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East Kimberley Regional Airport

Master Plan 2017

Prepared by The Airport Group
for the Shire of Wyndham-East Kimberley

July 2017

SHIRE of WYNDHAM EAST KIMBERLEY

Adopted by the Shire of Wyndham-East Kimberley on 22 August 2017

EXECUTIVE SUMMARY

This document contains the 2017 Master Plan for the East Kimberley (Kununurra) Regional Airport (EKRA). It is intended to serve as a planning framework for the long-term aeronautical and non-aeronautical development of EKRA in response to forecasted traffic growth over a 20-year planning horizon.

The objectives of this Master Plan are as follows:

- Provide strategic directions over a minimum 20-year development framework while recognising that it is a living document;
- Identify scope for diversification through new/expanded opportunity areas that could include the ability to accept larger aircraft, support the economic growth of Kununurra and the tourist, agriculture, resources sectors and defence capabilities; and
- Guide general community, local businesses and development industry through certainty, reduced potential conflicts and meeting statutory requirements.

East Kimberley Regional Airport (IATA: KNX; ICAO: YPKU) is located 3,200 km north east of Perth in the Kimberley region of Western Australia. The airport occupies a site of 275 hectares, and is owned and operated by the Shire of Wyndham-East Kimberley (SWEK). The airport infrastructure at EKRA currently accommodates Code 3C aircraft operations. EKRA has 46 weekly scheduled regular passenger traffic (RPT) services and is serviced by numerous operators, including Virgin Australia, Airnorth, charter airlines and the Royal Flying Doctor Service (RFDS). Passenger numbers peaked in 2012-13 to approximately 92,000, but has since declined due to the decrease in construction activities of the resources sector and Ord Irrigation Scheme. The number recorded during 2015-16 stood at 74,300 passengers.

In order for the EKRA Master Plan to satisfy the aforementioned objectives, a review of the 2013 Master Plan was first conducted to identify key areas requiring updates. The major EKRA stakeholders were then consulted to determine their key issues and concerns. Next, using a simple forecasting methodology, four growth scenarios for the airport were produced. Critical airport planning parameters were then considered in relation to the Manual of Standards (MOS) Part 139 – Aerodromes published by the Civil Aviation Safety Authority (CASA), which prescribes the requirements for aerodromes as per Australian legislation. Finally, a Land Use Plan, Facilities Development Plan and an Implementation Plan were prepared.

The growth scenarios forecasted the passenger number in 2036-37 to range between 92,146 passengers (low-growth 1) and 215,327 passengers (high growth). The high-growth scenario assumed the operation of two Boeing 737-800/Airbus 320-200 aircraft commencing operations, each at two different points in time during 2020-2030. That is, there will be two return flights a week on Code 4C aircraft by 2030. This scenario, whilst optimistic, is a possible scenario. This scenario was used for planning key airport developments that should occur in the short, medium and long term. Reasons for adopting this scenario for planning include the location of the airport relative to other ports, the east coast and Perth; and the characteristics of the region – abundance of natural resources, agriculture and tourist attractions.

The B737-800 was selected as the design aircraft. This consequently requires upgrading airport infrastructure from Code 3C to Code 4C.

This Master Plan has identified the following main aeronautical and non-aeronautical developments to be undertaken during the 20-year planning horizon:

- Expand the existing 1,829 metres x 30 metres runway, which is in a 12/30 orientation, to 2,430 metres x 45 metres;

- Increase the size of the passenger terminal to accommodate multiple Code 4C aircraft during the high-growth scenario;
- Develop a solar power plant to feed into the electricity grid of the passenger terminal;
- Acquire land, largely north of the runway, for purposes of airport safeguarding;
- Facilitate additional commercial development of airport land to encourage synergies, provide additional revenue sources and support economic development; and
- Investigate adjoining land acquisition as required.

Note that the scope of this 2017 Master Plan does not include environmental and sustainability or heritage issues. Further, comprehensive terminal planning is also outside the scope. Additionally, this document does not contain new Obstacle Limitation Surfaces (OLS), Procedures for Air Navigational Surfaces – Aircraft Operations (PANS-OPS) surfaces, Australian Noise Exposure Forecast (ANEF) contours or N-system contours. These are assumed to be similar (but not necessarily the same) to those produced in the 2013 Master Plan.

