30am
Demand linked to resource sector shifts

10pm – 1am
Interstate nightly services

10pm – 2am
Airline schedules linked to international

INTRASTATE

45.5%
of Australian export income

24%
of traffic is FIFO related

INTERSTATE

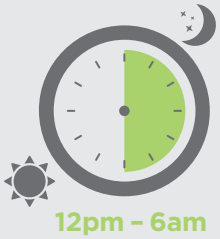
24/7
Due to demand airlines need to use larger aircraft & offer services 24/7

Red-eye special
provides a cheaper alternative

INTERNATIONAL

947,000
International visitors to WA

$2.39b
tourism dollars



12pm – 6am

OVERNIGHT FREIGHT

- Average of 36 tonnes of freight through Perth Airport each evening
- Supports express postage services for online shopping

Figure ES-3 Importance of 24/7 operations at Perth Airport
Source: Perth Airport (MDP Reference: Figure 1-8)

Planning at Perth Airport

Every five years, Perth Airport is required to develop, for public comment, a Master Plan which sets out the framework for development of the estate for a 20-year planning horizon. The Master Plan allows governments, the community and other stakeholders to comment on the way in which the airport intends to grow and develop into the future. It addresses planning issues involving aviation activity, land use and development, environmental management and ground transport access.

New Runway Planning

In 1973, a joint Commonwealth and State Government Committee commenced an investigation into the future aviation requirements for the Perth region. The Committee evaluated options based on the ability of the aerodromes to be a single primary airport site, capable of development to accommodate widely spaced parallel runways and handed down its final report in 1979.

Following extensive review of current and proposed airports in the Perth area, the Committee found that after weighing economic and environmental considerations, the existing Perth Airport should continue as the sole primary airport for the Perth Region and plan for a widely spaces parallel runway.

When the preferred new runway location was being considered, land use to the north and south of the airport was primarily agricultural farming land or low-density housing. At the time, this area was more sparsely populated and provided the opportunity for more appropriate development with sympathetic planning. The area immediately to the east of the estate was primarily agricultural land and provided the opportunity to be purchased for the long-term use of the airport.

The preferred location running north/south was first published in the Perth Airport Master Plan 1985 supported by the development of the first Australian Noise Exposure Forecast (ANEF) for Perth Airport.

Perth Airport Master Plan 2014, which includes the new runway, was approved by the Hon. Warren Truss MHR, (the then) Minister for Infrastructure and Regional Development, on 9 January 2015, with a Minor Variation approved on 15 June 2017. The NRP MDP is consistent with the Master Plan 2014.

Perth Airport Master Plan 2020 was approved in April 2020 and even though this is a more recent Master Plan, the 2014 Master Plan is the basis of this MDP given that the 2014 plan was current during MDP development and public consultation activities. Notwithstanding this, it is worth noting the NRP MDP is also consistent with Master Plan 2020.

Airport Investments

In May 2008, Perth Airport released its 'Vision for the Future' which, through a staged major redevelopment, would see all commercial air services consolidated in new facilities around the site of the existing T1 International terminal within the Airport Central Precinct. Perth Airport fully committed to the first stage of consolidation with a privately funded investment program worth more than $1 billion, including 92 projects each valued over $5 million. Key Projects are shown in Figure ES-4.

Included in this program of works was significant airfield infrastructure projects. $250 million was invested in new taxiways, taxiway widening, enhanced lighting and approach equipment as well as runway overlays.

Project
New Domestic Terminal (T2)

T2, which opened in March 2013 next to T1, marked the first stage of consolidation when Alliance Airlines, Virgin Australia Regional Airlines (formerly Skywest) and Tigerair relocated from Terminal 3 (T3) into T2.

T2 has a gross floor area of approximately 21,500 square metres and aircraft parking for up to 36 aircraft.

VALUE
$121 M

Project
Terminal 1 (T1) International Arrivals Expansion

Transformation of the international arrivals experience, including substantially expanded and enhanced customs, baggage reclaim, biosecurity and duty free retail areas. The first stage opened in November 2013, with full completion in late 2014.

VALUE
$80 M

Project
T1 International Departures Upgrade

Outbound immigration, passenger security screening and retail areas expanded and renewed, with the project completed in 2015.

VALUE
$41 M

Figure ES-4 Capital investment program of major projects at Perth Airport
Source: Perth Airport (MDP Reference: Figure 1-10)

Future of Perth Airport

Perth Airport is currently preparing for a $2.5 billion investment program over the next decade to support consolidation. Key projects include:

- expansion of international facilities
- consolidation of the Qantas Group to Airport Central, and
- construction of the new runway.

Figure ES-5 shows the location of the key new terminal buildings in relation to current terminals in Airport Central.

Figure ES-5 Airport Central concept plan
Source: Perth Airport (MDP Reference: Figure 1-11)

Section 2 - Need for Additional Runway Capacity

The Need for Additional Runway Capacity Section provides detail on the need for the construction and operation of the new runway at Perth Airport.

Passenger and Aircraft Traffic at Perth Airport

Over the past decade, Perth aviation markets have experienced unprecedented growth. This growth has been underpinned by:

- a strong Western Australian economy, substantially contributed to by investment in the resource sector,
- strong commodity prices and Australian dollar,
- increased presence of low-cost carriers both domestically and internationally,
- growing household incomes in Australia and overseas,
- declining real cost of airfares despite high fuel prices, and
- stimulus of domestic capacity increase, with wide-bodied trans-Australia aircraft seats increasing by 61.6 per cent from 2007 to 2017, including a surge of 52.4 per cent between 2011 and 2013.

Total passengers travelling through Perth Airport surged from 6.7 million passengers in 2005 to 14.9 million passengers in 2014. Since the peak in 2014, there has been a slowing in passenger numbers driven by a reduction in intrastate and interstate traffic with 2018 having 14.3 million total passengers.

An aircraft movement is defined as either an aircraft arriving to, or departing from the airport.

In 2005, Perth Airport experienced approximately 86,664 aircraft movements. This grew to its peak in 2013 with 151,335 annual movements. Since this time, aircraft movements have decreased to 129,924 in 2018. Aircraft movements from 2005 to 2018 are shown in Figure ES-6.

Historical trends in aircraft movements can be summarised as follows:

- Western Australia experienced a resource construction boom from 2007 until its peak in 2013, which contributed to significant aircraft movement and passenger growth at Perth Airport. During this period, Perth Airport was the fastest growing airport in Australia with an average annual passenger movement growth rate of 7.5 per cent, nearly twice as much as the next fastest growing airport (Brisbane). At the peak, airlines and passengers were experiencing significant delays which had flow on impact to the many industries and the wider Western Australian economy.
- domestic and general aviation movements have declined since 2013, mostly associated with a slowing of the economy and the Western Australian resource sector. However, this is a normalising of demand when considered in the context of the significant growth experienced between 2003 and 2015 when the Western Australian resource sector was in a strong construction phase, and
- international aircraft movements have shown relatively strong and stable growth with a CAGR of 8.2 per cent for the period 2008 to 2016. International aircraft movements declined in 2015 and 2016 as a result of airlines using larger aircraft. However, aircraft movements have begun to grow again in 2017.

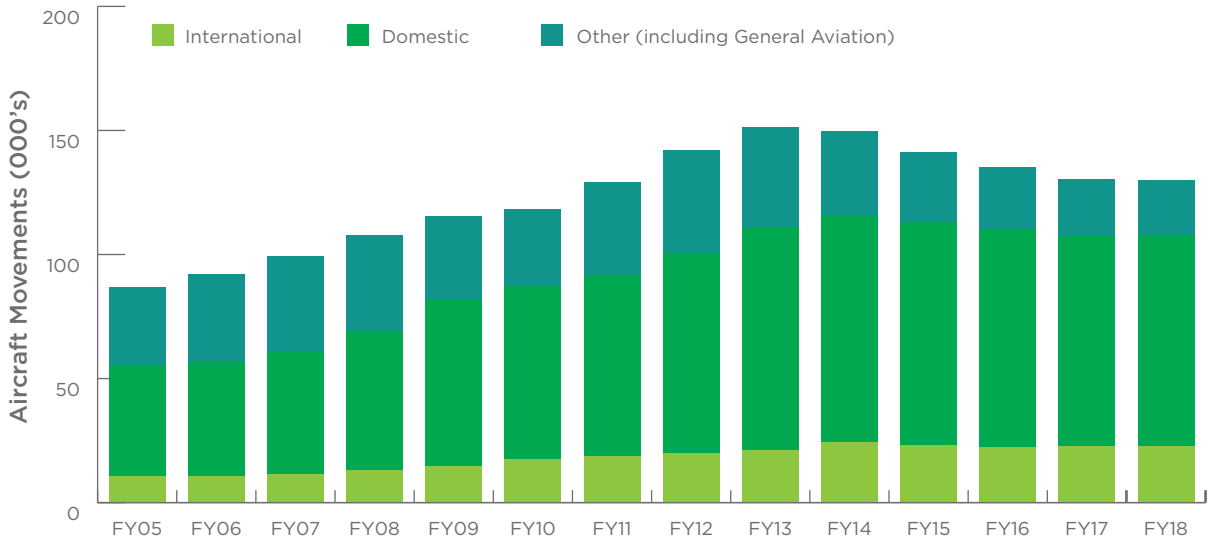


Figure ES-6 Aircraft movements at Perth Airport between 2005 to 2018
Source: Perth Airport (MDP Reference: Figure 2-6)

Forecast Aircraft Movements

In preparing passenger forecasts, Perth Airport develops scenarios for high, central and low passenger and aircraft movement growth.

Perth Airport publishes detailed forecasts every five years as part of the master planning process. Forecasts are also continually reviewed to assist with planning. The information that was used in the NRP technical assessments, and provided in this MDP, is based on forecasts prepared in May 2016 by Tourism Futures International (TFI). TFI is a research-oriented company specialising in aviation, travel and tourism forecasting.

For the purposes of the MDP, Perth Airport has prepared forecasts that extend to 2045.

Passenger forecasts are an important input to the aircraft movement forecasts. For Regular Passenger Transport (RPT) passenger services, airlines accommodate passenger increases through:

- an increase in passenger load per aircraft,
- changes to aircraft types (larger aircraft or increases in seats on existing aircraft types), and
- increases in the frequency of flights.

When developing aircraft movement forecasts the following are considered:

- the history of passenger and aircraft movements - examining the trade-off when passenger numbers increase, between growth in passenger seat factors, increased aircraft size and increased flight frequency,
- aircraft orders by Australia's domestic airlines and by overseas airlines, with anticipated future use of new aircraft types such as the Airbus A320/Airbus A321neo and Boeing 737MAX aircraft (narrow body aircraft mainly for domestic and shorter-haul international use) and the Boeing 787/Airbus A350 aircraft (mainly for international use) along with larger aircraft types such as the Boeing 777 and Airbus A380, and
- the trend for low cost carriers to have higher seat densities (numbers of seats per flight) than the full-service airlines for the same aircraft type.

As a result of these considerations the forecasts have assumed a growth in overall average passengers per movement for international and domestic services which results in aircraft movements growing at a slower rate than passenger numbers.

General aviation aircraft movement forecasts are based on trend analysis in the industry sectors within which these operators contract. Freight and passenger aircraft movement forecasts are combined to produce the total aircraft movements forecast.

Based on a central growth scenario, annual international aircraft movements at Perth Airport are forecast to grow from 22,486 in 2016 to 42,447 in 2045. In the same period, annual domestic aircraft movements (excluding general aviation aircraft) are forecast to grow from 89,485 in 2016 to 157,669 in 2045. Total annual aircraft movements are forecast to grow from 135,220 in 2016 to 241,216 movements in 2045 when you include the forecast 41,100 general aviation and freight movements. This is shown in Table ES-2.

	Actual ('000 movements)									Forecast ('000 movements)		
Financial Year	**2012**	**2013**	**2014**	**2015**	**2016**	**2015**	**2016**	**2017**	**2018**	**2025**	**2030**	**2045**
International	19.8	21.2	24.4	23.0	22.3	22.6	22.8	22.6	22.8	27.7	30.9	42.4
Domestic Total	80.6	89.2	90.9	90.2	87.9	84.8	84.9	84.8	84.9	110.1	123.2	157.7
Freight	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3	1.7	2.1	3.1
General Aviation	40.4	39.5	33.0	26.6	23.8	21.5	21.0	21.5	21.0	32.9	34.9	38
TOTAL	**142.1**	**151.3**	**149.7**	**141.3**	**135.2**	**130.1**	**129.9**	**130.1**	**129.9**	**172**	**191**	**241**

Table ES-2 Perth Airport aircraft movement forecasts central growth
Source: Perth Airport, Tourism Futures International (MDP Reference: Table 2-3)

Demand vs Existing Runway Capacity

Runway capacity is a complex issue that relies on a range of factors and the rules that affect capacity vary from airport to airport and from country to country. The capacity of a runway system is determined by considering several factors during peak periods including:

- the aerodrome reference code, that considers runway length and width,
- runway geometry including the number of runways available for simultaneous use,
- aircraft traffic flow,
- aircraft types that use the airfield, and
- airspace available, which is influenced by proximity to other airports, topography and aircraft noise considerations.

Additional runway capacity is needed when annual movements reach 145,000 movements. Annual aircraft movements peaked in 2013 with 151,335 movements. At this time, significant delays were experienced by airlines and passengers. Although annual aircraft movements have declined since 2012, it's reasonable to expect that the growth in demand could return at the same rate. As such, it is expected that 145,000 movements will be experienced again in the medium term as shown in Figure ES-7.

Due in part to the nature of the resource sector's FIFO workforce deployment, Perth Airport experiences significant peak periods of departures and arrivals demand.

As presented in the Master Plan 2014, the impact of the lack of capacity was being felt by intrastate, interstate and international airlines, and there was substantial evidence that if the capacity existed, airlines would prefer to schedule more services in peak periods. At the time of the Master Plan 2014, the agreed hourly capacity rate for departures was 38. Due to efficiency gains (as discussed in Section 3) a revised rate of 40 departures is now considered the maximum hourly departure capacity. There is no change to the arrivals hourly capacity, which remains at 24 arrivals per hour.

For the winter 2013 season, airlines requested 88 slots in the peak morning departures hours while the declared number of slots available was 78. Figure ES-8 shows winter 2013 departures slot demand for Wednesday, which is typically the busiest day of the week. The demand for arrivals slot filings for the winter 2013 season also exceeded capacity in the morning and afternoon peaks as shown in Figure ES-9. In the rolling interval at 9:30 am, demand exceeded supply by 12 slots. Requests for slots exceeding capacity were for new services, not changes to existing ones.

When the departures and arrivals demand are combined, it is evident that demand exceeded capacity during peak periods of the day. This is particularly evident on the Wednesday, which is typically the busiest day of the week, as shown in Figure ES-10.

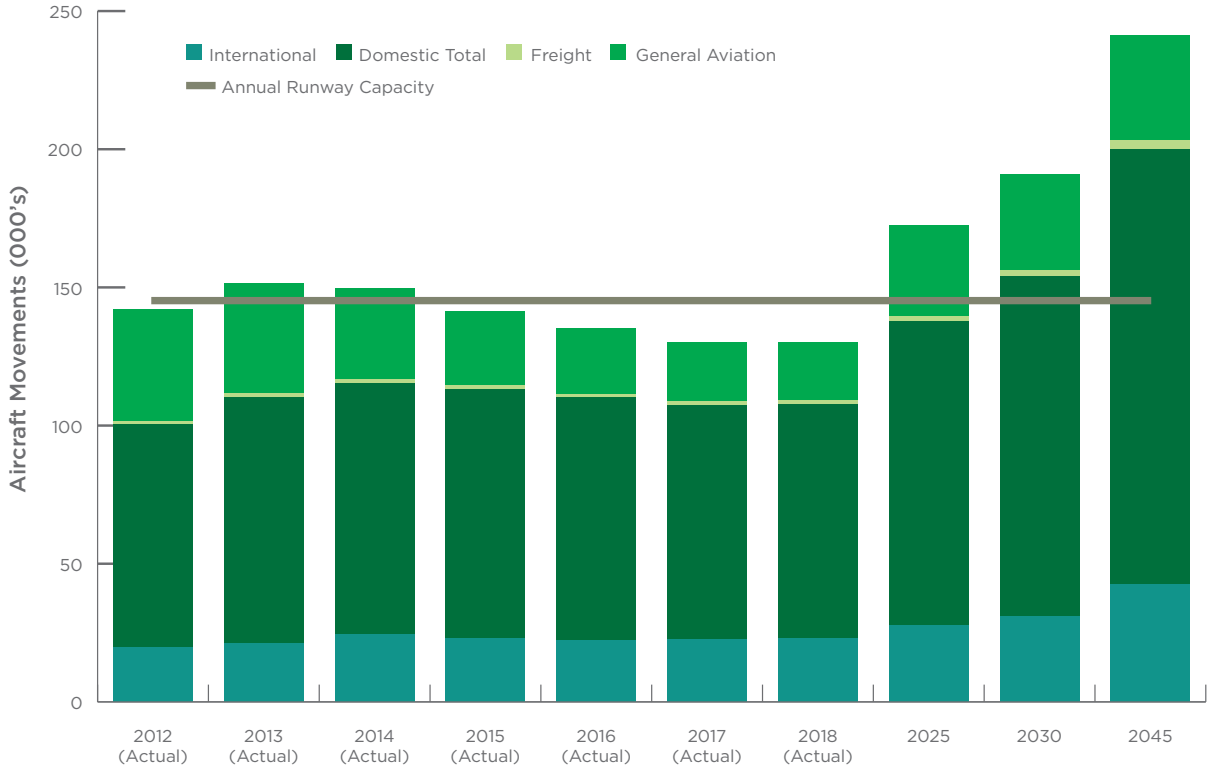


Figure ES-7 Historical and forecast aircraft movements compared against annual capacity at Perth Airport
Source: Perth Airport / Tourism Futures International (MDP Reference: Figure 2-33)

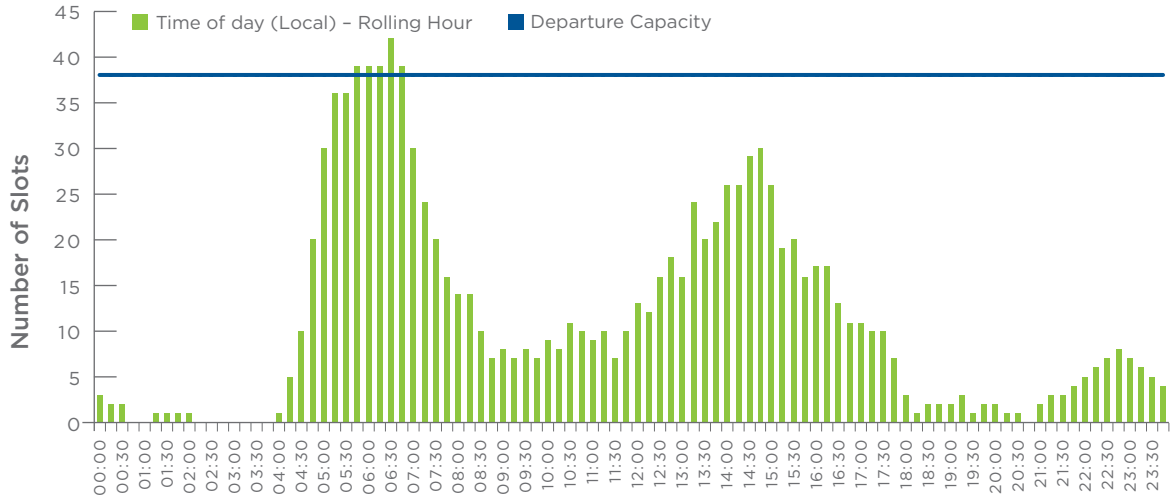


Figure ES-8 Wednesday departures slot demand - winter 2013 season
Source: Perth Airport Master Plan 2014, data sourced from Airport Coordination Australia (MDP Reference: Figure 2-34)

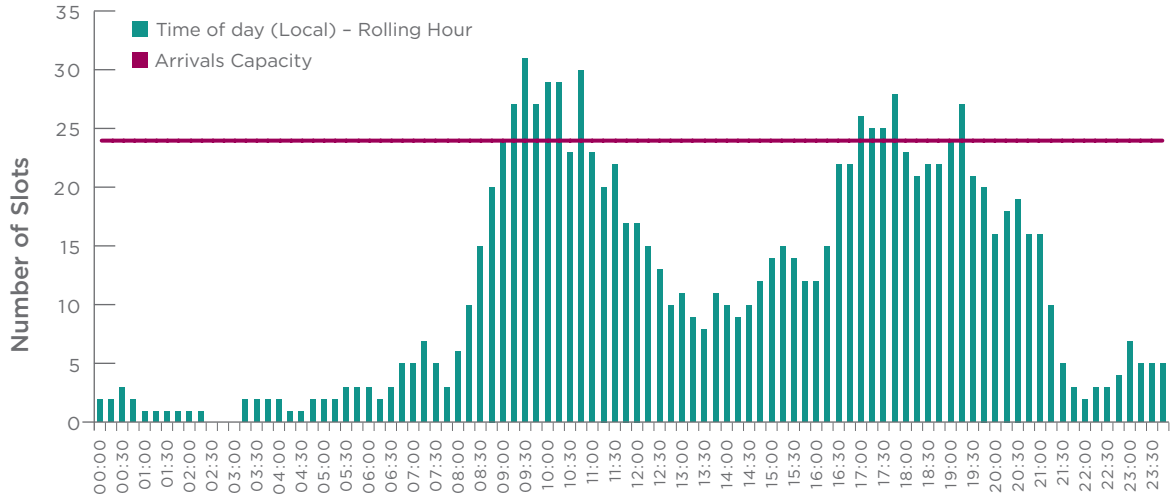


Figure ES-9 Wednesday arrivals slot demand - winter 2013 season
Source: Perth Airport Master Plan 2014, data sourced from Airport Coordination Australia (MDP Reference: Figure 2-35)

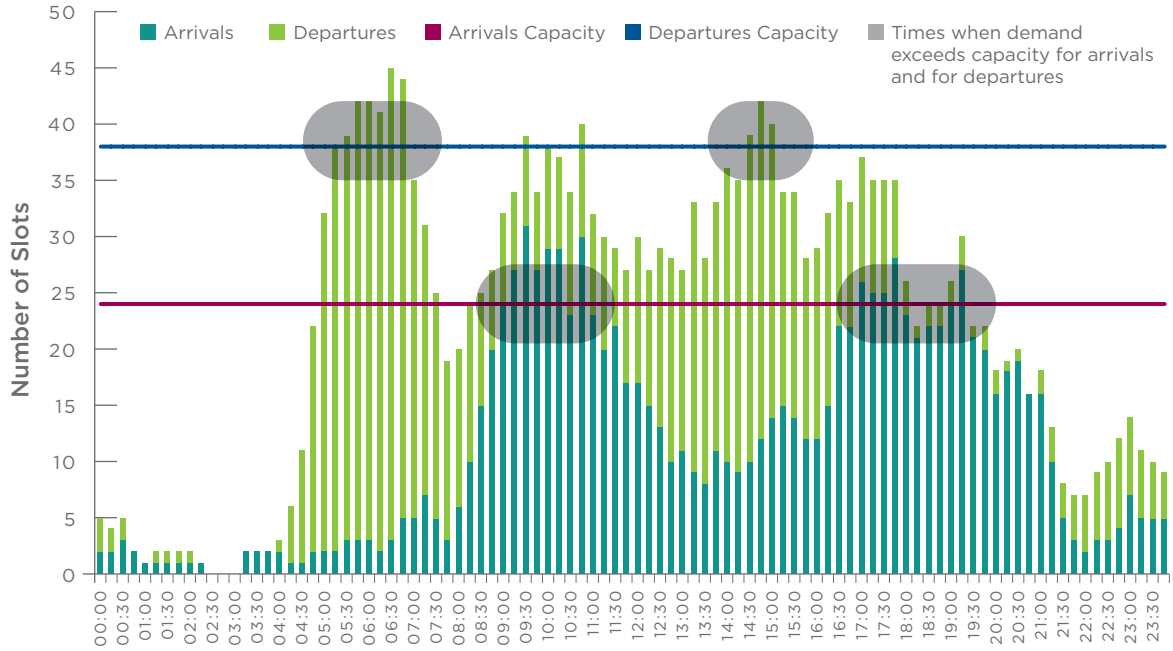


Figure ES-10 Wednesday total runway slot demand - winter 2013 season
Source: Perth Airport Master Plan 2014, data sourced from Airport Coordination Australia (MDP Reference: Figure 2-36)

Although aircraft movement numbers across the year and across the day have decreased since 2013, there remains periods in the day where demand exceeds available capacity and there are no slots available at Perth Airport, either for an arrival or a departure.

At the peak of the demand in 2012 and 2013, growth was constrained by the capacity at the airport and this was felt by the Western Australian economy. Figure ES-11 shows paper headlines from 2012 that reflected the level of public frustration at the delays caused by a lack of capacity.

Another example of the issues caused by a lack of airfield is reflected in the on-time performance statistics. At the same time Perth Airport's on time performance was the worst in Australia with only 69.7 per cent of planes departing on time.

New Runway Timing

There are a range of triggers for when additional runway capacity is required at Perth Airport. Considering the annual, daily and hourly requirements and a low, central and high forecast aircraft movement growth scenarios (prepared in May 2016) the new runway is expected to be required between by 2023 and 2032 as shown in Table ES-3.

Forecast	Timing Year
High	2023
Central	2027
Low	2032

Table ES-3 New Runway Project forecast year of opening
Source: Perth Airport (MDP Reference: Table 2-5)

Perth Airport has adopted a 'plan for high' and anticipate to 'deliver at central' approach to additional runway capacity. The development of a likely delivery range of 2023 to 2028 for the new runway allows industry to balance capital expenditure with appropriate levels of service and delays. However as highlighted, development may be later depending on actual demand and obtaining airline commercial agreement. Perth Airport will continue to review the timing of the new runway considering the latest forecast information.

Undertaking the early stage planning, design and approvals processes for the NRP is a prudent approach to runway capacity at Perth Airport having regard to the demonstrated volatility of demand and the significant adverse economic and societal impacts of running out of runway capacity in a state with such a high dependency on commercial aviation. Approval of the new runway positions Perth Airport to respond to increased demand in a timely manner.

Therefore, NRP approvals and design are being completed to allow additional runway capacity to be operational from 2023 at the earliest subject to actual demand and airline commercial agreement.

Figure ES-11 News clipping from 2012 calling for additional runway capacity
Source: The West Australian (MDP Reference: Figure 2-38)

Section 3 - Options and Alternatives

The Options and Alternatives Section provides detail of what options and alternative where considered when planning for the NRP.

As part of the initial planning for the new runway, several options were identified and assessed before determining that the new runway is the most appropriate development to meet the future demand for air services for Perth.

The location of the new runway was first considered as part of a joint State and Commonwealth Committee that considered the future aviation requirements for the Perth Region, which commenced in 1973.

Options considered include:
- no change,
- achieving more from existing infrastructure,
- increased use of other airports,
- use of RAAF Base Pearce,
- a second airport for Perth, and
- expanding existing runway infrastructure.

No-Change Scenario

The existing runway system reaches capacity during peak periods and this was most evident in 2013. Not constructing additional runway capacity and making no changes to the way in which the current runway system operates will:
- impact the efficient movement of aircraft and cause increasing delays for flights, and
- constrain growth, seeing a reduction in the number of people that would otherwise have travelled by air to and from Perth.

These impacts would have a flow-on effect and would result in economic losses to Perth and the wider State.

Delays Without the New Runway

Simulation modelling showed that the average flight delay would increase from an average of a five-minute delay in 2016 to 34 minutes by 2045.

An average 34-minute delay is unacceptable to airlines, passengers and aviation dependant companies. Significant impacts are experienced when delay starts to consistently be five to seven-minutes. Therefore, to reduce the likelihood of delay airlines would need to either:
- change flight times to times of lower runway demand,

- introduce larger aircraft to achieve higher volumes of passenger per aircraft movement, or
- discontinue services – repositioning aircraft to routes/ markets without the delays.

The impact on air services would differ in some respects for each market if Perth Airport does not have the capacity to meet airline scheduling preferences/ requirements, however the following common impacts can be expected:

- loss of services (less choice for Western Australians in terms of where to fly and when to fly),
- higher airfares due to higher unit costs for remaining services and less supply of aircraft seats to meet the available demand, and
- loss of economic opportunity for Western Australia, reflecting the knock-on impact on tourism and resources companies.

These costs were quantified by a range of parties at the height of the mining boom when demand for capacity peaked. In 2012, a Western Australian Treasury report estimated that the impact to the airline industry and its passengers of delays was $72 million per year. Qantas publicly stated that they estimated that the annual impact of runway delays at Perth Airport cost them $10.8 million per year, while the Chamber of Minerals and Energy Western Australia stated that a one-hour delay at a mine site cost approximately $100,000.

Constraints on Growth Without the New Runway

The no-change scenario would constrain the number of movements that can occur at Perth Airport. The extent to which airlines will forgo scheduling additional flights in the absence of additional runway capacity was modelled based on aircraft movement projections. Simulation modelling completed by Perth Airport shows that by 2045, without additional runway capacity being provided, approximately 140 aircraft movements will be forgone each day (or approximately 51,000 per year). Cumulatively, between 2025 and 2045, unmet passenger demand would total approximately 41.8 million passenger movements.

Achieve More from Existing Infrastructure

Perth Airport, in collaboration with Airservices, continually looks at opportunities to improve the efficiency and therefore capacity of the existing runway system by improving or changing operational processes or procedures. Any changes must be considered and balanced against any impacts on safety, environment and surrounding communities.

Through a series of improvements, the existing peak period hourly capacity has improved from 38 departures an hour to 40 departures per hour. However, the capacity gains have now been exhausted and there is a need for additional runway capacity.

Increased Use of Other Airports

Other than Perth Airport, there are no commercial aerodromes that support large passenger jet aircraft in the Perth region.

In examining whether alternate airports could be used to ease capacity constraints the following airports and airfields were considered:

- Jandakot Airport,
- Cunderdin Airport,
- Busselton - Margaret River Regional Airport, and
- other regional airfields.

These airports were not viable options as they do not have the runway or terminal infrastructure to support the large passenger aircraft types that use Perth Airport and many are not conveniently located near large population centres.

Use of RAAF Base Pearce

RAAF Base Pearce is approximately 30 kilometres north of Perth Airport and has been considered previously as an alternative civilan airport, however it was deemed as unacceptable due to operational constraints imposed by the topography of the nearby Darling Scarp. Furthermore, the Commonwealth Department of Defence has publicly stated that Pearce is not a suitable alternative civilian airport because operations at the airfield are not compatible with civilian airline operations because it is one of Defence's busiest and most complex airfields and it operates using very specialised air traffic procedures to allow for the large quantity and type of air traffic.

A Second Airport for Perth

A second metropolitan airport has been considered since the late 1970s. In 2015, the State Government released the State Aviation Strategy that considered a broad number of issues including a future second airport for Perth. The Strategy notes that preliminary work is being undertaken by the State Department of Planning, Lands and Heritage (previously Department of Planning) and State Department of Transport to identify a suitable site for a proposed second metropolitan airport, but notes Perth Airport is likely to meet Perth's requirements for the next 40 to 50 years or beyond. The State Government has not announced the preferred location of a second airport or provided any commitment or funding towards the projects in the strategy. In April 2018, the State Government announced that an updated State Aviation Strategy would be released in 2020 that would provide a framework for aviation in years to come.

When considering a secondary metropolitan airport, the significant cost, impact to newly affected areas and the timeframe to plan, approve and construct a new airport must be examined. In the case of Western Sydney, policy makers first considered the need for a second airport in Sydney in the 1940s. It wasn't until 1986, some 40 years later, that land began to be purchased at the Bagerys Creek site. An environmental impact statement was released for public comment October 2015 with the final approval granted in December 2016. Construction commenced early 2018 with operations starting in 2026. It is expected to cost in excess of $2.4 billion.

Combined with the cost of building the second airport and given the lead time for approvals and construction,

a second airport is not a viable option to meet the immediate growth needs or to meet forecast demand at Perth Airport.

Expand Existing Runway Infrastructure

The Master Plan 2014 considered three runway development options including:

- extending the cross runway 06/24 to the north-east from the current 2,163 metres to 3,000 metres, and
- extending the main runway 03/21 to the north from the current 3,444 metres to 3,800 metres, and
- construct a new runway.

The proposed extension of the cross runway (06/24) to 3,000 metres would enable the runway to accommodate all aircraft types, including the Airbus A380. This extension would allow for an increase in arrivals from the north/east and departures to the north/east. However, there would be very little increase in capacity when arriving from the south/west or departing to the south/west. The overall capacity would only be sufficient to accommodate around 193,000 annual aircraft movements, after which, a new runway would again be needed.

Increasing the length of the main runway from 3,444 metres to 3,800 metres would not provide an increase in arrival and departure capacity but simply cater for larger aircraft.

Therefore, extending the existing infrastructure would not cater for additional aircraft in the peak periods.

Construct a Parallel Runway System – Alternative Options

Prior to determining the preferred location of the new runway at Perth Airport, several options were explored.

The following factors are key considerations when determining the location of a parallel runway system:

- maximise future capacity by allowing separation distances to ensure independent parallel instrument runway operations, with a minimum of 1,035 metres between centrelines,
- prevailing wind taking into consideration cross-wind and downwind aircraft allowances,
- land available,
- land uses surrounding the airport,
- other airport infrastructure, including the current and future location of terminal facilities, and
- airspace and other airports in the area.

A runway parallel to runway (06/24) was not considered a viable option as it would restrict terminal development, make road access difficult and was restricted in length.

Prevailing winds at Perth Airport are from a north-east or south-west direction. As a result, the use of runway 11/29 was very limited and it is this lack of usage that led to it being closed and converted to a taxiway in 2001.

Construct a Parallel Runway System – Preferred Options

In 1979, the joint Commonwealth and State Committee study on Western Australian Airport Requirements considered airports that would be appropriate for a wide spaced parallel runway. The committee found that after weighing economic and environmental considerations, the existing Perth Airport should continue as the sole primary airport for the Perth Region.

When the preferred location for the parallel runway was being considered, land use to the north and south of the airport was primarily agricultural farming land or low-density housing. At the time this area was more sparsely populated and provided the opportunity for more appropriate development with sympathetic planning. The area immediately to the east of the estate was also primarily agricultural land and provided the opportunity to be purchased for the long-term use of the airport.

The location to the east of the estate also provided for the future expansion of terminals and the commencement of consolidating all terminals into a single location that is now referred to as Airport Central. Over time, Airport Central will see all regular passenger transport operating from this precinct.

The layout for consolidation of terminals and the location of the parallel runway system was first released for public comment as part of the Master Plan 1985 planning process. The Master Plan 1985, by the Department of Aviation, forecast that the new runway would be needed by 2004, so the process to acquire 284 hectares to be incorporated into the estate for the proposed new runway commenced.

Master Plan 2014 proposed the construction of the new runway as the preferred option to increase the capacity of Perth Airport and proposed that the runway was required in the short term.

Following approval of the Master Plan 2014, the Perth Airport Board of Directors approved a $45 million investment in pre-construction activities that included environmental and other approvals, preliminary airspace design and public consultation. In September 2015, Perth Airport appointed a joint venture between Aurecon and AECOM to undertake a preliminary design of the new runway and taxiways. The study considered major runway features including threshold locations, taxiways, lighting, drainage and support infrastructure.

First planned for in the 1970s, the new runway, which is two kilometres to the east of the main runway (03L/21R), has remained consistent with long-term planning and consistent with the need to develop the runway as part of an independent parallel runway system.

As such, to prevent unacceptable delays in aircraft operations, provide for the increasing demand and to support economic growth in Western Australia, a major expansion of airfield capacity is needed. The only way this can be achieved is with the development of a parallel runway system at Perth Airport through the construction of the NRP.

Section 4 - Benefits of Additional Runway Capacity

The Benefits of Additional Runway Capacity Section provides detail of economic, social and cultural benefits of the construction and operation of the NRP.

Perth Airport provides economic, social and cultural benefits to Western Australians by connecting lives, businesses and communities. This not only strengthens cultural, family and social ties, but also supports business, tourism and leisure travel. Perth Airport also plays an essential role in economic development by providing freight transport services for companies, and supporting them to undertake their operations, service their customers and grow their businesses.

Social and Cultural Benefits

The geographic isolation of Perth, the size of Western Australia and its proximity to Southeast Asia means that Perth residents rely on air transport more than most other Australians, in that they travel by air more frequently and over longer distances for work, education, recreation, health and to visit friends and relatives.

The bulk of high-level services, including health, education, retail and recreational services, are located within the Perth metropolitan area. The scale of the metropolitan population and the services in Perth, in comparison to the low and dispersed regional population, have resulted in the city becoming the primary source of regional workers for fly-in fly-out operations. Additionally, the lack of services in regional and remote areas of the State mean that these residents at various times need to access Perth, often via air travel, for services.

There are currently 50 intrastate, interstate and international destinations served by Perth Airport which link communities in regional Western Australia to the rest of Australia and the world. To the largest extent possible, this enables these communities to enjoy the same opportunities as Perth residents to engage with the rest of Australia and the world. The new runway will enhance and develop new services to new destinations.

Employment

Perth Airport is a major centre of employment. In 2013, Perth Airport employed (directly and indirectly) an estimated 12,570 aviation and 5,230 non-aviation related full-time employees. The increase between 2023 and 2045 as a result of the NRP is projected to average an additional 169 full-time equivalent jobs per year, including construction and operations. At the peak of construction, the NRP will create 744 full-time equivalent jobs nationally.

The effectiveness and success of the Western Australian resource sector is dependent on the fly-in fly-out system of employment. The resource sector's workforce mobilisation and rostering requirements requires the fly-in fly-out aircraft services to operate in narrow time windows, and the additional capacity provided by the NRP is critical to supporting future growth of the fly-in fly-out workforce.

Tourism

Air services are vital to the State's tourism industry and the employment it supports. Tourism Research Australia data shows that 93 per cent of visitors that travelled to Western Australia used air transport, with most arriving at Perth Airport. In the year ending September 2013, 1.14 million domestic visitors spent $2.45 billion in Perth and an additional $2.5 billion in regional Western Australia. In the same period, international visitors to Western Australia contributed $2.27 billion of which $1.92 billion was spent in Perth.

Data published by Tourism Research Australia shows that in 2016 international visitors to Perth spent an average of $2,288 and international visitors to regional Western Australia spent an average of $1,338. Domestic visitors to Perth spent an average of $804. Based on this spending, the tourism expenditure as a result of the additional air traffic capacity provided by the NRP is estimated to be $1.72 billion over two decades.

Productivity Improvements

The additional capacity provided by the NRP will result in productivity improvements to airlines as well as cost savings and productivity gains to businesses through avoided delays.

The avoided delay costs to airlines, comprising the avoided maintenance, crew and fuel costs, total $111.65 per minute of delay. By 2045, the cumulative impact of the delay cost savings to airlines is forecast to be $84 million for Perth, $1.3 million for the rest of Western Australia, and $993 million for the rest of Australia (as a result of most major domestic airlines being headquartered in other parts of Australia).

The cost of delay at Perth Airport has been calculated to be $48.52 per hour for leisure travellers and $155.29 per hour for business travellers. By 2045, the avoided delays as a result of the NRP is forecast to achieve a cumulative business cost saving of $887.3 million.

Economic Benefits

The construction of the NRP will add $329.1 million over the construction period to real income in the Perth region. The contribution of the NRP grows from approximately $40 million in 2026 to $385 million in 2045 as a result of additional operational expenditures by Perth Airport and airlines, costs savings from airlines due to reduced delays, business cost savings from reduced delays to business travellers and increased tourism expenditure.

The cumulative impact of the NRP on real economic output in the Perth region to 2045 in present-value terms is projected to be $1.03 billion in 2017 dollars and the cumulative impact of the NRP on real income, in present-value terms, is projected to be $1.2 billion in 2017 dollars.

The cumulative impact of the NRP on real economic output for the rest of Australia in represent-value terms under a seven per cent real discount rate is approximately $2.39 billion.

Undiscounted this equates to approximately $3.7 billion for Perth and $7.9 billion for Australia.

Section 5 - Consistency with State and Local Government Planning

The Consistency with State and Local Government Planning Section provides detail with respect to the NRPs consistency and alignment with State and Local Government plans and policies.

Planning at Perth Airport

Perth Airport is located on land owned by the Commonwealth of Australia and, although the day-to-day management of Perth Airport was privatised in 1997, the Commonwealth Government continues to play an important regulatory and oversight role through the Airports Act and associated regulations. The Airports Act required major projects to be consistent with State and Local government planning.

State Planning

State government planning is controlled by the Western Australian Planning Commission (WAPC) which administers the State Planning Framework and the Metropolitan Region Scheme (MRS) and disseminates policies and strategies on a wide range of planning matters. Perth Airport is identified as a 'specialised centre' in the State Planning Framework.

State Aviation Strategy

The State Aviation Strategy, published in 2015, confirms the status of Perth Airport as the sole and principal 24-hour airport for the Perth metropolitan region. A key finding of the Strategy is that the new runway will *"provide the step-change in capacity needed to cope with current peak hour demand as well as accommodate continuing high levels of growth at Perth Airport*", and "*will benefit all users, improving reliability, reducing delays and permitting peak-period demand growth across interstate and international sectors, as well as resource and other intrastate users*".

In April 2018, the State Government announced it would be reviewing the strategy. The updated draft strategy was released for public comment in 2020.

Given a key finding of the Strategy is that the new runway will provide the capacity needed to cope with demand into the future, the NRP is consistent with the intent of the State Aviation Strategy.

State Planning Strategy 2050

The State Planning Strategy 2050 identifies the need to provide efficient transport routes and hubs. It recognises Perth Airport as a key element in the movement network of the State, and as the international gateway to Perth and Western Australia is a focal point for the growth of the tourism industry.

The NRP is consistent with and supports the intent of the State Government through the State Planning Strategy 2050, given the project will secure an additional runway to support the growth of international tourism and the State's economic development.

Directions 2031 and Beyond

The 'Directions 2031 and Beyond' high level spatial framework and strategic plan for the Perth and Peel metropolitan region, identifies Perth Airport as a 'specialised centre' and recognised as critical to supporting the growth in the Western Australian resource sector, as well as providing Western Australia's primary link to the rest of Australia and the world.

The NRP is consistent with the intent of the strategy, which supports the growth of the airport and will generate additional employment both through construction and ongoing operations.

Perth and Peel @ 3.5 Million

Perth and Peel @ 3.5 Million, the adopted State strategic plan sees the Perth Airport estate designated as a 'specialised activity centre' and is acknowledged as supporting employment generating land uses.

The NRP is consistent with the intent of the plan, which supports the growth of the airport and will generate additional employment both through construction and ongoing operations.

State Planning Policy 5.1 – Land Use Planning in the Vicinity of Perth Airport (2015)

The State Planning Policy 5.1 – Land Use Planning in the Vicinity of Perth Airport (SPP 5.1) applies to land in proximity to Perth Airport which is, or may be in the future, affected by aircraft noise, and states:

"Perth Airport is fundamental to the continued development of the Perth metropolitan region and the State as a whole. Investment in airport infrastructure and the economic opportunities associated with the operation of the airport are now recognised as important and perhaps critical elements in the prosperity of a city such as Perth. Accordingly, the airport and its ongoing development need to be recognised in the planning of the region, and its operation protected, as far as practicable, from development that could potentially prejudice its performance. One of the main issues to be addressed in the planning of areas in the vicinity of the airport is aircraft noise, which is the focus of this policy."

The role of this policy is to provide guidance to local governments in the vicinity of Perth Airport and the WAPC when considering developments on land adjacent to, or affected by, the airport.

In practice, the policy requires relevant Local Government authorities to give due consideration to Perth Airport's Australian Noise Exposure Forecast (ANEF) contours in local planning decision making. The intent of this is to ensure that policy measures (such as zoning, residential density, subdivisions, development, notification on titles, and advice) are appropriately applied to applications for development, to avoid potential land-use planning conflicts, which may subsequently impact and restrict airport operations.

Under the Airports Act, Perth Airport is required to produce an ANEF for technical endorsement by Airservices Australia. The ANEF is incorporated in each airport Master Plan which is reviewed every five years.

The new runway has been identified as a requirement for Perth Airport since the 1970s and has been incorporated in all ANEF contours prepared since 1985, although State policy measures first embedded the ANEF in land-use planning decisions made under the policy in 2004.

Consideration of aircraft noise impacts in line with the endorsed ANEF is beneficial, however the effectiveness of the policy to protect the community is dependent on both the continuity of its application, and further work in collaboration with the WAPC to strengthen policy measures. This may include the incorporation of elements of the NASF (National Airports Safeguarding Framework) and alternative metrics to trigger referral and assessment of incompatible land uses and development proximate to Perth Airport.

The NRP is consistent with the intent of SPP 5.1 given that the new runway has been incorporated in the preparation of the ANEF since 1985, and the endorsed ANEF is referenced in the policy, forming the basis for the assessment of land use-planning decisions within the vicinity of Perth Airport.

Local Government Planning Policy

Local governments are responsible for planning their local communities by ensuring appropriate planning controls exist for land use and development. Local planning schemes and strategies are prepared by each individual local government area to:

- set out the way land is to be used and developed,
- classify and determine the acceptability of various land uses, and
- establish the provisions for the coordination of infrastructure and development within the local government area.