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REFERENCE DOCUMENTS

The following documents were referenced in the preparation of the 2017 Master Plan:

- 2013 East Kimberley Regional Airport Master Plan, Rehbein Airport Consulting (2013)
- 2036 And Beyond: A Regional Investment Blueprint for The Kimberley (2015)
- Aeronautical Information Package En Route Supplement Australia Kununurra, Airservices Australia (2017)
- Civil Aviation Advisory Publication (CAAP) 235A-1(0) – Minimum Runway Width, Civil Aviation Safety Authority (2014)
- East Kimberley Regional Airport Runway 12/30 Extension Prefeasibility Study, GHD (2016)
- Kimberley Regional Planning and Infrastructure Framework: Part A: Regional Strategic Planning, (2015)
- Manual of Standards Part 139, Civil Aviation Safety Authority (2016)
- Officer Report on Runway Extension Width, Shire of Wyndham East Kimberley (2016)
- Airport Practice Note 4: Regional Airport Master Planning Guideline, Australian Airports Association (2014)
- Strategic Community Plan, Shire of Wyndham East Kimberley (2012)
- WA Tomorrow Population Report No. 10, Department of Planning (2015)

ABBREVIATIONS

AAA	Australian Airports Association
ACN	Aircraft Classification Number
BITRE	Bureau of Infrastructure, Transport & Regional Economics
CASA	Civil Aviation Safety Authority
EKRA	East Kimberley Regional Airport
FAA	Federal Aviation Administration
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
MTOW	Maximum Take Off Weight
NASF	National Airports Safeguarding Framework
OLS	Obstacle Limitation Surface
OTS	Office of Transport Security
PCN	Pavement Classification Number
PSA	Public Safety Area
PSI	Pounds per Square Inch
PSZ	Public Safety Zone
RESA	Runway End Safety Area
SWEK	Shire of Wyndham East Kimberley

GLOSSARY[1]

Aerodrome/Airport	A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft.
Airside	The movement area of an aerodrome, adjacent terrain and buildings or portions thereof, access to which is controlled.
Aircraft Classification Number (ACN)	A number expressing the relative effect of an aircraft on a pavement for a specified standard subgrade category.
Apron	A defined area on a land aerodrome intended to accommodate aircraft for the purposes of loading or unloading passengers, mail or cargo, fuelling, parking, or maintenance.
Aviation Security	A combination of measures and human and material resources intended to safeguard civil aviation against acts of unlawful interference.
Control Tower	A unit established to provide air traffic control service to Airport traffic.
Landside	The area of an Airport and buildings to which the public normally has free access.
Manoeuvring Area	Those parts of the aerodrome used for the take-off, landing and taxiing of aircraft, excluding aprons.
Movement Area	That part of the aerodrome to be used for the take-off, landing and taxiing of aircraft, consisting of the manoeuvring area and the apron(s).
Obstacle limitation surfaces (OLS)	A series of planes associated with each runway at an aerodrome that defines the desirable limits to which objects may project into the airspace around the aerodrome so that aircraft operations at the aerodrome may be conducted safely.
Obstacles	All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that are located on an area intended for the surface movement of aircraft or that extend above a defined surface intended to protect aircraft in flight.
Pavement Classification Number (PCN)	A number expressing the bearing strength of a pavement for unrestricted operations by aircraft with ACN value less than or equal to the PCN.
Regular Public Transport Service	A service consisting of Regular Transport aircraft operations as prescribed in the Civil Aviation Regulations.
Runway	A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.

[1] Definitions were extracted from the literature including MOS Part 139 (2016).

Runway End Safety Area	An area symmetrical about the extended runway centre line and adjacent to the end of the strip primarily intended to reduce the risk of damage to an aeroplane undershooting or overrunning the runway.
Runway-Related Activities/Facilities	Includes runways, taxiways, aprons, clearways, compass swing and engine run-up areas, glide path facilities, helicopter landing, parking, training and servicing, landing equipment, radar and all aircraft navigation aids.
Runway strip	A defined area including the runway and stopway, if provided, intended to reduce the risk of damage to aircraft running off a runway and protect aircraft flying over it during take-off or landing operations.
Shoulders	An area adjacent to the edge of a pavement so prepared as to provide a transition between the pavement and the adjacent surface.
Taxilane	A portion of an apron that is not a taxiway and that is provided only for aircraft to access aircraft parking positions.
Taxiway	A defined path on an aerodrome on land, established for the taxiing of aircraft from one part of an aerodrome to another. A taxiway includes an apron taxiway and a rapid exit taxiway.
Threshold	The beginning of that portion of the runway usable for landing.

1. INTRODUCTION

The Airport Group (TAG) was engaged by the Shire of Wyndham-East Kimberley (SWEK) to undertake a **review** of the 2013 Master Plan for the East Kimberley Regional (Kununurra) Airport (EKRA). As such, this document makes references to the previous EKRA Master Plan which was produced in January 2013 by Rehbein Airport Consulting.

1.1. Overview of the Airport

East Kimberley Regional Airport (IATA: KNX; ICAO: YPKU) is a regional airport located in the Kimberley region of Western Australia. The airport is located 3,200 km north east of Perth on a site of approximately 275 hectares. It has 46 scheduled regular passenger traffic (RPT) services each week and is serviced by two airlines: Virgin Australia and Airnorth[2]. The airport is owned and operated by the Shire of Wyndham-East Kimberley. During the past thirty years, the airport experienced two peaks in passenger numbers. The most recent peak occurred in 2012-13 with approximately 92,000 passengers. This number has since declined due to the decrease in construction activities of the resources sector and the Ord Irrigation Scheme. The passenger number recorded during 2015-16 stood at 74,300. In 2015-16, EKRA was among the top ten busiest RPT airports in Western Australia and the 50th busiest nationally.

1.2. Purpose of the Master Plan

The purpose of this Master Plan is to serve as a planning framework for the long-term aeronautical and non-aeronautical development of EKRA in response to forecasted traffic growth and potential economic growth opportunities.

1.3. Objectives of the Master Plan

The objectives of this Master Plan are as follows:

- Provide strategic directions over a minimum 20-year development framework while recognising that it is a living document;
- Identify scope for diversification through new/expanded opportunity areas that could include the ability to accept larger aircraft, support the economic growth of Kununurra and the tourist, agriculture, resources sectors and defence capabilities; and
- Guide general community, local businesses and development industry through certainty, reduced potential conflicts and meeting statutory requirements.

1.4. Methodology

This Master Plan was prepared using the following methodology:

- Review the 2013 Master Plan to identify the key areas to be updated;
- Consult with key airport stakeholders to identify their issues and concerns;
- Forecast passenger traffic based on four growth scenarios using a simple forecasting methodology;
- Determine critical airport planning parameters including the most demanding aircraft expected to regularly serve the airport in the future;
- Plan airport development using the critical planning parameters; and
- Develop a Land Use Plan, Facilities Development Plan and an Implementation Plan.

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[2] As of May 2017

1.5. Scope of the Master Plan

This Master Plan robustly reviews aspects such as airside and landside infrastructure including ancillary/commercial development opportunities based on forecasts of future aviation and economic activity. However, environmental, sustainability and heritage aspects have not been investigated as part of this review. Detailed terminal and car park planning together with busy hour forecasting is intended to be pursued by SWEK during implementation planning. New Obstacle Limitation Surfaces (OLS), Procedures for Air Navigational Surfaces – Aircraft Operations (PANS-OPS) surfaces, Australian Noise Exposure Forecast (ANEF) contours and N-system contours have not been reproduced as they are understood to remain similar to those in the 2013 Master Plan. Thus, the reader is referred to that document (which is available from SWEK) for information on airspace and aircraft noise. These two sections are also shown in Appendix C.

1.6. Key Consultation Findings

The following key airport stakeholder groups were engaged in the preparation of this Master Plan:

- Airport Staff (including the Airport Manager and the Operations & Compliance Manager);
- Airport Operators;
- Representatives from SWEK (including the Commissioner, CEO, Director Infrastructure, Planning Officer);
- Kimberley Development Commission;
- Kununurra Visitor Centre; and
- A local real estate agent.

These consultations revealed a number of aspects, of which the key findings are given below:

- EKRA has significant tourism potential due to its presence in the world-recognised and iconic Kimberley Region and vicinity to the UNESCO World-Heritage listed Purnululu National Park that contains the Bungle Bungle Range;
- Airport growth is limited by the existing airside infrastructure;
- The runway must be extended to accommodate Airbus 320-200/Boeing 747-800 jet aircraft;
- Runway widening from 30 metres to 45 metres will ultimately be required;
- A practical runway development strategy needs to be prepared;
- Limited capacity of utility services to the airport (communications, water, power and sewerage) is constraining development;
- There is demand for the development of airport land for both aviation and non-aviation related uses;
- Consideration should be given to land acquisitions that support airport activities as well as other developments that assist in the growth of the airport;
- Significant investments in assets such as aprons, taxiways, the runway and passenger terminal are needed for EKRA to reach full potential; and
- EKRA is managed in a responsible and financially responsible manner (user pays).

1.7. Report Structure

This Master Plan follows the template for a Regional Airport Master Plan which was published by the Australian Airports Association. It contains the following three sections:

- Introduction;
- Background Information – Master Planning Context, Current Situation, Strategic Vision and Objectives of EKRA and the Critical Airport Planning Parameters; and
- Airport Master Plan – Land Use Plan, Facilities Development Plan, Ground Transport Plan, Airport Safeguarding Plan and an Implementation Plan.

2. BACKGROUND INFORMATION

2.1. Master Plan Context

2.1.1. Regional Context

EKRA is located in the Shire of Wyndham-East Kimberley in the Kimberley region in Western Australia (WA). As such, it is approximately 3,200 km north-east of Perth and 4 km west of the town of Kununurra[3]. Furthermore, EKRA is approximately 38 km west of the border between WA and the Northern Territory (SWEK, 2015).