Perth Airport estate sits within three local authority areas, divided between the City of Belmont, City of Swan and the City of Kalamunda.

To provide an assessment of the NRP with respect to consistency with Local Government planning, the project was reviewed against the applicable Local Government planning schemes and strategies within a 15-kilometre radius of the estate. The key considerations include aircraft noise exposures, and protected airspace.

Perth Airport operations impact local government planning within a much wider catchment of the Perth Metropolitan area – largely due to the central location of the Perth Airport estate only 12 kilometres from the Perth CBD and strategic location within the metropolitan arterial road network. There are 18 individual local government areas within a 15-kilometre radius of the airport including:

- City of Belmont,
- City of Swan,
- City of Kalamunda,
- City of Bayswater,
- Town of Bassendean,
- Shire of Mundaring,
- City of Gosnells,
- City of Canning,
- City of Wanneroo,
- City of Perth,
- City of Vincent,
- Town of Victoria Park,
- City of South Perth,
- City of Nedlands,
- Town of Cambridge,
- City of Melville,
- City of Stirling, and
- City of Subiaco.

The NRP was found to be consistent with each of the 18-local government local planning schemes.

Section 6 - Project Description and Construction

The Project Description and Construction Section provides an overview of what the NRP includes and details the construction activities associated with the project.

Development Objectives

The NRP development objectives are to:

- deliver aviation services that airlines, members of the public, and business enterprises need, at a reasonable cost,
- ensure all facilities are safe and secure for all people who use them or live in the vicinity of the airport,
- ensure the airport's development and operations respect the strong bond that exists between the Noongar people and the land that comprises the estate, and
- ensure that the airport's developments and operation minimises adverse impact on surrounding communities and the environment, and that emissions which contribute to human-induced climate change are minimised.

Description of the New Runway Project

The NRP includes:

- construction, including clearing and site preparation, of a new runway up to 3,000 metres long with associated infrastructure, and
  - site clearance and placement of fill material,
  - a new runway 3,000 metres in length located parallel to the existing main runway (03L/21R),
  - runway shoulders and blast pavements, graded runway strip, and runway end-safety areas. These are generally flat areas surrounding a runway that are provided for the safety of aircraft operations but are not used for the landing, take-off or manoeuvring of aircraft,
  - associated parallel taxiways, cross taxiways and rapid exit taxiways to provide efficient aircraft taxiing between the runway and terminals,
  - runway and taxiway ground lighting to provide directional guidance during restricted visibility conditions, such as night-time and heavy rainfall,
  - visual guidance systems, such as high intensity approach lighting and precision approach-path indicators, that are used by pilots to visually identify the runway and align the aircraft for landing,
  - new air navigation systems, such as an instrument landing system, that transmit accurate vertical and horizontal guidance for pilots,
  - ducting systems for communications, low-voltage power, airfield ground lighting cables and a separate network for Airservices communications,
  - a new airside and landside emergency vehicle staging area similar to the existing staging area near the Dunreath Drive and Tonkin Highway interchange,
  - relocation of all affected services such as high-voltage power, sewer, potable water, irrigation water, communications,
  - vehicle-access road around the perimeter of the new runway area to maintain security inspections and provide access for maintenance and operational vehicles,
  - a new airside security fence and electronic security system to meet aviation security requirements, with crash gates for emergency response at appropriate locations,
  - civil infrastructure for Airservices communication, navigation and surveillance facilities. This includes communications and power ducting, power cabling, access roads with appropriate parking and turning areas for maintenance access, and graded areas appropriate to the facilities,
  - construction of an emergency egress point,
  - realignment of Perth Airport's two main drainage channels, (the northern main drain and the southern main drain) to manage stormwater and groundwater flows around the new runway and taxiways, and maintain flood control for associated areas.
  - provision of Aviation Rescue and Fire Fighting (ARFF) facilities to ensure the provision of a compliant ARFF service,
  - civil infrastructure associated with the new station. This includes communications and power ducting, power supply, potable water supply, sewer connection, a graded area for the station, perimeter security fencing, and access roads onto the airfield, and
  - reclosing of Grogan Road.
- development of an airspace management plan that will cater for the changes to current airspace and flight paths to accommodate operations of the new runway.

Following approval of the MDP, further detailed design of the infrastructure and airspace will be undertaken. As the design progresses to more detailed stages, the infrastructure requirements will be reviewed in line with any changes to regulations and stakeholder needs. The layout is designed to be flexible so that infrastructure construction can be staged as appropriate. Consultation will continue with key stakeholders including airlines and Airservices to determine the initial layout (including the exact runway length and number and location of exit and entry taxiways) that will be built to meet operational needs. Over time, the airfield layout will expand as needed to facilitate safe and efficient aircraft operations and meet forecast demand.

Grogan Road

The new runway will require the partial re-closure of Grogan Road, which was previously closed to through traffic between 1987 and 2005.

A transport study showed that currently more than 60 per cent of the traffic on Grogan Road during peak periods is non-airport traffic using the road as a shortcut. Initial planning considered Grogan Road being replaced by a tunnel beneath the new runway. During design work the cost for the tunnel was estimated to be in the order of $240 million.

This significant cost was driven by the requirements of the tunnel such as life safety elements, monitoring and response capabilities, and the length and distance below the runway that the infrastructure needed to be for safety and aviation security.

Access to Abbot Road from Abernethy Road via Grogan Road will remain.

Project Construction

The NRP is a large scale civil engineering project, with specific technical elements related to aircraft landing and navigation systems.

Although a contractor has not been appointed, it is envisaged that a single main contractor will be responsible for the project delivery, with specialist sub-contractors being used where required.

Where Airservices is responsible for its own facilities, such as air navigation infrastructure and any ARFF facilities, a separate process will be required and contracts will include provision for close liaison between Perth Airport's contractor and the Airservices contractor.

These contractors will be required to determine detailed construction methodologies and programs to meet the overall project schedule. Contractors will also be responsible for development and the implementation of construction environmental management plans (CEMPs) for their works.

Construction Timeframes

Based on preliminary design work, an outline construction program has been developed. An indicative construction timeframe of four to five years has been developed for the NRP. The hours of work for the NRP are expected to generally be from 7.00 am to 7.00 pm Monday to Saturday. To minimise interruption to airfield and aircraft operations, there may be a requirement for 24-hour construction activities at different stages, especially where the new works are required to interface with the existing operational airside areas.

Although site preparation is likely to commence following approval, construction of pavements and infrastructure is dependent on actual aircraft movement demand and a commercial agreement with airlines being reached. Pursuant to Part 5 Section 94 (7A) of the Airports Act, this approval permits the project to be substantially complete out to 2032. If construction does not commence prior to 2028, Perth Airport will liaise with and provide advice to the Commonwealth Minister.

Construction Management Plan

A detailed construction management plan will be prepared by the contractor prior to works starting. The plan will cover items such as:

- site management team, roles, responsibilities,
- emergency plans for accidents, spills and airport operational incidents etc.,
- site safety, materials handling etc.,
- noise and vibration management,
- sustainable construction plan,
- dust control,
- site security,
- approvals and permit system,
- airspace penetration assessments,
- interfaces with public areas, roads and traffic plans,
- how the works will be managed in accordance with the contract,
- define the program and construction targets,
- define the site constraints such as stormwater management, contaminated materials management and wastewater management,
- detailed risk assessment, materials sources, testing and quality assurance procedures,
- detailed demolition plans,
- excavation plans, and
- Method of Works Plans, in accordance with the CASR 1998 MOS Part 139. These plans detail the works that will interface with the operational airfield. Such works will take place generally towards the end of the project when the new security fence has been joined to the existing fence and the site is designated an airside security zone.

A Construction Environmental Management Plan (CEMP) will also be required.

Clearing and Site Preparation

Site clearance and preparation consists of the demolition and removal of buildings and hardstands from existing tenancies, and general clearance of trees, shrubs, other vegetation, top soil and any existing stockpiles not suitable as fill material. The construction of the NRP will involve the clearing and site development of approximately 293 hectares of land, including vegetated, open and already developed areas

Prior to clearing commencing, under Part 13 of the EPBC Act, a permit to clear threatened species and ecological communities must be obtained from the Commonwealth Department of Agriculture, Water and Environment.

Filling and Ground Improvement

The site requires a large amount of fill to ensure that finished pavement levels are at a level to protect the pavement from flood events. It is anticipated that material from cut and excavations will be used as fill, following suitable treatment where required. Export of cut material offsite will be discouraged unless material is unsuitable and requires controlled disposal.

The amount of fill material has been initially calculated at approximately 1.2 million cubic metres of imported fill material being required. Where this is to be placed under pavements, it will need to be a clean sand material that can provide an in-situ California Bearing Ratio of at least 12 per cent to act as a foundation. In pavement flanks, where aircraft loadings will not normally occur, a lower grade material may be acceptable.

The major source of the fill will likely be one or more of the established sand quarries in Western Australia, and there are several within reasonable distance of the airport.

Depending on the quality available, some fill may be acquired from stockpiles created by other Perth Airport projects within the estate. This will also depend on availability of existing stockpiles and will be determined during construction planning.

Allowing for a bulking factor of 25 per cent, the approximate amount of sand required to be imported is 1.5 million cubic metres, and this will require 71,600 truckloads to transport to site.

The program for earthworks is approximately 16 months, or 70 weeks, which equates to approximately 1,000 truck trips per week. To reduce the impact on specific roads, fill may be sourced from multiple locations.

Airspace Management Plan Development

In addition to the physical infrastructure, the NRP also includes the development of the airspace and flight paths to support parallel runway operations.

The draft Airspace Management Plan for the NRP is provided in Section 21.

Airspace Final Design

Airservices is responsible for the final design and implementation of the airspace.

Following MDP approval, and when the final design of infrastructure is complete, the formal airspace detailed design will be completed by Airservices and submitted to the Civil Aviation Safety Authority (CASA) Office of Airspace Regulation for approval.

The Office of Airspace Regulation will consider safety implications, environmental considerations, consultation, government policy, and the promotion and fostering of civil aviation

Commissioning and Flight Tests

Following completion of all construction works, the systems and new airfield will be commissioned.

The airfield lights and Instrument Landing System (ILS) will be checked on the ground and then during a series of flight checks which will be carried out by CASA approved specialists. Light aircraft and/or helicopters will fly the designed approach paths and engineers will assess and adjust the lights and systems as necessary.

The following elements need to be completed:

- check lights and instrument landing systems (ground and flight checks),
- check pavement surface quality (skid resistance and water runoff),
- check control systems,
- install airfield signage, and
- paint runway and taxiway markings.

Following successful commissioning, which may take six to 12 months, the new runway will be deemed operational and ready to take regular aircraft operations.

Section 7 - Community Engagement

The Community Engagement Section provides an overview of the consultation activities for the NRP prior to approvals, during the public comment period and Perth Airport's commitment to further engagement.

Commitment to Engage

Perth Airport is committed to effective and transparent engagement and employs a range of ongoing consultation and education mechanisms to:

- inform stakeholders and the community about on airport land-use planning, developments and potential impacts,
- seek input on alternative approaches and options,
- maintain transparency and stakeholder-focused relationships,
- meet legal and regulatory responsibilities, and
- provide stakeholders with the opportunity to influence the future of Perth Airport.

Perth Airport currently engages regularly through the following forums:

- Perth Airports' Municipalities Group (PAMG),
- Planning Coordination Forum (PCF),
- Perth Airport Community Forum (PACF),
- Perth Airport Aircraft Noise Technical Working Group (PAANTWG),
- Perth Airport Consultative Environmental and Sustainability Group, and
- Aboriginal Partnership Agreement Group (PAG).

Perth Airport undertakes ongoing review and assessment of each of the groups to ensure their effectiveness and suitability to meet the engagement needs and requirements as defined by the Commonwealth Airport Development Consultation Guidelines. As such the structure composition and terms of reference of the groups may be varied from time to time to ensure the best suitable model to achieve the required outcomes.

New Runway Project Consultation

One of the objectives of the Airports Act is to ensure there is an appropriate level of vigilance, transparency and scrutiny of airport planning so that the public interest requirements are met as the airport's development progresses.

In line with the Commonwealth Department of Infrastructure, Transport, Regional Development and Communications Airport Development Guidelines, the consultation process for the NRP is undertaken in four key stages:

- **Planning for the new runway:** general airport planning consultation activities undertaken as part of the Government enquiry into the future of Perth Airport in the 1970's, which determined the need for a future parallel runway, and all Perth Airport Master Plans since 1985, including Master Plan 2014 which identified the need to bring forward the approval and construction of the new runway,
- **Preliminary new runway design:** Perth Airport's ongoing consultation since the approval of the Master Plan 2014 and subsequent preliminary runway infrastructure design and technical and environmental studies,
- **Approvals:** detailed engagement supporting the development and release of a MDP for public comment and subsequent development of the final proposal for consideration by the Commonwealth Minster for Infrastructure, Transport and Regional Development, and
- **Final design and construction:** following approval and prior to construction, the on-ground and airspace management plan will be finalised including further consultation.

Planning for the New Runway

Engagement on the new runway commenced in the 1970's. In 1973, the Joint State and Commonwealth Commission commenced a formal study on the aviation requirements for the Perth Region. Membership of the working group included State and Commonwealth Government departments, Local Governments, with input from a range of observers including industry associations and airlines. The final report was publicly released by the Commonwealth-State Advisory Committee in December 1979, and confirmed that Perth Airport would be developed as the primary airport for the Perth metropolitan region and that it would be based on a future parallel runway system.

The location of the parallel runway system was first released for community comment as part of the Master Plan 1985 planning process, undertaken by the Department of Aviation.

Following privatisation of Perth Airport in 1997, the planning for the parallel runway system was revisited in the Master Plan 1999, and subsequently for Master Plan 2004, Master Plan 2009, and Master Plan 2014. The development of each Master Plan required extensive consultation with Commonwealth, State and Local governments as part of its preparation, as well as a formal public comment period of 60 business days. The future requirement for the new runway was confirmed in each Master Plan.

Preliminary New Runway Design

The Master Plan 2014 identified that the runway was required in the short term to increase the capacity of Perth Airport. Consultation commenced in 2012 as part of feasibility studies, and the Concept of Operations (CONOPS) was developed in consultation with Airservices and airlines.

In 2015, the Perth Airport Board of Directors approved a $45 million investment in pre-construction activities for the new runway that included environmental and heritage approvals, preliminary airspace design and public consultation.

During the preliminary design process for the new runway ground infrastructure, it was determined that recent changes to runway lighting design standards could allow shorter high-intensity approach lighting to be installed, and therefore a longer runway accommodated within the Airfield Precinct as defined in the Master Plan 2014. A proposal to amend the new runway length from 2,700 metres to 3,000 metres via a Minor Variation to the Master Plan 2014 was released for public comment in January 2017 and approved by the Commonwealth Minister for Infrastructure and Transport in June 2017. The current approved Perth Airport Master Plan 2020 is consistent with this MDP.

Throughout the development of technical studies and design stages, Perth Airport has undertaken extensive engagement with a range of stakeholders. Perth Airport has also continued to engage, update and report key findings to the PCF, PAMG and community members through the PACF and Perth Airport website.

Perth Airport has met with Traditional Custodians of the land, including the Aboriginal Partnership Agreement Group members, Whadjuk Working Group and, South West Aboriginal Land and Sea Council, to discuss the impact of the NRP to the heritage values and the approval process under the *Aboriginal Heritage Act 1972*.

Approvals

The development and operations of any development at Perth Airport must be consistent with a range of legislation and regulations. Section 1 also outlines the various approvals required prior to the construction of the new runway, including:

- Section 18 approval under the *Aboriginal Heritage Act 1972*,
- MDP approval under the Airports Act and the EPBC Act, and
- a part 13 permit under the EPBC Act.

The NRP MDP has been prepared to address the various legislative approvals required for a new runway at Perth Airport and provides a combined approvals document to ensure a whole of project is represented. The MDP is a detailed approvals document that has been structured and prepared to meet regulatory requirements of the Airports Act and the EPBC Act. A MDP goes through various stages as outlined in Figure ES-12.

During each stage of the MDP, extensive consultation with Commonwealth, State and Local government departments, stakeholders and community is undertaken.

Consistent with the Airport Development Consultation Guidelines, Perth Airport has undertaken an extensive consultation process for the development of the Draft MDP.

Throughout this comprehensive consultative process, Perth Airport has given due regard to interim feedback and has, where possible, incorporated comments raised in the preparation of the Draft MDP.

Formal Public Comment

In accordance with Section 92 of the Airports Act, the Preliminary Draft MDP was made available for public comment for a period of 60 business days and appropriate parties notified of its release.

An advert was published in The West Australian newspaper on 30 May 2018, notifying the release of the Preliminary Draft MDP and inviting members of the public to provide written comments on the proposed development.

Section 80 of the Airports Act requires that, prior to the Preliminary Draft MDP being published for public comment, the document must be drawn to the attention of:

- the Minister of the State in which the airport is situated with responsibility for town planning or use of land,
- the authority of that State with responsibility for town planning or use of land, and
- each Local Government body with responsibility for an area surrounding the airport.

On 29 May 2018 a letter advising of the commencement of the formal public comment period with a copy of the Preliminary Draft Major Development Plan was sent to the following parties:

- Minister of Transport; Planning; Lands
- Director General – Department of Transport
- Director General – Department of Planning, Lands and Heritage
- Chairman – Western Australian Planning Commission
- Chief Executive Officer – City of Swan
- Chief Executive Officer – City of Kalamunda
- Chief Executive Officer – City of Belmont

Obtain a Copy

A copy of the Preliminary Draft MDP was available for download, free of charge, from newrunway.com.au and perthairport.com.au

Hard copies of the MDP were available for viewing at:

- the Perth Airport Experience Centre, located at Hkew Alpha Building, Ground Floor, 2 George Wiencke Drive, Perth Airport,
- NRP information stands at various shopping centres,
- public information expos, and
- selected public libraries.

Viewing times and locations were available at newrunway.com.au.

Hard copies were also available for purchase at the Perth Airport Experience Centre.

Engagement Materials and Activities

To ensure that the community had an opportunity to comment on the proposed NRP development, public engagement included a range of activities and the production of additional material including:

- an advert in The West Australian,
- a project introduction letter,
- social media,
- the New Runway Project website (newrunway.com.au), and
- other communication, such as local government websites.

Supplementary Information

Perth Airport also prepared a range of supplementary information, including:

- New Runway Project Summary,
- fact sheets,
- Aircraft Noise Information Portal, and
- e-newsletters.

Get Involved

Perth Airport staff were also available to answer questions on the project through the following avenues:

- **Airport Experience Centre:** the Perth Airport Experience Centre located at Hkew Alpha Building, Ground Floor, 2 George Wiencke Drive, Perth Airport, was open to the public during the public comment period. Visitors had the opportunity to view simulations and speak with Perth Airport staff. Online public comment submissions could also be made at the Perth Airport Experience Centre. The Perth Airport Experience Centre opening times were available at newrunway.com.au.
- **Public Displays:** Public information expos were held in a wide range of local government areas. Notices regarding the times and locations of the public information expos were published at newrunway.com.au, in The West Australian and/or relevant community newspapers, and through Perth Airport social media. The first will be held at City of South Perth on 31 May 2018.

Submissions Received during the Public Comment Period

Under the Act, Perth Airport must have due regard for written comments received during the public comment period. Following closure of the comment period a total of 2030 individual submissions were received.

The key matters raised in these submissions were:

- The Draft Airspace Management Plan and where planes will fly
- Aircraft noise from proposed flight corridors and mitigation measures
- Options and alternatives considered for the project
- Social impacts of the project
- Impacts to health
- Environmental impacts of the project
- Closure of the cross runway, and
- The need for 24/7 operations at Perth Airport.

Submission of Draft MDP to the Minister

Once all comments were received and reviewed, Perth Airport prepared a Draft MDP, incorporating, where possible, the concerns and issues raised during the formal public comment period. Minor amendments and additions were made and the Draft Major Development Plan was presented to the Commonwealth Minister for Infrastructure, Transport and Regional Development for consideration on 19 September 2019.

The submission to the Minister was accompanied by the following materials:

- copies of all comments received during the public comment period, and
- a written certificate signed on behalf of Perth Airport, containing:
  - a list of names of the people or organisations that provided written comments to the Preliminary Draft MDP,
  - a summary of the comments received, and
  - evidence that Perth Airport has given due regard to those comments in preparing the Draft MDP.

The Commonwealth Minister for Infrastructure, Transport and Regional Development, the Hon Michael McCormack MP, approved the New Runway Project Major Development Plan on 21 November 2020.

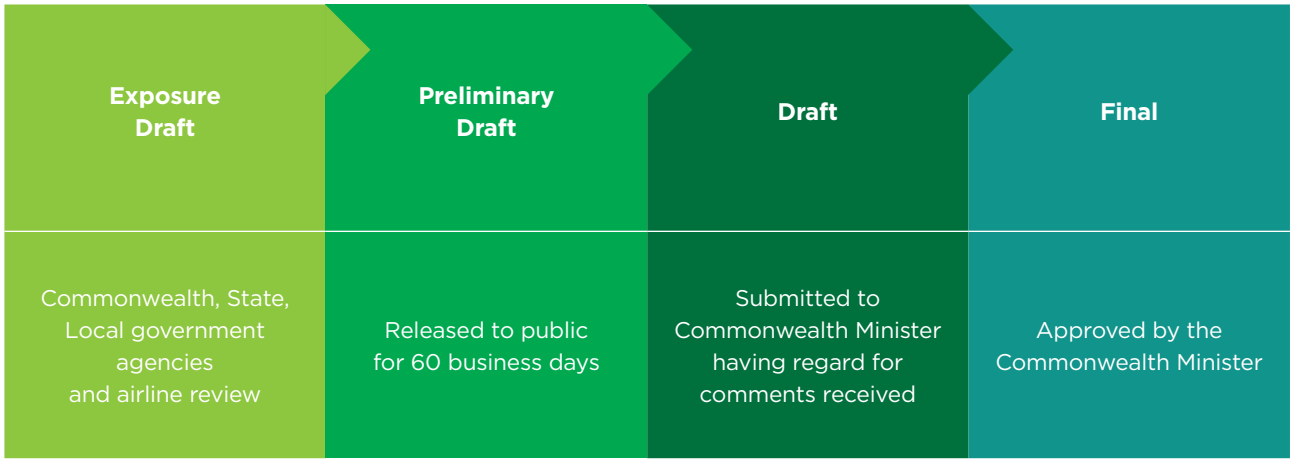


Figure ES-12 Major Development Plan approval process
Source: Perth Airport (MDP Reference: Figure 7-1)

Publication of Final MDP

In accordance with Section 86 of the Airports Act, Perth Airport has undertaken the following notifications upon approval of the Major Development Plan:

- published a newspaper notice advising that the MDP has been approved,
- made copies of the final MDP available for inspection or purchase at Perth Airport, and
- made a copy of the approved MDP available on the Perth Airport website, perthairport.com.au

A summary of Perth Airport's response to key issues raised during the public comment period has also been prepared and published on Perth Airport's website.

Once the final airspace design is completed, Perth Airport will revise the aircraft noise modelling and flight path communications materials. A Stakeholder Engagement Plan will be developed to ensure that the community is informed of the updated flight path and aircraft noise information.

Final Design and Construction

Perth Airport recognises that there will be strong interest in the NRP beyond the approval of the MDP. Community members and key stakeholders will be kept informed of the progress of the NRP activities leading up to and during the construction process, with regular communications maintained through the Perth Airport website, e-newsletter distribution, and the ongoing consultation forums.

B

Environment, Heritage and Traffic Assessment Overview

Volume B describes the initial conditions, impacts and mitigation strategies associated with the on-ground construction and operation activities of the New Runway Project. The volume also provides details for environment, heritage and traffic management for the project.

Section 8 – Environment, Heritage and Ground Transport Introduction

The Environment, Heritage and Ground Transport Introduction Section provides an overview of the process taken to assess the environmental, heritage and traffic impacts during construction and operation of the NRP.

Environment, Heritage and Ground Transport Assessment Overview

The new runway and associated infrastructure has been designed to minimise or avoid effects on environment and heritage on the airport estate, as much as reasonably practicable. Extensive technical studies have been undertaken to design, assess and mitigate the effects of the NRP on geology, hydrology, flora and fauna, ground-based noise, air quality, visual impact and heritage.

These on-ground environmental and heritage impacts associated with the construction and operation of the NRP are described in Volume B, in discipline specific Sections as follows:

- Geology and soils (Section 9),
- Wetlands and Hydrology (Section 10),
- Flora and vegetation (Section 11),
- Fauna (Section 12),
- Ground-based noise (Section 13),
- Air quality and greenhouse gas (ground) (Section 14),
- Landscape and visual impact (Section 15), and
- Heritage (Section 16).

A ground transport assessment has also been completed. To assess the impact that the construction of the new runway will have on the road network surrounding the airport, a traffic model was developed showing how the network would perform, both with and without the runway construction.

Impact Assessment Framework

To quantify the extent to which changes associated with the construction and operation of the new runway impact the environment, Perth Airport has adopted a risk-based approach. An impact assessment framework was established to assess the potential impacts of the project and identify appropriate mitigation.

Perth Airport employed a two-stage assessment process. The first stage involved risk characterisation and assigning a level of risk based on the application of standard mitigation measures. If the risk rating was found to be medium, high or very high, additional mitigation measures were applied and the risk rating reassessed after consideration of any change to the likelihood and consequence of the risk activity. This step results in the assignment of a residual risk rating for the activity.

Section 9 – Geology and Soils

The Geology and Soils Section describes the impacts on geology, soils and contamination resulting from the construction and operation of the NRP.

Geology and Soils

To assess the impact to geology and soils of the construction of the NRP, a desktop review of publicly available information, and information from prior studies was undertaken. Based on the interpretation of this data, a fieldwork plan was developed, and a field investigation was conducted.

The assessment shows that the existing ground elevations vary from less than five metres Australian Height Datum (AHD) up to approximately 30 metres AHD across the estate. The NRP area is relatively flat with elevations generally ranging between 17 metres and 21 metres AHD with a slight regional gradient from west to east.

The surficial soils across the NRP area can be broadly characterised into two groups, the Bassendean Sand Plain (and associated infilled areas) and the Pinjarra Plain.

Soil Erosion Potential

Physical and chemical laboratory testing including Emerson Class, phosphorus retention and cation exchange capacity were conducted.

Soils samples tested were generally collected from shallow depths (three metres below ground level) as these were most likely to be disturbed or affected by the construction and operation of the NRP, such as from excavations for stormwater drains and basins.

The results of the laboratory testing showed:

- the Bassendean Sands have low cation exchange capacity. The majority of the cation exchange capacity results from calcium and magnesium exchangeable ions,
- clayey materials within the Bassendean Sand and Guildford units are dispersive with moderate cation exchange capacity, and
- phosphorus retention indices reflect the clay content of a soil, the higher the clay (fines) content the greater the potential to retain phosphorus.

The Emerson Class was either two or eight for the materials tested, with most samples tested returning a class of two.

Emerson Class two soils are highly likely to discolour water if the soils are exposed to rainfall or flowing water, and Emerson Class eight soils are nondispersive soils which do not react or swell on contact with water. Construction activities proposed in areas containing Emerson Class 1 or 2 soils have a very high pollution potential. Emerson Class 2 soils should not be used for retaining structures unless adequately treated or covered with non-dispersible soils (IECA 2008).

Erosion and slope stability risks are applicable to both the construction and operation phases of the NRP. Given that the erosion potential of the shallow soils within the NRP area has been identified as very high, erosion control and management will be necessary throughout construction and during operations in accordance with industry practices.

Acid Sulfate Soils

Acid sulfate soils are naturally occurring soils, sediments and peats that contain iron sulfides, predominantly in the form of pyrite materials.

The results of the desktop review, coupled with the results of the field investigation and laboratory testing, confirm that acid sulfate soils are present in both the Bassendean Sand and Guildford Formations.

Most cut required to achieve a level grade for the NRP is less than three metres below the current surface elevation. Areas of deeper cut coincide with areas of current high topography. Therefore, the areas where the most excavation (or cut) is required are located above the groundwater table and therefore the risk of excavating, disturbing and generating acid from acid sulfate soils during general excavation at the site is low.

Surface and groundwater at the site has been demonstrated to have (on average) high alkalinity and therefore with appropriate management of disturbance to acid sulfate soils during the development, the risk of impacting surface water and groundwater during cut and fill of the site is low.

Based on the impact assessment, risks associated with acid sulfate soils while constructing the proposed Northern and Southern Main Drain were identified as high with risks from soil erosion and geotechnical work rated low or very low. Notwithstanding the low risk, noting the potential outcomes of acid sulfate impacts, a precautionary approach has been adopted and as such, additional treatment of the impact from the proposed Northern and Southern Main Drains will be applied.

Acid sulfate soils investigations have determined that prior to the construction of the Northern Main Drain and the Southern Main Drain, additional studies will be required to delineate areas of higher risk acid sulfate soils so that appropriate management plans in line with the Acid Sulfate Soil and Dewatering Management Plan can be implemented.

As part of this process an Acid Sulfate Soil Management Plan will be developed in line with DWER guidelines. This additional mitigation measure will maintain the impact of the NRP as low.

A further geological study, prior to construction, will be undertaken so that management can be targeted at high-risk areas. This treatment will reduce the risk level to low.

Potential Contaminants

The assessment of potential contaminants was completed through a preliminary site investigation (including desktop review) and a detailed site investigation.

Perfluoroalkyl and Polyfluoroalkyl Substances

Per- and poly fluoroalkyl substances (PFAS) are a large group of compounds consisting of a fluorinated hydrophobic alkyl chain of varying length with a hydrophilic end group. Certain PFAS have been identified as contaminants, including perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), of emerging concern in Australia and internationally. PFAS are very stable with a moderate mobility and highly resistant to biological degradation and, therefore, persistent within the environment. In addition, PFAS are bio-accumulative and are noted to be ubiquitous in the food chain.

Aqueous film-forming foams containing PFAS have been used internationally in firefighting activities since the 1960s. The PFAS used in aqueous film-forming foams reduce the surface tension of the water and allow an aqueous film to spread over flammable liquid and suppress vapours during firefighting.

During their historical use and storage on the estate, aqueous film-forming foams have been released to the environment through firefighting activities as well as being used on hydrocarbon spills for fire prevention. Aqueous film-forming foams may have also been released through firefighting training activities and during the maintenance, cleaning and testing of firefighting equipment, as well as through spills and leaks from storage and transfer activities.

Only three per cent of PFAS produced globally is used in firefighting foams, and of that only half is used for aviation purposes. The other 97 per cent of the PFAS produced is used in common industrial and domestic uses such as industrial lubricant, water proofing, Teflon coating, surfactants in chemicals, scotch guards amongst many other uses.

A number of investigations, including a human health and ecological risk assessment, as well as ongoing monitoring for PFAS in both groundwater and surface water, have been undertaken across the estate.

PFAS concentrations within the NRP area were below the laboratory limit of reporting (LOR) in all soil samples. However, PFAS was reported above the laboratory LOR and adopted assessment criteria in surface water and groundwater samples. Appropriate mitigation measures will be put in place to reduce risk to workers and the environment during construction. Including:

- the placement of soil will be considered to ensure that no unacceptable increase in contamination risk, no increase in off-site release risk, and no increase in risk to groundwater and surface water, and
- the risk to workers from exposure to contaminated ground or surface water can be managed using standard personal protective equipment (long sleeve trousers and shirts, gloves and glasses) to limit any exposure to potentially contaminated groundwater.

Contaminated Sites Database

To understand the soil conditions surrounding the NRP area, a search of the State Government Contaminated Sites Database was undertaken.

Site observations and analytical data for the soil samples indicate that contamination only exists within the NRP area at Soil Bore SB01, where surface staining with hydrocarbon odours was observed.

Historical site activities have resulted in contamination at various locations across the NRP area. However, much of this contamination is localised. Surface and groundwater contamination appears to be more widespread and not limited to the NRP area. That is, the results obtained as part of this assessment are indicative of the quality of surface and groundwater that flows into and across the estate.

Conclusion

Perth Airport has undertaken studies that assessed the existing geological and contaminant conditions within the NRP area. Studies noted the existence of acid sulfate soils and soils with high erosion potential. Contaminants of potential concern were also found within the NRP area. A majority of contaminants had a localised impact within the NRP area. However, the results for surface and groundwater suggest that the quality of water on the estate is indicative of the wider quality of water that flows into and across the estate from outside sources.

Risks posed by geology, soils and contamination will require management and treatment during the construction phase of the NRP. This will be done through the preparation of the Construction Environmental Management Plan that includes an Acid Sulfate Soil and Dewatering Management Plan. With appropriate mitigation in place, the risks identified can be managed.

Key Findings

The key findings from investigations into geology and soils include:

- Any disturbance of soils close to (within one metre) or below the groundwater table during the construction of the NRP should be assumed to be disturbing acid sulfate soils and therefore likely to release acidity. Active acid sulfate soil management (stockpiling) and treatment (addition of lime) will be required to protect local soil and groundwater from the release of acidity and metals.
- The erosion potential of the shallow soils within the NRP area have been identified as very high, and erosion control and management will be necessary throughout construction and during operations in accordance with industry practices.
- To manage the impacts of ground movement during construction, a further geotechnical study to inform consolidation and settlement will occur prior to construction. Detailed analysis and design of excavation and soil retaining systems will also occur along with careful construction sequencing during excavation. Settlement will be monitored and early intervention undertaken if needed.
- Per- and poly fluoroalkyl substances (PFAS) concentrations within the NRP area were below the laboratory limit of reporting (LOR) in all soil samples. However, PFAS was reported above the laboratory LOR and adopted assessment criteria in surface water and groundwater samples. Appropriate mitigation measures will be put in place to reduce risk to workers and the environment during construction.
- Spills of hazardous substances and hydrocarbons may occur during the construction phase of the NRP. It is intended that low impact and low toxicity chemicals are used where practical during the construction phase to reduce the risk. The NRP construction and operation will include a range of management measures including preparation and implementation of an Acid Sulfate Soil and Dewatering Management Plan. Remediation of the existing contaminants will result in a beneficial impact where contaminants are removed, and appropriate risk minimisation will be undertaken where contaminants are left in situ.

Section 10 – Wetlands and Hydrology

The Wetlands and Hydrology Section describes the impacts on wetlands and hydrology resulting from the construction and operation of the NRP.

The major physical impacts to stormwater infrastructure of the NRP are:

- The clearing of the NRP area and construction of infrastructure will result in the unavoidable loss of 80 hectares across seven wetlands considered commensurate with Conservation Category Wetlands (CCW) and 18 hectares of twelve wetlands considered commensurate with Resource Enhancement Wetlands (REW),
- the NRP will fill in areas that are currently used as stormwater storage, both excavated and naturally low-lying areas,
- the existing overflow channel that drains stormwater into Munday Swamp from the Northern Main Drain (NMD) in storm events larger than one exceedance per year will be cut off due to the taxiway layout, and
- the required NMD realignment will result in Munday Swamp receiving additional surface water in storm events that are larger than a one exceedance per year event.

To assess the impact to hydrology from the construction of the NRP an assessment of wetland values, stormwater, groundwater and water quality was undertaken.

Wetlands

Remaining wetlands within the Perth Airport estate have been subject to disturbance over time and changes to hydrology which have impacted wetland values. Major drainage lines, for example, have previously been constructed, redirected and upgraded to manage surface water flows and shallow groundwater tables affecting development of the site; as well as to convey stormwater from large urban catchments upgradient of the Airport estate through to the Swan River.

The NRP boundary includes 257.5 hectares mapped as wetland in the current Geographic Wetlands of the Swan Coastal Plain (GWSCP) dataset, 88 per cent of the total NRP area. Of this, 68.1 hectares is mapped as a CCW and 49.4 hectares as REW, with the remainder mapped as Multiple Use Wetland. As a result of the remapping process undertaken for the purpose of assessing impacts of the NRP, 19 potential REW or CCWs were identified in and around the NRP, in addition to Munday Swamp. In total, the boundaries of these wetlands cover 191.5 hectares, of which 97.6 hectares are within the NRP.

Stormwater

Perth Airport is located on the Swan Coastal Plain and sits within two of the 30 major stormwater catchments of the Swan and Canning rivers system. The Northern Main Drain (NMD) and the Southern Main Drain (SMD) are two open-channel main drains that traverse through the estate, draining two of those 30 catchments. The NMD catchment and the SMD catchment both extend from the top of the Darling Scarp down to the Swan River.

The concept for Perth Airport's stormwater design criteria relating to airside infrastructure is to protect all runways and taxiways from a one per cent annual exceedance probability storm event. Implementing that concept across the estate means that flood water on the airport estate would only be a limiting factor for aircraft movements in extreme rainfall events.

In the Perth Airport Master Plan 2014, Perth Airport has stated that it will provide stormwater infrastructure that has the capacity to meet the peak inflows and peak storage requirements from upstream sources as at 1997 values, as well as provide relevant peak stormwater storage requirements for all new development within the airport estate since 1997. Subject to the suitable management of inflows, Perth Airport will control outflows out of the estate and into external infrastructure, water courses and ultimately into the Swan River to the same peak rates as per 1997.

Stormwater assessment for the airport estate has been undertaken as part of the Perth Airport Master Drainage Strategy 2017 update (MDS). Three of the scenarios assessed for the MDS are relevant for the NRP. They are:

- 'Existing' situation scenario (developments and surface levels) on the airport estate (as at February 2016),
- NRP scenario ('Existing' situation with NRP infrastructure constructed), and
- 'Ultimate' scenario (developments and surface levels based on future planned land uses for both aeronautical, with NRP infrastructure, and non-aeronautical).

Specialised computer software programs were used to create a model of each scenario. The output information includes flow rates, flow depths, areas of surface flooding flood depths, water velocities and at some locations on the airport estate the time of inundation has also been provided.

The modelling results of the first two scenarios were used to assess the impacts of the NRP, and the last scenario was used to check that the NRP design would not negatively impact on future concept plans for aeronautical and non-aeronautical developments across the estate.

The NRP will result in changes to the hydrological regime within the estate.

Northern Main Drain

Changes to the NMD infrastructure will not increase the peak flows being discharged from the estate.

The NMD is to be redirected around the NRP with flows draining through a treatment train process ending in an infiltration basin which will have a capacity to contain a one exceedance per year rainfall event. Flows larger than this will then flow through the basin and into Munday Swamp.

Munday Swamp Hydrology

In the instance of a storm event, larger than a one exceedance per year, which typically occurs mid-winter and there is not another large event over the spring or summer period, the swamp would typically drawdown in a few months, and maintain its normal hydroperiod. As such, the expected flood durations are within the tolerance of Munday Swamp's environment and its associated flora and fauna, and therefore there is not a significant risk to the vegetation.

The modelling has considered the location of the highest flow velocities. The velocities that are above the concept design value are slow enough to be managed by increasing the flow resistance with local provenance vegetation if detailed design still indicates that is needed. The flow velocities draining through the swamp are considered to pose little impact to fauna and vegetation.

Downstream of the New Runway Project – Flooding

The NRP infrastructure will not cause an increase in the flood level upstream of the cross runway (06/24) emergency access road culvert. The water level will be lower than the current situation.

Downstream of the New Runway Project – Water Quality

Due to the NMD flow draining through the treatment train upstream of Munday Swamp, the large majority of pollutants will be stripped from the flow at that point. This will provide a positive benefit to the water quality in the NMD downstream of Munday Swamp and into the Swan River.

High Wycombe and Macao Road Branch Drains

There will not be any downstream conditions affecting flow in these drains. There will also be no impact to these drains or the land abutting them.

Southern Main Drain

Stormwater modelling has shown that changes to the SMD infrastructure as part of the NRP and the future concept realignment through or past Runway Swamp will not increase the peak flows being discharged from the estate.

Downstream of Horrie Miller Drive a new section of SMD will be constructed to meet up with the existing SMD where it reaches the western airport boundary after flowing under the existing main runway (03/21).

Groundwater

Groundwater modelling was undertaken specifically for the NRP to assess impacts caused by infrastructure changes. The modelling was undertaken using a specialised computer software program called Visual MODFLOW.

Scenarios that were modelled as part of the impacts assessment were:

- post NMD and SMD changes,
- post NRP pavement construction,
- post NRP - Seasonal High Groundwater Level, and
- post NRP - Seasonal Low Groundwater Level

The modelling results for the seasonal low situation indicate that there will be minimal to zero changes across the NRP area and beyond. The largest impacts are for the seasonal high situation which will be slightly lower but within the existing seasonal range.

Water Quality

Perth Airport have been monitoring surface water and groundwater since being granted the lease in 1997. Results are submitted to the Commonwealth Department of Infrastructure, Transport, Regional Development and Communications. The monitoring program covers the estate and is a risk based approach with higher risk areas/locations with 'high' readings being monitored more often than other areas.

Perth Airport monitors water quality in the NMD and SMD at their upstream and downstream boundaries. The stormwater contains the expected pollutants from an urban and former farmland catchment. There is no specific surface water pollution issue in the NRP area that Perth Airport is currently required to manage apart from the standard stormwater industry issues dealt with as part of Water Sensitive Urban Design.

Environmental Impacts

Environmental impact of changes to wetlands and hydrology were also assessed.

Wetlands

Based on the wetland boundary remapping and evaluations, direct impacts to wetlands as a result of the NRP relate to a loss of 79.8 hectares across seven wetlands considered commensurate with CCWs and 17.8 hectares of twelve wetlands considered commensurate with REWs. Although the scale of direct loss of wetland within the NRP project area is moderate, the impact represents a complete (i.e. high intensity, permanent and irreversible) loss of wetland within the project area. Considering the historical loss of wetlands on the Swan Coastal Plain, the interconnected nature of the NRP wetlands within an extensive mosaic of wetland and bushland vegetation that is part of a fragmented ecological linkage with the Swan River, the directs impacts of the NRP on wetlands have been assessed at a level of High Adverse significance.

Realignment of NMD into Munday Swamp – Ecological Protection

The infiltration basin will capture and infiltrate all flows from storm events that occur once per year or more often. Based on historical rainfall information recorded at the Perth Airport Bureau of Meteorology weather station, this basin will infiltrate approximately 80 per cent of all water from upstream of the airport in the NMD catchment.

Increased Stormwater Runoff and Changes to Hydrogeological Regimes

Modelling work undertaken to date suggests that the predicted changes in groundwater levels are less than typical seasonal variability (i.e. greater than between 0.6 metre to 1.6 metres depending on site location). It is therefore interpreted that negative impacts due to groundwater levels are very unlikely.

Contamination and Mobilisation of Affected Surface Water and Groundwater

Dewatering of in-situ acid sulfate soils during construction and subsequent acidification of soil and groundwater is a potential impact where groundwater level drawdown is greater than typical seasonal variability.

The potential for contamination of surface and groundwater from chemical or fuel spills is temporarily increased due to construction activities. Surface water runoff has the potential to mobilise contaminated water beyond the estate boundary.

Changes to Contaminants that may affect Flora and Fauna in Munday Swamp

The new drainage system constructed as part of the NRP is likely to intercept potentially contaminated soils and waters (including the highly recalcitrant emerging contaminants, PFOS/PFAS) when creating the new drainage system. Acid sulfate soils can also be expected due to the known presence of coffee rock as well as peats and clays.

Conclusion

The flood-modelling work undertaken as part of the Master Drainage Strategy has shown that the storage being lost for the NRP can be managed by incorporating storage within the new storage areas and open channels proposed for the NRP.

The realignment of the NMD will allow for stormwater to continue to drain into Munday Swamp during rain events larger than one exceedance per year, however, the total volume will be more than the current situation. Potential scouring of the swamp base and the banks by the water draining through the swamp can be managed by design of the infiltration basin and the area between that and the swamp to control the water's velocity. Any possible negative hydrological effects on the flora and fauna within the swamp due to the increase in water volume can be negated or minimised through design of the swamp's new outlet structure to keep the depth of water and its inundation time to levels that are tolerable to the flora and fauna.

The residual risks were mostly assessed as low or very low, with two retaining a medium risk. The potential increase in the risk of weeds and pollution entering Munday Swamp and increased metals, nutrients, hydrocarbons and other pollutants in the water affecting vegetation growth and fauna, have both been identified as retaining a medium risk.

Any disturbance of the pollutants captured in the upstream treatment train can be minimised in the detailed design phase by use of high-level overflow structures or similar engineered elements. Management of contamination and nutrient transport that may affect vegetation growth and fauna will be monitored and managed in line with Perth Airport's Environment Strategy. Weed management within Munday Swamp area will continue to be undertaken as required.

In summary, the studies and modelling undertaken by Perth Airport suggest that potential hydrological impacts can be adequately managed through the implementation of the standard and additional mitigation strategies outlined in this Section.

Key Findings

Key findings from investigations into wetlands across the NRP include:

- Sixteen priority wetlands were identified in and around the NRP, comprising sumplands and damplands of the Mungala consanguineous suite. In total, the boundaries of these wetlands cover 191.5 hectares, of which 97.6 hectares is within the NRP.
- The clearing of the NRP and construction of infrastructure will result in the unavoidable loss of 79.8 hectares across seven wetlands considered commensurate with Conservation category wetlands and 17.8 hectares of twelve wetlands considered commensurate with Resource Enhancement category wetlands.

Key findings from investigations into stormwater across the New Runway Project area include:

- Sections of the NMD and SMD are required to be realigned to facilitate the safe operation of the NRP and to provide adequate drainage capacity. The design of the drainage network will cater for the one per cent annual exceedance probability events and will include additional water flowing through Munday Swamp.
- Flood modelling indicates that any flooding as a result of the proposed stormwater infrastructure system changes, will not result in an increased risk of harm or damage to property on, or off the airport estate.
- Changes to surface water and groundwater affecting Munday Swamp will be within the tolerance levels of the swamps flora and fauna.
- For flows larger than the one exceedance per year storm event, there will be an increased volume of water flowing into Munday Swamp. Potential scouring of the Munday Swamp base and the banks by the water draining through the swamp will be managed by the design of the proposed pollution capturing basins, an infiltration basin and measures to control the velocity of water flow. These measures will be designed to reduce the velocity of the water before it enters Munday Swamp.
- Construction activities that result in a risk of mobilising sediment, acid sulfate soil and other contaminants into Munday Swamp will be managed through the design process and via the implementation of a CEMP. Where the same risks are expected post construction, they will be addressed in the detailed design work.

Section 11 – Flora and Vegetation

The Flora and Vegetation Section describes the impacts on flora and vegetation resulting from the construction and operation of the NRP.

The NRP will impact flora and vegetation across the site as a result of:

- clearing within the NRP area,
- realignment of drainage infrastructure,
- infill of the southern section of Munday Swamp, and
- the construction, maintenance and operation of the runway.

Therefore, the potential impacts on flora and vegetation have been identified as:

- clearing and site preparation,
- habitat fragmentation,
- invasion of weed, disease and/or pest species,
- plant-pollinator associations,
- increase in the occurrence of bushfire during construction and operation,
- increase in the occurrence of dieback, and
- change in hydrological regime.

Perth Airport will seek to avoid and minimise clearing of native vegetation as the detailed design of the NRP progresses.

Flora and Vegetation

As Perth Airport is located on Commonwealth land, impacts on flora and vegetation must be considered under *the Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This consideration is developed in accordance with Significant Impact Guidelines 1.1: Matters of National Environmental Significance, and Significant Impact Guidelines 1.2: for Actions on or impacting upon Commonwealth land and actions by Commonwealth agencies.

Significant Impact Guidelines 1.1 covers Matter of National Environmental Significance (MNES) that are specified in the EPBC Act. Significant Impact Guidelines 1.2 covers other matters that are of environmental significance not specified as MNES, which would normally be assessed under State legislation. This is considered as a "Whole of Environment" approach to flora assessment, and includes potential impacts (direct, indirect and offsite), mitigation and significance to MNES, state listed species and other remnant native vegetation.

Under Part 13 of the EPBC Act, a permit to clear threatened species and ecological communities must be obtained from Department of Agriculture, Water and Environment (DAWE) prior to clearing any matters of national environmental significance. This process has been started and will be completed in parallel with the MDP process.

Flora and Vegetation Assessment

Perth Airport has undertaken a series of studies dating back to 1994 to understand flora and vegetation across the estate. These studies have been used to inform the work underpinning the NRP assessment.

To define the existing flora conditions, assess the potential impacts from the construction and operation of the NRP, and propose mitigation measures, a new assessment (2019) of the impacts of the NRP on flora and vegetation has been undertaken. This includes various field surveys within the NRP area and a desktop assessment of relevant State and Commonwealth databases. The latest assessment includes previous data analyses as well as current vegetation and flora information.

Native Remnant Vegetation

This MDP is seeking approval to clear up to 139.4ha of native remnant vegetation. Perth Airport will seek to minimise the clearing of native vegetation as the detailed design of the NRP progresses. The vegetation condition in over 51 per cent of the NRP area was classified as degraded. About 40 per cent of the remnant vegetation in the NRP area was considered to be in good to excellent condition. No vegetation in the NRP area was considered to be in pristine condition due to the presence of weed species or evidence of disturbance including feral animals, and vehicle tracks across the entire NRP area.

Threatened Ecological Communities

Banksia Woodlands of the Swan Coastal Plain

Under the EPBC Act, the Banksia Woodlands of the Swan Coastal Plain community is listed as Endangered. There are twelve patches of the Banksia Woodlands of the Swan Coastal Plain threatened ecological community (Banksia Woodlands TEC) in the NRP area that meet the diagnostic criteria of the DEE's Banksia Woodland TEC Conservation Advice. A total of 41.4 hectares of the Banksia Woodland TEC will be impacted by the clearing for the NRP.

According to the Conservation Advice, the area of Banksia Woodlands remaining on the Swan Coastal Plain is believed to be around 336,000 – 337,000 hectares. The total area of 41.4 hectares to be cleared for the NRP represents 0.013 per cent of the remaining Banksia Woodlands TEC. Therefore, it is highly unlikely the clearing for the NRP will adversely affect either the survival or recovery in nature of Banksia Woodlands or its conservation status.

Forests and Woodlands of deep seasonal wetlands of the Swan Coastal Plain

Under the Biodiversity Conservation Act 2016 (BC Act), the Forests and Woodlands of Deep Seasonal Wetlands of the Swan Coastal Plain, SCP 15, community is listed as Vulnerable. There are six records of the SCP 15 community over a 270 kilometre range across the Swan Coastal Plain. A total of 4.07 hectares of the SCP 15 community will be removed by the NRP. This represents all of the community within the Perth Airport estate. Based on the limited occurrences of the community and potential for the extent of the community to also be limited, the potential impacts of the NRP on TEC SCP 15 are considered to be significant.

Clay Pans of the Swan Coastal Plain

Herb rich saline shrublands in clay pans (SCP 07) is listed as a TEC and classified as Vulnerable pursuant to the BC Act and also listed as a TEC that forms a component of the EPBC Act listed TEC 'Clay Pans of the Swan Coastal Plain' which is classified as Critically Endangered. It was listed as occurring at the Perth Airport estate by the State Department for Biodiversity, Conservation and Attractions (DBCA) from a single vegetation quadrat.

However, subsequent on ground surveys conducted in 2014, 2017 and 2018 and also significant floristic statistical analysis of all available data have shown that the record of SCP 07 is likely to be erroneous. Instead, it is more aligned with other Floristic Community Types than SCP 07; and additionally, the surface soil conditions of the site are sandy and not consistent with clay pans. Therefore, it is considered that this TEC does not occur on the Perth Airport Estate.

Threatened Flora Species

EPBC Listed Species – *Conospermum undulatum* and *Macarthuria keigheryi*.

Conospermum undulatum

Conospermum undulatum is an erect shrub up to two metres with wavy leaves that taper to the base. It has woolly flowers with long white hairs and is typically multi stemmed. It is listed as Vulnerable by the Commonwealth and State.

Conospermum undulatum

The Recovery Plan for *Conospermum undulatum* (DEC 2009) identified that in 2008 it was known from 25 historical populations (65 sub-populations) between the Swan and Canning Rivers of which 20 contained extant plants, with two known populations located at Perth Airport at that time. The Recovery Plan listed all 65 populations and sub-populations as most important and that provided the greatest contribution to the long term survival of the species.

DBCA database records (2018) report a total of 32 populations of *Conospermum undulatum*, of which 28 are extant. The total reported number of individuals of C. undulatum is 11,400. The NRP will result in:

- the loss of three populations of the four populations within the Airport estate,
- the loss of 206 plants from 237 within the Perth Airport estate, and
- the loss of 1.8 per cent of the total 11,400 individuals recorded by the DBCA.

The species has a restricted distribution with records on known locations distributed over 21 kilometres with 14 other locations across its range having extant populations. Based on the limited range of *Conospermum undulatum* occurrence, and the recognised importance of the Perth Airport populations to the survival of the species, the potential impacts of the NRP to *Conospermum undulatum* as a species are considered significant.

Macarthuria keigheryi

Macarthuria keigheryi is small shrub that grows to 0.4 metres tall by 0.6 metres wide, with hairy, bright yellow to green stems, with leaves present mainly at the base of the stems. It is listed as Endangered under Commonwealth and State legislation.

Macarthuria keigheryi

The Recovery Plan for the species identified that in 2009 there were six recorded populations of *Macarthuria keigheryi* with an estimated 10,070 plants located over a range of 160 kilometres (DEC 2009). Current (2018) DBCA records show a total of nine extant populations and 19 subpopulations of *Macarthuria keigheryi*, containing an estimated 41,700 individuals. These records come from four broad regional locations over a range of approximately 167 kilometres: Cooljarloo – Falcon in the north; unallocated Crown Land near Lake Guraga; the Moore River National Park - Whitfield Springs Road; and in the Perth metropolitan area (Kewdale – Forrestfield Area). The Perth metropolitan area has the smallest populations, with 1,368 known individuals representing 3.2 per cent of the known total population.

Recent flora surveys within the Perth Airport estate for the presence of *Macarthuria keigheryi* have been undertaken in 2016 and 2017, with two additional surveys undertaken by separatist botanists in 2018. The most recent survey data indicates that 855 plants from 1355 across the estate will be impacted as a result of the NRP. This is 2.05 per cent of the known regional individual plants. Based on the wide range of *Macarthuria keigheryi* occurrence, the low proportion of extant plants potentially taken, and the abundance at known locations likely to be under represented by the current data the potential impacts of the NRP to *Macarthuria keigheryi* as a species are not considered significant despite the Interim Recovery Plan determination of this population as important to the survival of the species. However, the reported genetic differentiation of the Airport population from other populations may indicate additional significance of the Airport population, and therefore the impact of the NRP on *Macarthuria keigheryi* is considered significant.

Macarthuria keigheryi occurs over a wide range, is likely to be underrepresented by current data, and the fact that a low proportion of the extant plants will be taken for the NRP suggests that there will not be significant impacts to the species. However, a genetic study between the Airport population and one to the north showed distinct genetic differentiation and suggested that the populations should be considered genetically unique. For this reason, the impact of the NRP on *Macarthuria keigheryi* is considered significant.

Department for Biodiversity, Conservation and Attractions Listed Priority Species

Eight DBCA listed Priority Flora Species occur within the NRP area, see Table ES-4.

Taxon	DBCA Priority Flora Category
Jacksonia gracillima	P3
Johnsonia pubescens subsp. cygnorum	P2
Ornduffia submersa	P4
Platysace ramosissima	P3
Schoenus benthamii	P3
Schoenus pennisetis	P3
Stylidium longitubum	P4
Verticordia lindleyi subsp. lindleyi	P4

Table ES-4 DBCA Priority Flora occurring within the NRP
Source: Woodman Environmental, 2019 (MDP Reference: Table 11-23)

Species range, genetic diversity, number of populations and individuals and any other available information (including species life form, reproductive and habitat requirements) regarding each species was examined. The potential impacts of the NRP are not considered to be significant on any of the above listed Priority Species.

Aquatic Flora

Three species of macrophytes were recorded from aquatic samples at Munday Swamp:
- *Elatine gratioloides*,
- *Ottelia ovalifolia*, and
- *Lepilaena australis*.

The NRP may potentially impact on adjoining groundwater and/or surface water fed vegetation, in particular that of Munday Swamp, as a result of the infilling of the southernmost section of the swamp, changes to surface water flows, localised groundwater drawdown or acidification of groundwater both during construction and operation.

Mitigation

Standard and additional mitigation measures will be applied through the design, construction and operation of the NRP. These measures include:
- minimisation of vegetation clearing within NRP area,
- construction plans to include delineation of clearing extents, and identification and signage or fencing of exclusion zones where required,
- supervision of vegetation clearing near conservation significant species by environmental representative,
- weed and pest hygiene requirements (cleaning and inspection of vehicles and machinery),
- spill and emergency response measures,
- dewatering management measures for drainage realignment and groundwater dewatering,
- vehicle movement management, and
- implementation of a conservation-significant flora and vegetation management plan to identify opportunities for e.g. collecting genetic materials, rehabilitation of sites that were subject to temporary disturbance during construction, and
- management of rootstock and seedbank (soil).

Conclusion

To support safe and critical infrastructure, the NRP requires the development of a 293 hectare site, and the clearing of up to 139.4 hectares of native vegetation.

Key Findings

Key findings relating to flora and vegetation across the NRP area include impact to:
- 139.4 hectares of remnant vegetation,
- the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed:
  - Banksia Woodlands of the Swan Coastal Plain community (Endangered), 41.4 hectares,
  - *Conospermum undulatum* (Vulnerable, including State listed), 206 plants, and
  - *Macarthuria keigheryi* (Endangered, including State listed), 855 plants,
- the State *Biodiversity Conservation Act 2016* (BC Act) listed:
  - 4.07 hectares of Forests and Woodlands of Deep Seasonal Wetlands of the Swan Coastal Plain, SCP 15, community (Vulnerable), and
- eight Priority Species Listed by the State Department of Biodiversity Conservation and Attractions (DBCA).

Section 12 – Fauna

The Fauna Section describes the impacts on fauna resulting from the construction and operation of the NRP.

The NRP will impact fauna as a result of:
- clearing in the NRP area,
- the infilling of the southernmost section of Munday Swamp, and
- the construction and operation of the runway.

Therefore, the potential impacts on fauna have been identified as:
- loss of habitat affecting population survival,
- loss of habitat lading to population fragmentation,
- degradation of habitat due to weed, pest or disease invasion, leading to population decline,
- increased mortality,
- species interactions, including predation and competition, and
- changes in the hydrological regime.

Perth Airport will seek to avoid and minimise clearing of native vegetation to reduce impacts to fauna habitat as the detailed design of the NRP progresses.

Fauna and Fauna Habitat

As Perth Airport is located on Commonwealth land, impacts to fauna must be considered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This consideration is developed in accordance with Significant Impact Guidelines 1.1: Matters of National Environmental Significance, and Significant Impact Guidelines 1.2: for Actions on or impacting upon Commonwealth land and actions by Commonwealth agencies.

Significant Impact Guidelines 1.1 covers Matter of National Environmental Significance (MNES) that are specified in the EPBC Act. Significant Impact Guidelines 1.2 covers other matters that are of environmental significance not specified as MNES, which would normally be assessed under State legislation. This is considered as a "Whole of Environment" approach to fauna assessment, and includes potential impacts (direct, indirect and offsite), mitigation and significance to MNES, state listed species and other vegetation in terms of fauna habitat.

Fauna Assessment

Perth Airport has undertaken a series of studies dating back to 1994 to understand fauna and fauna habitat across the estate. These studies have been used to inform the work underpinning the NRP assessment.

An approach to fauna impact assessment was developed based upon Significant Impact Guidelines 1.1. The approach is used to assess the significance of an area for fauna species and the potential impacts to fauna. Environmental context is then used to identify and describe the fauna assemblage, the occurrence of conservation significant fauna and assign a site status for all fauna within the project area. The entire fauna assemblage assessment is based on Significant Impact Guidelines 1.2 (i.e. "Whole of Environment fauna") and includes an assessment of Vegetation and Substrate Associations, patterns of biodiversity and ecological processes.

Fauna Assemblage

While the project footprint is the area that is physically affected by the proposed works, the study area for the fauna assessment is the region defined at an appropriate scale to capture potential and contextual impacts. The assessment area therefore includes the NRP and where relevant, adjacent areas within the Airport Estate.

There were 204 vertebrate species identified as potentially occurring in the Airport Estate. These include: five fish, 12 frogs, 42 reptiles, 130 birds (six introduced) and 15 mammals (five introduced). Of these, 174 species (two fish, 11 frogs, 32 reptiles, 116 birds and 13 mammals) have been recorded in the Airport Estate and are considered highly likely to be present in the NRP. A small number of species (six birds) have been recorded recently but are now probably locally extinct, leaving a current assemblage of 168 vertebrate species (Table ES-5). Not all species listed in Table ES-5 are likely to occur in the project area, some species may be resident, while others may be regular or irregular visitors to the site as a part of an annual cycle.

	Potential	Recorded	Highly Likely	Locally extinct
Fish	5 (1 introduced)	1 (1 introduced)	1	1
Frogs	12	10	1	0
Reptiles	42	22	10	4
Birds	130 (6 introduced)	103 (4 introduced; 6 considered Locally Extinct)	13 (1 introduced)	1
Mammals	15 (5 introduced)	12 (5 introduced)	1	13
Total	**204**	**148**	**26**	**19**
		174 (168 current)		

Table ES-5 Composition of vertebrate fauna assemblage of the Airport Estate
Source: Bamford Consulting Ecologists, 2019 (MDP Reference: Table 12-4)

Conservation Significant Fauna

Of the 174 species of vertebrate fauna that have been recorded, or that are highly likely to occur in the area, nine are considered to be of conservation significance. Of these, only four species (two birds and two mammals) are expected to be regularly present and five species (all birds) irregularly present. No listed conservation significant fish, frogs or reptiles have been recorded or are expected to occur.

EPBC Listed Fauna: Black Cockatoos

All three EPBC listed species of Black Cockatoo occur on the estate. They comprise: Carnaby's, Baudin's and Forest Red-Tailed Black Cockatoos. Carnaby's Black Cockatoo is the most abundant of the black cockatoos on the Airport Estate and on the coastal plain in the Perth region generally.

Foraging habitat for Carnaby's Black Cockatoo was recorded in the project area. Approximately 232 hectares provide some foraging value for Carnaby's Black Cockatoo with a foraging value from negligible to high. There are 45.9 hectares of moderate to high foraging habitat for this species within the project area.

Carnaby's Black Cockatoo is able to forage on a wider variety of vegetation types than the other two black-cockatoo species. Foraging habitat for Baudin's and Forest Red-Tailed Black Cockatoo was also recorded in the project area. Approximately 63.9 hectares (of the total 232 hectares) provides some foraging value for Baudin's Black Cockatoo with a foraging value of negligible to high. There are 12.0 hectares of moderate to high foraging habitat for these species within the project area. Approximately 229 hectares of the project area had no foraging value for Baudin's and Forest Red-Tailed Black Cockatoos.

None of the three Black Cockatoos currently breed in the project area or the Airport Estate but limited suitable habitat is present and they do breed elsewhere on the coastal plain in small numbers. Additionally, no roosting sites or roosting activity was recorded in the Estate.

There is likely to be an impact to all three Black Cockatoos at the local and regional scales through the loss of foraging habitat and a potentially altered local distribution of the species, but this is not expected to have a significant impact at the species scale for any of the three Black Cockatoos. The NRP is unlikely to result in a significant residual impact to the Black Cockatoos.

DBCA Listed Priority Species: Quenda – Priority 4

Quenda were found to be abundant in the project area and Airport Estate. Evidence of the species (e.g. tracks and foraging holes) were found, including in native vegetation, in areas where weeds provide dense cover and riparian vegetation.

The development of the NRP will result in the loss of 232.7 hectares of Quenda habitat. There is likely to be an impact to Quenda at the local and regional scales through the loss of foraging habitat and a potentially

altered local distribution of the species, but this is not expected to have a significant impact at the species scale. Pre-clearing trapping and relocation to a suitable release site will reduce direct mortality. The regional population (defined as within a 12 kilometre radius) will persist. The NRP is unlikely to result in a significant residual impact to the Quenda.

DBCA Listed Priority Species: Rakali – Priority 4

The Rakali (water-rat) is present in the area but is likely restricted to permanent wetlands outside the Perth Airport estate, with seasonal dispersal onto the estate at Munday Swamp and along the main drains which flow through the NRP area. Drains may provide connectivity for Rakali between the Abernethy Road wetlands and the Swan River. The NRP will result in the disturbance of up to 5.6 hectares of rakali habitat as artificial drains. There is likely to be an impact to Rakali at the local scale through temporary disruption of movement through the landscape, but this is not expected to have a significant impact at either the regional or species scale. The NRP is unlikely to result in a significant residual impact to the Rakali.

DBCA Listed Priority Species: The native bee *Hylaeus globuliferus* – Priority 3

The species is known to forage on the flowers of Woollybush (*Adenanthos cygnorum*) and Banksia attenuata, which are both present in Banksia woodland of the project area. Field investigations carried out in the NRP in early 2019 did not locate the species, but some likelihood of presence remains and advice from the WA Museum is that the species may be more widespread and common than realised.

The development of the NRP will result in the loss of approximately 20.6 hectares of *Hylaeus globuliferus* habitat. There is likely to be an impact to *Hylaeus globuliferus* at the local and regional scales through the loss of habitat and a potentially altered local distribution of the species, but this is not expected to have a significant impact at the species scale. The NRP is unlikely to result in a significant residual impact to *Hylaeus globuliferus*.

Mitigation

Standard and additional mitigation measures will be applied through the design, construction and operation of the NRP. These measures include:

- minimisation of vegetation clearing within NRP area,
- construction plans to include delineation of clearing extents, and identification and signage or fencing of exclusion zones where required,
- supervision of vegetation clearing near conservation significant species by environmental representative,
- weed and pest hygiene requirements (cleaning and inspection of vehicles and machinery),
- spill and emergency response measures,
- dewatering management measures for drainage realignment and groundwater dewatering,
- vehicle movement management, and
- topsoil and stockpile management.

Conclusion

To support safe and critical infrastructure, the NRP requires the development of a 293 hectare site, and the clearing of up to 232 hectares of fauna habitat.

Key Findings

Key findings from fauna investigations across the NRP area include impacts to:

- three species of Black Cockatoos protected under the EPBC Act,
- three Priority species listed by DBCA includes the Quenda (Priority 4, DBCA), Rakali (Priority 4, DBCA) and a native bee species (*Hylaeus globuliferus*) (Priority 3, DBCA), and
- the general fauna assemblage that meets the requirement of "Whole of Environment" fauna within Guideline 1.2.

Section 13 – Ground-Based Noise

The Ground-Based Noise Section describes the impact of noise from ground-based sources during construction and operation of the NRP.

Ground Based Operational Noise

The sources of ground-based noise are:
- engine ground running,
- use of auxiliary power units, and
- aircraft taxiing.

Noise levels from the ground-based sources have been assessed using the Environmental Noise Model (ENM). ENM is the widely used and accepted computer-based, environmental noise model which allows calculation of noise levels from a series of noise sources into the surrounding area.

To validate and calibrate the ENM computer model, real-time noise loggers were placed in six suburbs around the estate to record the existing level of noise. This also allowed a baseline noise level that the predicted noise levels can be compared to.

Forecasting of ground-based noise involves assessment under acoustically neutral and typical worst case meteorological conditions that exacerbate the noise impact on nearby sensitive receivers.

Noise levels from ground-based operations have been calculated for the future periods both with and without the NRP:
- 2025 (opening year) – with and without the NRP, and
- 2045 – with the NRP.

Engine Ground Running

Perth Airport does not have major airline-maintenance facilities and so has less ground running than other major airports such as Sydney, Brisbane and Melbourne. There is, however, a continuing requirement for airlines to carry out Engine Ground Running (EGR) at Perth Airport.

A typical EGR consists of a period of running the engine at idle power, a short full power run of the engine, or a combination of both. When possible, aircraft are oriented into the wind to mitigate the noise impact on downwind receptors. Perth Airport has in place an EGR Management Plan that sets out the rules and procedures for engine testing. There is currently one primary EGR location. Historically, the EGR Management Plan has been successful, with Perth Airport receiving very few noise complaints that can be attributed to a recorded instance of EGR.

The greatest potential impact is likely to occur under temperature inversion conditions, when there is generally little wind. Noise levels will be greatest in Ashfield (CA4), South Guildford (CA5) and High Wycombe (CA6). For any individual engine running, not all of the above areas would be affected at the same time. This is because aircraft would be oriented in a particular direction during an engine run-up, usually facing into the prevailing wind and noise would not be radiated or propagated equally in all directions, with noise levels behind and downwind much higher than in-front and upwind.

The predicted noise levels reflect both current and future operations whereby noise levels over a 15-minute period are not expected to increase as there is only one primary engine ground run location. Similarly, the duration of any engine ground running sequence will not increase and it is likely only one event will occur in any one night.

However, the number of occurrences of engine ground runs over a year is expected to increase in line with increased airport operations of those aircraft types.

Perth Airport will continue to maintain, review and monitor EGR so that any impact on residents can be effectively assessed. In addition, Perth Airport will consider improved communication of information to surrounding residents on ground-based noise.

Auxiliary Power Units and Aircraft Taxiing

Most aircraft operating at Perth Airport will have an auxiliary power unit (APU), though fixed ground-power unit (fGPU) is available at most bays. APUs are sometimes preferred by airlines. Additionally, fGPU is not available at stand-off bays. The use of ground power and preconditioned air for aircraft at the gates avoids the use of aircraft APUs and the associated noise. However, these sources are not the dominant contributor to overall operational noise levels and therefore this measure would have a relatively small benefit to surrounding residences.

Modelling of aircraft taxiing showed that at CA1-CA5 (Cloverdale, Redcliffe/Belmont, Redcliffe, Bassendean and South Guildford) areas to the west of the airport, the comparison of noise levels with and without the new runway are within a few decibels for the worst-affected sensitive receivers. Figure ES-13 and Figure ES-14 show the without new runway (2025) in neutral conditions and with new runway (2025) in neutral conditions. This difference is only just able to be detected by a sensitive human ear. To the east, the most sensitive receivers will experience a significant increase in noise, though it will be consistent with the background noise level experienced in an average suburb and well below conversation level.

It is only in CA6, High Wycombe, where the worst-affected sensitive receivers would experience noise levels that approach a normal conversation. Even then, this is only expected to become a reality by 2045 and only in adverse weather conditions. Most receivers in this catchment area will experience significantly lower than the highest predicted noise levels as the noise will rapidly attenuate with distance.

Aircraft taxiing noise would be relatively low in comparison to other noise associated with operation of the airport. There are few, if any, practicable mitigation measures that would reduce this noise.

Accordingly, a holistic approach is best adopted to the assessment and control of airport noise. One of the best methods of limiting any increase in potential impact over time is good planning around the estate, including limiting residential development near the site. Perth Airport works closely with local planning authorities seeking to ensure appropriate land-use planning is implemented.

Road Traffic Noise

The development of the NRP would result in increased construction and operational traffic near the estate.

With the NRP, the expected noise level increase is less than one decibel compared to the without scenario for most roads. Accordingly, it is concluded there would not be a perceptible noise increase resulting from road traffic because of the NRP.

This outcome reflects the relative proportion of airport-induced traffic as a component of the total regional traffic forecast to use these roads.

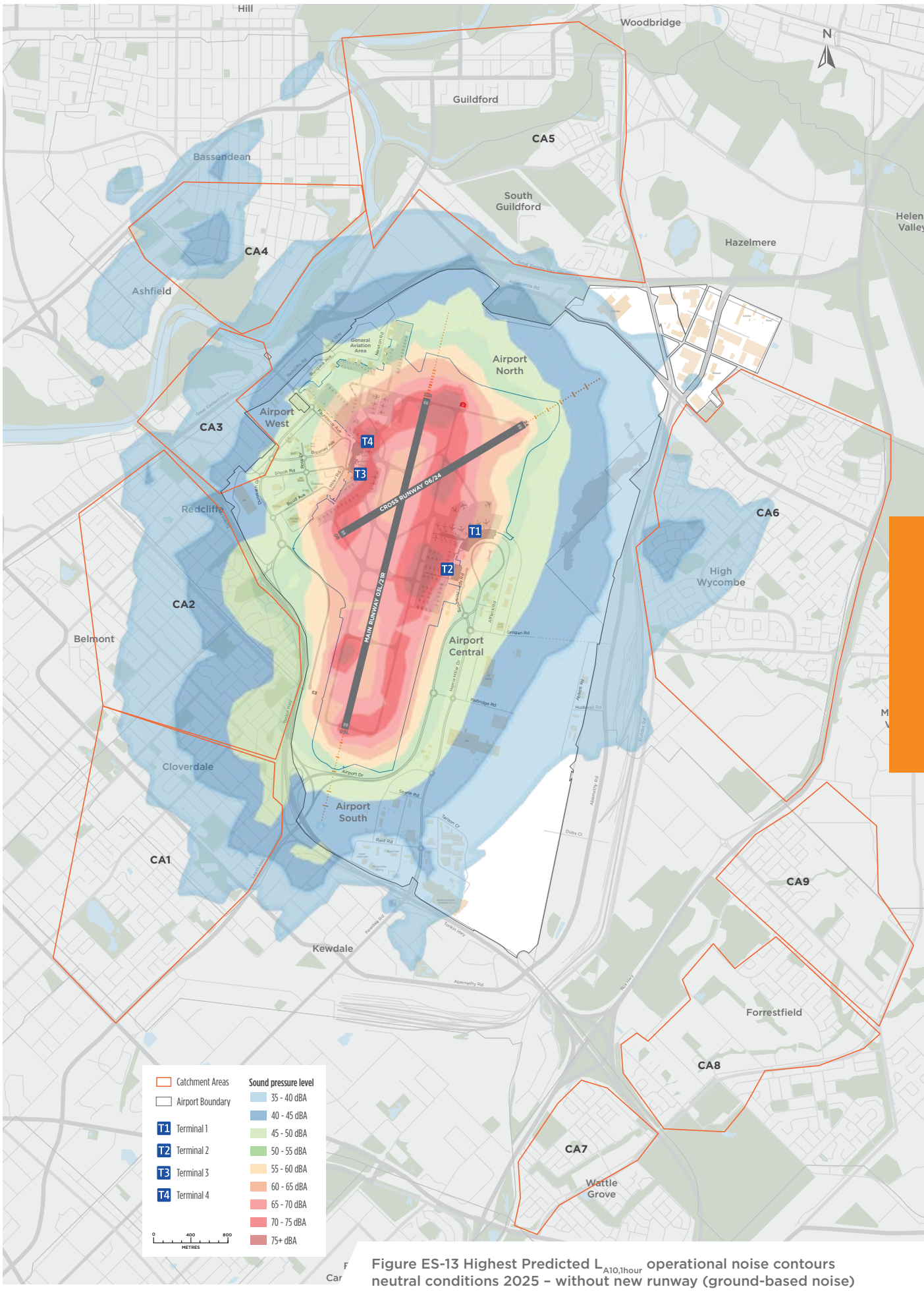


Figure ES-13 Highest Predicted $L_{A10,1hour}$ operational noise contours neutral conditions 2025 – without new runway (ground-based noise)
Source: Wilkinson Murray (MDP Reference: Figure 13-13)

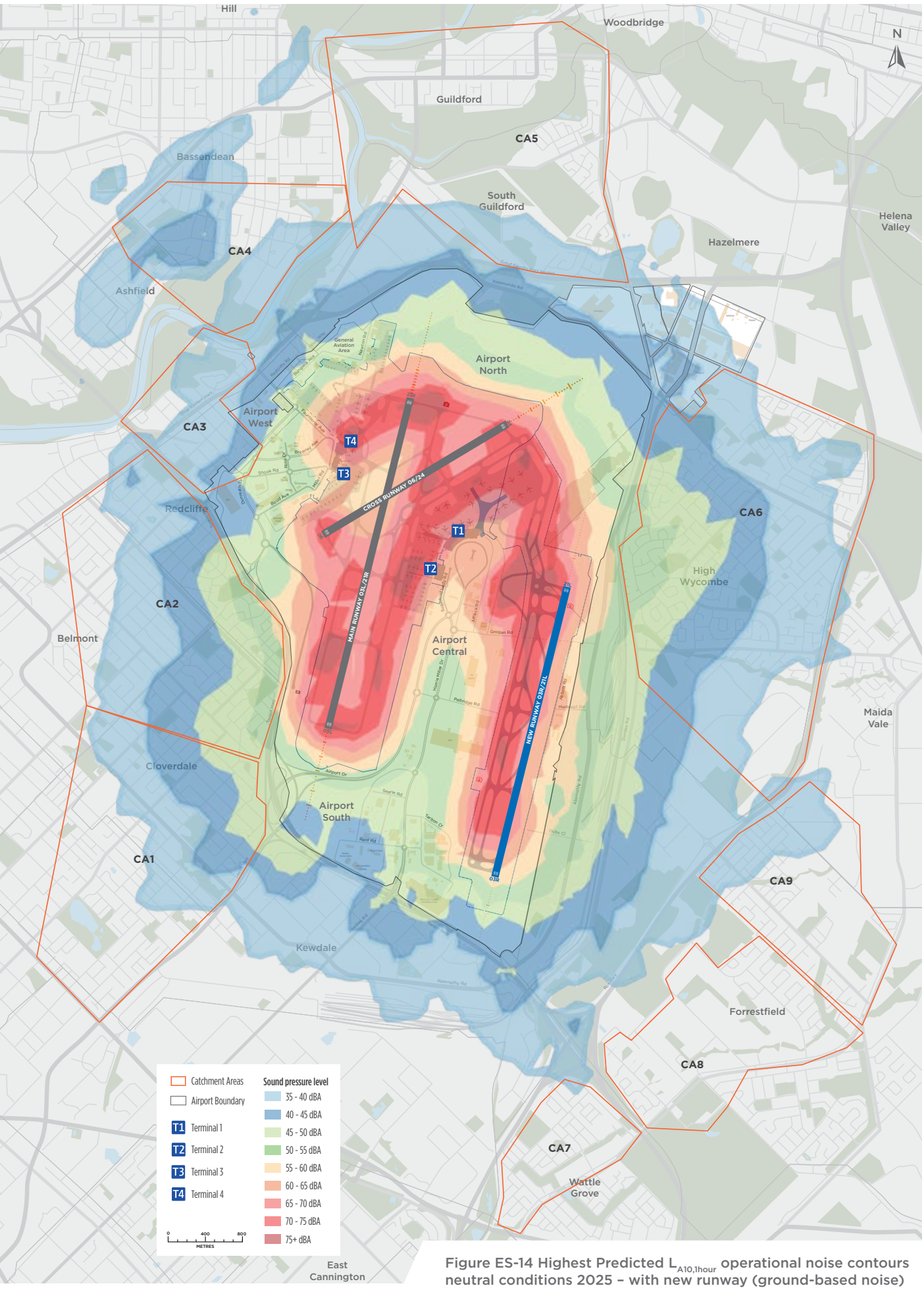


Figure ES-14 Highest Predicted $L_{A10,1hour}$ operational noise contours neutral conditions 2025 – with new runway (ground-based noise)
Source: Wilkinson Murray (MDP Reference: Figure 13-15)

Construction Noise and Vibration

The assessment indicates that traffic noise levels at the nearest potentially affected residences will increase between 0.3 dBA for peak hour and 0.2 dBA for the day period. These increases are acoustically insignificant and would not represent a noticeable change in noise levels at this receiver.

In the case of sensitive receivers in CA6, High Wycombe, (which contains the closest sensitive receivers to the NRP) construction noise levels can be expected to be up to 63 dBA at the closest residences to the NRP. This magnitude compares with existing ambient L_{A10} noise levels of 47 to 48 dBA.

The greatest impact will be when earthworks and paving occurs in the northern section of the worksite. This noise level is still consistent with the level of a normal conversation and will be lower indoors.

Vibration would be generated by the proposed construction works. As a very conservative approach, the lower guideline value (from DIN 4150-3) applying to vibration sensitive buildings (three millimetres per second) has been adopted as the threshold of damage from construction vibration. Given that any piling associated with building construction would occur well within the NRP area, there would be no risk of damage to buildings from vibration outside of the estate even if it were to be used.

Vibration may also be generated by the ripping of rock, but again the guideline value of a peak component particle velocity of three millimetres per second is likely to be complied with inside the estate and there is no risk of damage outside the estate.

A range of possible approaches to reducing the impact of construction noise and vibration will be considered. A CEMP, developed prior to construction, will address the issues relating to construction noise impact management

Conclusion

The impacts from ground-based noise are mostly benign and naturally mitigated by the distance between operations on the airport and the nearest sensitive receivers.

Little can be done to mitigate noise from APU noise. APU noise could be diminished by encouraging the use of fGPU. However, as this contribution is minimal it would do little to ameliorate noise impact in surrounding catchment areas.

Good planning of the airfield layout combined with limiting residential development in noise-affected areas is the best measure to minimise the impact of aircraft taxiing noise. Perth Airport works closely with local planning authorities seeking to ensure appropriate land-use planning is implemented. Perth Airport is committed to clear and transparent engagement with the community and will work to provide information to the community on ground-based noise.

The EGR Management Plan, as well as limited occurrence of major maintenance at Perth Airport, already results in very few complaints that can be attributed to EGRs. The greatest impacts, which are on the nearest sensitive receivers in each of the catchment areas, are comparable to the noise level of a normal conversation.

The worst-affected receivers will experience ground based noise levels above background level associated with construction of the northern section of the NRP area. This level is comparable to a normal conversation and is well below the 75 dBA criterion set out in the AEPR. This will nevertheless be managed by a noise management plan as part of the CEMP. The additional noise due to increased road traffic after the runway is operational will be negligible; well below what is detectable by the human ear.

Key Findings

Key findings from investigations into ground-based noise include:

- The impacts from ground-based noise as a result of the NRP are naturally mitigated by the distance between operations on the airport and the nearest sensitive receivers.
- In the areas to the west of the airport, the comparison of noise levels with and without the new runway are within a few decibels for the worst-affected sensitive receivers. The difference is only just enough for a sensitive human ear to detect. To the east, sensitive receivers will experience an increase in noise, though well below the 75 dB criterion set out in the Airports (Environment Protection) Regulations 1997 (the AEPR) and consistent with the background noise level experienced in an average suburb.
- Aircraft taxiing noise will be audible in the areas adjoining the eastern boundary of the estate. However, the noise levels would be relatively low in comparison to other noise associated with operation of the airport, such as aircraft arrivals and departures.
- Changed vehicle traffic volumes as a result of the NRP will result in a noise level increase of less than one decibel during the peak hour, which is well below what is detectable by the human ear.
- As airborne noise is the dominant noise source, the cumulative impact of air and ground-based noise, when considered together will not exceed that of aircraft noise when considered in isolation.

Section 14 – Air Quality and Greenhouse Gas (Ground)

The Air Quality and Greenhouse Gas (Ground) Section describes the impacts on air quality and greenhouse gas emissions from ground-based activities resulting from the construction and operation of the NRP.

Air Quality

Four scenarios were assessed for the impact to air quality from the construction and operation of the NRP, including:

- baseline - reflective of current operations (based on 2016 data),
- opening with NRP - reflective of operations in 2025 with the NRP,
- opening without NRP - reflective of operations in 2025 without the NRP, and
- 20 years - reflective of operations 20 years after opening the NRP (2045) with the NRP.

The air quality assessment for the NRP consists of two separate studies: an assessment of dust impacts during construction; and an assessment of operational impacts (relating to ground-based emissions).

The air dispersion model, AERMOD, was used for assessment of both operational and construction impacts.

For the ground-based operational assessment, air quality was assessed at a total of 57 sensitive receptors.

Terrain, ambient air quality and sensitive-receptor locations influence air quality at sensitive receptor locations at Perth Airport and surrounding areas.

Considering the sensitive receptors surrounding Perth Airport, the following observations were made from inspection of land use zoning and aerial imagery:

- sensitive receptors are located in high density within urban zones, predominantly residential properties,
- sensitive receptors exist in medium to low density within rural zones, and
- many public properties are located near the airport, including schools, halls and nursing homes.

Some receptors may have a heightened sensitivity to air quality, particularly those that support the elderly and young. Several industrial zones are located near the airport. Properties within these industrial zones contain emission sources which affect local air quality.

Caversham (CA) monitoring station is located closest to estate, thus air quality monitoring data for all pollutants (other than SO_2) collected from the CA monitoring station were used to establish existing air quality at Perth Airport and compared against the relevant air quality criteria.

Operational

In 2025 with or without the new runway, operations of APUs is the biggest contributor to annual emissions of NO_2, $PM_{2.5}$ and PM_{10} with road traffic being the second-largest. With impacts being the same for scenarios with and without the NRP in 2025 this highlights that adverse air quality impacts are due to ground-based operations resulting from the normal airport operations and is proportional to the number of aircraft movements. Those impacts that have been modelled to exceed criteria in 2025 will be considered as part of Perth Airport's overall environmental management.

For the 2045 scenario, adverse impacts were predicted for a one hour averaging period (NO_2), 24-hour averaging period (PM_{10} and $PM_{2.5}$) and annual averaging period ($PM_{2.5}$). Exceedances of the limit for $PM_{2.5}$ 24-hour and annual averaging period, and NO_2 one-hour averaging period were predicted.

The most-affected receptor (considering impacts for all pollutants and for with and without NRP scenarios) is the on-site receptor R57. At this receptor, Auxilliary Power Unit (APU) and Ground Services Equipment (GSE) emissions from the General Aviation area are most influential. No exceedances of air-quality limits were predicted at any other receptor (both on-site and off-site).

In considering the duration of the averaging periods for the exceedances, and that people are unlikely to linger at the receptor R57 location, it is unlikely the general public will experience adverse health effects from the air quality impacts.

Construction

The 99.9th percentile ground level concentrations demonstrate no exceedances at incremental concentrations at receptor locations, and exceedances for cumulative concentrations for only four receptor locations (including two on-site receptors, R2 and R3). The two affected off-site receptors are R9 (child care centre) and R41 (industrial site), both located immediately to the east of the estate. PM_{10} concentrations at these receptors are predicted to be 62 µg/m^3 and 59 µg/m^3, respectively. While these exceedances are considered high adverse (using the 99.9th percentile ground level concentrations for the reasons stated above) in terms of impact significance, standard controls for dust generated by construction activities are expected to reduce the residual risk of the impacts to low.

Odour

It is considered that current aviation operations conducted at Perth Airport do not result in odour issues. Despite the much larger number of aircraft movements expected to occur in 2045 compared to baseline conditions, the amount of TVOCs emitted from APUs is expected to be similar due to greater use of Ground Power Units (GPUs).

Increased future combustion of diesel by airport Ground Service Equipment and the associated emissions of TVOCs is unlikely to create odour impacts at sensitive receptors. Predicted concentrations due to airport ground-based operations are well below criteria.

The risk of odour impacts resulting from construction and operation of the NRP have been assessed as being low, even without additional mitigation measures.

Greenhouse Gas Emissions

For the purposes of this impact assessment, Perth Airport's Scope 3 emissions include sources such as the transfer of waste offsite, operation of aircraft APUs, GSE by airlines, and electricity purchased offsite and consumed by tenants. Operation of the NRP is expected to affect such sources which makes accounting for and reporting of Scope 3 emissions necessary for the impact assessment.

Western Australia's greenhouse gas emissions inventory was last documented for the year 2014. Stationary energy (power generation) sector produces the most amount of greenhouse gas emissions in Western Australia, meanwhile the transport sector is the second largest contributor. Within the transport sector, emissions are predominantly attributed to road transport.

To assess the impact of airport operations on greenhouse gas emissions upon completion of the NRP, it was first necessary to establish current greenhouse gas emissions. Scope 1, 2 and 3 emissions were calculated.

Perth Airport exceeded the NGER reporting thresholds in 2016 with baseline operations. Electricity purchased by Perth Airport is the most significant source of Scope 1 and Scope 2 emissions for baseline operations. Scope 3 emissions are optional for reporting purposes and not owned or controlled by Perth Airport. Scope 3 emissions are the most significant contributor to the airport's total greenhouse gas emission inventory. Emissions produced by tenants, including electricity purchased by tenants on the estate, and operation of APUs are the most significant greenhouse gas emission sources.

Operational

Greenhouse gas emission estimates for scenarios with and without the NRP during the opening year (2025) are consistent for quantities of Scope 1 and Scope 3 emissions. Scope 2 emissions are slightly higher with the NRP compared to the scenario without due to increased airfield electricity consumption, which is mainly due to runway lighting.

The largest difference in emissions observed for the scenario with the NRP 20 years post-opening is Scope 3 emissions, resulting from APU usage and waste processing all driven by the difference in aircraft movements.

Perth Airport already operates a cogeneration plant that reduces the Scope 2 emissions. Implementation of additional abatement measures will allow Perth Airport to reduce impacts from greenhouse gas emissions. Beyond Perth Airport's emissions, Perth Airport also has an opportunity to influence tenant's emissions producing activities and reduce Scope 3 emissions from tenants' ground-based operations.

Construction

Greenhouse gas emissions from construction activities are expected to be emitted over a period of approximately four years. Annual emissions are approximately 13,600 t CO2-e. Negligible impacts are expected to result from construction greenhouse gas emissions.

Prior to construction, a CEMP including greenhouse gas management, will be prepared.

Conclusion

An assessment was conducted of air quality and greenhouse gas for existing and predicted future ground-based conditions at Perth Airport, including construction impacts. Establishment of baseline conditions was necessary to allow quantitative assessment of ground-based air and greenhouse gas impacts due to construction and operation of the NRP.

From the assessment of operational greenhouse gas emissions, it is apparent that current emissions exceed the NGER reporting threshold. Impacts for all future scenarios are classified as minor adverse or negligible due to the contribution of Perth Airport's emissions relative to national transport emissions. The only scenario whereby operation of the NRP was shown to produce a difference in greenhouse gas impacts was 2045, where minor adverse impacts occur with the NRP.

Emissions of operational air pollutants for baseline conditions do not result in exceedances of air-quality limits at any sensitive receptor (on-estate and off-estate). From assessment of future operational scenarios, some exceedances of the $PM_{2.5}$ 24-hour and NO_2 one-hour limit were predicted in 2045 at one receptor, which is located on-estate near the General Aviation area. However, these exceedances were found to be due to activity in this area rather than due to the new runway.

Operational odour impacts for the NRP were considered qualitatively by analysing emissions of TVOCs, particularly emissions from combustion of jet fuel by APUs. It is considered unlikely that operation of the NRP will create odour impacts as combustion of jet fuel by APUs is expected to be lower in future years compared to current levels due to increased use of GPUs.

Construction impacts for air quality and greenhouse gases were also assessed. Results obtained from air dispersion modelling demonstrate that, unless suitable mitigation measures are implemented, high adverse impacts are possible resulting in a medium risk identified. Although negligible impacts are anticipated for construction greenhouse gas emissions, greenhouse gas mitigation measures will be implemented wherever possible during construction to minimise greenhouse gas emissions from construction and, therefore, the impact of the NRP on the environment.

Key Findings

Key findings from investigations into air quality and greenhouse gas from ground-based sources include:

- The only ground based activity directly impacted by the NRP is the road traffic as a result of the additional aircraft capacity provided by the new runway.
- The majority of Perth Airport's greenhouse gas emissions result from electricity consumption and the NRP will not significantly contribute to electricity use across the estate.
- It is considered unlikely that operation of the NRP will create odour impacts as combustion of jet fuel by auxiliary power units is expected to be lower in future years due to increased use of ground power units compared to current levels.

Section 15 – Landscape and Visual

The Landscape and Visual Section describes the impact of visual changes resulting from the construction and operation of the NRP.

The NRP will impact the landscape and visual appearance as a result of:

- the development of 293 hectares of land (including clearing of 129 hectares of vegetation of good or better quality),
- construction and operation of the new runway, and
- installation of lighting infrastructure.

Landscape and Visual Assessment

The visual amenity and scenic value is influenced by topography, vegetation cover and land use.

A study was undertaken to examine the existing visual appearance of the NRP area, assess the impacts of the NRP by comparing the impact of changes from different viewpoints, and identify appropriate mitigation measures.

A three-dimensional assessment, using digital terrain data, identified locations around Perth where the NRP may be visible from. A field study was then conducted to assess 11 representative viewpoints.

Construction

The construction of the NRP has the potential to alter the visual amenity in the NRP area. The following processes will impact on the visual amenity:

- vegetation clearance,
- earthworks and transportation of materials, and
- construction access and pavement construction.

The industrial area directly adjacent to the eastern boundary of the estate will be visually impacted during construction. The area referred to in this assessment as the Sandy Airports Flats character area, is a mix of industrial, freight and transport, small businesses and the contrasting sandy wetlands. Users of this area, adjacent to the south of the estate will lose the green buffer to the airport during construction.

Visually, the elevated areas approximately 20 kilometres to the east of Perth in the Darling Escarpment have the most prominent views. These rural and semirural areas are most likely to be impacted by any reduction in visual amenity due to the visibility of the airport. However, the distance between the new runway and the existing runways within these views renders any visual change low or negligible.

Operation

The operation phase elements that have the potential to alter the visual amenity (excluding the sight of aircraft on the ground or overflying) include:

- airside road and fencing,
- runway and taxiway pavement, and
- airfield lighting including the High Intensity Approach Lighting at the ends of the new runway (north and south).

Although the nature of the potential impact will vary between constructions to operation, the assessment is anticipated to be broadly consistent, with potential for a reduction in impact as the landscape and grassed areas begin to mature and green over time, reducing the visibility of exposed earth and vertical elements such as construction equipment.

The operational impacts of the new runway will be an incremental increase in the existing overall lighting impact to the area and surrounds - which already contains stand out features such as the coloured 'Sky Ribbon' road lighting and the Gateway WA road network, terminal lighting and lighting from the surrounding industrial / distribution precinct.

Mitigation

Standard mitigation measures will be implemented during the design, construction and operational phases to minimise impacts and risks to landscape and visual. During the construction phase of the NRP, site hoarding may minimise visual impacts to neighbouring areas. Workers will also seek to minimise light spill and glare associated with construction lighting by ensuring the layout of the construction site minimises visual impacts where possible.

The design of the runway will consider the visual impact of airfield and approach lighting to visual amenity and will ensure compliance with the safety regulations. Perth Airport will also investigate moving the airside fence adjacent to walking tracks in Kwenda Marlark (man-made wetland within the airport estate) to minimise the projects impacts. Also, over time, as grass matures, the landscape of the runway should soften the edge of the NRP area.

Conclusion

Visual impacts from the NRP will be derived not only from the runway itself, but from the clearing of vegetation, the runway light system and construction activities. These impacts will vary from day to night.

Through the use of publicly accessible viewpoints around the airport the visual impacts of the NRP on local residents, workers and road users has been considered. Overall the visual impact is low from the majority of viewpoints assessed.

Key Findings

Key findings from investigations into the landscape and visual impact of the NRP include:

- Visually, the elevated areas approximately 20 kilometres to the east of Perth and in the Darling Escarpment have the most prominent views. These rural and semi-rural areas are most likely to be impacted by any reduction in visual amenity due to the visibility of the airport. All off-estate visual impacts have been assessed as negligible.
- The NRP will alter the visual amenity through airside road and fencing, runway and associated pavements and the installation of high intensity approach lighting at the northern and southern extents of the new runway.
- The operation of the NRP will result in an incremental increase in the existing overall lighting impact to the airport area and its surrounds, which already contains stand out features such as the coloured 'Sky Ribbon' road lighting and the Gateway WA road network, terminal lighting and lighting from the surrounding industrial and distribution precinct.

Section 16 – Heritage

The Heritage Section describes the impacts on the Aboriginal, European and natural heritage values associated with the NRP.

The NRP will impact heritage values in and around the NRP area as a result of:

- clearing and site preparation of the NRP,
- realignment of drainage channels and conduits for service, and
- the construction, operation and ongoing maintenance of the new runway and associated infrastructure.

Heritage Approvals

Perth Airport is located on Commonwealth land, so State legislation generally only applies for activities for which Commonwealth legislation does not exist. The *Aboriginal Heritage Act 1972* (AH Act) is the key State legislation applicable to the Aboriginal heritage values associated with the NRP.

The AH Act and associated regulations provide for the preservation (on behalf of the community) of places and objects customarily used by, or traditional to, the original inhabitants of Australia or their descendants. In the absence of any prescriptive Commonwealth legislation, the AH Act bears direct relevance, particularly where the State Department of Planning, Lands and Heritage (DPLH) Register of Aboriginal Sites indicates the presence of sites. Under Section 17 of the AH Act, it is an offence to disturb an Aboriginal site without prior written permission.

In June 2017, Perth Airport submitted an application under Section 18 of the AH Act for the purpose of obtaining approval to develop, maintain and operate the NRP. The application was subsequently approved by the State Government in May 2018.

Heritage Assessment

To quantify and understand heritage values, Perth Airport has undertaken a number of studies, including numerous ethnographic and archaeological assessments of the NRP area.

An archaeological European heritage survey was undertaken in 2017.

Natural heritage values were identified through the Commonwealth Heritage List database.

Aboriginal Heritage Assessment

The land on which Perth Airport is located forms part of the traditional network of communication routes, meeting places and camping sites of the Noongar people. The Noongar groups traditionally lived throughout the south-west corner of Western Australia, from Geraldton on the west coast and across to Esperance on the south coast. As the Traditional Custodians, the Noongar people maintain a strong interest in the airport and its operations.

As shown in Figure ES-15, the NRP area comprises two known Aboriginal heritage sites that meet the definition of a 'Site' under Section 5 of the AH Act: Site 3719 Munday Swamp and Site 3888 Munday Swamp: Poison Gully.

The NRP area also comprises eight Other Heritage Places (OHP). These are places that do not, or no longer, meet the definition of a Site under Section 5 of the AH Act.

Site 3719 Munday Swamp

Site 3719 Munday Swamp is a wetland that covers approximately 20 hectares in the east of the estate. The site was originally recorded by archaeologists in 1979 and has since been the subject of numerous archaeological and ethnographic surveys. The DPLH Register of Aboriginal Sites identifies Site 3719 as a site with ceremonial, mythological, hunting and camp ground, and plant resource values. It is also listed as an artefact scatter, indicating that archaeological material has been recorded at the site at a point in time, and may have been salvaged or may remain in situ.

Charcoal was recovered within Site 3719, allowing carbon dating to be undertaken. Dating indicated that Aboriginal occupation of the area ranged from 453 to 4,581 years before present.

Since colonisation, Site 3719 has been disturbed as a result of historical surrounding land-use that has included cattle grazing, and more recently, repeated illegal four-wheel drive and trail bike access. Overall, the various environmental values remain intact.

Site 3888 Munday Swamp: Poison Gully

Site 3888 Munday Swamp: Poison Gully was first recorded in the 1970s as an archaeological deposit and camp site.

The condition of Site 3888 has been influenced by a number of natural or anthropogenic factors. The area has been substantially disturbed by vehicle access and livestock. Overall the condition of the site is poor, however a small portion of the place remains relatively intact.

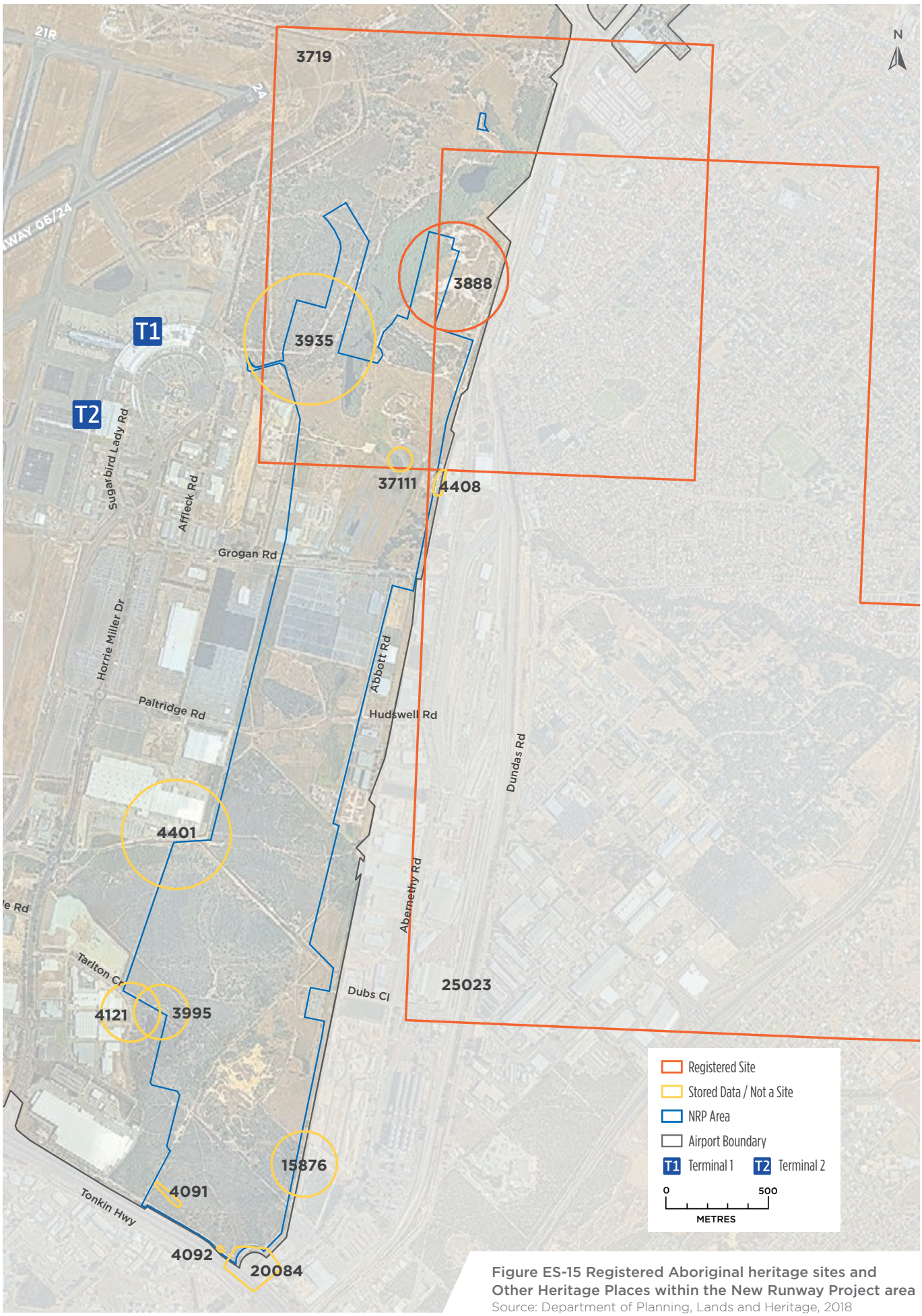


Figure ES-15 Registered Aboriginal heritage sites and Other Heritage Places within the New Runway Project area
Source: Department of Planning, Lands and Heritage, 2018
(MDP Reference: Figure 16-2)

Impact Assessment

Where practical, the design of the NRP has minimised impacts to heritage values while still ensuring the new runway can be developed and operated in a safe and effective manner.

The new runway has been planned since the 1970s, with the location published in the first public Perth Airport Master Plan, Master Plan 1985. The original length of the runway was 3,800 metres, which would have resulted in the complete destruction of Munday Swamp. Recognising the importance of Munday Swamp to the Noongar community, the design of the new runway was significantly amended in 1999. The runway threshold was shifted south and the overall length of the runway was reduced from 3,800 metres to 2,700 metres. This reduced the proposed impact to Munday Swamp and resulted in the swamp being materially retained.

During more recent project design, Perth Airport has made significant adjustments to taxiways, boundary and security fences, roads and drainage infrastructure to further minimise impacts on Munday Swamp.

Figure ES-16 illustrates the NRP construction impacts to Aboriginal heritage values. These comprise:

- installation of approach lighting including High Intensity Approach Lighting (HIAL) at each end of the runway, which is used by pilots to visually identify the runway and align the aircraft prior to landing,
- new airside security fence and electronic security system, required to meet aviation security requirements,
- a perimeter road around the new runway for security, operational, maintenance and emergency response,
- emergency access road to allow emergency vehicles, including Aviation Rescue and Fire Fighting (ARFF) tenders to access the area at the end of the runway in the event of an emergency,
- realignment of the drainage infrastructure and construction of an infiltration basin,
- the infill of the southern portion of Munday Swamp to support taxiway and fence infrastructure,
- an engineered drainage outlet to allow water to flow through Munday Swamp and into the airport drainage network, and
- new conservation fencing parallel to prevent unauthorised access and mitigate further impact to Munday Swamp by illegal trespasses operating trail bikes and four-wheel drives.

The operation of the new runway may pose ongoing impacts to heritage values for which Perth Airport has received the necessary approvals under Section 18 of the AH Act.

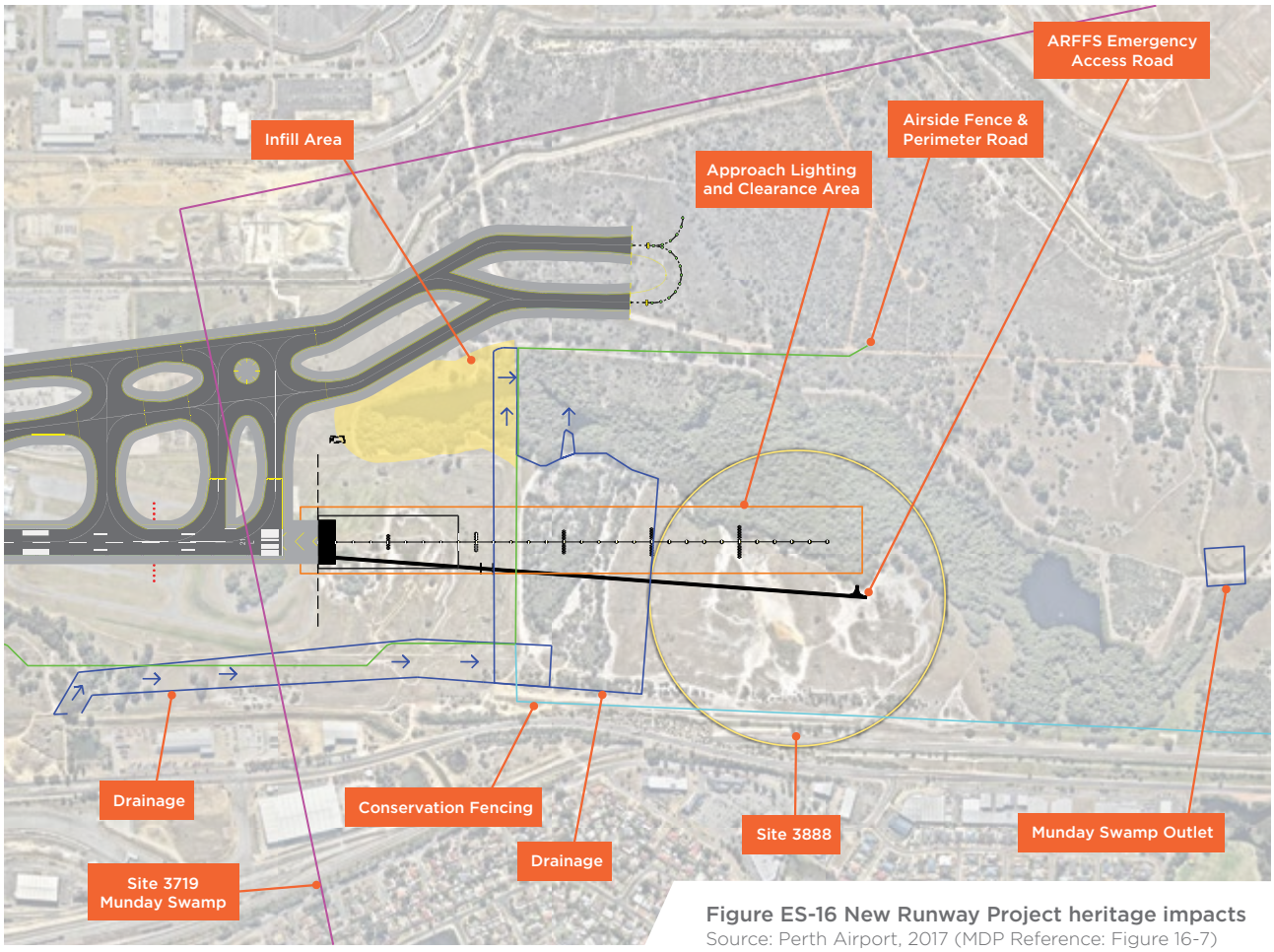


Figure ES-16 New Runway Project heritage impacts
Source: Perth Airport, 2017 (MDP Reference: Figure 16-7)

Consultation

Prior to submission of the application under Section 18 of the AH Act, Perth Airport undertook extensive consultation with Traditional Custodians and relevant organisations. A total of 43 Traditional Custodians and cultural knowledge holders were consulted over three workshops, held on country at Munday Swamp, during April and May 2017.

Consultation elicited various positions and no clear consensus was reached. Responses recorded during consultation varied from objection to the project having any impact on Munday Swamp, through to conditional support subject to measures to minimise impacts where possible.

As a result of the consultation with the Traditional Custodians, as part of the NRP Perth Airport is committed to:

- minimising impacts to Munday Swamp, including;
  - constructing secure fencing between Munday Swamp and Abernethy Road to control illegal access, camping and dumping in the area,
  - installing water quality and nutrient stripping basins to improve water quality entering into Munday Swamp, and
  - reconnecting surface water flows from Poison Gully to Munday Swamp to restore the natural system
- maintaining access for Traditional Custodians to Munday Swamp for traditional activities such as hunting for turtles,
- engaging Traditional Custodians to monitor project works, in accordance with Perth Airport's standard practice, during works related to disturbances of ground or vegetation,
- developing an Aboriginal business participation programme, and
- conducting cultural ceremonies at key milestones of the project such as commencement of works and formal opening.

European Heritage Assessment

Early European occupation of the land within the vicinity of the estate dates to the mid-late 1800's and is intrinsically related to the establishment of the Swan River Colony in 1829. The foundation of Guildford to the north-west of the estate occurred within the first years of the colony. It was chosen for its ideal location between the Swan and Helena Rivers. Due to its location, the town site served as an inland river port and market centre for the surrounding agricultural districts.

Recent surveys confirmed that one place of historical age occurred within the NRP area: a stockyard that exhibits a postwar agricultural structure.

The stockyard is not considered to be of significance. It is in poor condition and provides little potential for any additional historic, scientific or social values to be revealed. It is not considered to hold any spiritual values.

Natural Heritage Assessment

A search of the Commonwealth Heritage List identified two places in the vicinity of the NRP area:

- Forrestfield Bushland, Horrie Miller Drive, Newburn via Perth Airport, and
- Munday Swamp and surrounding bushland, Kalamunda Road, Perth Airport.

Both sites are classified as 'indicative places' on the Commonwealth Heritage List, meaning that data in relation to both potential sites have been provided to or obtained by the Heritage Division and been entered into the database. However, a formal nomination has not been made and the Australian Heritage Council has not received the data for assessment.

Mitigation

The NRP will be designed, constructed and operated in line with the AH Act Section 18 commitments and conditions placed on the approval.

Perth Airport's Heritage Management Framework ensures that potential impacts to archaeological and ethnographic Aboriginal heritage values from the development and ongoing operation of the airport are considered, managed and mitigated.

Figure ES-17 outlines the Draft Heritage Management Framework.

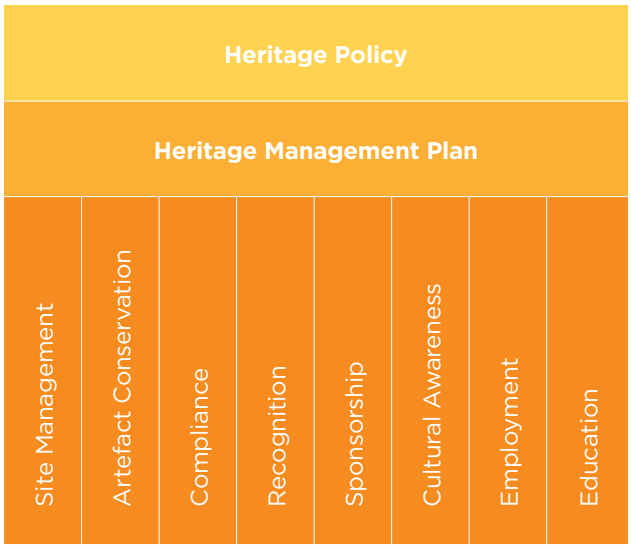


Figure ES-17 Perth Airport Draft Heritage Management Framework
Source: Perth Airport, 2016 (MDP Reference: Figure 16-1)

A Heritage Management Plan will be developed prior to the commencement of construction to ensure that:

- the NRP is compliant with the AH Act Section 18 approval, and associated commitments and conditions attached to the approval,
- the NRP does not impact on known Aboriginal, European or natural heritage values outside of approvals,
- the risk of disturbing unknown Aboriginal heritage values is minimised,
- engagement with Traditional Custodians regarding the ongoing management of Aboriginal heritage values on the estate continues throughout construction,
- all staff associated with the NRP undertake cultural awareness training and are aware of the heritage values synonymous with the project, and
- that Traditional Custodians (cultural knowledge holders) will be engaged to monitor project works involving ground disturbance in accordance with the Perth Airport Monitoring Procedure.

Additional investigations will be undertaken and management strategies developed as the design and construction plan are finalised if required.

Conclusion

Perth Airport recognises that the land on which Perth Airport is located forms part of the traditional network of communication routes, meeting places and camping sites of the Noongar people. Aboriginal heritage values within the NRP area comprise both archaeological and ethnographic sites indicative of prior occupation. The NRP area also comprises natural values with Munday Swamp.

In recognition of the heritage values present on the estate, as part of the NRP design, Perth Airport has made significant adjustments to runway length and location, taxiways, boundary fences, roads, drainage and approach lighting while still preserving the basis for a safe and efficient runway system critical to the future economic and social growth of Western Australia.

Throughout construction and operation of the new runway, measures will be applied to manage heritage values including engagement of Traditional Custodians to monitor construction works and ongoing cultural awareness training for workers involved in the project.

Approval for impacts to heritage is governed by the AH Act. The application under Section 18 of the AH Act was subsequently approved by the State Government in May 2018.

Perth Airport remains committed to ongoing engagement with the Traditional Custodians, under the guidance of Perth Airport's Heritage Management Framework, in a manner that recognises the significance of the area to the Aboriginal community and acknowledges the strong link that exists between them and the land on which Perth Airport is situated.

Key Findings

Key findings from investigations into heritage values within the NRP area include:

- The NRP area comprises two known Aboriginal heritage sites that meet the definition of a site under the *Aboriginal Heritage Act 1972* (AH Act) and are listed as 'ethnographic and archaeological sites' on the State Department of Planning, Lands and Heritage (DPLH) Register of Aboriginal Sites.
- European heritage is linked to the establishment of the Swan River Colony in 1829 and there is one place of historical age within the NRP area: a stockyard. The stockyard is not considered to be of significance, is in poor condition and provides little potential for any additional historic, scientific or social values to be revealed.
- Two sites within the vicinity of the NRP area have been classified as 'indicative places' on the Commonwealth Heritage List in relation to natural heritage values.
- In recognition of the Aboriginal heritage values within the estate, Perth Airport has made significant adjustments to the location and length of the new runway, design of taxiways, boundary fences, roads, drainage and approach lighting to minimise the impacts on heritage areas within the estate. A range of measures will be applied throughout the construction of the NRP to further minimise and mitigate impacts.
- Perth Airport has received approval from the State Government, under Section 18 of the AH Act, to develop, maintain and operate the new runway.
- Perth Airport remains committed to ongoing engagement with the Traditional Custodians, under the guidance of Perth Airport's Heritage Management Framework, in a manner that recognises the significance of the area to the Noongar community and acknowledges the strong link that exists between them and the land on which Perth Airport is situated.

Section 17 – Environment and Heritage Management

The Environment and Heritage Management Section outlines how environment and heritage management will be implemented throughout the NRP to minimise impacts and achieve regulatory compliance.

Environment and Heritage Management

It is Perth Airport's objective that all environment and heritage impacts during construction and operation of the NRP are avoided or minimised as far as practicable. Extensive analysis and assessment has occurred in the planning and design of the NRP to achieve this outcome. However, there will be an unavoidable level of environment and heritage impact and disturbance attributable to the delivery and operation of the NRP.

High and Medium Impacts

To effectively manage environmental impacts associated with the NRP, it was necessary to identify relevant environmental aspects and assess the significance of potential impacts.

The assessment of impacts of the NRP was first undertaken with standard mitigation applied to determine the initial risk. If the initial risk was found to be medium, high or very high, the same assessment was repeated but with additional mitigation measures applied to determine the residual impacts, and hence the overall risk level.

A summary of potential impacts is summarised in Table ES-7. A summary of the medium, high and very high levels of initial risk for the NRP is provided in Table ES-6. Impacts with low risk ratings are still addressed during the development of mitigation and management measures including appropriate measures to be included in future managements plans.

Aspects	Impacts	MDP Section
Geology and Soils	Disturbance of acid sulfate soils resulting in impacts to surface water, groundwater or ecological receptors	9
	Ground movement from dewatering, excavation or soil loading	
	Erosion and sedimentation	
	Impacts to surface or groundwater and ecological receptors from disturbance of existing hydrocarbon contaminants	
	Disturbance of asbestos containing material	
	Exposure of contaminated groundwater (Per- and poly fluoroalkyl substances (PFAS) or acid sulfate soils) with impacts to works or ecological receptors	
	Contamination from spills during construction or operation	
	Contaminated runoff from pavement areas during operation	
Wetlands and hydrology	Clearing and filling wetlands	10
	Infill of southern section of Munday Swamp	
	Pruning/clearing of Munday Swamp wetland vegetation for construction of high intensity approach lighting	
	Acidification of surface or groundwater due to dewatering	
	Erosion and sedimentation from opening of new drains, vegetation clearing or earthworks	
	Lowering of groundwater affecting vegetation or structures	
	Introduction of weeds, pollutants or sediment to Munday Swamp due to realignment of Northern Main Drain (NMD)	
	Change to hydroperiod and storage area in Munday Swamp affecting flora and fauna	
	Rise in groundwater levels due to vegetation clearing	
	Change in rainfall recharge pattern resulting in groundwater drawdown	
	Spills or leaks during construction or operation causing contamination of stormwater	
Flora and vegetation	Loss of Commonwealth-listed flora species and ecological communities from clearing of vegetation	11
	Flora habitat fragmentation leading to change in microclimate	
	Potential spread of weeds and dieback	
Fauna	Loss of fauna habitats from clearing	12
	Loss of biodiversity from clearing	
	Possible fragmentation of populations from clearing linked areas	
	Possible change in species interactions leading to possible population declines and behaviour of species	
Ground-based noise	Growth in aircraft movements following construction of runway may lead to increased noise exposure for sensitive receivers	13
Air quality and greenhouse gas	Excessive levels of dust generated by construction activities	14, 23
Heritage	Possible disturbance of known heritage values from unauthorised activities and ground works	16
	Possible disturbance of unknown heritage values from ground works	

Table ES-6 Summary of medium, high and very high risk environmental aspects and impacts of the New Runway Project
Source: Perth Airport (MDP Reference: Table 17-1)

				Initial Assessment				Residual Assessment			
Section Number	Impacting Process	Impact Detail	Project Phase	Standard Mitigation	Significance/ Consequence	Likeli-hood	Initial Risk	Additional Mitigation	Significance	Likeli-hood	Residual Risk
Section 9 Geology and Soils	Construction of new Northern Main Drain and Southern Main Drain	Disturbance, management and treatment of acid sulfate soils resulting in acidification of surface or groundwater or impacts to ecological receptors	Construction	Preparation and implementation of Acid Sulfate Soil and Dewatering Management Plan in accordance with DWER guidance	Moderate Adverse	Almost Certain	High	Further investigation prior to construction to delineate area of higher risk of acid sulfate soils along Northern Main Drain and Southern Main Drain so that management can be targeted	Minor Adverse	Unlikely	Low
Section 9 Geology and Soils	Contaminated groundwater encountered during dewatering and groundwater management activities	Exposure of PFAS contaminants to surface water runoff which may impact surface-water and or groundwater quality and construction workers or ecological receptors	Construction	Preparation and implementation of an Acid Sulfate Soils and Dewatering Management Plan including: • re-injection of groundwater to align with proposed groundwater management strategies	Moderate Adverse	Possible	Medium	PFAS evaluation and risk assessment of soil concentration and leachability, and of groundwater and surface water that may be impacted Consideration of soil placement to ensure no unacceptable increase in contamination risk, no increase in off-site release risk, and no increase in risk to groundwater and surface water Consideration of water extraction, handling and placement to ensure no unacceptable increase in contamination risk, no increase in off-site release risk, and no increase in risk to groundwater and surface water Conformance with the PFAS National Environmental Management Plan and other relevant guidance documents Ongoing monitoring of PFAS concentrations in groundwater and surface water throughout construction Reporting of evaluation, risk assessment, management activities and monitoring results to the Airport Environment Officer (AEO) Submission of the CEMP and ASSDMP to the AEO for review prior to commencement of bulk earthworks and dewatering activities	Moderate Adverse	Unlikely	Low

Table ES-7 Summary of environmental and heritage impacts and mitigation measures (with initial risk of medium or higher)
Source: Perth Airport (MDP Reference: Table 17-2)

				Initial Assessment				Residual Assessment			
Section Number	Impacting Process	Impact Detail	Project Phase	Standard Mitigation	Significance/ Consequence	Likeli-hood	Initial Risk	Additional Mitigation	Significance	Likeli-hood	Residual Risk
Section 9 Geology and Soils	Contamination spills (Early works and construction phase)	Storage and use of fuels, oils etc. resulting in the release of substances to soil, surface water or groundwater which may impact on ecological and social receptors	Construction	Preparation and implementation of a CEMP to include: • appropriate measures for the storage and use of hazardous substances as per statutory requirements • spill response procedures • regular maintenance of vehicles to prevent leaks or spills • monitoring of construction water quality-control measures	Moderate Adverse	Possible	Medium	Select low impact or low toxicity chemicals during construction Physical spill containment bunds/ barriers Pumping options to remove contaminated surface waters Incident register to be monitored to identify recurring problems which can then inform maintenance programs	Minor adverse	Possible	Low
Section 10 Wetlands and Hydrology	Clearing and filling wetlands	Loss of 98 ha of priority wetlands (80 ha of CCW and 18 ha of REW) including areas considered part of the Perth Airport Woodlands Swamp listing on the Directory of Important Wetlands in Australia.	Construction	Restrict clearing footprint to NRP area, demarcate clearing extent and exclusion zones.	High Adverse	Almost certain	High	No additional mitigation measures identified	High Adverse	Almost certain	High
Section 10 Wetlands and Hydrology	Infill of southern section of Munday Swamp	Changes to hydrochemistry affecting vegetation and faunal communities	Construction	Design of infill areas to minimise area as far as practicable	High Adverse	Likely	Medium	Sourcing, testing and verification of suitable soils free from chemical or biological contaminants including weeds and pathogens and compatible with existing wetland hydrochemistry.	High Adverse	Unlikely	Medium
Section 10 Wetlands and Hydrology	Pruning/ clearing of Munday Swamp wetland vegetation for construction of high intensity approach lighting	Changes to wetland ecology due to increased exposure to sunlight, evaporation, and artificial light.	Construction	Detailed design will seek to minimise area of disturbance as far as practicable. Pruning will be employed in preference to clearing.	High Adverse	Likely	Medium	Guidance on tree pruning to be developed focussing on minimisation of potential impacts. Revegetation of cleared areas with low vegetation compatible with the approach lighting to ensure continued groundcover.	High Adverse	Possible	Medium

Table ES-7 Summary of environmental and heritage impacts and mitigation measures (with initial risk of medium or higher) (Continued)

				Initial Assessment					Residual Assessment		
Section Number	Impacting Process	Impact Detail	Project Phase	Standard Mitigation	Significance/ Consequence	Likeli-hood	Initial Risk	Additional Mitigation	Significance	Likeli-hood	Residual Risk
Section 10 Wetlands and Hydrology	Realignment of open channel (NMD) – Munday Swamp	Introduction and spread of weeds in Munday Swamp affecting native flora and fauna habitat	Operation	Upstream treatment train to include a contaminant basin and a vegetated infiltration basin sized to fully infiltrate up to one exceedance per year storm to capture weed propagules	Moderate Adverse	Possible	Medium	Engagement with upstream stakeholders Active weed management of the NMD, gross pollutant, contaminant and infiltration basins post development	Moderate Adverse	Unlikely	Low
Section 10 Wetlands and Hydrology	Realignment of open channels (NMD)	Groundwater level fluctuations at Munday Swamp negatively affecting flora and fauna	Operation	Design: Drain levels to be at or above Master Drainage Strategy 2017 concept design levels	High Adverse	Unlikely	Medium	Detailed groundwater modelling specifically for the Munday Swamp area to be undertaken to a sufficient degree of detail to inform design	High Adverse	Highly Unlikely	Low
Section 10 Wetlands and Hydrology	NMD - Contamination of surface water from upstream sources	Major (based on volume) oil/ chemical spills, most likely from upstream sources entering Munday Swamp	Operation	Engineered treatment train as described in the 'Infiltration Storage' section	Major Adverse	Highly Unlikely	Medium	Incident to be notified to Airport Control Centre (ACC) to action a spill response procedure which includes emergency services	High Adverse	Highly Unlikely	Low
Section 10 Wetlands and Hydrology	Realignment of open channels (NMD)	NMD realignment with increased sediment loads, turbidity reporting to Munday Swamp impacting local water dependent flora and fauna	Operation	Integration of a gross pollutant control basin and infiltration basin upstream of Munday Swamp. Sediment to be captured in gross pollutant basin prior to entering infiltration basin Regular monitoring and maintenance of gross pollutant basin via Perth Airport MMS system Regular monitoring of surface water downstream of the gross pollutant basin i.e. within Munday Swamp via Perth Airport MMS system Design to consider plant species and other requirements to minimise bird strike risk	High Adverse	Unlikely	Medium	Maintenance of the treatment train pollution capturing elements to help ensure that capacity is available for pollutants Design of area between infiltration storage and swamp to be bioengineered to provide a high Manning value to keep stormwater velocity low enough to avoid sands and gravels being carried by water	Moderate Adverse	Highly unlikely	Low

Table ES-7 Summary of environmental and heritage impacts and mitigation measures (with initial risk of medium or higher) (Continued)

				Initial Assessment					Residual Assessment		
Section Number	Impacting Process	Impact Detail	Project Phase	Standard Mitigation	Significance/ Consequence	Likeli-hood	Initial Risk	Additional Mitigation	Significance	Likeli-hood	Residual Risk
Section 10 Wetlands and Hydrology	Normal construction operations - Accidental chemical, fuel spills or other dangerous goods	Accidental spills or leaks from construction equipment mobilised by stormwater runoff into the surface-water drainage system	Construction	CEMP to include: • appropriate measures for the storage and use of hazardous substances as per statutory requirements • spill response procedures • regular maintenance of vehicles to prevent leaks or spills • monitoring of construction water quality control measures	Moderate Adverse (dependent upon nature, quantity and timing of spill or leak)	Possible	Medium	Select low impact or low toxicity chemicals during construction Physical spill containment bunds/ barriers Pumping options to remove contaminated surface waters Incident register to be monitored to identify recurring problems which can then inform maintenance programs	Minor Adverse	Possible	Low
Section 10 Wetlands and Hydrology	Normal construction operations - Excavations	Exposure of ASS and other contaminants to surface-water runoff which may impact surface water and groundwater quality and ecological receptors	Construction	Acid Sulfate Soils and Dewatering Management Plan including: Release of treated groundwater to align with proposed groundwater management strategies	Moderate Adverse	Possible	Medium	PFAS strategy to be developed based on latest guidelines	Moderate Adverse	Unlikely	Low
Section 11 Flora and Vegetation	Vegetation clearance	Loss of EPBC-listed Banksia Woodlands TEC	Construction	Restrict clearing footprint to NRP area, demarcate vegetation clearing extent and exclusion zones	Major Adverse	Almost Certain	Very High	Offsets in accordance with EPBC environmental offsets policy Collection of plants, rootstock and seedbank Exclusion of predators, weed control *Phytophthora* management Fire management Conservation significant flora and vegetation management plan	Moderate	Almost Certain	High
		Loss of habitat for species of conservation significance (Commonwealth) (*Conospermum undulatum, Macarthuria keigheryi*)	Construction		High Adverse to Major Adverse	Almost Certain	High		High Adverse	Almost Certain	High
		Removal of regionally significant vegetation and loss of habitat for species of conservation significance (State)	Construction		Moderate Adverse (all Priority listed species)	Almost Certain	High		Moderate	Likely	Medium
Section 11 Flora and Vegetation	Flora habitat fragmentation and edge effect	Change of microclimate (i.e. more light and higher climate in remaining habitat)	Construction	Restrict clearing footprint to NRP area	Minor Adverse	Likely	Medium	No additional mitigation measures identified	Minor	Likely	Medium

Table ES-7 Summary of environmental and heritage impacts and mitigation measures (with initial risk of medium or higher) (Continued)

				Initial Assessment				Residual Assessment			
Section Number	Impacting Process	Impact Detail	Project Phase	Standard Mitigation	Significance/ Consequence	Likeli-hood	Initial Risk	Additional Mitigation	Significance	Likeli-hood	Residual Risk
Section 11 Flora and Vegetation	Movement or introduction of dieback disease	New infestations of dieback in previously uninfested areas due to movement of vehicles, soil or water	Construction and operation	Demarcation of Infested areas Dieback management plan to be prepared to include vehicle movement and wash-down management procedures, stockpile management, active treatment if required during construction, dieback assessments and hygiene management Imported soil to be dieback free	Moderate adverse	Possible	Medium	Fence off dieback free areas not impacted by the NRP Location of stockpiles considered e.g. infested soil to be located downslope of uninfested areas Stockpile areas are away from drainage channels Test soil prior to importation as dieback free	Moderate adverse	Unlikely	Low
Section 12 Fauna	Loss of habitat	Decline in population survival	Construction	Well-defined and rationalised clearing footprint that avoids sensitive habitat where possible,	Moderate Adverse	Almost certain	High	Offset in accordance with EPBC offset policy. Acquire offsets	Moderate	Possible	Medium
Section 12 Fauna	Loss of habitat	Population fragmentation	Construction and Operation	Clearing designed to retain linkage where possible, Restrict clearing footprint to NRP area Minimise edge effects through air quality (dust) and weed management	Moderate Adverse	Almost certain	High	Where possible replace or enhance connectivity	Moderate	Likely	Medium
Section 12 Fauna	Loss of habitat	Increased mortality	Operation	Wildlife Management Plan in place	Minor Adverse	Likely	Medium	Avoid Black Cockatoo forage trees along high-speed roads	Minor	Possible	Low
Section 12 Fauna	Species interactions	Predation and competition leading to population decline	Operation	Existing control of feral species as per Perth Airport's estate-wide plan. Dieback management	Moderate Adverse	Likely	Medium	Extend fox control to target feral cats	Moderate	Possible	Medium
Section 12 Fauna	Dust, light, noise and vibration	Impacts to predator-prey interactions, changes to mating and nesting behaviour, increased competition and predation within and between invertebrates, frogs, birds and mammals	Construction and Operation	Management plans to incorporate measures to manage dust, light, noise and vibration in accordance with legal environmental limits	Moderate Adverse (invertebrates)	Likely	Medium	CEMP to include requirement to direct construction lighting away from retained native vegetation Further macroinvertebrate surveys/monitoring during and after construction	Moderate Adverse (invertebrates)	Possible	Medium

Table ES-7 Summary of environmental and heritage impacts and mitigation measures (with initial risk of medium or higher) (Continued)

				Initial Assessment					Residual Assessment		
Section Number	Impacting Process	Impact Detail	Project Phase	Standard Mitigation	Significance/ Consequence	Likeli-hood	Initial Risk	Additional Mitigation	Significance	Likeli-hood	Residual Risk
Section 13 Ground-based Noise	Growth in aircraft movements following new runway construction	Increase in aircraft taxiing in line with growth in movements will impact on sensitive receivers	Operation	Taxiway design is undertaken in accordance with Manual of Standards (MOS) 139 - Aerodromes Part 6.3 Taxiways	Moderate Adverse	Likely	Medium	Improved communication of information to surrounding residents on ground-based noise	Minor Adverse	Possible	Low
Section 14 Air quality and greenhouse gas (ground)	Construction dust-generating activities	Excessive levels of dust generated resulting in complaints and adverse air-quality impacts	Construction	Dust management as part of the CEMP, including watering	High Adverse	Possible	Medium	Increased levels of watering, sealed roads, covers on exposed areas and stockpiles	Minor Adverse	Possible	Low
Section 16 Heritage	Unauthorised Activities	Disturbance of known values	Construction	WA AH Act - S18 approval and Ministerial conditions Perth Airport Consent DIRDC Airport Building Permit Aboriginal Heritage Monitors	High Adverse	Possible	Medium	Inductions – heritage Inductions – consents Onsite spot checks and auditing	Moderate Adverse	Unlikely	Low
Section 16 Heritage	Authorised ground-disturbing works	Disturbance of known values	Construction, Operation and Maintenance	Perth Airport Consent DIRDC Airport Building Permit Aboriginal Heritage Monitors Inductions – heritage Inductions – consents Onsite spot checks and auditing	High Adverse	Almost Certain	High	WA AH Act - S18 Ministerial conditions Heritage Management Plan	Moderate Adverse	Almost Certain	High
Section 16 Heritage	Authorised ground-disturbing works	Disturbance of unknown values	Construction	Inductions – heritage Onsite spot checks and auditing	Moderate Adverse	Possible	Medium	WA AH Act - S18 approval and Ministerial conditions Heritage Management Plan	Minor Adverse	Possible	Low

Table ES-7 Summary of environmental and heritage impacts and mitigation measures (with initial risk of medium or higher) (Continued)

Environmental Management Framework

The Environmental Management Framework, shown in Figure ES-18, sets out how Perth Airport seeks to meet its obligations under Commonwealth and State legislation.

Perth Airport expects the principles of the Framework to be incorporated into the CEMP during construction and the OEMP during operation of the NRP.

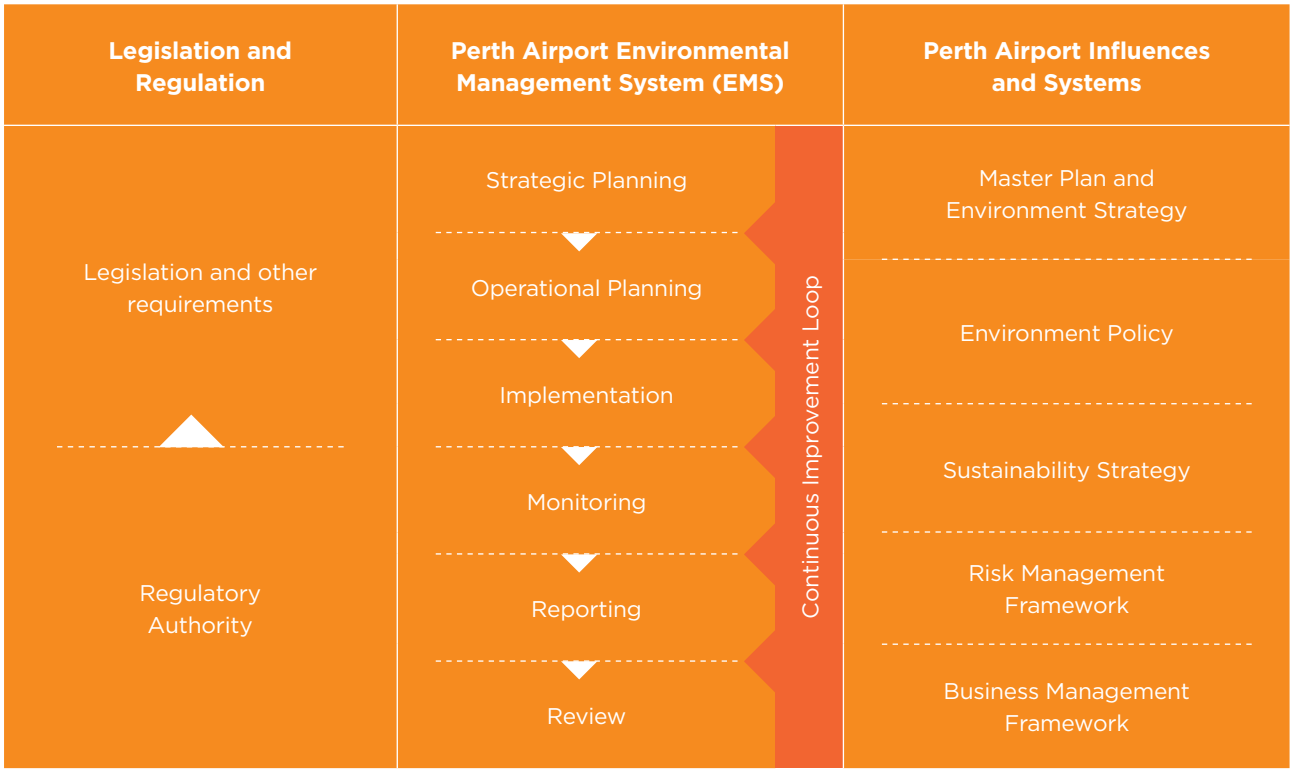


Figure ES-18 Perth Airport Environment Management Framework
Source: Perth Airport (MDP Reference: Figure 17-1)

Construction Environment Management Plan

The construction contractor is expected to develop and implement a CEMP during construction activities for the NRP. The CEMP must address the environmental aspects and develop mitigation measures for the impacts identified throughout this MDP.

The CEMP must also address the consultative and reporting aspects for the NRP as follows:

- project management structure,
- environmental incidents,
- community complaints and consultation,
- performance monitoring, reporting and compliance with all aspects of the Perth Airport EMF,
- identify management measures for construction of the NRP that are in accordance with relevant legislation and policy, and with accepted Perth Airport standards, and
- address community and government expectations of transparency and accountability by identifying management actions.

Operational Environmental Management Plan

Perth Airport will develop an OEMP for the NRP. The OEMP will be aligned with Perth Airport's EMF and will include the following:

- risk assessment and review,
- environmental incidents and reporting,
- community complaints and consultation,
- performance monitoring, reporting and compliance with all aspects of the Perth Airport EMF and legislative requirements,
- actions to be undertaken to manage the environmental impacts during operation of the runway, in accordance with legislative requirements and accepted Perth Airport standards,
- management and reporting structure, roles and responsibilities, training, monitoring and management review expectations, and
- contingency management.

Heritage

In keeping with the conditions set by the State in relation to the application made under Section 18 of the AH Act, a written report will be provided to the Registrar of Aboriginal Sites within 60 days of the completion of the NRP and will detail:

- the extent of the impact on an Aboriginal site, including the level, effect and type of impact, and supported by photographs taken before and after the impact,
- any archaeological or cultural salvage undertaken on an Aboriginal site, including when and how such salvage took place, who was present at the salvage, where the material was relocated, and the results of the salvage and any subsequent analysis conducted, and
- the results and findings of any monitoring of ground distributing works.

As part of Perth Airport's obligation to complete an Annual Environment Report, the relevant information will be also passed on to the Commonwealth Government in sufficient detail to allow for the impact of development activities on Perth Airport to be assessed.

Application of Offsets

An environmental offsets proposal, aligned with the Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy (October 2012) (the offsets policy) and focused to address the impact specifically to the EPBC Act listed *Macarthuria keigheryi*, *Conospermum undulatum* and Banksia Woodlands TEC, will be implemented.

The proposed offset is shown in Figure ES-19 and has been developed to be aligned broadly with the objectives of the species-specific recovery plans for relevant Commonwealth-listed species and communities impacted by the NRP.

Impacts to Environmental Values and Proposed Offset

Environmental Value:

Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community

Environmental Value:

Black Cockatoos

1. Carnaby's Black Cockatoo
2. Baudin's Black Cockatoo
3. Forest Red-Tailed Black Cockatoo

Environmental Value:

Conospermum undulatum

Environmental Value:

Macarthuria keigheryi

Restoration Offset - for loss of Threatened Ecological Community and for Black Cockatoo foraging habitat

Land Purchase Offset – balance of area required to offset BlackCockatoo foraging habitat impacts

Offset for removal of individual plants:
- Translocation and propagation programs
- Research funding to DBCA

Offset for removal of individual plants:
- Translocation and propagation programs
- Research funding to DBCA

Figure ES-19 Overview of Proposed Offsets to mitigate residual impacts from the NRP
Source: Perth Airport (MDP Reference: Figure 17-2)

Conclusion

Perth Airport has developed frameworks to identify, assess and manage environmental and heritage values on the estate. The Perth Airport environment and heritage management frameworks provide guidance and set out expectations on the level of mitigation undertaken, or offset required, to adequately manage construction and operational impacts from the NRP.

A summary of impacts which have been assessed to pose medium and high levels of risk from the NRP will guide construction contractors during the development of a CEMP. Perth Airport will work closely with the construction contractor to develop an effective CEMP for the NRP. An OEMP will be developed following construction to mitigate against environmental and heritage impacts from the operation of the NRP and current Perth Airport operating procedures will be updated where required. Perth Airport will implement reporting and incident management processes to ensure ongoing compliance with legislative requirements and approval conditions.

A draft offset proposal has been prepared to guide the development of an appropriate offsets to mitigate against the loss of EPBC Act listed values from activities associated with the NRP. Perth Airport continues to receive guidance from DEE and DBCA to address the impacts of the NRP through appropriate application of the Commonwealth Environmental Offsets Policy.

Section 18 – Ground Transport

The Ground Transport Section describes the impacts on the ground transport network from the construction and operation of the NRP.

Perth Airport Ground Transport Plan

Perth Airport's Ground Transport Plan is articulated in the Master Plan 2014, covering a five-year period and includes the NRP. The development and implementation of the Ground Transport Plan is based on a core principle of seeking to provide multiple options and streamline the efficiency and customer experience for people coming from and going to the airport. Perth Airport is surrounded by several major arterial roads that provide transport links within Perth and to the regional areas.

To determine the impacts of the NRP, a traffic model was built using the AIMSUN traffic modelling software and considered both day of opening (2025) and 20 years from the day of opening (2045).

The following impacts were considered:
- closure of Grogan Road on the road network surrounding the airport, and
- traffic flow with and without the NRP.

	2016 Base	2025 (Without New Runway)	2045 (Without New Runway)
Vehicle hours travelled	**3,307**	5,768	10,019
Vehicle kilometres travelled	**201,481**	283,859	392,947
Total number of vehicles	**30,044**	46,379	59,800
Mean speed kilometres per hour	**60.9**	49.2	39.2

Table ES-8 Existing road network, morning peak-period modelled network statistics
Source: Aurecon 2017b (MDP Reference: Table 18-4)

	2016 Base	2025 (Without New Runway)	2045 (Without New Runway)
Vehicle hours travelled	**3,571**	7,564	11,469
Vehicle kilometres travelled	**217,405**	311,526	449,757
Total number of vehicles	**32,527**	49,251	66,458
Mean speed kilometres per hour	**60.9**	41.2	39.2

Table ES-9 Existing road network, afternoon peak period modelled network statistics
Source: Aurecon 2017b (MDP Reference: Table 18-5)

	2016 Base	2025 (Without New Runway)	2045 (Without New Runway)
Vehicle hours travelled	**2,789**	4,697	7,047
Vehicle kilometres travelled	**175,609**	264,930	372,052
Total number of vehicles	**26,313**	42,080	56,876
Mean speed kilometres per hour	**63.0**	56.4	52.8

Table ES-10 Existing road network, airport peak period modelled network statistics
Source: Aurecon 2017b (MDP Reference: Table 18-6)

External Roads

To determine the impacts of the NRP on the road network, an assessment of traffic flows without and with the new runway was undertaken. The difference between these two scenarios therefore demonstrates the impacts of building the NRP.

Following the calibration and validation of the AIMSUN model, the existing road network with the upgrades was modelled for 2025 (date of opening of the new runway) and for 2045 (after 20 years of operation). The outputs from the modelling show that if the existing external road network around the estate is upgraded in line with the planned network improvements, then the network will perform as shown in the tables of the AIMSUN outputs in Table ES-8 to Table ES-10.

Grogan Road

The new runway will require the re-closure of the central section of Grogan Road, which was previously closed to through traffic between 1987 and 2005.

A transport study showed that currently up to 60 per cent of the traffic on Grogan Road during peak periods is non-airport traffic using the road as a shortcut.

Early planning considered Grogan Road being replaced by a tunnel beneath the new runway for access to Airport Central. During concept design of the NRP, the alignment of the tunnel moved further south, to achieve the necessary clearances and approach and exit gradients, making the route less attractive to the traffic accessing the terminals, being over 3.1 kilometres longer than the current route along Grogan Road. The associated infrastructure and management requirements for the tunnel also increased significantly. The cost of the tunnel was estimated at $240 million. The significant cost was driven by the requirements of the tunnel such as fire safety elements, monitoring and response capabilities, and the length and distance below the runway that the infrastructure needed to be for safety and aviation security.

The results of the network modelling showed that the performance figures and modelled traffic volumes both with and without the runway constructed are similar and lie within acceptable ranges.

The 2045 modelling results show that while the network is close to capacity even without the new runway, and has been extensively upgraded to avoid excessive congestion, the re-routed traffic does not significantly impact the performance of the model.

Results showed that the impact to the performance of the external road network without the access from Grogan Road is not significant, and that the construction of a tunnel beneath the runway is not warranted.

The construction of a tunnel to serve the low volume of airport related traffic could therefore not be justified.

The re-closure of Grogan Road will result in a change of access to Terminals 1 and 2 and access to the businesses in Airport Central. Alternative routes to T1 and T2 will be via the Roe and Tonkin Highways. Grogan Road will remain open from Abernethy Road to Abbott Road to ensure access to businesses along Abbot Road.

Internal Roads

As a result of the construction of the NRP and the capacity for additional flights, the peak period will see the potential for vehicle traffic to increase.

As the vehicle traffic grows, the level of service on the internal airport roads reduces, however, progressive road upgrades within the estate will ensure an acceptable level of service is maintained.

The modelling results show that, by removing Grogan Road as an alternative route into the Airport, the on-airport road intersections perform more efficiently as there are fewer interruptions to the flow of traffic to and from the terminals (although the level of service of the Airport Drive / Sugarbird Lady Road / Grogan Road intersection is reduced).

Construction Traffic

Construction of the NRP and civil works are anticipated to take over four years and require the placement of approximately 1.5 million cubic metres of material, much of it brought onto the estate from off airport. Due to the extent of the project works, it is anticipated that several site access points will be needed.

It is also anticipated that whenever possible, materials will be transported using B-Double trucks (RAV Network 3 and 4), as these can use the surrounding road network and will reduce the total number of vehicle movements required to undertake the task when compared to a standard truck-and trailer vehicle. A construction traffic management plan will be prepared to manage and minimise impacts to surrounding areas as much as practicable. This will be agreed with Main Roads and the City of Kalamunda.

Conclusion

The traffic assessment considered options for the year of opening for the new runway (2025) and after 20 years of operation of the runway (2045). These scenarios included planned and suggested changes and upgrades to the road network and the impact of the closure of Grogan Road on network operation, and whether replacement of the route with a tunnel beneath the runway is required.

Overall, the model results demonstrated that the partial removal of Grogan Road to construct the new runway would result in a minor impact on the major road network surrounding the airport, and that these roads have sufficient capacity to accommodate this traffic. The modelling showed that a comparison of the impact on traffic flows if a tunnel is built beneath the new runway demonstrated that construction of a tunnel is not justified.

By 2025, the model predicted some queues on Roe Highway and Tonkin Highway at peak times. The delays are the result of the right-turn movements from Roe Highway (north) and Tonkin Highway off-ramp (east), and indicate that full grade separation of the intersection will be required at some stage after this time.

Construction of the new runway will see additional heavy vehicles on the surrounding network. Access at six locations off Horrie Miller Drive and Abernethy Road for B-Double trucks will be provided to reduce the impact on external roads. A construction traffic management plan will be prepared and agreed with Main Roads and the City of Kalamunda prior to works commencing to ensure that any impacts are mitigated and understood.

The NRP will not impact the local public-transport network, pedestrian or cycling routes, while the Forrestfield Airport Link project, which will result in the rail tunnels running adjacent to the NRP, has been designed to accommodate the construction and operation of the NRP.

Key Findings

Key findings from investigations into ground transport include:

- Initial planning considered Grogan Road being replaced by a tunnel constructed beneath the new runway. Modelling identified that the performance of the road network is similar with or without the tunnel constructed, and the cost benefit for construction of a tunnel to serve the low volume of terminal related traffic that would use it could not be justified.
- The vehicle traffic associated with flights will increase during the peak periods as more flights are able to be accommodated by the NRP, as well as through the future growth of flights to meet the travel demand. The impact of the growth in vehicle traffic attributed to the NRP in comparison to the natural increase in traffic volumes is found to be minimal.
- The NRP will require the partial re-closure of Grogan Road, resulting in a change of access in Airport Central for local traffic to the east of the estate. More than 60 per cent of the traffic using Grogan Road during peak periods is non-airport traffic using the road as a short cut to reduce travel distance and avoid congestion on the major road network. By 2045 there will be a moderate adverse impact on the traffic volumes on Abernethy Road caused by the closure of Grogan Road, however, this is primarily caused by the non-airport traffic. The level of this impact is only in the morning peak period and is mainly caused by the diversion of local traffic not destined for the airport.
- The impacts of construction traffic will be temporary and will be managed so that it does not adversely impact the internal or external road networks.
- The importation of fill for bulk earthworks will be the highest impact activity of the NRP construction to the surrounding road network. A conservative program of 16 months for bulk earthworks results in an average of 12 vehicles per hour delivering materials to the site. Construction vehicle access can be provided at six locations off Horrie Miller Drive and Abernethy Road, reducing the impact on the traffic network when compared to that which would occur if a single point of access was used.
- Debris removal facilities, such as a wash down facility or rumble strips for vehicles leaving the site, will be implemented to ensure the public road network is kept free from construction materials. All trucks carrying loose material will have their loads covered to ensure dust and debris is contained within the truck.
- A traffic management plan will be prepared and agreed prior to construction works commencing.


Domestic departures

C
Airspace Management Plan
Overview

Volume C outlines the plan for airspace management. It also describes the impacts and mitigation strategies proposed as a result of the operation of the new runway as part of a parallel runway system.

Section 19 – Airspace Management Plan Introduction

The Airspace Management Plan Introduction Section provides an overview of the process taken to develop and assess the draft Airspace Management Plan, aircraft noise and emissions and social impacts of the NRP.

Airspace Management Plan Overview

A draft Airspace Management Plan has been prepared that is focused on achieving the most efficient airspace outcomes while prioritising safety and addressing the complex airspace environment.

The draft Airspace Management Plan refines the Concept of Operations (CONOPS) that was reported in the Master Plan 2014 and outlines the expected airspace architecture and management framework for parallel runway operations at Perth Airport.

The design of the airspace and final flight paths will commence approximately three years out from opening and will including extensive consultation.

The draft Airspace Management Plan and impacts associated with the airborne components of the NRP are described in this Volume C, in discipline specific sections as follows:

- Background and existing airspace management (Section 20),
- Airspace management plan (Section 21),
- Aircraft noise (Section 22),
- Air quality and greenhouse gas emissions (Section 23),
- Health (Section 24),
- Social (Section 25), and
- Hazards and risks to airport operations (Section 26).

Section 20 – Background and Existing Airspace Management

The Background and Existing Airspace Management Section provides background information to assist in understanding why aircraft fly where they do.

Existing Airspace Considerations

The principal consideration in deciding where and how aircraft arrive and depart from an airport is safety. This takes precedence over all other matters. Following safety there are a wide range of other factors that influence the use of current and future runways, and the location and design of where aircraft fly, including:

- demand and volume of aircraft traffic,
- weather variations,
- departure and arrival procedures,
- modes of runway operations and capacity (the maximum number of aircraft which can be processed over a period of time),
- aircraft sequencing,
- efficiency including fuel burn and carbon emissions,
- managing the impact to surrounding communities through noise abatement procedures,
- local airspace coordination, and
- flight path design.

Existing Operations

Modes of Operations

Both ends of the runway can be used for arrivals and departures. The direction used is referred to as the operating or duty runway. Operating mode is the use of a certain runway or a combination of runways. The mode selected is based on a number of factors (e.g. wind/weather) and selection criteria. Within each operating flow (South Flow or North Flow), there are various modes of operation. These modes for the existing runways at Perth Airport are summarised and illustrated in Figure ES-20.

- 21/24 mode – arrivals from the north for runway 21 and the north-east for runway 24 and all departures to the south off runway 21,
- 21 mode – all arrivals from the north and all departures to the south,
- 24 mode – all arrivals from the north-east and all departures to the south-west,
- 03/06 mode – all arrivals from the south for runway 03 and departures to the north off runway 03 and to the north-east off runway 06,
- 06 mode – all arrivals from the south-west and all departures to the north-east, and
- 03 mode – all arrivals from the south and all departures to the north.

Interaction with Other Airports

RAAF Base Pearce

The close proximity of RAAF Base Pearce's restricted airspace to Perth Airport has necessitated development of specific air traffic procedures to ensure safety of civilian aircraft arriving and departing Perth with military operations in the adjoining restricted airspace.

During certain times, or for certain activities, restricted airspace is activated to accommodate military activities.

When the restricted airspace is not active, Perth air traffic control can process aircraft on more direct routes which results in fewer miles flown, therefore saving fuel burn and carbon emissions. This can also provide noise improvements for the community.

Jandakot Airport

The majority of Jandakot Airport flights do not affect Perth Airport. Some aircraft departing Jandakot in poor weather need to climb into Perth airspace to ensure safe flight above terrain.

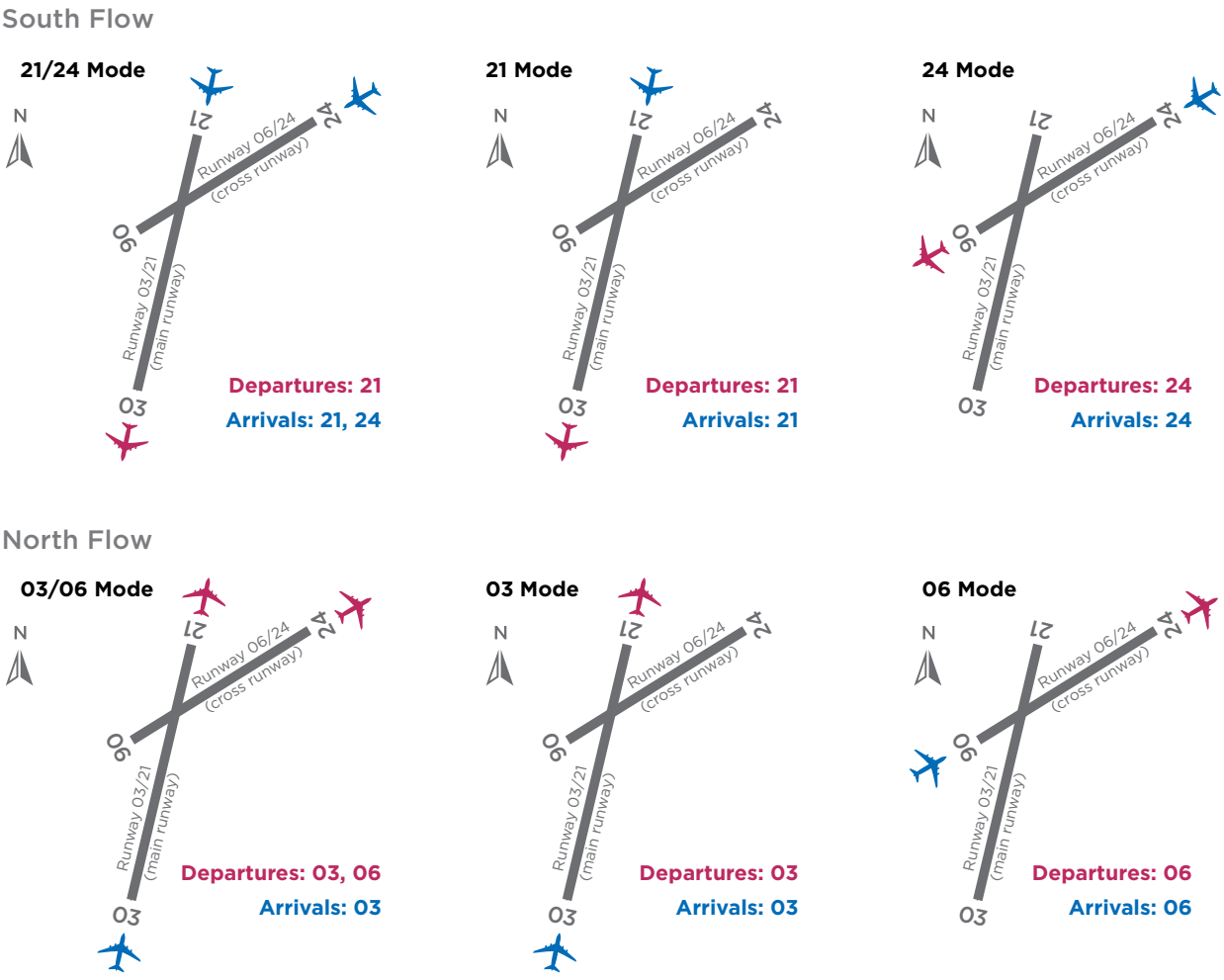


Figure ES-20 Existing runway system and modes
Source: Perth Airport (MDP Reference: Figure 20-8)

Section 21 – Airspace Management Plan

The Airspace Management Plan Section provides an overview of the draft Airspace Management Plan for the NRP.

Development of Flight Paths and Airspace Architecture

Development of the flight paths and airspace architecture for the NRP is undertaken in stages, as shown in Figure ES-21.

Concept of Operations

In 2013, UK NATS was engaged by Perth Airport to support Perth Airport and Airservices in developing a Concept of Operations (CONOPS) for a parallel runway system. UK NATS is highly credentialed to complete the CONOPS following the detailed analysis they undertook during the Airport Capacity Enhancement Project, and their experience in worldwide planning for airport infrastructure upgrades.

The CONOPS provides a high-level overview of how the runways could operate, noting:

- the optimal operation of the airport in terms of ground movements and airspace design was considered,
- Perth Airport and Airservices reached in-principle agreement on the CONOPS,
- planning and airspace modelling identified a CONOPS which considered the complex airspace environment,
- the use of the cross runway (06/24) during peak periods would reduce the efficiency and the available runway capacity,
- parallel runways should operate in independent mixed mode when possible. This means each runway would cater for both arrivals and departures and operate independently of the other runway, and
- aircraft should be allocated to the runways based on terminal arrivals and compass departures.

2013

Concept of Operations

Concept of Operations (CONOPS) developed to provide a high-level overview of how parallel runways at Perth Airport could operate.

Preliminary design

Preliminary design of flight paths to determine flight corridors. The flight corridors inform the impact assessment and the draft Airspace Management Plan.

2017

2018

Community consultation

Major Development Plan (MDP) released with detail on how the new runway will likely operate.

Approval

Target for Major Development Plan (MDP) to be approved by the Commonwealth Minister for Infrastructure, Transport and Regional Development.

2019

2019

Decision to build

Perth Airport and airlines reach a commercial agreement to commence construction of the new runway subject to actual demand. Construction of on-ground infrastructure commences.

Flight path and airspace detail design

Airservices Australia will lead the final detailed design of airspace and flight paths. This will take around three years and include extensive consultation with the Department of Defence, the Civil Aviation Safety Authority (CASA), airlines and Perth Airport.

2019

2022

Office of Airspace Regulation (OAR) approval

Civil Aviation Safety Authority (CASA) via their Office of Airspace Regulations (OAR) approves airspace changes.

Operational testing

Flight test and commissioning of the new runway undertaken.

2022

2023

Runway open

New runway will be opened between 2023-2028 subject to demand and a commercial airline agreement being reached.

Post implementation review

Airservices Australia to review the operation of airspace and flight paths.

2024

Figure ES-21 Stages of development of the flight paths and airspace architecture for the New Runway Project
Source: Perth Airport (MDP Reference: Figure 21-1)

Independent Mixed Mode

To maximise capacity, on day of opening and into the future, two operating modes were considered for parallel runway operations:

- segregated, and
- independent or dependent mixed mode.

Segregated mode operations involve having one runway allocated for departures and the other for arrivals.

Independent mixed mode is where both runways are used for both arrivals and departures, and the separation of aircraft is not dependent on each other. Although this mode can cater for traffic patterns at Perth Airport it does require sufficient airspace to process the aircraft onto two final flight 'legs' (the final approach to the airport).

Due to the location and operations of RAAF Base Pearce, in order to achieve independent mixed mode all of the time, more airspace would be required than is currently available for civil operations when Pearce restricted airspace is active.

When the airspace is not available, dependent mixed mode operations would be required. The mixed mode operations require separation between aircraft on final approach for each runway and results in a significant decrease in capacity.

Runway Allocation

The development of the CONOPS considered current and future terminal locations and airline use, as well as taxiing distances, the number of runway crossings, and the air-track miles for departures and take-offs. The final flight path design will also consider any safety, economic penalty or runway balancing impacts.

To minimise the impact of additional airspace required for the parallel runway operation, the CONOPS recommended that, in peak periods, aircraft are allocated to the runways based on compass departures and terminal arrivals.

Compass arrivals and departures are when aircraft arrive and depart from the runway nearest to its direction of flight.

Terminal arrivals and departures are defined as when aircraft arrive and depart from the runway nearest the terminal they operate from Figure ES-22.

Departures concept

Arrivals concept

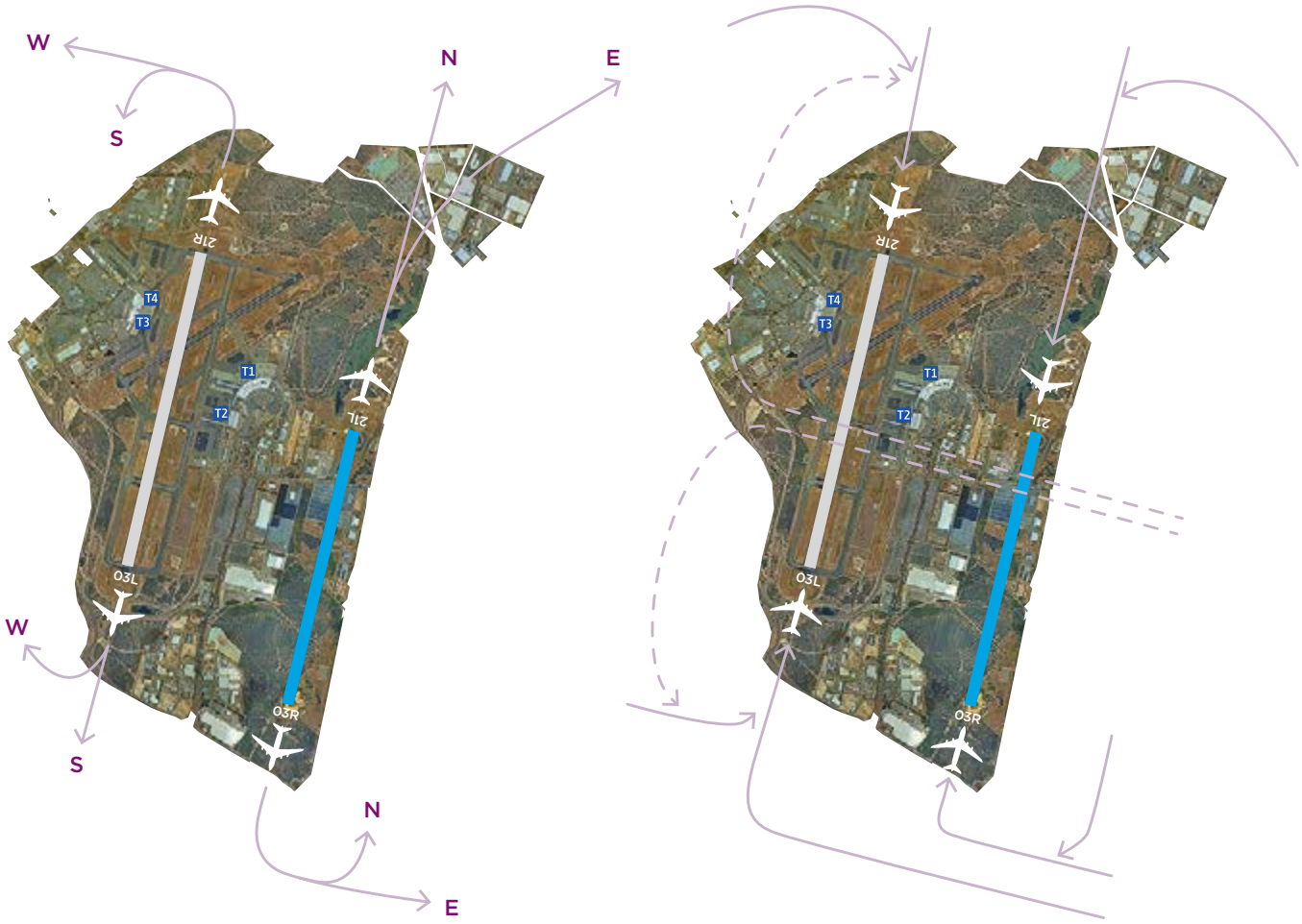


Figure ES-22 Compass departures and terminal arrivals concept of operation for parallel runway operations at Perth Airport
Source: Perth Airport (MDP Reference: Figure 21-2)

Cross Runway

The CONOPS showed that the continued use of the cross runway (06/24), once a parallel runway is operational, would reduce the efficiency and overall runway capacity at Perth Airport, therefore negating the benefits of the new runway.

Consistent with the Master Plan 2014, Perth Airport is considering closing the cross runway (06/24) when the parallel runway is constructed and operational. Although an assessment of whether the cross runway will be required to accommodate aircraft operations, post commissioning of the parallel runway system, was completed, no decision on the future use of the cross runway has been made at this time.

Draft Airspace Management Plan

The draft Airspace Management Plan refines the CONOPS and outlines the expected airspace architecture and management framework for parallel runway operations at Perth Airport.

The process for developing the draft Airspace Management Plan has involved extensive consultation, including collaborative review and analysis of the airfield and airspace with Airservices and the Commonwealth Department of Defence. This process focused on achieving the most efficient airspace outcomes while prioritising safety and addressing the complex airspace environment.

The draft Airspace Management Plan is based on:

- the approved CONOPS as outlined in the Master Plan 2014,
- parallel runway operation,
- existing flight paths to and from Perth Airport, and the principle of maintaining as many of the current flight paths as possible and therefore minimising new overfly areas,
- need to optimise airport capacity on day of opening and into the future,
- current preferred runway rules and Noise Abatement Procedures (NAP),
- the environmental conditions of Perth, including prevailing wind conditions,
- allowance for arrival procedures to ensure flexibility for design,
- ensuring that the airspace design and flight paths are simple and can be consistently applied to maximise safety and efficiency,
- collaboration to design procedures that cater for all airspace users; including working with the Department of Defence and Airservices to achieve an outcome that is mutually beneficial and does not impact safety and efficiency of both operations,
- ensuring flexibility for the final design to cater for improvements in operations, and
- current rule sets and known potential changes and the amalgamation of existing procedures with new procedural requirements for parallel operations.

Proposed Flows of Operation

Parallel runway operations will continue to use the south and north flows, as shown in Figure ES-23.

Proposed Flight Corridors

The proposed flight corridors have been developed in conjunction with Airservices to ensure the design is a workable solution addressing safety as the number one consideration. As the actual flight paths are subject to Airservices final design prior to opening of the runway, the actual location of flight paths has not been finalised.

The proposed flight corridors are shown in Figures ES-24 to ES-27 and were established considering the following guiding principles:

- continuation of south and north flows of operation,
- establishment of an arrival route from the north-west to allow arriving aircraft to be processed to the existing main runway (03L/21R),
- provision for arrivals from the east to cross overhead the airport to access the existing main runway (03L/21R),
- allowance for independent instrument approaches and dependent approaches on runway 21R and 21L (if access to RAAF Base Pearce airspace is unavailable at night or in instrument conditions),
- allowance for separate arrival routes for independent visual approaches by day and by night where possible, to limit the number of track miles required to be flown, when conditions permit this to be done safely and without restriction on capacity,
- provision of Required Navigation Performance - Authorisation Required (RNP-AR) approaches to be made available to suitably equipped aircraft when traffic conditions permit,
- aircraft operations should be concentrated, as much as possible, over non-noise sensitive areas and premises, and
- maintain existing flight corridors as much as possible.

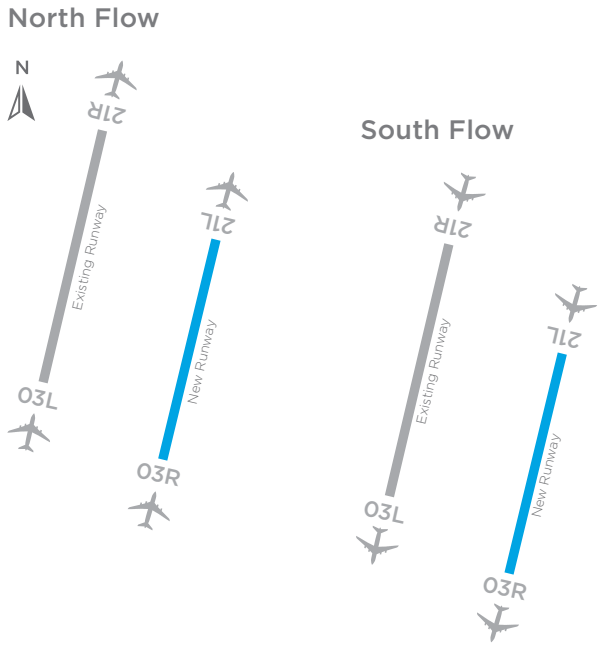


Figure ES-23 Operating flows for new parallel runway
Source: Perth Airport (MDP Reference: Figure 21-3)

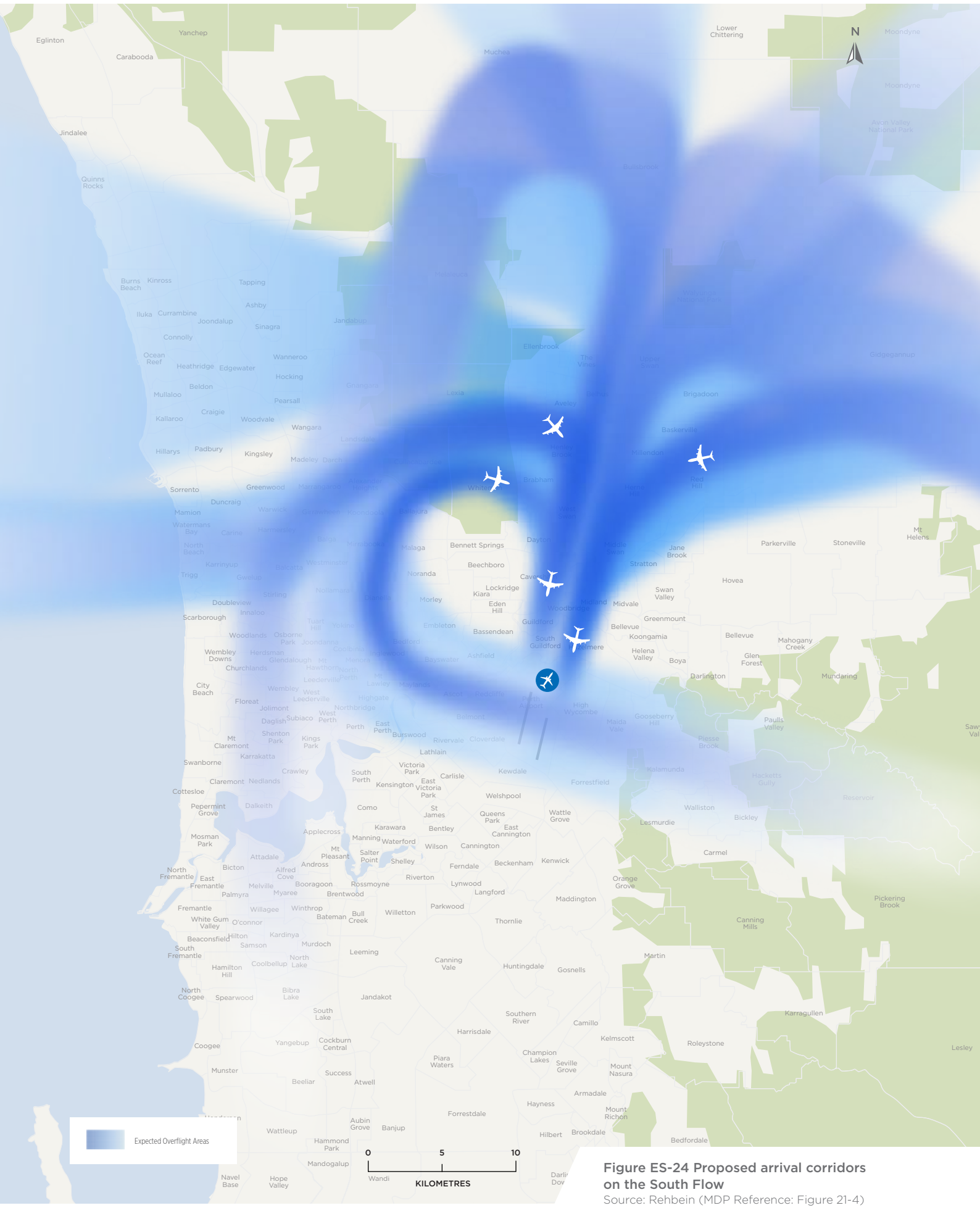


Figure ES-24 Proposed arrival corridors on the South Flow
Source: Rehbein (MDP Reference: Figure 21-4)

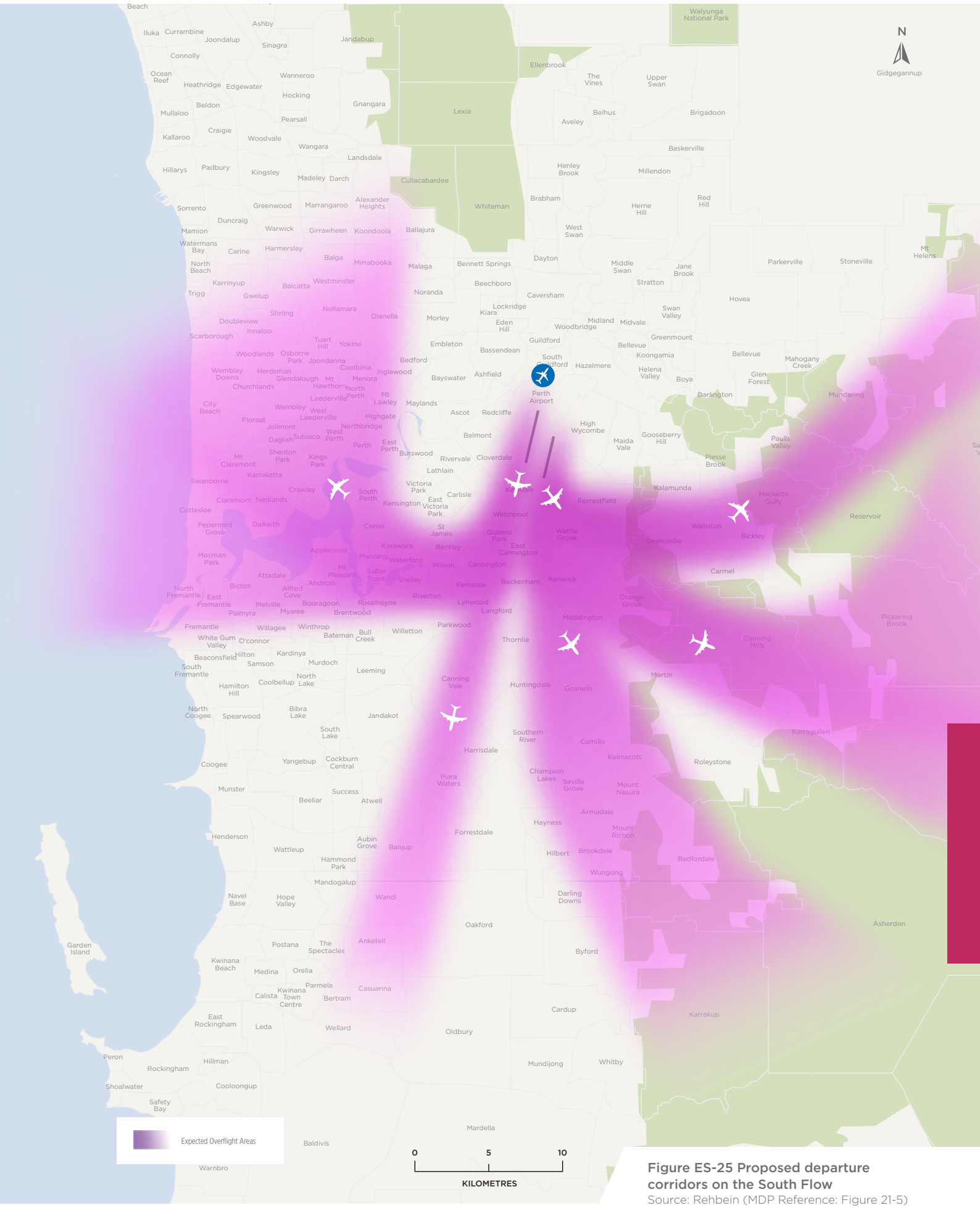


Figure ES-25 Proposed departure corridors on the South Flow
Source: Rehbein (MDP Reference: Figure 21-5)

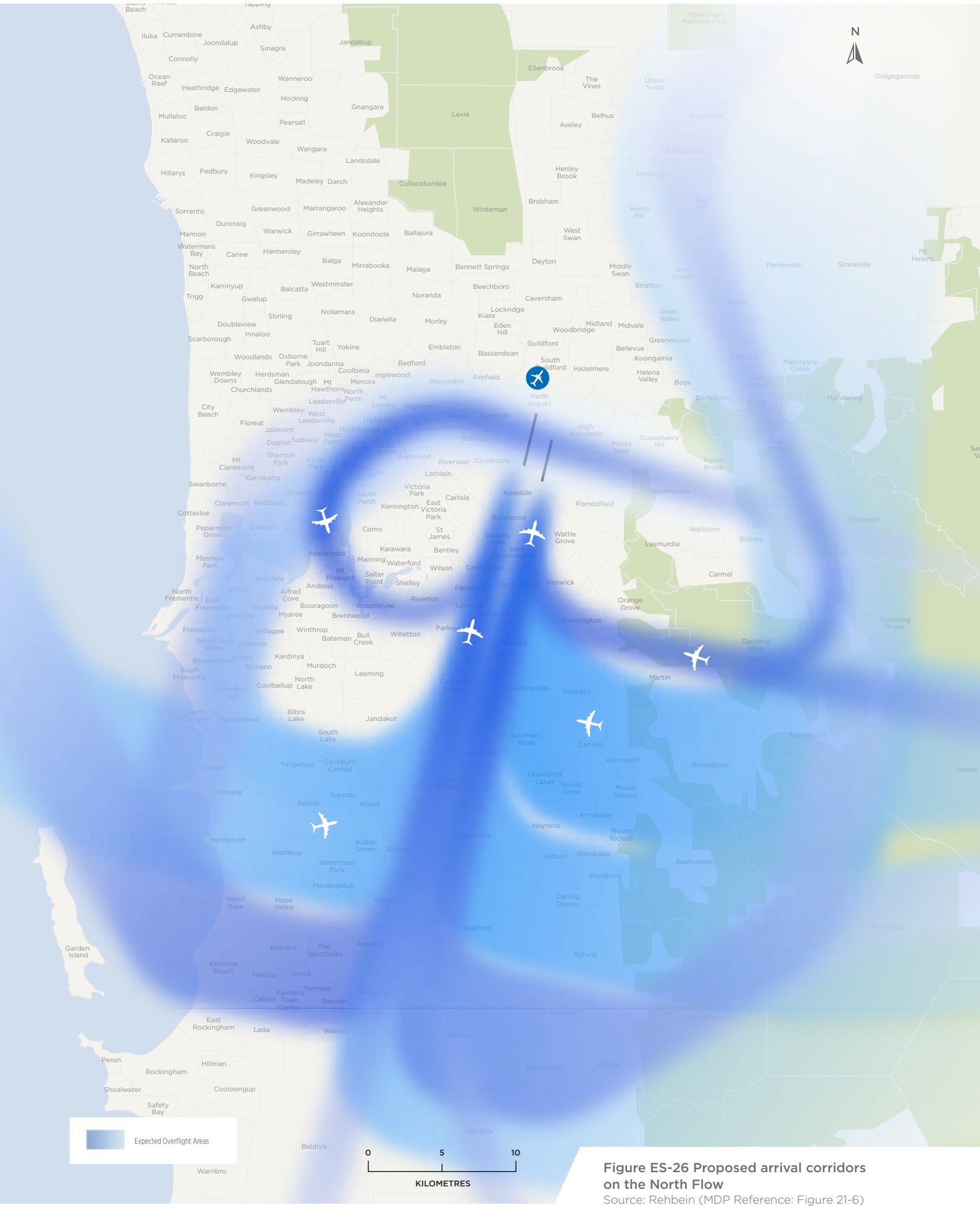


Figure ES-26 Proposed arrival corridors on the North Flow
Source: Rehbein (MDP Reference: Figure 21-6)

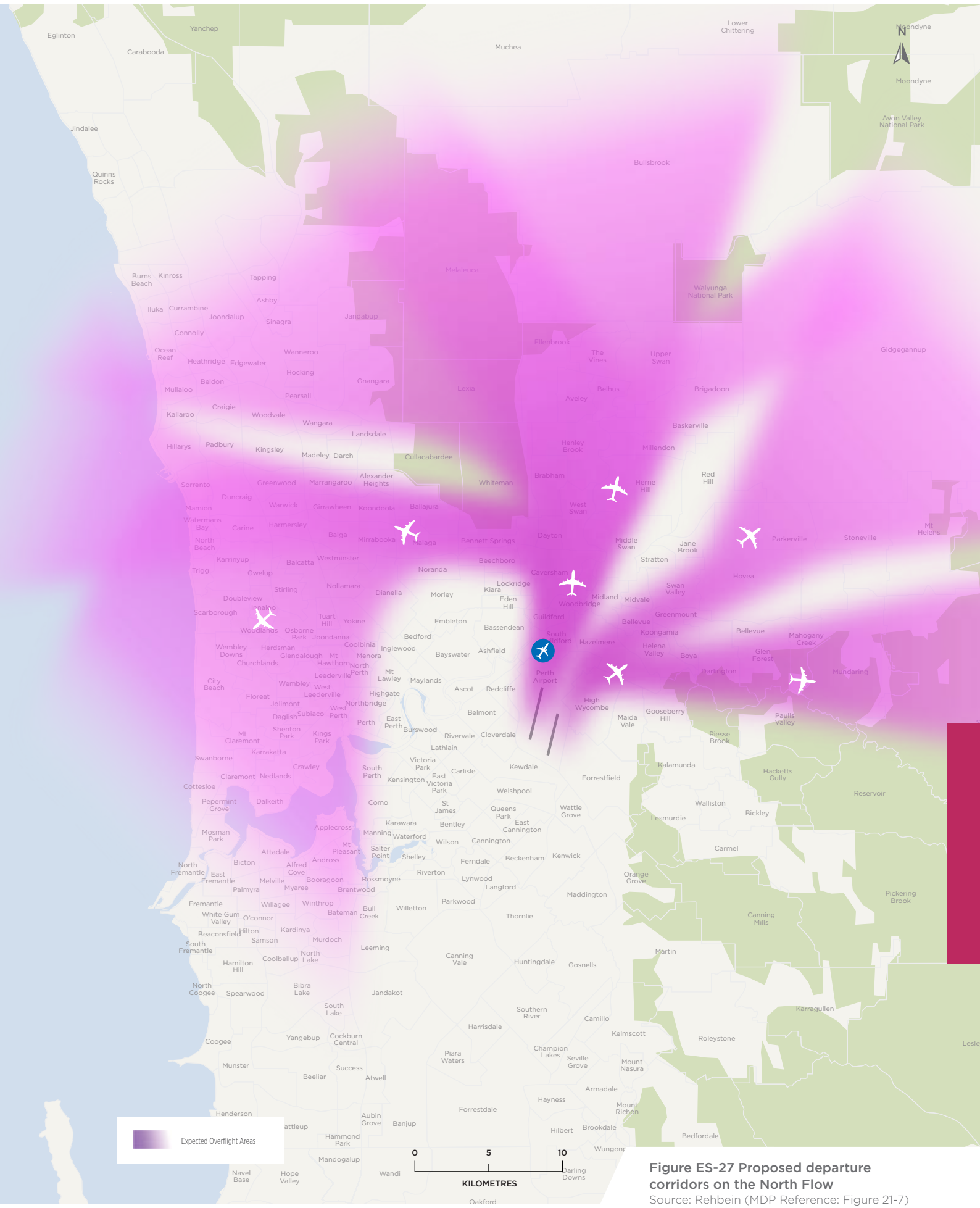


Figure ES-27 Proposed departure corridors on the North Flow
Source: Rehbein (MDP Reference: Figure 21-7)

Proposed Airspace Changes

To accommodate parallel runway operations at Perth Airport an application to change controlled airspace may be required, to maximise capacity in all conditions and in all modes of operation

Airspace North of Perth

To the north of Perth Airport changes to airspace may be required to allow aircraft to be processed via the long final leg required for independent parallel instrument approaches.

Airspace South of Perth

To the south of Perth Airport similar changes to airspace may be required to allow aircraft to be processed for independent parallel instrument approaches. This airspace could extend south of Jandakot Airport and may impact on some general aviation activities. However, during detailed design, measures including the use of technology, will be considered to reduce impacts.

Final Design

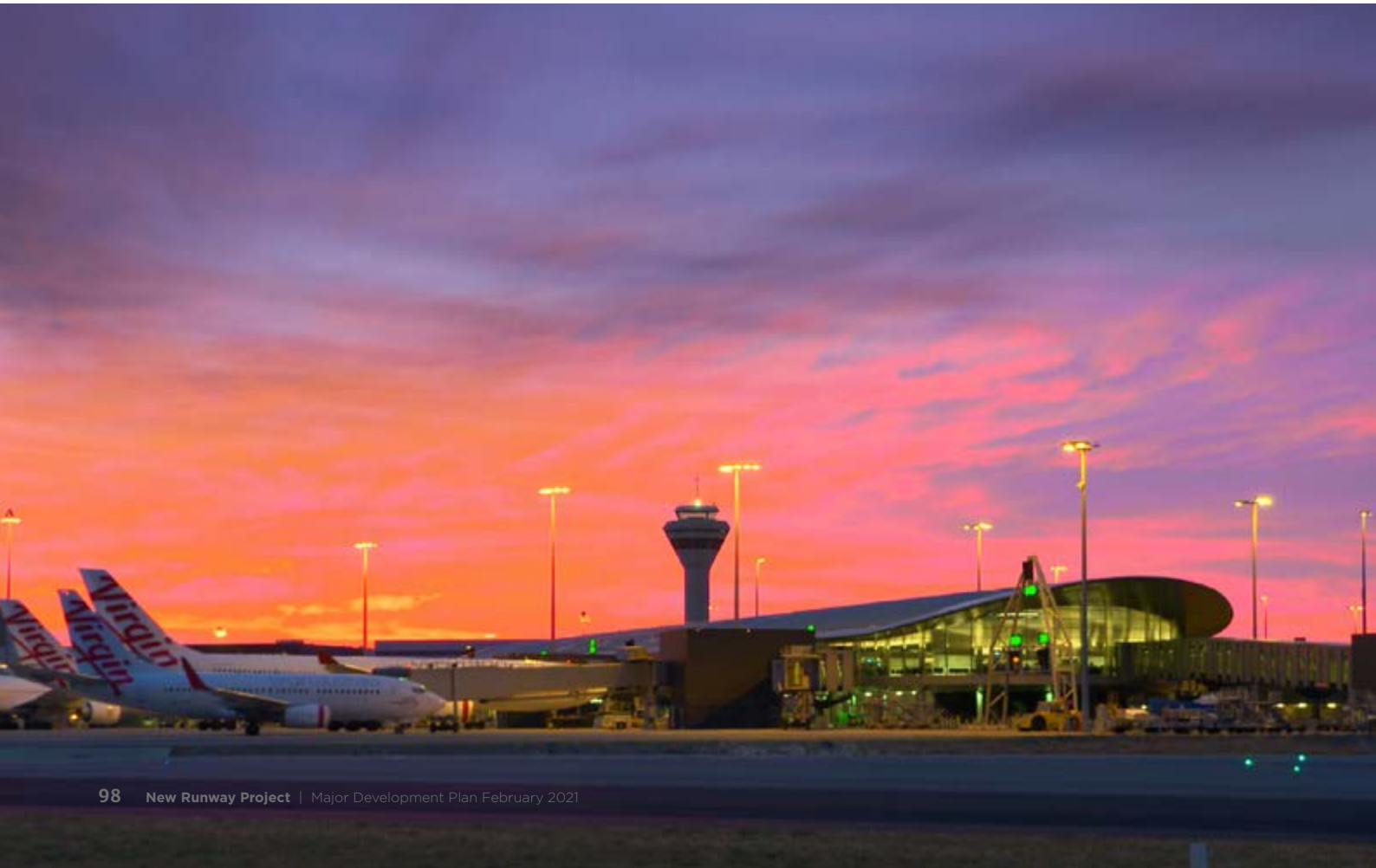
Airservices is the airspace and navigation service provider responsible for the final design and publication of airspace, and arrival and departure procedures, at Perth Airport. The final design is required to meet Airservices as low as reasonably practicable (ALARP) risk principles for safety, traffic management and the environment and will need to be approved by CASA as Australia's airspace regulator.

The final airspace design generally commences three years prior to the introduction of any proposed flight path procedure or modes of operation for the parallel runway system, and will require extensive industry and community engagement by Airservices supported by Perth Airport.

Future Change to Airspace

This MDP details the proposed flight corridors and airspace changes anticipated for the day of opening of the NRP based on current procedures. After opening there may be changes that may impact flight paths and airspace just as there are changes made now to the current flight paths and procedures. There may also be changes required after opening due to changes in technology or in air traffic management rules.

The airspace change process is an existing process that is used to make changes to flight paths, airspace or procedures that involves widespread consultation and approval from the Office of Airspace Regulation within CASA. This process will continue to be applied, and will be used for any changes made to procedures at Perth Airport after the new runway opens.



Section 22 – Aircraft Noise

The Aircraft Noise Section describes the changes to aircraft noise exposure resulting from operations of the NRP as part of a parallel runway system.

Aircraft Noise Descriptors

Noise Levels

The volume (loudness) of a sound depends on its sound-pressure level, which is expressed in decibels (dB). For measurement purposes, A-weighted decibels (dBA) are generally used because they take into account varying sensitivity of the human ear to different frequencies of sound. The human ear cannot distinguish the noise variance of three dBA or less.

Individuals may perceive the same sound differently and may be more or less affected by a particular sound. Experience has shown that many factors can influence an individual's response to aircraft noise, including:

- the specific characteristics of the noise (e.g. the frequency, intensity and duration of noise events) and the time of day noise events occur,
- background noise levels, and whether background noise is natural, industrial, desirable (e.g. bird song) or undesirable (e.g. road traffic),
- their personal circumstances and expectations about the number, frequency, loudness and timing of noise events,
- their individual sensitivities and lifestyle (e.g. whether they spend a lot of time outdoors or sleep with a window open),
- their reaction to a new noise source (in the case of a new airport or new runway) or to changed airport operational procedures,
- their understanding of whether the noise is avoidable and their notions of fairness, and
- their attitudes towards the source of the noise (e.g. general views about aviation activities and airports).

Descriptors of Aircraft Noise

The impact of aircraft noise is dependent on a number of factors, four of the most important are:

- aircraft noise levels,
- frequency of occurrence of aircraft noise events/ number of events,
- duration of aircraft noise events, and
- the character of aircraft noise (e.g. low frequency noise).

Various noise metrics are used to communicate these key factors.

N-above contours

Aircraft noise exposure can be described by the number of noise events above a threshold level. These metrics are referred to as Number Above contours, or N-above, contours, and describe the nature of aircraft noise exposure at any point.

They show the number of times that a sound level, e.g. 65 dBA, is exceeded. Figures in this Section show these as colour-coded contours so that the distribution of aircraft noise can easily be seen.

The level of detail is intended to allow communities and individuals to better understand the likely impact of the noise.

The use of N-above contours to communicate and assess aircraft noise exposure is outlined by the National Airports Safeguarding Framework (NASF) Guideline A prepared by the National Airports Safeguarding Advisory Group (NASAG) in 2016 and Standards Australia Handbook SB HB 149:2016 Acoustics—Guidance on producing information on aircraft noise.

The most commonly-used noise descriptor in this system is N70, which represents the number (N) of aircraft noise events per day exceeding 70 dBA. A noise level of 70 dBA outside a building will generally result in an internal noise level of approximately 60 dBA, if windows are open to a normal extent. This noise level is sufficient to disturb conversation, in that a person speaking will generally need to raise their voice to be understood. An internal aircraft noise level of 60 dBA (i.e. an external level of 70 dBA) is likely to cause some words to be missed in speech from a television or radio.

N70 values therefore indicate the average number of times per day when such events would occur. If external windows are closed (providing greater noise attenuation through the façade) an internal noise level of 60 dBA would be experienced when the external noise level is approximately 80 dBA. For a listener outside, who is receiving no noise attenuation from a building, the described effects would be experienced with an external aircraft noise level of approximately 80 dBA.

Perth Airport recognises that Perth residents enjoy an outdoor lifestyle, supported by a mild climate, and an abundance of warm weather and sunshine during the summer months. As a result, Perth Airport has historically adopted N65 contours (i.e. the number of aircraft noise events exceeding 65 dBA per day) in preference of N70. This is a conservative approach compared to other Australian airports to account for the anticipated prevalence of outdoor living and practice of leaving doors and windows open.

For assessment of night-time noise impacts, it is customary to consider N60 values. The N60 describes the number of events exceeding 60 dBA external to a building, which would typically result in a maximum noise level of 50 dBA within a building having windows open to a normal extent. If this were the case in a room where a person is sleeping, a 50 dBA maximum noise level is considered to be close to the point at which noise may cause awakening.

For the purpose of this assessment, N-above contours are presented for various periods of time:
- full 24-hour period,
- day period (6.00 am to 7.00 pm),
- evening period (7.00 pm to 11.00 pm), and
- night period (11.00 pm to 6.00 am).

Noise metrics are also shown in variations of time, including weekday and weekends.

Aircraft Noise Modelling

A complex modelling process is undertaken to consider the wide range of factors which affect the potential noise exposure from future aircraft operations at Perth Airport. The objective of the noise modelling process is to calculate values of the noise descriptors for current operations, and to predict values for future scenarios, such as the operation of the new runway.

The modelling process considered the following inputs:
- scenarios,
- validation of the aircraft noise model,
- modelling inputs,
- selection of aircraft types,
- number of aircraft operations,
- runway dimensions and allocation to respective operations,
- adoption of future procedures by air traffic control,
- flight track and flight track dispersal,
- aircraft destinations or origins,
- terrain data, and
- meteorological data.

Aircraft Noise Assessment

To assess the change in noise exposure, a comparison of the day before opening (without new runway 2025) and day of opening (with new runway 2025) was undertaken. Twenty years from day of opening was also considered (with new runway 2045).

Figure ES-28 and Figure ES-29 present the without new runway day and night in 2025 scenarios. As a comparison, the equivalent with new runway scenarios for 2025 are shown in Figure ES-30 and Figure ES-31.

Comparing the new runway 2025 contours to the without new runway contours, the contours extend similarly along the extended centreline of the existing main runway (03L/21R), coinciding with the majority of proposed arrival tracks. The NRP contours are also similar to the scenario without the new runway along prominent departure tracks turning west off the existing main runway (03L/21R) centreline at approximately seven kilometres north and south of the airport.

Areas along the new runway (03R/21L) centreline are captured within the N65 contours for the NRP scenario. Some of these areas are not captured by the corresponding without new runway contours.

Departures to the east with the NRP are predicted to generally use the new runway under the compass departures concept. Therefore, the without new runway N65 contours are not mirrored by the NRP N65 contours in this regard.

South of the airport, departures off runway 21L turn left soon after they cross the end of the runway. This is far sooner than the scenario without the new runway tracks, which turn approximately seven kilometres south of the existing runway (03L/21R). The left turn soon after the runway end is a requirement of independent parallel runways, to provide adequate separation between the procedures for each runway. Noise contours in this area (Beckenham, Wattle Grove, Kenwick, Orange Grove and surrounds) differ from the without new runway scenario, impacting some areas that would be regarded as newly affected. More detailed analysis in the detailed design stage will be conducted to determine optimal routes.

Proposed departure procedures off runway 03R (northerly direction) consider using the corridor along the existing cross runway (06/24) centreline, northeast of the airport. The with new runway N65 contours for 2025 in this area are generally within the corresponding without new runway contours, with the N65 five events extending less than 20 kilometres in the with new runway scenario compared with over 30 kilometres in the without new runway scenario.

The area around Stratton, north east of the airport, is predicted to experience fewer noise events (as described by the N65) with the new runway. This is due to departures heading east using the new runway, along the tracks described above. In the without new runway scenarios those departures are expected to continue using the current departure tracks, which turn east approximately seven kilometres north of the airport.

Assessment out to 2045 was also undertaken. The N65 five event contour for the 2025 and 2045 with the new runway are similar because these are ultimately determined by the noise footprint of the louder aircraft. The forecast growth in operations is most evident in the remaining N65 contours. The progression of the 10, 20, 50 and 100 event N65 contours away from the airport is apparent across the three assessed years.

In both 2025 and 2045 scenarios, the typical busy day N65 (dotted line, $NX_{(90)}65$) is generally only slightly larger than the average N65, indicating consistent operations and runway use. Where arrival and departure tracks diverge, the typical busy day N65 and average N65 differ. The typical busy day N65 indicates that for areas such as Huntingdale and Southern River to the south of runway 03R/21L, on at least ten per cent of days in 2025 five or more events exceeding 65 dBA are predicted.

Figure ES-28 Without new runway 2025 N65 day 24-hour
Source: Wilkinson Murray (MDP Reference: Figure 22-28)

This N65 represent where the majority of aircraft will fly, however all areas of Perth will have aircraft from Perth Airport, Jandakot Airport or RAAF Base Pearce flying overhead from time to time.

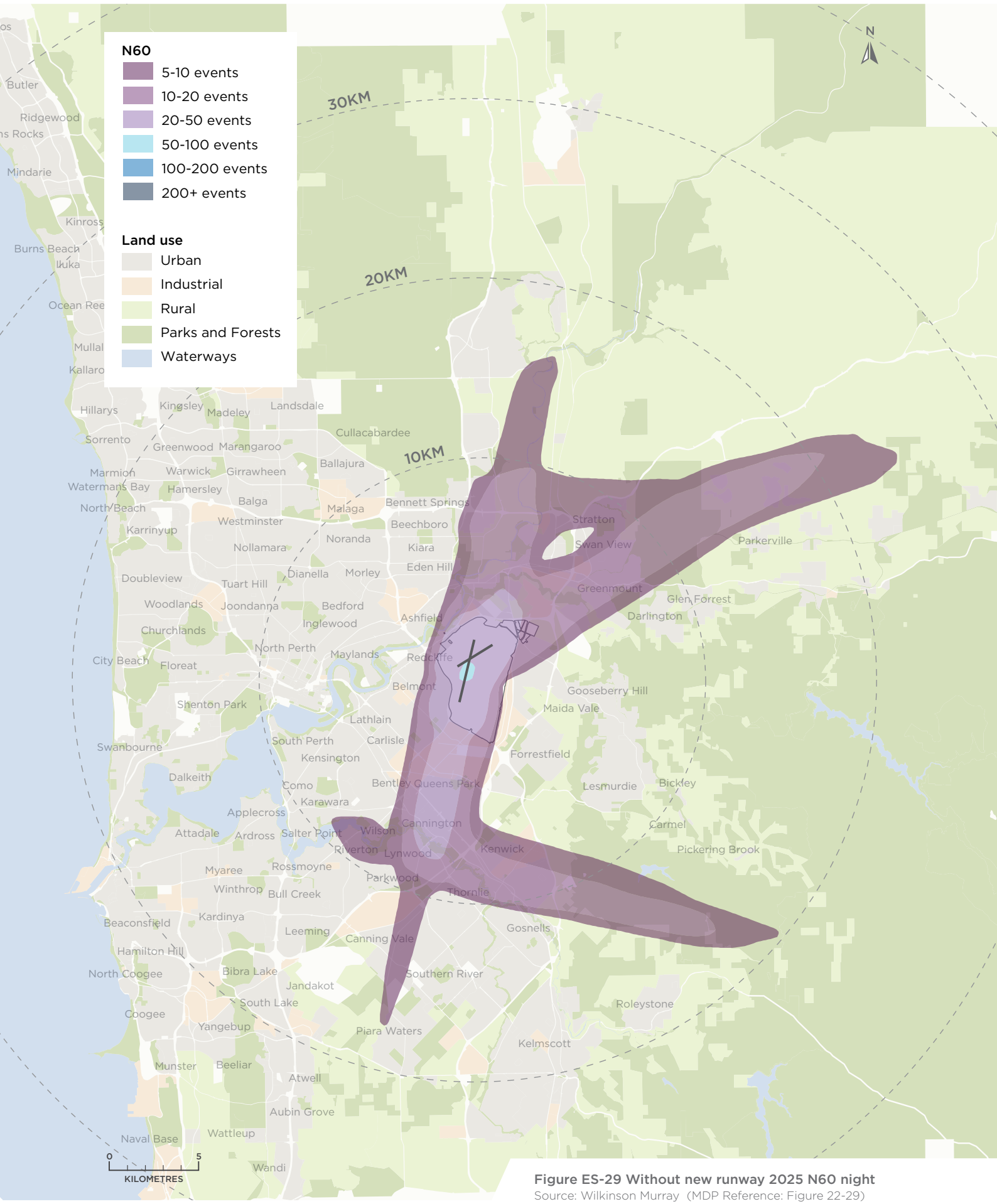


Figure ES-29 Without new runway 2025 N60 night
Source: Wilkinson Murray (MDP Reference: Figure 22-29)

This N60 represent where the majority of aircraft will fly, however all areas of Perth will have aircraft from Perth Airport, Jandakot Airport or RAAF Base Pearce flying overhead from time to time.

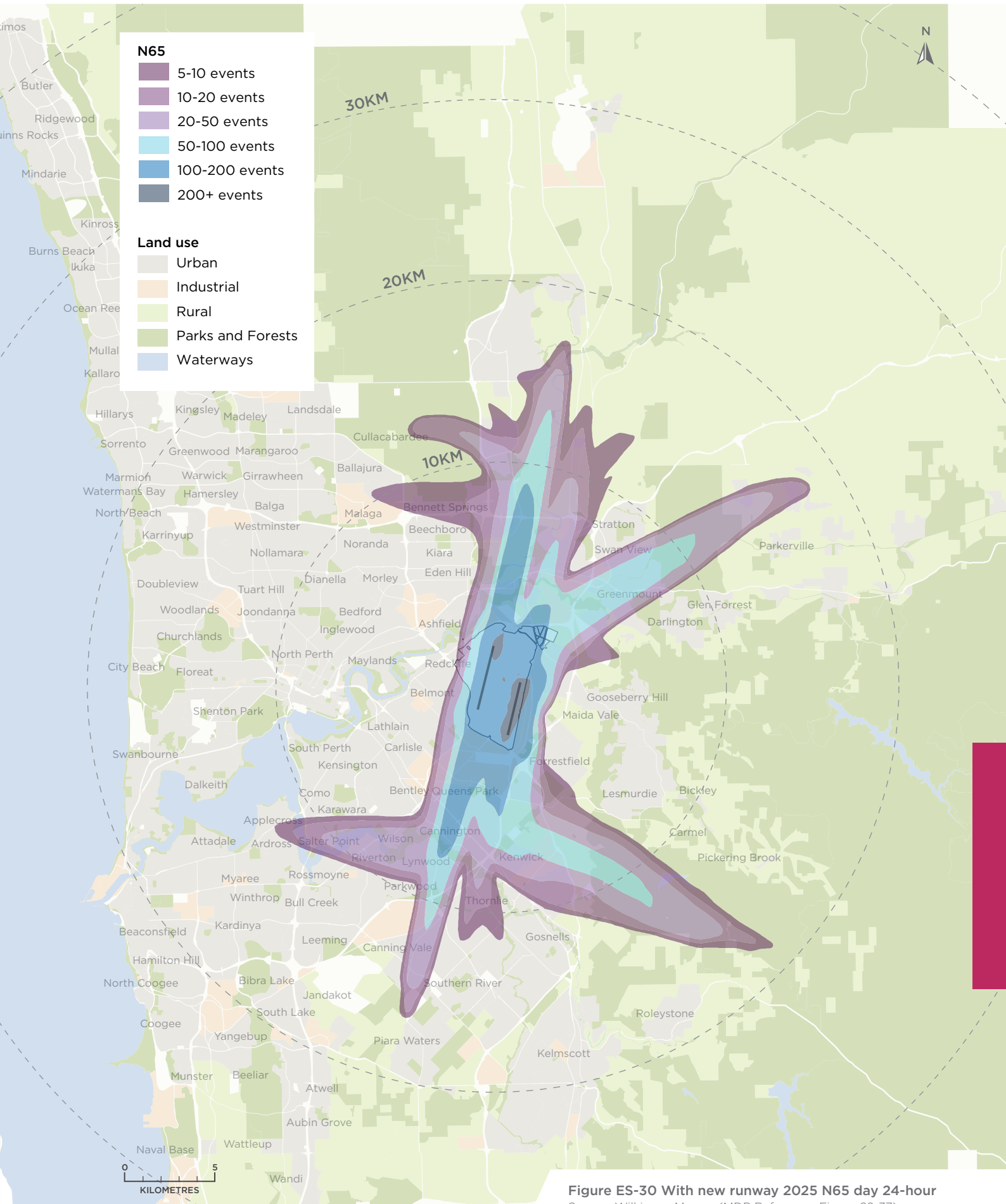


Figure ES-30 With new runway 2025 N65 day 24-hour
Source: Wilkinson Murray (MDP Reference: Figure 22-37)

This N65 represent where the majority of aircraft will fly, however all areas of Perth will have aircraft from Perth Airport, Jandakot Airport or RAAF Base Pearce flying overhead from time to time.

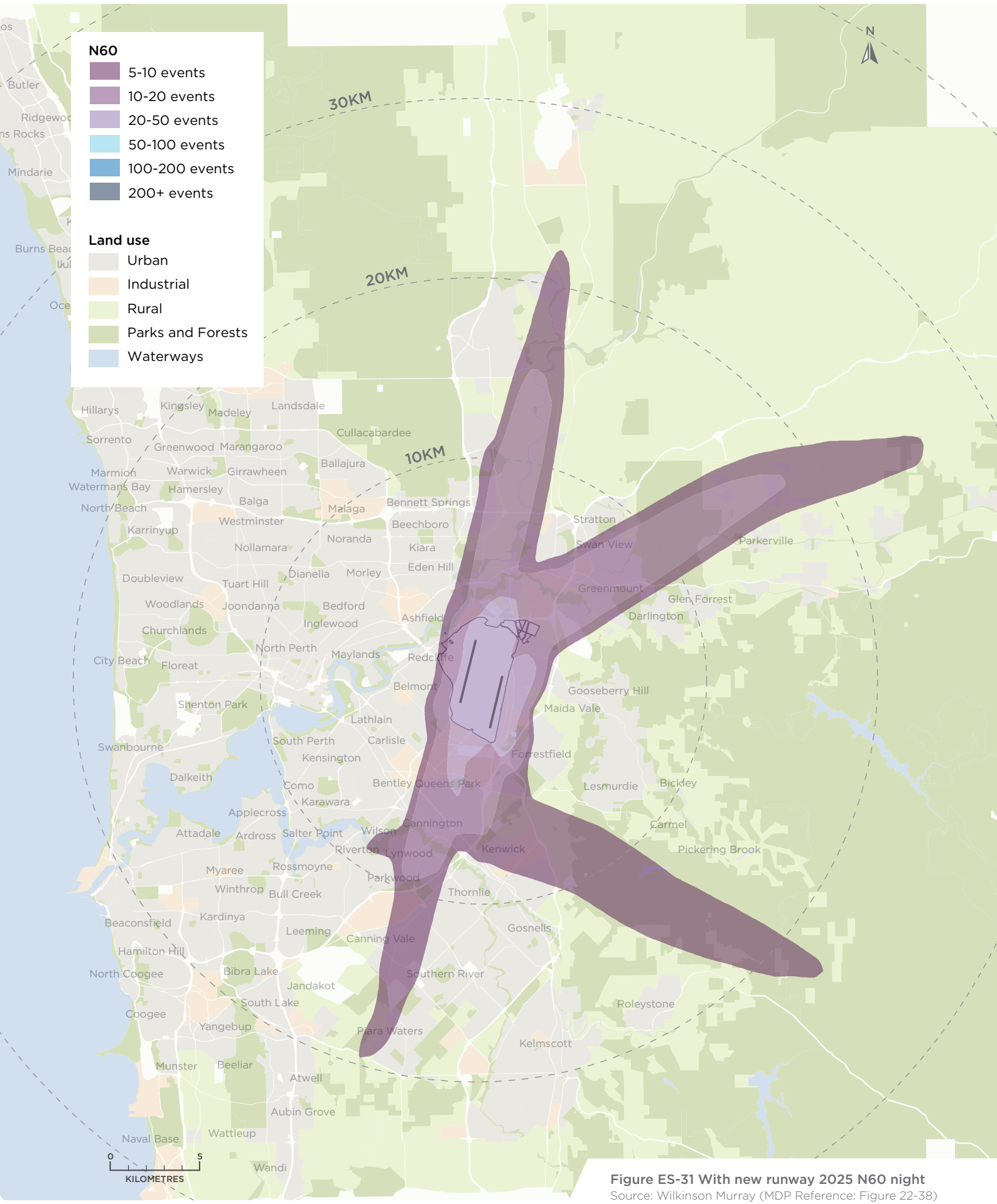


Figure ES-31 With new runway 2025 N60 night
Source: Wilkinson Murray (MDP Reference: Figure 22-38)

This N60 represent where the majority of aircraft will fly, however all areas of Perth will have aircraft from Perth Airport, Jandakot Airport or RAAF Base Pearce flying overhead from time to time.

N-above Difference Charts

The differences in N-above values between with and without the new runway scenarios are presented graphically in Figure ES-32 and Figure ES-33.

These figures represent the change in N-above values between the with new runway and without new runway scenarios at 2025. The purple areas indicate a reduction in N-above events and the blue areas indicate an increase in N-above events.

Australian Noise Exposure Forecast

The Australian Noise Exposure Forecast (ANEF) system was developed through a major socio-acoustic survey carried out in the vicinity of a number of Australian airports in 1980. Based on the results of this work the system then in use in Australia—the Noise Exposure Forecast (NEF) system—was modified to suit Australian conditions and became termed the ANEF system. The ANEF system incorporated a weighting for the period 7.00 pm to 7.00 am (as opposed to the 10.00 pm to 7.00 am period under the NEF system) as the study showed that this gave the best correlation between noise and community reaction.

Perth Airport developed its first ANEF as part of the 1985 Master Plan, over 30 years ago. Since that initial noise forecast which included the three-runway system, the overall footprint of the noise exposure forecast is relatively the same.

An important point to recognise is that, since 1983, there has been considerable development and infill, approved by the State and local governments, in and around Perth Airport within the defined ANEF contours. During that time the published ANEF referred to in each subsequent Master Plan every five years has not changed significantly as shown in Figure ES-34.

New or increased density residential development close to the airport, and in particular those areas located within an aircraft noise exposure level of greater than 20 ANEF, should not occur.

The 2014 ANEF, which was endorsed as part of Master Plan 2014, was the current ANEF at the time this MDP was developed.

Since the submission of the draft MDP, Perth Airport has developed a new ANEF as part of Master Plan 2020. The 2020 Ultimate Capacity ANEF continues to demonstrate consistency with the noise modelling contained within this MDP and was generally similar to the 2014 Ultimate Capacity ANEF. While a review of the airport's ultimate capacity increased the total number of annual aircraft movements from 350,000 to 360,000, this did not result in significant overall changes to 2020 ANEF contours. The 2020 Ultimate Capacity ANEF and detail regarding its composition can be found in Master Plan 2020.

The planning for the new runway is consistent with both the 2014 and 2020 ANEF. The respective new runway Australian Noise Exposure Concept (ANEC) are generally within both ANEFs. It is however, difficult to compare the new runway contours against the existing ANEF because the ANEF is a composite of three different scenarios (2018 ANEC, 2022 ANEC and 2059 ANEC). Therefore, a comparison against the ANEF and the 2059 ANEC is also provided in Figure ES-35.

As the new runway contours are generally within the ANEF, this confirms the NRP is consistent with the endorsed ANEF and the existing land-use planning protection offered by the ANEF system which includes the forecast use of the NRP.

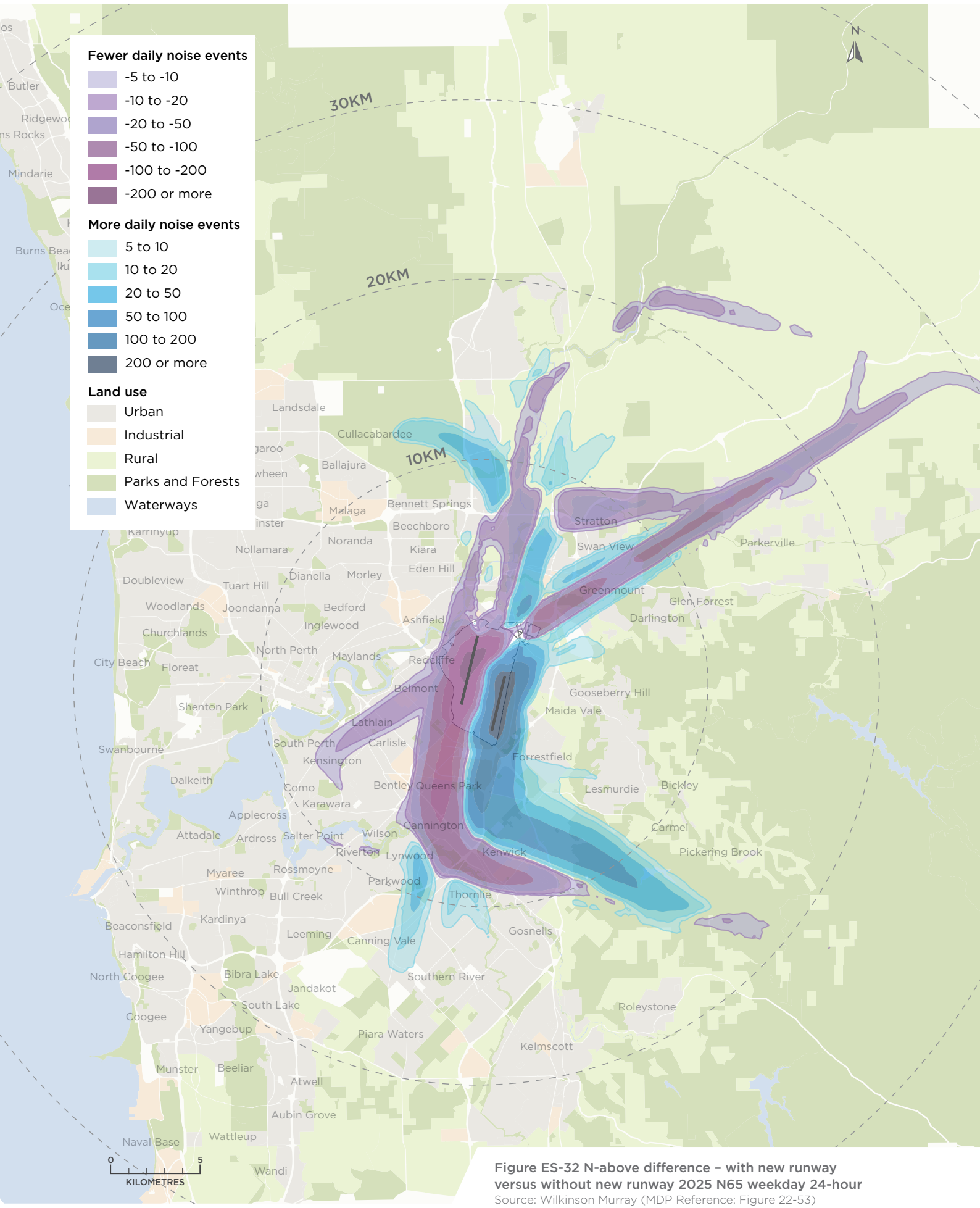


Figure ES-32 N-above difference – with new runway versus without new runway 2025 N65 weekday 24-hour
Source: Wilkinson Murray (MDP Reference: Figure 22-53)

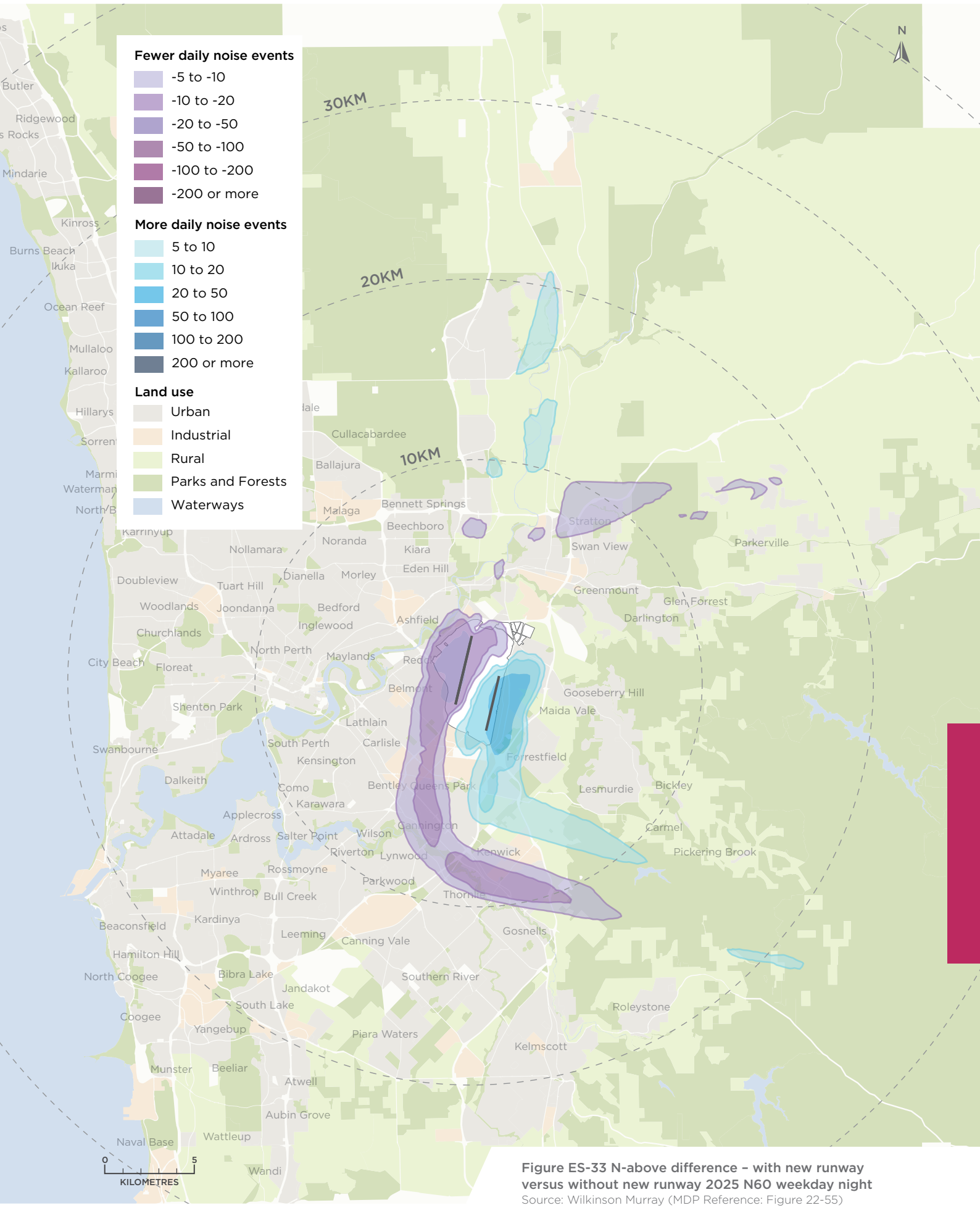


Figure ES-33 N-above difference – with new runway versus without new runway 2025 N60 weekday night
Source: Wilkinson Murray (MDP Reference: Figure 22-55)

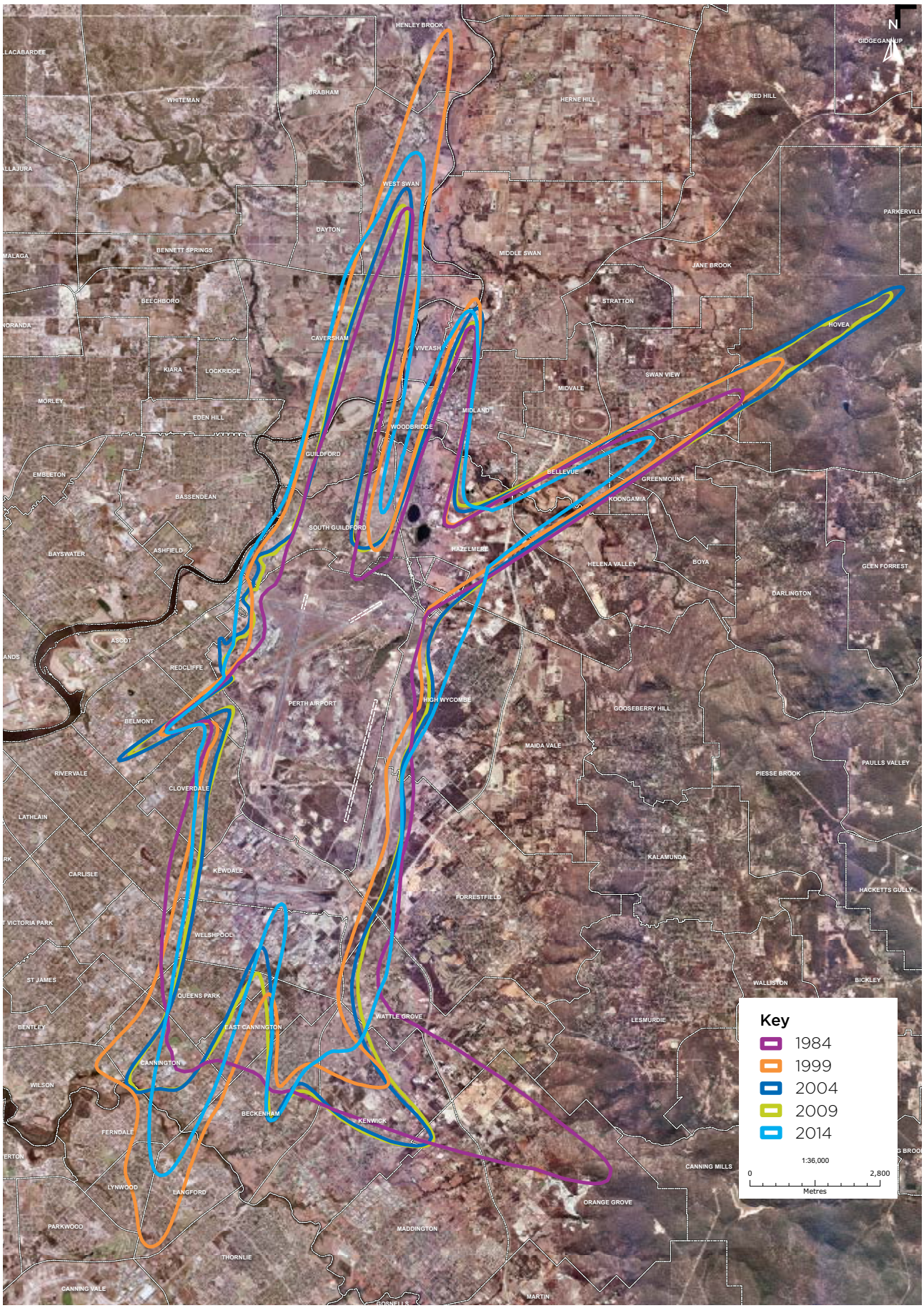


Figure ES-34 Comparison of Australian Noise Exposure Forecast 20 - 25 zone contours overlaid on 1983 Aerial Image
Source: Perth Airport (MDP Reference: Figure 22-5)

Figure ES-35 Comparison of new runway 2045 scenario with Australian Noise Exposure Forecast
Source: Wilkinson Murray (MDP Reference: Figure 22-49)

This ANEF represent where the majority of aircraft will fly, however all areas of Perth will have aircraft from Perth Airport, Jandakot Airport or RAAF Base Pearce flying overhead from time to time.

Noise Induced Vibration

An assessment of the potential for vibration induced by noise and by aircraft vortices associated with the NRP was undertaken.

The issue of vibration from sound pressure waves can be considered by identifying the level of (low frequency) sound energy predicted at the nearest buildings to the proposed runway, and comparing this with standard thresholds for potential damage and for secondary noise generation (i.e. rattling). It was concluded that the future operations forecast to occur at Perth Airport on the NRP will have low potential to cause rattling at the dwellings closest to the new runway as the 90 dBA contour is contained within the airport environs.

Mitigation of Aircraft Noise Impacts

Aircraft noise is an unavoidable consequence of an operating airport and regulations and standards that ensure the safe and efficient operation of the airport may limit the availability of potential noise mitigation options.

Three fundamental options for mitigation of aircraft noise are:

- reduce noise emissions from the aircraft,
- plan infrastructure, flight paths and airport operating strategies to achieve lower exposure over noise sensitive areas, and
- develop land use planning or other controls to ensure that future noise-sensitive uses are not located in noise-affected areas.

Aircraft noise emissions have reduced substantially over the past 40 years, and improvements are expected to continue. As such, some reduction in aircraft noise emissions over time has been incorporated into the predictions in this assessment, through the progressive evolution of the fleet mix in the forecast schedules.

However, all aircraft types used in modelling are currently in use, and hence the assumed reduction is considered to be conservative – future noise levels are likely to be, if anything, lower than assumed. In addition to the three fundamental mitigation options detailed above, the provision of information to both existing and potential residents in areas likely to be exposed to noise is vitally important.

Aircraft Noise Management

Perth Airport works to actively manage aircraft noise exposure and its effect on the community while balancing the need for critical and safe air services. This has the benefits of:

- enabling the community to make informed decisions about aircraft noise exposure on their lives,
- providing guidance to achieving appropriate land-use outcomes around the airport,
- managing, mitigating and, where possible, working towards reducing the impacts of aircraft noise, and
- protecting Perth Airport's 24-hour seven-days-a-week operations.

Perth Airport has adopted the International Civil Aviation Organization's (ICAO) 'balanced approach' to aircraft noise management for managing noise in the vicinity of the airport. This involves identifying an airport's noise issue and then analysing the various measures available to reduce noise.

The four principal elements of the ICAO balanced approach are:

- reduction of noise at source,
- land-use planning and management,
- noise-abatement operational procedures, and
- operating restrictions.

Roles and responsibilities

Perth Airport only has some control over the management of ground-based aircraft noise.

The Civil Aviation Safety Authority (CASA) is responsible for the administration and regulation of Australian-administered airspace under the *Airspace Act 2007*. Airservices is responsible for managing the approved airspace around Perth Airport, including designing flight paths that are safe, efficient and minimise noise impacts on the community to the extent possible.

The management of aircraft noise is the responsibility of several organisations and Perth Airport is committed to working with Airservices, airlines, Commonwealth, State and Local Governments to identify opportunities for improvement.

Aircraft Noise Management Strategy

Perth Airport's commitment to managing aircraft noise is guided by Perth Airport's Aircraft Noise Management Framework (ANMF) as shown in Figure ES-36 This framework takes into account aircraft taking off, departing, approaching, landing and manoeuvring on the airfield, including engine testing, within the airport site.

This framework includes six key themes that guide Perth Airport's effective management of aircraft noise on surrounding communities.

Aircraft Noise Mitigation in the New Runway Infrastructure and Airspace Design

Aircraft noise-mitigation measures have been incorporated into the planning, and will develop over the various stages of the NRP.

Managing Aircraft Noise in Areas of Significance

The Airports Act requires a management plan for areas forecast to be above significant levels (30 ANEF). In 2045 with the new runway, it is predicted that no residents or public buildings would be within the 30 ANEF or 25 ANEF contour respectively due to new runway operation.

Aircraft Noise Insulation Schemes

Whether or not noise insulation schemes are introduced, or extended in relation to Australian capital city airports is a Commonwealth Government public policy decision. Perth Airport has considered the likely impacts of the scheme being implemented.

If the Commonwealth policy was to be applied to Perth Airport, as has previously been done at Sydney and Adelaide airports, for buildings and residents near the new runway, this would see only six houses in the 30 contour and one aged care facility and one church within the 25 contour at 2025.

Insulation schemes are not without their challenges. Insulation programs are administered by the Commonwealth Government with strict metrics applied as to eligibility for the scheme. In the case of Adelaide, the scheme applied to one side of a street that fell within the requisite ANEI contour, while other noise-exposed residents that were on the opposite side of the street did not qualify. Programs like this are complex to administer with the costs and building works undertaken over multiple years. Insulation schemes also impact the passengers, as the cost of any scheme is passed on to the travelling public by way of higher airfare ticket prices.

There are also questions about the effectiveness of insulation schemes. Often, they target properties where owners have purchased them knowing the exposure to aircraft noise. Residents with aircraft noise exposure, but further from the airport, are generally not eligible. The schemes do not allow for the lifestyle of residents, for instance providing no relief for those whose concern is outdoor living areas, or who wish to sleep with windows open. Perhaps for such reasons the history of similar schemes around the world has shown they do not reduce annoyance to the degree expected, despite very high costs.

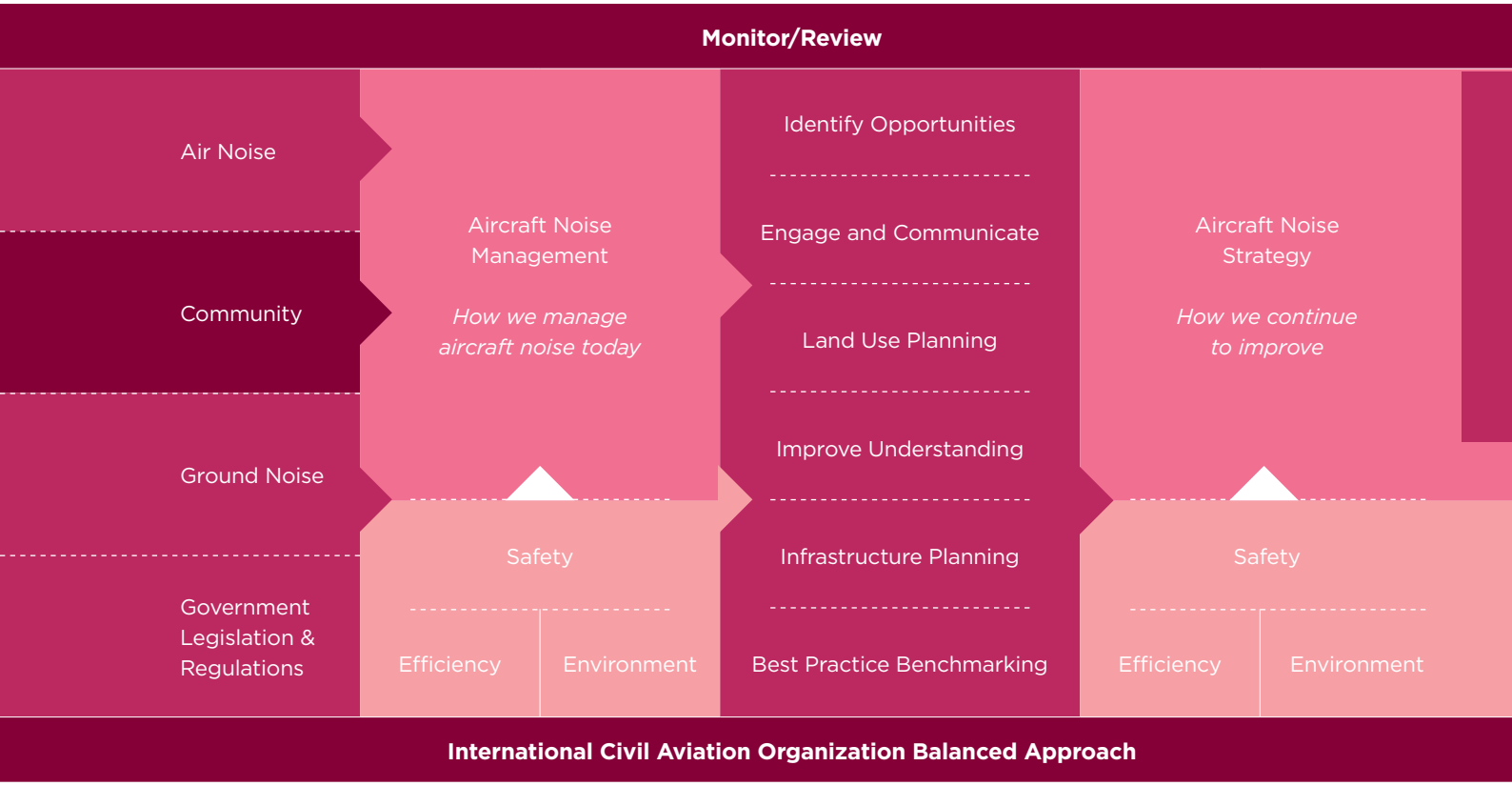


Figure ES-36 Perth Airport Aircraft Noise Management Framework
Source: Perth Airport (MDP Reference: Figure 22-4)

Conclusion

An assessment of changes to aircraft noise exposure with operation of the NRP as part of a parallel runway system was undertaken.

The assessment adopted a comprehensive methodology for the prediction, assessment and communication of aircraft noise, which represents industry best practice. Existing flight data were analysed to determine existing aircraft noise exposure, flight tracks, statistical geometric dispersion about those tracks, as well as air traffic control behaviour. This analysis was applied to forecast schedules for two assessment years, along with over 14 years of historical meteorological data to predict, to the extent possible, future operations and their associated aircraft noise exposure. A scenario without the new runway, whereby the airport continues to operate with the existing infrastructure, was used to evaluate the impact of the NRP.

A suite of aircraft noise metrics and supplementary information is included in the MDP. The information includes ANEC/ANEF, N-above, typical busy day N-above, indicative noise-altitude-distance charts and flight zone diagrams.

The aircraft noise exposure is predicted to increase in areas north and south of the new runway, as well as areas near new flight paths associated with the new runway. Some areas that are presently impacted by aircraft noise can expect a reduction in this noise with the new runway.

In 2025, upon opening of the new runway, approximately 5,600 fewer dwellings are predicted to be affected by aircraft noise, described by N65 of five or more; a reduction of approximately seven per cent. There are predicted to be approximately 8,200 newly affected dwellings, based on the N65 metric in 2025. The majority of these are north and south of the new runway, including parts of Canning Vale, East Cannington, Forrestfield, Herne Hill, High Wycombe, Thornlie and Wattle Grove.

Key Findings

Key findings from the assessment of aircraft noise resulting from operations on the new runway include:

- The changes to flight paths and airspace will result in a reduction in the number of noise events for some areas, an increase in noise events for other areas, and some newly impacted areas.
- On opening, operation of the new runway will improve the noise environment for many people exposed to aircraft noise, especially in the evening and night time periods, due to the spreading of aircraft movements across the parallel runway system.
- Areas to the east and south/south-east of the airport are the most likely to experience an increase in aircraft noise events or be newly affected by aircraft noise events. Areas to the west and south-west are the most likely to experience a decrease in aircraft noise events, on day of opening, but this is expected to grow again as traffic grows.
- The levels of vibration due to the highest expected aircraft noise levels are well below those which may cause structural damage to buildings. However, they may result in secondary sound generation from loose windows and other building elements in areas close to the airport boundary.

Section 23 – Air Quality and Greenhouse Gas (Air-based)

The Air Quality and Greenhouse Gas (Air-based) Section describes the impacts on air quality and greenhouse gas emissions from air-based activities resulting from the construction and operation of the NRP.

For this assessment, emissions resulting from aircraft operations were defined as all emissions from an aircraft's main engines. The significant aircraft-based activities considered are:

- engine start-up,
- aircraft taxiing on the airfield,
- aircraft take-off and climb out, and
- aircraft approach and landing.

Air Quality

While Perth enjoys relatively good air quality compared to many countries around the world, it can still impact susceptible people and ground level concentrations can still exceed current air quality standards. Both short-term and long-term exposure to air pollutants can cause health problems. Therefore, it is important to consider impacts from air-based activities associated with the new runway to air quality.

Four operational scenarios of the new runway were assessed:

- baseline - reflective of current operations (based on 2016 data),
- opening - reflective of operations in 2025 with the new runway,
- opening - reflective of operations in 2025 without the new runway, and
- 20 years - reflective of operations 20 years after opening the new runway (2045).

Carbon Monoxide

CO emissions from aircraft are dominated by taxiing, which typically accounts for approximately 90 per cent of total CO emissions. The modelling of aircraft taxiing is very conservative, particularly in the 2025 with new runway scenario. Despite aircraft movements in 2045 increasing by more than 20 per cent over those in 2025, CO emissions only increase by approximately four per cent. This is most likely due to fewer movements by some older aircraft. Future improvements in aircraft engine emissions are likely to reduce CO emissions from new aircraft.

The worst-case air quality index for eight-hour average CO is predicted to be very good during all assessment scenarios. Aircraft operations associated with the NRP are predicted to have a negligible impact on ambient CO concentrations.

Nitrogen Dioxide

The data shows that NO_x emissions are dominated by the take-off and climb out modes of the landing take-off cycle, where aircraft engines are being operated at or close to full power. It is calculated that the take-off and climb out modes typically account for approximately 80 per cent of total NO_x emissions from aircraft movements. Future improvements in aircraft engine emissions are likely to reduce NO_x emissions from new aircraft. Therefore, since newer aircraft have not been modelled in AERMOD, future NO_x emissions from aircraft are expected to be lower than those presented.

The maximum one-hour average NO_2 concentration is predicted to exceed the established impact assessment criterion of 246 µg/m^3 at several sensitive receivers in the 2045 with new runway scenarios.

For aircraft operations associated with the NRP are considered to have a minor adverse effect on ambient NO_2 concentrations.

Sulfur Dioxide

Based on the predicted impacts, aircraft operations associated with the NRP are predicted to have a beneficial impact on ten minute and one-hour ambient SO_2 concentrations and a negligible impact on 24-hour and annual ambient SO_2 concentrations. Overall, this impact is regarded as negligible.

Particulate Matter (PM_{10})

During all assessment scenarios, the AQI for 24-hour average and annual average PM_{10} is fair and good respectively, and aircraft operations associated with the NRP have a negligible impact on ambient PM_{10} concentrations.

Particulate Matter ($PM_{2.5}$)

During all assessment scenarios, the AQI for $PM_{2.5}$ is poor for both 24-hour and annual averages. However, analysis indicates aircraft operations associated with the NRP have a negligible impact on ambient $PM_{2.5}$ concentrations.

Odour

The existing odour impacts associated with aircraft operations at Perth Airport are very low, as evidenced by only one odour complaint being received in the past five years. On this basis, the increased Volatile Organic Compound (VOC) emissions associated with the NRP are considered unlikely to result in significant nuisance odour impacts from aircraft operations at Perth Airport.

Greenhouse Gas

Greenhouse gas emissions from aircraft are categorised as Scope 3 emissions and are therefore not reportable under the NGER. Nevertheless, it is prudent to investigate the effect of the NRP on aircraft greenhouse gas emissions from an air-based perspective. Take-off produces more greenhouse gas emissions than any other single landing take-off mode, typically accounting for approximately one-third of aircraft greenhouse gas emissions during the landing take-off cycle.

The results show that the greenhouse gas emissions from taxiing are significant. In most assessment scenarios, the combined greenhouse gas emissions from the taxi-out and taxi-in modes are greater than those from the take-off mode alone. The modelling of aircraft taxiing is conservative, and these results are therefore considered an overestimate of greenhouse gas emissions.

Mitigation

The air quality assessment has demonstrated that aircraft operations associated with the NRP would have a low impact on ambient air quality in the vicinity of Perth Airport.

Nevertheless, the AERMOD emissions estimates demonstrate that aircraft emissions during taxiing are significant. This is particularly the case for VOC where, notwithstanding the conservative nature of the modelling, taxiing typically accounts for more than 60 per cent of total VOC emissions from aircraft in the landing take-off cycle. Unnecessary taxiing reduces the overall efficiency of the airport and increases the amount of fuel used by aircraft. Accordingly, Perth Airport places considerable emphasis on the layout of the taxiway network to reduce the amount of taxiing required. It also highlights the importance of consolidation of all commercial air services into Airport Central Precinct, between the parallel runways, for long-term efficiency and associated environmental benefits.

Conclusion

The maximum one-hour average NO_2 concentration is predicted to exceed the established impact assessment criterion of 246 µg/m³ at several sensitive receivers in the 2045 with new runway scenarios. In each of these instances, the second highest predicted one-hour NO_2 concentration complies with the impact assessment criterion, indicating that the NEPM goal of no more than one exceedance of the one-hour NO_2 standard per year would be met.

The predicted concentrations of all other criteria pollutants and air toxics investigated comply with the established impact assessment criteria.

Potential nuisance odour impacts associated with the NRP have been assessed qualitatively, based on the changes in annual VOC emissions. The existing odour impacts associated with aircraft operations at Perth Airport are very low, as evidenced by only one odour complaint being received in the past five years.

On this basis, the increased VOC emissions associated with the NRP are considered unlikely to result in significant nuisance odour impacts.

A risk assessment for local air quality impacts associated with aircraft movements under the NRP has been conducted, considering the impacts of greatest significance across all assessment scenarios at the most affected sensitive receptors. Specifically, this corresponds to one-hour NO_2 which was assessed as being subject to a minor adverse impact at the most affected receptor locations. The risk rating of adverse impacts to local air quality is determined to be low.

NO_2 concentrations have been identified. However, NO_X emissions from newer aircraft are anticipated to reduce in the future as aircraft engine technologies improve, and it is likely that the significance of the impact of the NRP on ambient NO_2 concentrations will reduce in years to come. Notwithstanding, the residual risk of adverse impacts to local air quality due to aircraft movements under the NRP is assessed as being low.

Aircraft greenhouse gas emissions are categorised as Scope 3 emissions for Perth Airport, and are therefore not reportable under the NGER. While there are limitations to what Perth Airport can do to reduce air-based air quality and greenhouse gas emissions, there are several strategies and initiatives, implemented by industry, which attempt to reduce their impact.

Perth Airport has a degree of control over aircraft taxiing, to the extent that the design and operation of the airport can seek to reduce taxiing as much as possible. The new runway and associated taxiways being constructed as part of the NRP have been designed to ensure efficient aircraft operations, as far as possible, while maintaining compliance with airport safety standards.

Key Findings

Key findings from investigations into air quality and greenhouse gas from air-based sources include:

- The potential impact of NRP aircraft operations on air quality impacts and greenhouse gas emissions is determined to be low, with the predicted concentrations of all criteria pollutants and air toxics complying with the established impact assessment criteria.
- Emissions from newer aircraft are anticipated to reduce in the future as aircraft engine technologies improve, and it is likely that the impact of the NRP operations on air quality concentrations will reduce in years to come.
- The increased volatile organic compounds emissions associated with aircraft operating on the NRP are considered unlikely to result in significant nuisance odour impacts.

Section 24 – Health

The Health Section describes the potential impacts on health resulting from the operation of the NRP.

Health

A desk top review of relevant literature relating to the health impacts of aircraft noise exposure, including research, reviews and guidelines was undertaken and then compared against the exposure expected from the new runway operations.

The assessment considered 168 articles that have been published between 1993 and 2017. Each article was assessed in terms of its research methodology, strength of findings, and relevance to Perth Airport operations.

In 1948, the World Health Organization (WHO) defined health as 'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity'. Based on this definition, it is accepted that health is a broad concept.

The health impact assessment has considered the potential health impact from aircraft noise on five main health consequences:

- psychological effects,
- cognitive impairment,
- cardiovascular disease,
- sleep disturbance, and
- annoyance.

The potential health impacts associated with aircraft air emissions have also been considered. Impacts associated with construction noise have not been assessed as construction noise is a short-term activity and the anticipated noise exposure is much lower than for that expected for aircraft operations.

Research Considerations and Limitations

Many studies are based on aircraft traffic volume and noise levels very different from what is expected as a result of the NRP operations. This does not make the results of health studies at those busier airports irrelevant, but it does require caution when translating studies undertaken at one airport to the circumstances of another.

Impact Assessment

Although the various health consequences of aircraft noise exposure are generally considered under separate headings, they in fact are intricately linked, as shown in Figure ES-37.

Psychological Effects

A range of health outcomes are relevant in considering the possible psychological effects of aircraft noise, at the most serious end is mental illness.

There is limited evidence of mental health concerns due to aircraft noise exposure. The data is unclear and any impact would appear to be short term. Studies identifying such impacts have generally been based on much higher levels of aircraft noise exposure than are forecast for Perth Airport.

Cognitive Impairment

Cognitive impairment is a term generally used to refer to any form of impairment that affects the mind or the brain. In relation to aircraft noise exposure, the focus has been on the capacity of individuals to process information, most frequently in the context of learning.

A number of studies have identified links between high levels of exposure to noise and children's learning.

Despite all the uncertainties in this area of research, there is evidence to conclude that aircraft noise exposure can have a detrimental effect on some cognitive outcomes and some areas of learning in primary age school children. The most evidence exists for reading comprehension and some types of memory. The major studies that provide the primary source of data for this area of research have been undertaken in Europe and the US, often at airports with much higher levels of aircraft activity than will occur at Perth Airport.

Cardiovascular Effects

Research in this field takes a broad view, and includes related conditions that may link to cardiovascular disease, such as hypertension (persistent long-term high blood pressure).

There is some evidence for an association between environmental noise and increased risks of hypertension, with a general view that this also links to increased risks of ischaemic heart disease. Much of the research on which this conclusion is based has considered levels of exposure above those that are forecast for Perth Airport.

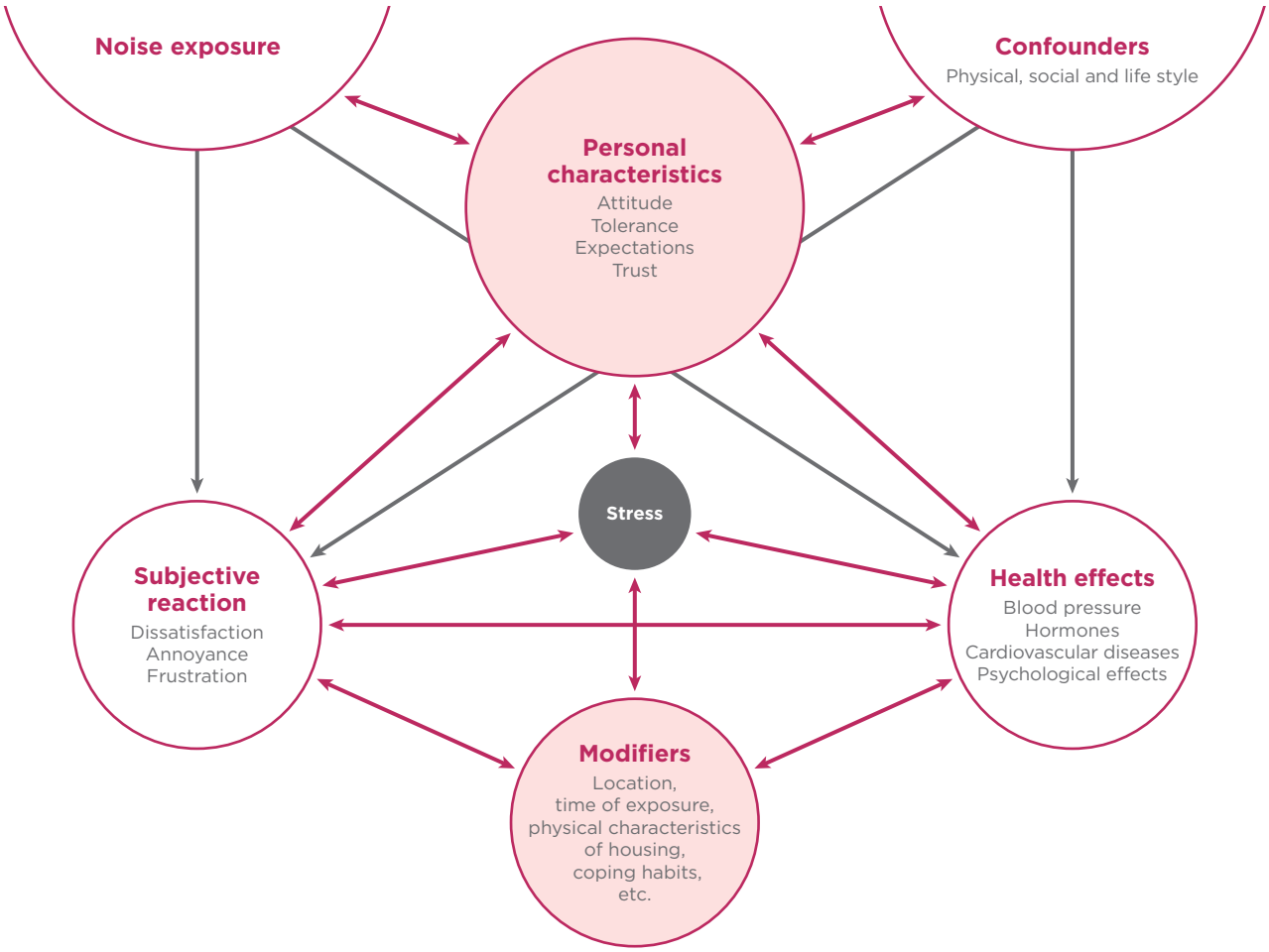


Figure ES-37 Interdependent health impacts
Source: Berry and Sanchez, The Economic and Social Value of Aircraft Noise Effects: A Critical review of the State of the Art (2014)
(MDP Reference: Figure 24-2)

Sleep Disturbance

From the research, the most commonly agreed health consequence of noise is sleep disturbance. It has also been cited as the most adverse health effect (WHO 2011) due to the knock-on effects of sleep deprivation. These include an increased risk, in the long term, of obesity, diabetes and cardiovascular outcomes (Swift 2010).

The noise levels at which sleep disturbance occurs varies across studies.

The extent to which noise can penetrate a dwelling varies greatly, and is dependent not just on house construction and insulation, but also on factors that are difficult to isolate in research such as open windows or the orientation of bedroom windows.

The NRP and operation of a parallel runway system will result in changes to flight paths around Perth Airport at night time. The opening of the NRP will also impact on community facilities that may be sensitive to sleep disturbance during the day such as child care or kindergarten facilities.

Annoyance

The health effects of aircraft noise contribute to annoyance, and are contributed to by annoyance. In other words, annoyance at aircraft noise is not just a response to the noise itself but also a response to what the noise represents. Perceived and real health consequences of aircraft noise contribute to the annoyance that the noise provokes, and annoyance can result in increased stress which can lead to health consequences.

Numerous sources cite non-acoustic factors as more significant than actual noise levels in predicting or explaining annoyance, such as:

- unmet expectations (e.g. that there would be less, or no aircraft noise),
- change (linked to expectations that there would be no change, and a failure of communication about change),
- lack of understanding (e.g. why aircraft fly where they do),
- fear (e.g. aircraft noise prompting an associated fear of aircraft crashing),
- individual sensitivity to noise (individual responses to noise vary greatly), and
- valuation placed on the cause of noise (the greater the value placed on the source of the noise, i.e. aviation services and sector, the less likely an individual will be annoyed).

A change in the noise can be a driver of annoyance, as well a change in an individual's situation, such as changed hours of work or change in stress from other sources.

Emissions

Operation of the NRP will eventually result in a greater number of annual aircraft movements than what could operate at Perth Airport without the NRP. The increased aircraft capacity will result in small increases in pollution levels. However, increased efficiency in operations due to the parallel runway system will also have some impact in reducing emissions by reducing airborne delays for incoming aircraft, and ground running for aircraft queued for departure. This, in turn, will reduce engine run times (and emissions) from arriving aircraft and aircraft with engines running and awaiting departure.

Nitrogen oxide emissions from newer aircraft are anticipated to reduce in the future as aircraft engine technologies improve, and it is likely that the impact of the new runway operations on ambient nitrogen oxide concentrations will reduce in years to come.

Auditory Health

There is consistent evidence to show that hearing impairment occurs only at prolonged exposure to high levels of noise well beyond the levels from aircraft over-flights.

Studies indicate that sustained noise exposure above at least 75 dBA is necessary for auditory damage to occur (Airports Commission 2013; Basner et al 2014). Aircraft noise is by nature intermittent - albeit in extreme situations it can be intermittent at relatively high levels - and for only short periods does it exceed 75 dBA. Noise induced hearing impairment is thus highly unlikely to result from community exposure to aircraft noise (WHO 2011).

Mitigation

Strategies to minimise aircraft noise impact can assist in reducing the health impacts of aircraft noise. These strategies include:

- appropriate land planning around airports through State and Local government policy and decision making to ensure that future noise sensitive uses are not located in noise impacted areas,
- operational procedures that include noise abatement procedures,
- direct engagement with populations and community facilities under flight corridors,
- provision of clear and comprehensible information about the likely aircraft noise exposure, including published Number above contours and the Interactive Aircraft Noise Information Portal,
- provision of clear information to assist those affected by the noise to undertake amelioration measures that can reduce noise penetration into homes, such as the 'Reducing noise in existing homes brochure',
- comprehensive Perth Airport Aircraft Noise Management Plan, and
- the Perth Airport Aircraft Noise Technical Working Group, which enables the aviation industry to initiate and evaluate operational changes while ensuring that the noise impact of those changes is considered and opportunities to improve noise outcomes are explored.

Additional mitigation measures to be applied throughout the design of the airspace and operations of the new runway, include:

- careful route planning and incorporating existing arrival and departure routes into the airspace design wherever possible,
- improved use of new navigation technology,
- review of noise abatement procedures for NRP and parallel runway operations,
- provision of timely information, and
- direct engagement with newly impacted education facilities.

Conclusion

The NRP will not, of itself, increase the total aircraft noise load over Perth in the short term. It will allow better management of the growth in air traffic that has already occurred at the airport, and improve efficiency, customer service and effectiveness of operations. There will come a stage, well into the future, at which the additional runway will allow a greater total volume of air traffic than the current runway system can accommodate.

As noted earlier, the evidence on the health impacts of aircraft noise is sometimes unclear and often contradictory, but there is evidence to show a range of health issues exist. This is applicable to the NRP even though many of the studies undertaken have considered noise levels significantly higher than what will be experienced at Perth Airport. Importantly, the evidence not only points to the potential negative impact of increased noise but also the benefits of reduced noise exposure. In the case of the NRP, there will be reductions in aircraft noise for some populations under existing air routes, and increased or new noise events for others.

The significance of the patterns of air traffic, the importance of non-acoustic factors, and the variability in the dose/response relationships that drive evaluations of total noise load suggest that effective, noise sensitive management of air traffic can moderate the health consequences that flow from that traffic. This suggests that there is potential to use the options created by an additional runway to reduce the negative health outcomes from air traffic though the greater flexibility in design of air traffic routes and the management of air traffic on those routes.

The key conclusions that can be drawn about the impact of the NRP are:

- the noise levels associated with the new runway are well below those in many of the major studies on health impacts of aviation undertaken around the world,
- the key health issues are likely to be:
  - cognition in learning for schools overflown,
  - sleep disturbance, and
  - annoyance,
- depending on the usage of the new runway, the noise levels generated will be most likely be below key levels for identifiable cardiovascular health impacts, and
- the key health concerns are amenable to a range of measures to ameliorate their impact.

Some individuals will find impacts, in the form of sleep disturbance and annoyance, from the new runway as significant. Through careful and sensible long-term planning and engagement with affected populations and schools, these impacts are likely to be small, or restricted to relatively few people.

In summary, the research and review undertaken by Perth Airport suggests that potential health impacts can be adequately managed and mitigated through the application of transparent community information and the application of the identified mitigation strategies. However further research and community engagement on a sector wide scale is recommended.

Key Findings

The key findings from investigations into the health impacts of aircraft noise exposure include:

- Research into the health impacts of aircraft noise exposure has generally been conducted at airports much busier than Perth Airport, with no specific research completed for the Perth area.
- Generally, and not specific to the NRP, the research found that:
  - the most adverse health effect from aircraft noise exposure is considered to be sleep disturbance, due to the knock-on effects of sleep deprivation that includes an increased risk, in the long term, of obesity, diabetes and cardiovascular outcomes. Some groups, such as children and the elderly, are considered to generally be more susceptible to sleep disturbance,
  - some research has shown that aircraft noise exposure can impact on some cognitive outcomes and some areas of learning in primary age school children, with the most evidence existing for reading comprehension and some types of memory,
  - with regards to the increased risks of hypertension and the linked increased risks of ischaemic heart disease, research identifies that this risk is higher for long-term (10-15 years) exposure to aircraft noise and more prevalent in older people (over 65 years),
  - perceived and real health consequences of aircraft noise contribute to the annoyance that the noise provokes, and annoyance can result in increased stress which can lead to health consequences. The health consequences of annoyance are generally a mediator for other health issues such as stress, which is in turn linked to cardiovascular disease. Annoyance can be reduced through information, engagement to improve understanding of aircraft noise, and for those affected, manage the noise in the least intrusive way reasonably possible, and
  - the health consequences associated with air pollution include stroke, heart disease, lung cancer, and both chronic and acute respiratory diseases, including asthma, with particulate matter being the major contributor.
- With careful planning, and through engagement with affected populations, any potential health impacts resulting from NRP operations are likely to be small, or restricted to relatively few people.
- The NRP is unlikely to cause adverse psychological impacts on the surrounding communities.
- Noise induced hearing impairment is highly unlikely to result from community exposure to aircraft noise from NRP operations as hearing impairment occurs only at prolonged exposure to high levels of noise well beyond the levels from NRP flight operations.
- The operation of the NRP will impact on a small number of kindergartens, pre-schools and schools that may be sensitive to cognitive and learning impact.
- The NRP and operation of a parallel runway system will result in changes and flight paths around Perth Airport at night time. The opening of the new runway will alter the pattern of aircraft noise exposure and result in reduced aircraft noise exposure in some areas and new or higher aircraft noise exposure in other areas.
- Operation of the NRP will in the longer-term result in a greater number of annual aircraft movements than what could operate at Perth Airport without the NRP and the increased aircraft capacity will result in small increases in pollution levels. However, increased efficiency in operations due to the parallel runway system will also have some impact in reducing emissions by reducing airborne delays for incoming aircraft and ground running for aircraft queued for departure. This, in turn, will reduce engine run times (and emissions) from arriving aircraft and aircraft with engines running and awaiting departure. Additionally, over the timescale identified, it is likely that aircraft noise and emission standards will be considerably improved over the modelled current technology.
- Strategies to minimise noise impact can assist in reducing the health consequences of aircraft noise exposure. These include appropriate land planning around airports, careful route planning, noise abatement procedures, provision of clear and comprehensible information about the likely exposure to aircraft noise, as well as information to assist those affected by the noise to undertake amelioration measures that can reduce noise penetration into homes.
- Further research is required into the effect of aircraft noise and potential health impacts, with nearly every study suggesting further research is required.

Section 25 – Social

The Social Section provides as assessment of the social impacts from the construction and operations of the NRP.

The social impact assessment focuses on identifying potential impacts of the NRP associated with people's way of life, their community, their environment, their health and wellbeing and their personal and property rights.

To identify impacts, the assessment considers the following scenarios:

- 2025 without the new runway compared to the 2025 with the new runway to identify where social impacts and benefits may be expected at day of opening,
- 2045 with the new runway scenario to show how Perth Airport is predicted to grow with the new runway over time.

Where the number of people has been described, Western Australia's average household size of 2.55 people per dwelling has been used.

The NRP will have both beneficial and adverse impacts on regional and local communities and social services and facilities. Changes to the social environment as a result of the construction and operation of the NRP are considered for:

- demographics,
- housing and property, and
- aircraft noise exposure.

Demographics

The NRP is not expected to have a direct impact on Perth's demographic profile in relation to population, age structure, cultural and ethnic characteristics, workforce participation, income or overall socio-economic status.

Although the NRP is not considered to have a direct impact on the demographics of surrounding communities, the improved access to Perth enabled by the NRP may have some role in growth and demographic change over time, including increased migration and visitor numbers. With the anticipated growth in Perth's population, the NRP will be key to supporting the growing city, its surrounding regions and the State of Western Australia generally. Impacts to Perth's demographic structure could be experienced if the NRP did not proceed, due to the capacity constraints that would occur at Perth Airport.

Housing and Property

Construction and operation of the NRP will not have a direct impact on the cost or type of public or private housing as there is no additional land requirements for the project.

Indirect impacts to housing and property may occur as a result of noise exposure associated with aircraft operations in the vicinity of Perth Airport. These indirect impacts would come about through restrictions to land use due to the ANEF and amenity related impacts associated with the noise environment. The ANEF is used for land-use planning purposes, and is applied in conjunction with Australian Standard 2021:2015 (Acoustics – Aircraft noise intrusion – Building siting and construction) to provide guidance on the acceptability of certain types of development within the ANEF zones. The ANEF for Perth Airport has included the operation of a parallel runway system since the early 1980s.

In relation to property values, analysis of 212,210 property sales transactions between 1995 and 2015 identified that over the past 20 years the house price growth within the current Perth Airport N65 noise contours has been slightly faster than in the areas within five kilometres of the N65 contours. This indicates that other factors may dominate considerations when purchasing a house, such as proximity to the Perth CBD, traffic infrastructure, local investment in amenity and urban regeneration, changes in local school performance in national rankings, changes in the location of employment and the workforce mix, along with other local developments.

Aircraft Noise Exposure

The NRP will result in changes to airspace and flight paths around Perth Airport. These changes, as well as the projected future growth in air traffic, will alter the pattern of aircraft noise exposure and result in reduced noise exposure in some areas and new or higher noise exposure in other areas.

The new runway will not, of itself, increase the total aircraft noise load over Perth in the short term. It will allow better management of the growth that has already occurred in air traffic at the airport, and improve efficiency and effectiveness of operations. There will come a time when the new runway will allow a greater total number of aircraft movements than the current runway system can accommodate.

The opening of the new runway requires new flight paths for aircraft using the new runway, as well as changed flight paths on the existing main runway to accommodate parallel runway operations.

The assessment considers the forecast growth in aircraft movements between 2025 and 2045, increasing from 175,000 to 241,000 annual aircraft movements. This growth in air traffic will result in dwellings being exposed to an increasing number of noise events, as well as more dwellings being exposed to noise events.

Day time (6.00 am to 7.00 pm)

As shown in Table ES-11 the opening of the new runway will result in an overall net reduction of 1,268 dwellings that will experience five or more 65 dBA noise events during the day time. Suburbs closer to the airport and closer to the future flight corridors are more likely to receive higher frequencies of 65 dBA noise events than those further away from the airport and flight corridors.

By 2045, due to the growth in aircraft movements at Perth Airport, 71,346 dwellings would experience five or more 65 dBA noise events during the day time period.

Table ES-12 shows that the overall number of community facilities located within N65 daytime contours decreases by nearly 11 per cent on day opening of the new runway. By 2045, the total number of existing community facilities exposed to N65 daytime noise events will increase to 233, which is still a reduction from the 245 existing facilities impacted in 2025 without the new runway.

While there is an overall decrease, the changes in the distribution of these contours mean that some facilities would no longer be affected, some would experience a decrease or increase in noise event frequency, and some would be newly affected by five or more N65 daytime noise events.

Number of dwellings within N65 day contours				
Average daily noise events	**2025 Without New Runway**	**2025 With New Runway**	**Change at Day of Opening**	**2045 With New Runway**
5-10	17,668	15,948	-1,720	15,202
10-20	17,552	16,331	-1,221	11,589
20-50	18,102	23,816	5,714	22,489
50-100	10,263	10,703	440	15,726
100-200	5,670	1,194	- 4,476	6,332
200+	5	0	-5	8
Total dwellings	**69,260**	**67,992**	**-1,268**	**71,346**

Table ES-11 Number of dwellings within N65 day contours
Source: Arup (MDP Reference: Table 25-5)

Number of community facilities within N65 day contours				
Facility type	**2025 Without New Runway**	**2025 With New Runway**	**Change at Day of Opening**	**2045 With New Runway**
Aged care and retirement	30	20	-10	22
Childcare	33	26	-7	30
Community centre	23	19	-4	19
Hospital	6	5	-1	5
Kindergarten or pre-school	11	11	0	11
Place of worship	73	73	0	77
Prison or detention centre	2	2	0	1
School	66	60	-6	67
Tertiary education	1	2	1	1
Total	**245**	**218**	**-27**	**233**

Table ES-12 Summary of community facilities within N65 day contours
Source: Arup (MDP Reference: Table 25-6)

Evening (6.00 pm to 11.00 pm)

Table ES-13 shows the estimated number of dwellings within each of the N65 evening contours. At 2025, day of opening there is an overall reduction of 16 per cent in the number of dwellings within the N65 evening contours. By 2045, due to the growth in aircraft movements, 24,241 dwellings would experience an average of five or more 65 dBA noise events during the evening.

Table ES-14 identifies that the number of existing community facilities located within N65 evening contours reduces from 81 to 67. While there is a small decrease, the distribution of these contours results in some facilities that will no longer be included, some that will experience a decrease or increase in noise event frequency, and some that are newly exposed to more than five 65 dBA evening noise events. By 2045, the number of existing community facilities exposed to N65 evening noise events will be similar to the pre-NRP counts.

Number of dwellings within N65 evening contours				
Average daily noise events	**2025 Without New Runway**	**2025 With New Runway**	**Change at Day of Opening**	**2045 With New Runway**
5-10	10,413	9,273	-1,140	11,897
10-20	6,708	6,824	116	11,098
20-50	3,052	807	-2,245	1,246
50-100	0	0	0	0
100-200	0	0	0	0
200+	0	0	0	0
Total dwellings	**20,173**	**16,904**	**-3,269**	**24,241**

Table ES-13 Number of dwellings within N65 evening contours
Source: Arup (MDP Reference: Table 25-7)

Number of community facilities within N65 evening contours				
Facility type	**2025 Without New Runway**	**2025 With New Runway**	**Change at Day of Opening**	**2045 With New Runway**
Aged care and retirement	3	4	1	5
Childcare	10	6	-4	8
Community centre	8	5	-3	7
Hospital	0	4	4	4
Kindergarten or pre-school	6	4	-2	4
Place of worship	29	21	-8	25
Prison or detention centre	1	1	0	1
School	23	21	-2	31
Tertiary education	1	1	0	1
Total	**81**	**67**	**-14**	**86**

Table ES-14 Summary of community facilities within N65 evening contours
Source: Arup (MDP Reference: Table 25-8)

Night (11.00 pm to 6.00 am)

N60 is the metric used to describe night time noise impacts.

Table ES-15 shows the estimated number of dwellings within each of the N60 night contours. At 2025 day of opening there is an overall reduction of 6,256 dwellings within the night contours. By 2045, due to the growth in aircraft movements at Perth Airport, nearly 87,000 dwellings would experience five or more noise events above 60 dBA during the night time period. The main change to the N60 night contours is not a spread of the contours, but rather an increase in the density of number of noise events.

As shown in Table ES-16, the number of existing community facilities located within N60 night noise contours decreases by 12. While there is an overall decrease, the distribution of these contours results in some facilities that are no longer included, some that experience a decrease or increase in frequency.

By 2045, the number of existing community facilities impacted by N60 night noise events will have increased.

Number of dwellings within N60 night contours				
Average daily noise events	**2025 Without New Runway**	**2025 With New Runway**	**Change at Day of Opening**	**2045 With New Runway**
5-10	26,383	27,765	1,382	36,222
10-20	26,464	24,692	-1,772	29,919
20-50	8,278	2,415	-5,863	20,800
50-100	3	0	-3	0
100-200	0	0	0	0
200+	0	0	0	0
Total dwellings	**61,128**	**54,872**	**-6,256**	**86,941**

Table ES-15 Number of dwellings within N60 night contours
Source: Arup (MDP Reference: Table 25-9)

Number of community facilities within N60 night contours				
Facility type	**2025 Without New Runway**	**2025 With New Runway**	**Change at Day of Opening**	**2045 With New Runway**
Aged care and retirement	20	11	-9	25
Hospital	5	2	-3	4
Prison or detention centre	3	3	0	3
Total	**28**	**16**	**-12**	**32**

Table ES-16 Summary of community facilities within N60 night contours
Source: Arup (MDP Reference: Table 25-10) Growth to 2045

The growth in air traffic over time will result in dwellings being exposed to an increasing number of noise events, as well as an increased number of dwellings being exposed to aircraft noise events. The projected number of dwellings within each of the noise event contours for 2045 day (24-hour) and night (11.00 pm to 6.00 am) is shown in Table ES-17.

Average Daily Noise Events	Number of dwellings within N65 day (24-hour) contours, 2045 With New Runway	Number of dwellings within N60 night (11.00 pm to 6.00 am) contours, 2045 With New Runway
5-10	18,850	36,222
10-20	13,414	29,919
20-50	19,331	20,800
50-100	20,041	0
100-200	10,646	0
200+	849	0
Total dwellings	**83,131**	**86,941**

Table ES-17 Number of dwellings within day and night noise contours – 2045 with new runway
Source: Wilkinson Murray (MDP Reference: Table 25-13)

Non-Airspace Related Impacts

Construction of the new runway would result in changes at the airport which include the removal of vegetation, landform changes and the presence of construction related activity on the NRP site. These works would result in some temporary amenity impacts (such as ground based noise, dust, visual) in areas very close to the new runway area which may have an impact on people in surrounding areas.

In relation to local roads, construction is expected to add around 1,000 vehicles per day to roads in the vicinity of the airport. Grogan Road would be re-closed at the start of construction. (Access to Abbott Road via Grogan Road is maintained). This closure may add minor delays to the local road network, but would have minimal impact on the wider road network.

Airspace Related Impacts

Community Facilities and Vulnerable Populations

Individuals respond to sound and noise differently and there can be large variation in their response. While the average or majority response by a population is used to determine aircraft noise thresholds, certain groups within the population are particularly noise sensitive or vulnerable to new or increased aircraft noise exposure levels. The World Health Organization's Guidelines for Community Noise (1999) suggest that some groups are often underrepresented in socio-acoustic studies on noise exposure, including:

- infants and children,
- older adults,
- people with mental or physical medical conditions,
- people with hearing or speech challenges, and
- shift workers.

These people may be more vulnerable to noise exposure depending on the nature of their condition or circumstance.

In relation to N65 noise events, in the short term, operation of the NRP would reduce the number of aircraft noise events in some areas, but over time, aircraft noise exposure in an area will grow to similar pre-NRP levels. Vulnerable people may be less able to cope with changes to aircraft noise exposure and therefore may be at greater risk of effects. This is especially relevant to segments of the population that would receive new aircraft noise exposure as a result of the NRP.

Sensitive community facilities such as schools, child care centres, hospitals and aged care facilities are also more likely to be used by population groups that are more noise sensitive.

People's Way of Life and Environment

Exposure to aircraft noise has the potential to adversely impact people's way of life including "how they live, work, play and interact with one another on a day-to-day basis" (Vanclay, Esteves, Aucamp, & Franks, 2015). According to the WHO Guidelines (1999), the effects of community noise (such as aircraft and road transportation) depends on the extent to which it interferes with different activities.

The guidelines state that in the context of aircraft noise, interference with rest, recreation and watching television are the most important issues for people. The N65 noise contour is used as the threshold for interference with speech communication and can be used as a proxy for determining the number of dwellings, and thus the number of people, that may be affected by noise related disturbance.

Opening of the new runway would improve the noise environment for some people currently exposed to aircraft noise, especially in the evening and night time periods. In the following years, the forecast growth in flights at Perth Airport would mean this noise exposure would grow over time in line with aviation traffic growth. By 2045, more dwellings would be exposed to N65 noise event (day and evening) and N60 noise events (night) than at 2025.

The impacts associated with new or additional exposure to aircraft noise and people's way of life might include:

- use of dwellings and buildings,
- television watching and radio,
- speech disturbance,
- annoyance, and
- sleep disturbance.

Community Interactions

Exposure to aircraft noise has the potential to impact people's community including its cohesion, stability, character, services and facilities.

People's connection to their community comes from their interaction with neighbours and other people in their local environment. The impact of excessive noise on certain sections of the community has the potential to change the way that people use their outdoor living spaces, reducing incidental interactions with neighbours where people aren't outside as frequently. It may also impact their use of community facilities in their local area. This may result in some people being or feeling less connected to their local community.

Mitigation

As discussed in Section 21, the design of preliminary flight corridors for the NRP has been undertaken to consider and avoid noise exposure on populated areas as much as possible. However, the impact of increased or new aircraft noise exposure will be unavoidable in some areas, largely due to the increasing number of flights to and from Perth Airport over time.

Perth Airport actively manages aircraft noise exposure and its effect on the community. Strategies to minimise aircraft noise exposure are detailed in Section 22.

It is acknowledged that new and additional aircraft noise exposure will be experienced by some people who live, work and recreate in areas near Perth Airport and its associated flight paths or corridors. These impacts will be considered through the final design of flight paths and operational procedures. This residual impact is an unavoidable outcome of operating a major airport that services the travel needs of the city, and State, and provides significant economic outcomes for the people of Perth and Western Australia.

Conclusion

The requirement for a future parallel runway system at Perth Airport has been identified and planned for since the 1970's.

The relative isolation of Perth as an Australian capital city and the vast distances between major population centres makes air travel and Perth Airport indispensable to the people of Western Australia and to the State's economic, social and cultural development. Perth Airport is both the primary airport in Western Australia and the hub through which nearly all regional aviation is serviced.

Perth residents rely on air transport more than most other Australians in that they travel by air more frequently and over longer distances for work, education, recreation, health and to visit friends and relatives.

Perth's forecast population growth will also result in an increased demand for aviation services for both passenger and freight transport purposes.

Aircraft movements at Perth Airport are expected to increase, reaching 172,000 annual aircraft movements by 2025 and 241,000 by 2045.

Without the new runway, by 2025, delays would regularly occur at Perth Airport as the runway capacity is exceeded. By 2045, approximately 140 aircraft movements would be foregone each day, resulting in significant constraints to the community and State development. Construction of the NRP will result in changes at the airport which include the removal of vegetation, landform changes and the presence of construction related activity on the airport. These works would result in some temporary amenity impacts (such as ground based noise, dust, visual) in areas very close to the NRP which may have an impact on people in these areas.

These impacts are considered to be manageable and would be addressed via mitigation and management actions outlined in the CEMP which will be developed before site works commence. In relation to local roads, construction is expected to add around 1,000 vehicles per day to roads in the vicinity of the airport. Grogan Road will be re-closed at the start of construction which will have minimal impact on the wider road network.

Once operational, the new runway will increase the size of Perth Airport's visible infrastructure from on and off airport viewpoints, but given the current scale of the airport, the infrastructure that is already in place and the activities it facilitates, this change is considered to be negligible.

In relation to the social impact of aviation related noise, on opening in 2025, the NRP would change the community's exposure to aircraft noise due to aircraft traffic being distributed across the parallel runway system. This will result in a reduction in the number of noise events for some areas, an increase in noise events for other areas, and some new noise events for other areas.

During the day, some areas to the north-east and west of the airport would receive less frequent and lower decibel noise, while areas to the north and south of the new runway would receive new aircraft noise. While there are changes to where noise will be experienced, overall the number of dwellings and community facilities impacted by noise events during the day remains fairly consistent. On opening, in the evening and the night time, there will be an overall decrease in the number of dwellings and community facilities located with the noise event contours. Due to the growth in aircraft movements over time and the increased capacity enabled by the new runway, by 2045 the areas exposed to aircraft noise events will increase.

Measures to manage social impacts or improve social benefits have been identified based on the social benefits and impacts that have been discussed throughout this MDP. Measures were identified based on standard statutory mitigation measures as well as industry best practice. Measures recommended will be adapted based on detailed design work.

To address the impacts of new or changed exposure to aircraft noise, Perth Airport will continue to work with State and Local governments, airlines and Airservices to implement Perth Airport's Aircraft Noise Management Framework. This includes advocating for appropriate land use planning in the vicinity of the airport, using appropriate metrics to identify noise sensitive areas and actively discouraging development in noise sensitive areas. The ANEF system has its limitations, and as such, Perth Airport will advocate for the N-contours to be considered when updating planning provisions associated with the airport.

Perth Airport will continue to engage with stakeholders and the community about the growth of Perth Airport and the impacts and benefits this growth brings. Perth Airport will continue to provide information on aircraft noise and its exposure to assist the community manage and even lessen the impacts where possible.

Key Findings

- The NRP will not, of itself, increase the total aircraft noise load over Perth in the short term. It will allow better management of air traffic at the airport, and improve efficiency and effectiveness of operations. In the longer term the new runway will allow a greater total number of aircraft movements per year than the existing runways can accommodate.
- Over an average day (24-hour period) at day of opening (2025), it is estimated that:
  - the number of existing dwellings to experience five or more aircraft noise events above 65 decibels (dBA) is expected to decrease from approximately 83,600 to 78,000,
  - of these, approximately 27,500 dwellings will average at least five fewer daily noise events,
  - 25,600 dwellings will average at least five additional daily noise events, and
  - nearly 8,200 dwellings will be newly affected.
- By 2045, due to the growth in aircraft movements, the number of dwellings exposed to increase to approximately 83,000.
- During the daytime period (6.00 am to 7.00 pm) at day of opening (2025), it is predicted that:
  - the number of existing dwellings to experience five or more aircraft noise events above 65 dBA is expected to decrease from approximately 69,300 to 68,000, and
  - by 2045, the number of dwellings exposed will increase to 71,400.
- During the evening period (7.00 pm to 11.00 pm) at day of opening (2025), it is expected that:
  - the number of existing dwellings to experience five or more aircraft noise events above 65 dBA is expected to decrease from approximately 20,200 to 16,900, and
  - by 2045, the number of dwellings exposed will increase to 24,300.
- During the night-time period (11.00 pm to 6.00 am) at day of opening (2025), it is estimated that:
  - the number of existing dwellings to experience five or more aircraft noise events above 60 dBA is expected to decrease from approximately 61,200 to 54,900, and
  - by 2045, the number of dwellings exposed will increase to 86,941.
- Areas to the east and south/south-east of the airport are the most likely to experience an increase in aircraft noise events or be newly affected by aircraft noise events. Areas to the west and south-west are the most likely to experience a decrease in aircraft noise events.
- The majority of the dwellings with a reduced impact are located in the southern suburbs of Beckenham, Kenwick, Langford, Maddington and Thornlie, and to the north and north-west, the suburbs of Bassendean, Belmont, and Cloverdale.
- The areas with an increased impact are mainly located in the southern suburbs of Canning Vale, Ferndale and Thornlie, northern suburbs of Midland, High Wycombe and Swan View, and Forrestfield and Wattle Grove to the east, the majority of newly impacted dwellings are located north and south of the airport, including High Wycombe, Thornlie, Wattle Grove and Forrestfield.
- Suburbs to the south and south-west, such as Wilson, Waterford, Riverton, and Manning, will not experience a significant change in impacted dwellings at day of opening of the new runway.
- The number of community facilities impacted by aircraft noise events, including aged care and retirement facilities, hospitals, childcare, education facilities, and prisons and detention centres, will decrease on day of opening of the new runway.

Section 26 – Hazards and Risks to Airport Operations

The Hazards and Risk to Airport Operations Section assesses the hazards and risks to aviation activities as a result of aircraft operations on the new runway.

A review of the risks posed to aviation activity associated with the operation of the new runway has been completed. The key areas considered were:

- airspace protection,
- communication, navigation and surveillance systems,
- aircraft crash,
- bird and animal strike,
- windshear and turbulence,
- exhaust plumes (high velocity discharge),
- glare,
- hazardous land use surrounding the airport, and
- air traffic management considerations.

National Airports Safeguarding Framework – Control of Development in the Vicinity of Airports

The Commonwealth Government recognises that the current and future viability of aviation operations at Australian airports can be impacted by inappropriate developments in areas beyond the airport boundary.

The National Airports Safeguarding Advisory Group (NASAG), comprising high-level Commonwealth, State and Territory transport and planning officials, prepared and released the National Airports Safeguarding Framework (NASF) in July 2012.

The NASF aims to safeguard airports and the communities in their vicinity, and to develop, with State, Territory and Local governments, a national land-use planning regime. Where applicable this framework has been used to assess the key areas.

Airspace Protection

Protection of airspace required for Perth Airport's current and future needs is essential to provide a safe, predictable environment for the arrivals and departures of aircraft using Perth Airport in all weather conditions. The Airports (Protection of Airspace) Regulations 1996 (APARs) prescribe airspace around the airports for protection from activities that could pose a hazard to air navigation. These are referred to as controlled activities, and include, but are not limited to:

- construction or erection of any building or other structure that may intrude into prescribed airspace, including construction cranes and equipment,
- an activity that results in artificial or reflected light that exceeds acceptable light intensities or is capable of blinding or confusing pilots,
- an activity that results in air turbulence, and
- an activity that results in the emission of smoke, dust or other particulate matter.

Prescribed airspace comprises the airspace above the lower of two sets of defined invisible surfaces above the ground known as the Obstacle Limitation Surfaces (OLS) and Procedures for Air Navigation Services - Aircraft Operations (PANS-OPS) surfaces.

In 2001, Perth Airport declared the prescribed airspace including the new runway at 2,700 metres long. Following the approval of the Master Plan 2014 Minor Variation, which altered the runway length from 2,700 to 3,000 metres, Perth Airport has commenced the process of updating the prescribed airspace and declaration in accordance with Part 2 of the APARs. Perth Airport will ensure notice is issued as per the APARs and new prescribed airspace charts are published.

Perth Airport completed an assessment to determine if there are any new obstacles within the new runway's OLS and PANSOPS, considering the 3,000 metre length. No infringements, other than those already identified and lit accordingly for current day operations, were found.

Communications, Navigation and Surveillance Systems

There are a number of communication, navigation and surveillance systems required for the NRP that are critical to the safe and efficient operation of aircraft. Airservices typically installs and maintains these systems at Perth Airport. Such systems required for the NRP, or are currently in operation at Perth Airport, include:

- Instrument Landing System (ILS) (localiser/ glideslope),
- VHF Omnidirectional Range (VOR) / Distance Measuring Equipment (DME),
- microwave link path, and
- terminal area radar.

The NRP may include the installation of new communication, navigation and surveillance infrastructure such as an ILS, for each runway end, and additional Advanced Surface Movement Guidance and Control System surveillance equipment. Perth Airport will continue to work with Airservices to identify appropriate sites for the new infrastructure and ensure these are suitably protected now and into the future.

Aircraft Crash

Perth Airport has never had a fatal aircraft crash involving Regular Public Transport (RPT), charter or general aviation aircraft operating passenger carrying services. There has also never been a fatality involving high capacity commercial aircraft types, similar to those that operate at Perth Airport, in Australia.

Approximately 30 per cent of fatal accidents occur at take-off or landing with another 30 per cent occurring during initial climb or final approach.

Public Safety Areas (PSA) are areas of land at the ends of the runways, identified by quantifiable risk contours, within which development is restricted in order to control the number of people on the ground at risk of death or injury in the event of an aircraft accident on take-off or landing. PSA risk contours are developed based on

runway use statistics correlated against international crash data, and provide an objective basis for precautionary planning decisions in those areas of highest risk.

Perth Airport has adopted the United Kingdom approach to PSAs to assist with assessing appropriate developments.

Perth Airport has developed PSA contours that reflect the ultimate development and demand of the airport at 475,000 movements per year.

The 1-in-10,000 PSA contours for the NRP are retained within the airport boundary and therefore developments within this area can be controlled by Perth Airport. The 1-in-100,000 risk contours extend out of the airport boundary to the north and south, however current land uses within these areas align with the NASF PSA guideline.

An assessment of the Air BP fuel depot outside of the estate was completed, including its proposed future expansion plans. The current fuel depot is outside of the 1-in-10,000 contour but partially within the 1-in-100,000 contour. The assessment concluded, that as the depot was an existing development, the majority of which was light industrial, it may be retained and apportioned it a low level of risk.

While the likelihood of an aircraft crash incident will potentially rise with an increase in aircraft operations, overall, the risk of an aircraft crash incident posed by the development of the new runway is as low as reasonably practicable.

Bird and Animal Strike

Wildlife around aerodromes can present serious hazards to aircraft operations. The most obvious of these is the presence of birds, but other animals can also present a hazard. The NRP assessment has concentrated on bird activity at Perth Airport as, in terms of wildlife, it represents the greatest risk to aircraft using the new runway.

Although bird strikes have a very low probability of causing aircraft accidents, Perth Airport and the aviation industry take this risk very seriously. All strikes are reported to the Australian Transport Safety Bureau (ATSB).

ATSB reporting shows the majority of strikes in Australia occur between 7.30 am and 10.30 am, with a smaller peak between 6.00 pm and 8.00 pm. For Perth Airport, data indicates there is a higher likelihood of a bird strike in the morning between 6.00 am and 8.00 am and a smaller peak between 6.00 pm and 9.00 pm. This is generally in line with ATSB nationwide reporting and reflects two distinct peaks over a day.

The periods of increased bird strike activity at Perth Airport coincide with the morning departure peak and evening arrivals peak.

The birds which cause the most bird strike incidents at Perth Airport are kestrels (16.1 per cent) and duck species (17.1 per cent). For approximately 15 per cent of confirmed bird strike incidents, the species of bird could not be identified. This is likely to occur when a bird strike has been witnessed, however, evidence has been removed (either in-flight or during cleaning), minor damage to an aircraft is observed but no evidence of wildlife is found, DNA testing is inconclusive, or if only part of a bird carcass has been found. There has been a rise in black cockatoo strikes in recent years (5.4 per cent). Perth Airport recorded its first strike of a black cockatoo in 2014 and then another 10 strikes have occurred. This number may also be higher than indicated, as it can be difficult to identify the number of birds involved in a strike.

Habitat and Attractants

Birds are attracted to airports for numerous reasons. The large, open grassed areas found on an airport provide perfect feeding, resting and nesting areas. Short grass provides protection against predators such as snakes, cats and foxes. However, short grass also attracts predatory birds like raptors (kestrels are a common species at Perth Airport) in search of rodents and other food sources. Water, lying in wetlands or drainage channels and basins on the airport, attracts waterfowl such as ibis and ducks. Large open hangars and other flat roofed buildings typically associated with airports can also provide excellent nesting areas.

A number of habitat areas and attractants for birds and other fauna have been identified in the airport vicinity. Some are within the estate, while others are up to 16 kilometres from the airport.

The key bird and fauna habitats or attractants that are also likely to affect operations from the new runway include:

- Munday Swamp, and
- CBH Metro Grain Centre.

Munday Swamp is located approximately 775 metres to the north of the new runway and aircraft will overfly the swamp on departure from runway 03R or arriving on runway 21L. Munday Swamp is an identified habitat for wetland birds such as ducks (a species with a high likelihood of a bird strike incident).

Additionally, ibis are known to use Munday Swamp as a nesting ground, with active management of the population undertaken since 2014. Although Ibis are known to nest in Munday Swamp they do not currently account for significant incidents of bird strikes at Perth Airport.

CBH Metro Grain Centre is located on Abernethy Road, in Forrestfield; approximately 400 metres from the estate boundary and 700 metres from the new runway. Grains that have fallen loose during loading, unloading, and transport at CBH are an attractant for ducks that visit the site primarily during night hours. Surveys have shown that some ducks fly to CBH from the northwest, overflying across the estate.

Additionally, development of the NRP will require the construction of new drainage channels and basins in the areas adjacent to the runway. The short grass in the airside areas and standing water in the drainage system will act as an attractant for birds and potentially other fauna similar to existing areas of the airfield.

Bird and Animal Hazard Management

Under Manual of Standards (MOS) Part 139, Perth Airport is required to control the risk of wildlife striking operating aircraft. Perth Airport has a comprehensive Wildlife Hazard Management Plan that incorporates monitoring, assessment, reporting, and control methods for bird and animal hazards. CASA regulates and conducts surveillance and ensures that the risk of wildlife striking aircraft at Perth Airport is being adequately managed.

To minimise the likelihood of a bird strike, Perth Airport implements a number of bird control techniques such as:

- monitoring of bird activity by Airport Operations Officers, particularly during the three hours after sunrise which has been identified as the time with the highest bird activity,
- reducing the amount of water lying on the airport grounds to avoid attracting ducks etc.,
- maintaining the grass at a length which deters birds,
- actively removing vegetation around the estate,
- minimising available food,
- bird harassment using vehicle lights, horns and cracker shots, and
- netting of airside open drains

Overall, provided the ongoing application of the management of bird hazards on and around Perth Airport continues, the risk of aircraft crash incidents as a result of bird strikes with the NRP operation should be considered as low as reasonably practicable and thus broadly acceptable.

Windshear and Turbulence

The risk of windshear (a change of wind speed or direction over a relatively short distance) created from a large building or terrain in the vicinity of a runway is a critical consideration for safe airport operations. Windshear poses the greatest risk on approach, landing and take-off when an aircraft's speed is low and the pilot's ability to respond is more limited.

Buildings

Building generated windshear becomes critical to safety when a significant obstacle, such as a building, is located in the path of a cross-wind to an operational runway. In such circumstances, wind flow will be diverted around and over the building, causing the cross-wind speed to vary along the runway. In accordance with NASF guidelines, Perth Airport considers the risk of building generated windshear, and turbulence for buildings located:

- 1,200 metres or closer perpendicular to the runway centreline,
- 900 metres or closer in front of runway threshold, and
- 500 metres or closer from the runway threshold along the runway.

The assessment found that only the Woolworths Regional Distribution Centre (WRDC), adjacent to Horrie Miller Drive, and a handful of buildings external to the estate were within the defined zone of influence.

Buildings in High Wycombe and Kewdale which fall within the 'zone of influence' are shielded from the runway centrelines by surrounding topography. Further assessment found that the WRDC will have some minimal impact on aircraft operations on the new runway (03R/21L) in certain wind conditions.

While there are currently minimal building generated windshear impacts identified, it is important to safeguard the new runway from any future developments. Perth Airport will continue to assess developments in the vicinity of the new runway in accordance with the NASF Guideline B.

Terrain

Perth Airport is located on the Swan Coastal Plain approximately eight kilometres west of the Darling Ranges. In the vicinity of Perth Airport, the range rises to heights of approximately 950 feet. Due to its height and proximity to the estate, the Darling Scarp would pose the greatest risk of terrain induced wind shear and turbulence to aircraft operations on the new runway.

To be affected, winds would need to be coming from the east over the Darling Range, before reaching Perth Airport. Winds from the east quadrant are the prevailing winds at Perth Airport.

While the modelling shows there is negligible impact due to topography, it is generally acknowledged that there is turbulence experienced below 3,000 feet at Perth Airport during the summer months when there is a strong easterly wind gradient. This is notified to pilots via an entry in the aeronautical information publication En-Route Supplement Australia (ERSA) which contains information for pilots operating at the airport. By showing negligible impact, the study confirms that the turbulence experienced on the new runway will be no more severe than that currently encountered at Perth Airport on the existing runways.

Exhaust Plumes

Exhaust plumes of significant vertical velocity (plume rise) can emanate from ground activities such as vents and stacks, and can interfere with aircraft operations in various stages of flight. MOS Part 139 provides that CASA may determine that an exhaust plume, having a velocity in excess of 4.3 metres per second, is or will be a hazard to aircraft operations because of the velocity or location of the efflux.

Information regarding the velocity, temperature, composition of the effluence and any particulate matter must be provided in any application for development on the estate where an exhaust plume is present. After internal review the exhaust plume information is provided to CASA for assessment if required. An example of this process, applicable to Perth Airport, was the construction of the BGC Brickworks on the estate which includes a chimney stack. This development, to the north-east of the airport, was assessed by CASA which determined the specified plume was within acceptable limits and did not pose a risk to airport operations. As part of the approval, conditions were placed on the development to ensure monitoring was regularly undertaken confirming compliance with the specification.

There are no other existing sources of plumes that would pose an unacceptable risk to aircraft operations from the new runway (03R/21L).

Glare

Glare from ground lights or large reflective surfaces near the runway have the potential to obscure vision or cause confusion and distraction for pilots and air traffic controllers. MOS Part 139 specifies ground lighting intensities (measured at three degrees above the horizontal) within four light zones.

While there are light sources (street and building lights) present to the east of the new runway and within 300 metres from the centreline (Zone A) (refer to Section 26), there are no direct light sources that protrude above the horizontal. The light sources are therefore not considered to be a hazard to aircraft operations. The light sources present within Zone A are also on the estate and come under the control of Perth Airport, should a hazard be identified during flight testing for the new runway, Perth Airport has the ability to remediate the source prior to aircraft operations commencing.

Other light sources contained within Zones B – D, which include various types of lighting, are similar to those encountered on the current runways. While there are potential sources of glare, the risk to aircraft operations, on the new runway is considered low.

Hazardous Land Use Surrounding the Airport

Hazardous land uses are provided for within industrial zones and allow the presence of facilities related to hazardous industry. State Planning Policy 4.1 State Industrial Buffer (SPP 4.1) defines hazardous industry as *'an industry which, when in operation and when all measures proposed to minimise its impact on the locality have been employed (including measures to isolate the industry from existing or likely future development on other land in the locality), would pose a significant risk in relation to the locality, to human health, life or property, or to the biophysical environment. Examples of such industry include oil refineries and chemical plants'.* Hazards present include those related to individual and societal health, air quality, noise and odour.

Two hazardous facilities were identified in close proximity to the new runway, they are:

- BP Fuel Depot, Abernethy Road, Kewdale, and
- CBH Metro Grain Centre (Grain Silos), Abernethy Road, Forrestfield.

A risk assessment of these facilities found that they posed a low risk to the operations of Perth Airport and aircraft using the new runway. The risk assessment specific to the BP Fuel Depot, which is south of the new runway and slightly west of the extended centreline, also found there to be a low risk from aircraft operations to the Depot itself.

Air Traffic Management Considerations

Air traffic management is undertaken at Perth Airport by two control units, the Air Traffic Control (ATC) tower and the Terminal Control Unit (TCU). The ATC tower is responsible for the control of aircraft on the ground and on approach to the airport. The TCU is responsible for aircraft operating in airspace around Perth up to 36 nautical miles from Perth Airport.

The NRP and the procedures adopted for operating a parallel runway will change the way operations are conducted in both the ATC tower and TCU.

New airport infrastructure, such as a new runway, are assessed by Airservices for any impacts on the provision of Air Traffic Control, Aviation Rescue and Fire Fighting (ARFF), communication and navigations services. These services are subject to strict regulations.

Tower Line of Sight

MOS Part 172 requires air traffic controllers within a control tower to have the ability to visually detect movement of a departing aircraft within a certain timeframe. Although this relates to a new control tower, Perth Airport has considered the requirements with regard to the construction of the NRP.

The MOS Part 172 also states that the five second requirement applies to a control tower commissioned after 1 July 2000. The Perth ATC tower was opened in 1987. Airservices has advised Perth Airport that given the date of commissioning of the tower, this requirement does not apply to Perth Airport ATC Tower.

Impact of NRP Construction

All developments, works or buildings in the vicinity of the airport generally require an assessment by Perth Airport prior to approval. Perth Airport will assess proposed developments to ensure that no infrastructure, such as underground cables, will be damaged and, as detailed earlier in this Section, any buildings or machinery will not infringe the protected airspace limits required to ensure aircraft flight paths remain unobstructed. Airservices may be required to complete an assessment should Perth Airport determine there is an infringement to the protected airspace or if their operations may be impacted. Airservices will assess whether any building or equipment used will infringe the separation tolerances for any approach or departure procedure or interfere with crucial infrastructure such as infringing the path of a microwave link that transmits radar data.

Additionally, an assessment will include any impact to Airservices infrastructure such as navigation aids and other impacts such as activities that may cause afternoon glare in the tower.

This rigid approval process will be required for all phases of construction of the new runway infrastructure and will ensure there is no negative or unexpected impact to air traffic control procedures and therefore airline operations.

The risk posed to aircraft operations as a result of constructing the new runway is as low as reasonably practicable when taking into account the assessment processes undertaken.

Conclusion

Although a number of potential hazards and risks were identified, the majority are common to aircraft operations around the world, and therefore mitigated, to the highest level possible, through regulatory requirements and standards, airport and aircraft operator's processes and procedures.

While the risk of an aircraft crash incident will always be present around an airport, the mitigation measures currently in place, or to be established when the new runway is constructed, will ensure the risks are as low as reasonably possible.

Key Findings

Key findings from the assessment of hazards and risks to aviation activities as a result of aircraft operations on the new runway include:

- No new obstacles have been identified within the protected airspace of the new runway.
- While the likelihood of an aircraft crash incident will potentially rise with an increase in aircraft operations, overall, the risk of an aircraft crash incident posed by the development of the new runway is as low as reasonably practicable.
- Perth Airport has a comprehensive Wildlife Hazard Management Plan that incorporates monitoring, assessment, reporting, and control methods for bird and animal hazards. Activities include maintaining low grass heights around the airfield and airside areas to deter birds and animals, netting of drainage channels or basins where there is standing water, bird harassment using vehicle lights and horns, cracker shots or live shotgun rounds, and actively removing vegetation around the estate.
- The reaction time for air traffic controllers to detect movement on the new runway 03R threshold exceeds the upper limit set by the Manual of Standards Part 172. A safety case with proposed mitigators may be required and this will be submitted to the Civil Aviation Safety Authority.
- Due to its height and proximity to the estate, the Darling Scarp poses the greatest risk of terrain induced wind shear and turbulence to aircraft operations on the new runway. Modelling shows there is negligible impact due to topography, and turbulence potential on the new runway will be no more severe than that currently encountered at Perth on the existing main runway (03L/21R).
- Some building generated windshear impacts have been identified for the NRP operations.
- There are no existing sources of exhaust plumes of significant vertical velocity (plume rise) that will emanate from ground activities such as vents and stacks, that would pose an unacceptable risk to NRP aircraft operations.
- There are no existing direct light sources that are considered likely to obscure vision or cause confusion and distraction for pilots and air traffic control vision.
- A risk assessment of the hazardous land uses in close proximity to the NRP, found that the BP Fuel Depot in Kewdale and CBH Metro Grain Centre (Grain Silos) in Forrestfield, posed a low risk to the operation of the NRP.

Appendices

Glossary of Terms

03L/21R

Existing main runway designation.

03R/21L

New runway designation.

06/24

Existing cross runway designation.

Air Traffic Control

Air Traffic Controllers manage the safe and orderly flow of aircraft into, out of and between airports.

Aircraft Movement

Either a take-off or a landing by an aircraft.

Aircraft sequencing

The process of air traffic control arranging spacing between aircraft to allow an orderly landing sequence with enough spacing to allow a landing aircraft to vacate the runway prior to the next one being cleared to land.

Airport Central

The terminal area between the existing main and new runways which currently houses Terminal 1 and Terminal 2.

Airport Infrastructure

Refers to all facilities provided at an airport. It includes runways, taxiways, terminals, roads, other buildings and navigation equipment.

Airshed

A geographical area within which the air frequently is confined or channeled, with all parts of the area thus being subject to similar conditions of air pollution.

Airside

The movement area of an aerodrome, adjacent terrain and building or portions thereof, access to which is controlled.

Airspace

The portion of the earth's atmosphere over which a nation exercises jurisdiction over aircraft in flight.

Airspace Management Plan

The Airspace Management Plan is a high level document that provides the parameters for which detailed flight path planning can be undertaken prior to the construction of the New Runway.

Section 160 of the *Environment Protection and Biodiversity Conservation Act 1999* notes that before the NRP MDP can be approved the Commonwealth Minister for Infrastructure, Transport and Regional Development must consider the advice of the Minister for the Environment in relation to the adoption of implementation of a plan for aviation airspace management involving aircraft operations that have or will have or are likely to have a significant impact on the environment.

Approaches

The course to be followed by an aircraft in approaching for a landing or in joining a traffic pattern.

Apron

A defined area on a land aerodrome intended to accommodate aircraft for loading and unloading passengers, mail or cargo, fuelling, parking or maintenance

Australian Noise Exposure Concept (ANEC)

An Australian Noise Exposure Concept (ANEC) chart represents a forecast produced for a hypothetical future usage pattern. ANEC forecasts are based on indicative data on aircraft types, flight paths, operating modes etc., and are generally used in environmental assessments to depict potential noise exposure for the scenarios being considered.

Australian Noise Exposure Forecast (ANEF)

An Australian Noise Exposure Forecast (ANEF) chart shows contours representing a forecast of future noise exposure around an airport that has been endorsed by Airservices Australia on the basis of approved operational arrangements and air traffic forecasts. In some cases an ANEF chart may be based on the outer envelope of contours from a number of ANEC charts.

Australian Noise Exposure Index (ANEI)

An Australian Noise Exposure Index (ANEI) chart is based on historical data from a previous year, where exact numbers and types of aircraft which used the aerodrome are known. It shows the average daily aircraft noise exposure around the aerodrome for that year.

A-Weighted Noise Level (dBA)

This is a value representing the loudness of a sound at a specific time, allowing for the differential response of the human ear to different sound frequencies.

Baseline

The point from which the change in the environment as a result of impacts is measured.

Compass departures

Compass departures sees the runway allocated according to the direction that the aircraft is going.

Corridor

A representation around an air route that indicates a range of flight paths that may be flown by aircraft as a result of weather diversions or air traffic control intervention. An area that final flight paths may be designed within.

Departure and Arrival Procedure

The Standard Instrument Departures (SID) used for departing aircraft or the Standard Arrival Routes (STAR) used for arriving aircraft

Dewatering

Removal or draining groundwater or surface water from a riverbed, construction site, caisson, or mine shaft, by pumping or evaporation.

Environmental Incident

Any event or impact on the environment involving Perth Airport and/or its contractor's actions or assets that is capable of:

- causing harm to the environment or any person or property,
- causing pollution, and/or
- coming to the attention of an environmental regulatory agency.

Fauna

The animals of a given region or period considered as a whole.

Flora

The plants of a particular region or period, listed by species and considered as a whole.

Flight Path

The track an aircraft may fly. Flight paths include Air Routes, Departure and Arrival procedures, Approach procedures and flight tracks.

Flight Track

The actual path in the air flown by an aircraft which may vary from the air route or the departure or arrival procedure.

Flora

The plants of a particular region or period, listed by species and considered as a whole.

Fly-in fly-out (FIFO)

Describes the pattern of work where by employees are flown to and from their place of work.

Forrestfield-Airport Link

The new railway line that is being constructed by the State Government to connect Forrestfield and Perth Airport to the Perth Central Business District.

General Aviation (GA)

Refers to all flights other than military and scheduled airline flights, both private and commercial.

Grade separation

Name given to a method of aligning a junction of two or more roads at different heights (grades) so that they will not disrupt the vehicle traffic flow on other routes when they cross each other.

Ground-based

Located on the ground as opposed to in an aircraft or in airspace.

Ground Based Augmentation Systems (GBAS)

A satellite-based precision landing system, recognised by ICAO as a potential future replacement for current instrument landing systems (ILS)

Holding

A manoeuvre designed to delay an aircraft already in flight while keeping it within a specified airspace.

Hydrology

Study of the stormwater runoff generated by rainfall in connection with geography and geology. e.g. An asphalt road generates more runoff per square meter than a lawn does.

Instrument Approach

An instrument approach is required in poor weather conditions where the pilot cannot see the ground and relies on the pilot receiving guidance to land from instruments located in both the aircraft and on the ground.

Interstate

Activities between States and/or Territories.

Intrastate

Activities within a State or Territory.

Landside

The portion of an aerodrome not designated as airside and to which the general public normally has free access.

Living Stream

A constructed or retrofitted vegetated waterway that mimics the characteristics of a natural stream.

Major Development Plan (MDP)

As defined by Section 91 (1) of the *Airports Act 1996.*

Master Plan

As defined by Section 71 (2) of the *Airports Act 1996.*

Movement

Either a take-off or a landing by an aircraft.

Movement areas

That part of an aerodrome to be used for the surface movement of aircraft, including the manoeuvring areas and aprons.

N60

N60 is a measure of noise exposure that indicates the average number of aircraft overflights per day (or other specified time period) exceeding 60 dBA. N60 is generally used to describe night time noise exposure.

N65

N65 contour map illustrates the average number of events per day over 65 dBA for a particular area. This corresponds to an outdoor sound level of 65 dBA and an indoor noise level of approximately 55 dBA.

NATS

The United Kingdom's provider of air traffic control services. In addition to providing services to 13 UK airports, and managing all upper airspace in the United Kingdom, NATS provides services around the world spanning Europe, the Middle East, Asia and North America. Additional information on NATS can be found at www.nats.aero

Native Vegetation

Any local indigenous plant community containing throughout its growth the complement of native species and habitats normally associated with that vegetation type or having the potential to develop these characteristics. It includes vegetation with these characteristics that has been regenerated with human assistance following disturbance. It excludes plantations and vegetation that has been established for commercial purposes.

New Runway Project

The New Runway Project (NRP) includes:

- construction, including clearing and site preparation, of a new runway up to 3,000 metres in length and with associated infrastructure.
- development of an airspace management plan that will cater for the changes to current airspace and flight pathsto accommodate operations of the new runway.

Noise Abatement Procedures

Every major airport has Noise Abatement Procedures (NAPs), which are designed to reduce the impact of aircraft noise on the community. They include procedures for runway use and flight paths.

Noise Contour

Developed by the [then] Commonwealth Department of Infrastructure and Transport to illustrate the average number of events per day that exceed a certain sound level.

N-contours

A term used to describe noise through reporting the number of aircraft noise events louder than the specified dB(A) level.

Noise Event

An event begins when the noise level exceeds a certain threshold value set in the noise monitor (which will be above the background noise level) and ends when the noise level drops below it.

Pavement

A prepared or semi prepared surface of a given depth for the purpose of providing added bearing capacity to an existing ground surface

Perth Airport Estate (the estate)

The parcel of land Perth Airport sits upon and that is leased from the Commonwealth Government

Precinct

A space or place of definite or understood limits.

Receptor

Various devices that receive information, signals etc

Retention Storage

An area that will store water until it has infiltrated into the ground and/or evaporated.

Runway

A defined rectangular area on a land aerodrome, prepared for the take-off and landing of aircraft along its length.

Taxiway

A defined path on an aerodrome established for the taxiing of aircraft and intended to provide a link between one part of the aerodrome and another, including:

- aircraft stand taxilane: a portion of an apron designated as a taxiway and intended to provide access to aircraft stands only,
- apron taxiway: a portion of a taxiway system located on an apron and intended to provide a through taxi route across the apron, and
- rapid exit taxiway: a taxiway connected to a runway at an acute angle and designed to allow landing aircraft to turn off at higher speeds than are achieved on other exit taxiways thereby minimising runway occupancy times.

Terminal Arrivals

When aircraft arrive and depart from the runway nearest the terminal they operate from.

Visibility

A measure of the distance at which an object or light can be clearly discerned.

Visual Approach

A visual approach is an approach to a runway conducted with reference to visual cues and clear of clouds.

Wetland

Land that is permanently, seasonally or intermittently waterlogged or inundated with water, but excludes watercourses.

Acronym / Abbreviation

03L/21R	Main runway designation
03R/21L	New runway designation
06/24	Cross runway designation
Airports Act	*Airports Act 1996*
Airservices	Airservices Australia
ANEF	Australian Noise Exposure Forecast
ARFF	Aviation Rescue and Fire Fighting
A-SMGCS	Advanced Surface Movement Guidance and Control System
CAGR	Compound Annual Growth Rate
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulations 1998
CBD	Central Business District
CEMP	Construction Environmental Management Plan
CONOPS	Concept of Operations
DAWE	Department of Agriculture, Water and Environment
DITRDC	Department of Infrastructure, Transport, Regional Development and Communications (Commonwealth)
DMP	Dewatering Management Plan (DMP)
DRR	Disease risk road
DSEWPAC	Department of Sustainability, Environment, Water, Population and Communities (now DEE) (Commonwealth)
DWER	Department of Water and Environmental Regulation (WA)
EGR	Engine Ground Running
EIS	Environmental Impact Statement (EIS)
EMF	Environmental Management Framework
EMP	Environmental Management Plan
EMS	Environmental Management System
EN	Endangered
ENM	Environmental Noise Model
EPA	Environmental Protection Authority (WA)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ERSA	Enroute Supplement Australia
F100	Fokker 100
FAA	USA Federal Aviation Administration
FAC	Federal Airports Corporation
FAL	Forrestfield-Airport Link
FCT	Floristic Community Type
fGPU	Fixed Ground Power Unit
FIFO	Fly-in fly-out

FTE	Full Time Equivalent
FUA	Flexible Use of Airspace
FY	Financial Year
GA	General Aviation
GBAS	Ground Based Augmentation System
GDP	Gross Domestic Product
gDWm²	Grams dry weight per square metre
GF	Guildford Formation
GHG	Greenhouse Gas
GHGI	Greenhouse Gas Index
GIS	Geographic Information System
GPS	Global Positioning System
GRP	Gross Regional Product
GSE	Ground Service Equipment
GSP	Gross State Product
HIAL	High Intensity Approach Lighting
hrs	Hours
HSL	Health Screening Levels
ICAO	International Civil Aviation Organization
ICOMOS	International Council on Monuments and Sites
IF	Influencing Factor
IFR	Instrument Flight Rules
IHD	Ischaemic Heart Disease
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
INM	Integrated Noise Model
ISCA	Infrastructure Sustainability Council of Australia
IVA	Independent Visual Approach
IVS	International Visitor Survey
JAMBA	Japan-Australia Migratory Bird Agreement
JUHI	Joint User Hydrant Installation
kg	Kilograms
km	Kilometre
KS	Kardinya Shale Member fines dominated
kt	Kilotonnes
KT	Knot (wind speed measured in nautical miles per hour)
LAHSO	Land and Hold Short Operations
LOR	Laboratory limit of reporting
LTO	Landing Take-off cycle
m	Metre

m^2	Square metre
m^3	Cubic metre
MAGS	Movement Area Guidance Signs
mAHD	Metres Australian Height Datum
Main Roads	Main Roads Western Australia
MDP	Major Development Plan
MDS	Perth Airport Master Drainage Strategy
mg	Milligrams
MNES	Matters of National Environmental Significance
MOS	Manual of Standards
MSDS	Materials Safety Data Sheet
MWh	Megawatt hour
NAP	Noise Abatement Procedures
NASAG	National Airports Safeguarding Advisory Group
NASF	National Airports Safeguarding Framework
NCA	Noise Catchment Area
NE	Not Evaluated
NEF	Noise Exposure Forecast
NEPM	National Environment Protection Measure
NFPMS	Noise and Flight Path Monitoring System
ng/m^3	Nanograms per metre cubed
NGER	National Greenhouse and Energy Reporting
NGER Act	*National Greenhouse and Energy Reporting Act 2007* (Commonwealth)
NMD	Northern Main Drain
NO_2	Nitrogen dioxide
NOC	Notice of Capacity
NOTAM	Notice to Airmen
NO_x	Oxides of nitrogen
NPD	Noise Power Distance
NPI	National Pollutant Inventory
NRP	New Runway Project
NT Act	*Native Title Act 1993*
NVS	National Visitor Survey
NZTA	New Zealand Transport Agency Model Development Guidelines
O^3	Ozone
˚C	Temperature in degrees Celsius
OECD	Organisation for Economic Cooperation and Development
OEMP	Operational Environmental Management Plan
OF	Osborne Formation
OHP	Other Heritage Place

ORAT	Operational Readiness Activation and Transition
OU/m³	Odour units
OW	Open Water
PAANTWG	Perth Airport Aircraft Noise Technical Working Group
PACF	Perth Airport Community Forum
PADG	Perth Airport Development Group
PAG	Partnership Agreement Group
PAMG	Perth Airports' Municipalities Group
PAPI	Precision Approach Path Indicator
PASS	Potential Acid Sulfate Soils
PCF	Planning Coordination Forum
PEC	Priority ecological communities
PER	Perth
PFAS	Per- and poly-Fluoroalkyl Substances
PFOA	perfluorooctanoic acid
PFOS	Perflorooctanesulfonate
PHCTR	Perth Control Zone
PM	Particulate Matter
PM_{10}	Particulate matter with aerodynamic diameter less than 10 µg/m³
$PM_{2.5}$	Particulate matter with aerodynamic diameter less than 2.5 µg/m³
PMP	Probable Maximum Precipitation
PMPDF	Probable Maximum Precipitation Design Flood
RAAF	Royal Australian Air Force
RADS	Regional Airports Development Scheme
RAV	Restricted Access Vehicles
RESA	Runway End Safety Area
RET	Rapid Exit Taxiway
RNP	Required Navigation Procedure
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
ROM	Regional Operations Model
ROT	Runway Occupancy Times
RPT	Regular Public Transport
RV	Revegetation
RWI Act	*Rights in Water and Irrigation Act 1914*
SA HB	Standards Australia Handbook
SCP	Swan Coastal Plain
SEL	Sound Exposure Level
SFC	Surface
SID	Standard Instrument Departure
SL	South Lake

SMD	Southern Main Drain
SMR	Surface Movement Radar
SO_2	Sulfur dioxide
SOIR	Simultaneous Operations on Parallel or Near Parallel runways
SOx	Oxides of sulfur
SPL	Sound Pressure Level
STAAS	Standard Terminal Area Arrival Speed
STAR	Standard Arrival Route
SWALSC	South West Aboriginal Land and Sea Council
SWIS	South West Interconnected System
T1	Terminal 1
T2	Terminal 2
T3	Terminal 3
T4	Terminal 4
TEC	Threatened Ecological Community
TFI	Tourism Futures International
TFP	TFP Database
TSP	Transport Security Program
TVOC	Total Volatile Organic Compounds
ULP	Unleaded petrol
US EPA	United States of America Environmental Protection Agency
VEM	Visual Envelope Map
VHT	Vehicle hours travelled
VKT	Vehicle kilometres travelled
VMC	Visual Meteorological Conditions
VOC	Volatile Organic Compound
VSAs	Vegetation and Substrate Associations
WAPC	Western Australian Planning Commission
WARRP	Western Australia Route Review Project
WC Act	*Wildlife Conservation Act 1950*
WGS84	World Geodetic System 1984 (a global reference system for geospatial information and is the reference system for GPS)
WHO	World Health Organization
WONS	Weeds of National Significance
WST	Western Standard Time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Perth Airport | New Runway Project

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