Neighbouring airports within Kimberley include Broome International Airport, Derby-Curtin Airport (RAAF airbase) and Halls Creek Airport at a distance of 1,040 km, 880 km and 360 km, respectively. All three airports are within a flying distance of 1.25 hours. EKRA also neighbours Darwin International Airport at a distance of 830 km (or 440 km by air), which is approximately a one-hour flight. Further, located 109 km to the north-west and also operated by SWEK is Wyndham Airport that supports its local community through a sealed strip and accommodates charter, private and RFDS flights. These neighbouring airports are shown in Figure 1.

Figure 1: EKRA and neighbouring airports

Regionally, EKRA is one of the two main regular passenger transport (RPT) airports. However, Broome International Airport dominates the region's total passenger numbers, with that recorded in 2015-16 for Broome being approximately five times greater than the annual passenger number at EKRA.

However, EKRA has a key role both locally and regionally, providing an air transport service to the largest shire in the region. The key airport drivers are the following:

- local community;
- business;
- tourism;
- agriculture based on the Ord Irrigation Scheme and aquaculture; and
- the resources sector.

[3] Distances within this section are approximate road distances unless otherwise specified.

Analysis of visitations to the region found that between 2009-10 and 2015-16, the Kimberley region recorded 615,000 annual visitors on average[4]. Figure 2 shows their main reasons for visiting the region and Figure 3 shows their main methods of accessing the region.

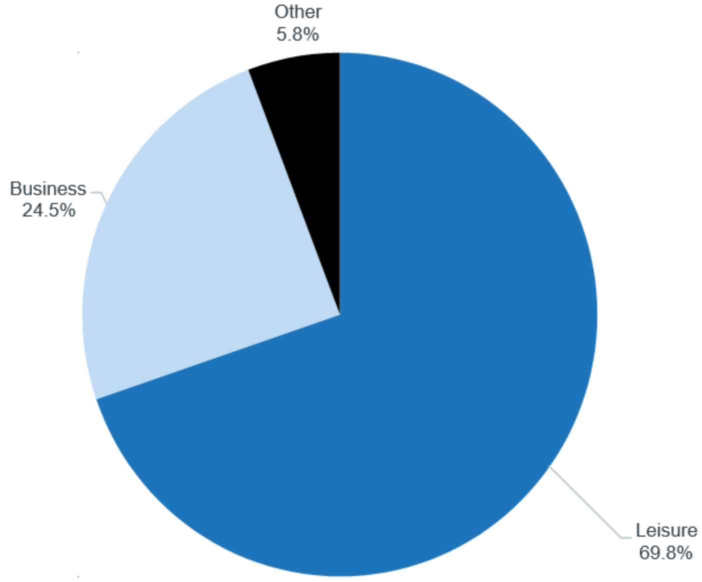


Figure 2: Reason for visiting the Kimberley region between 2009-10 and 2015-16

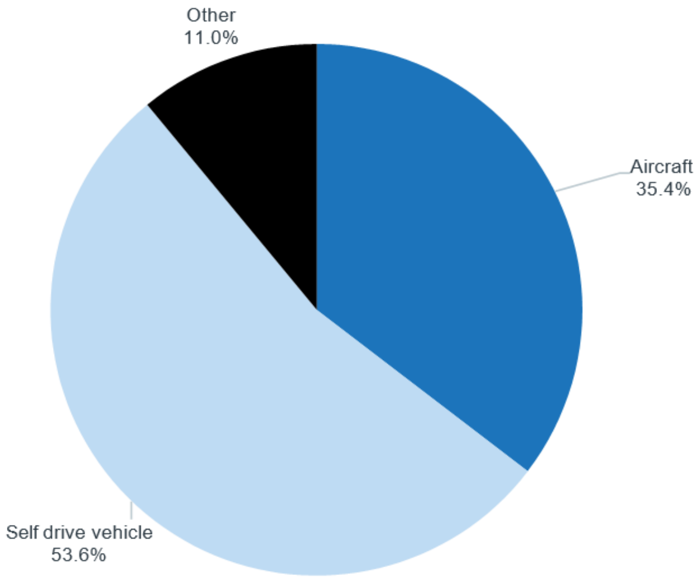


Figure 3: Method of accessing the Kimberley region between 2009-10 and 2015-16

As can be seen, 69.8% of all visitors during this period visited the Kimberley region for leisure purposes and 35.4% of all visitors accessed the region by air transport.

[4] Visitor data has been collected by SA2 catchments and summed to the region. The statistics presented here do not adjust for any persons who visited several SA2s within the region potentially overstating the total.

According to the Kimberley Development Commission (2015), the Kimberley region has the following comparative advantages:

- Agriculture and Food;
- Rangeland Industries;
- Tourism;
- Location/proximity to Asia;
- Strong biodiversity;
- Climate for food production; and
- Mineral & energy endowment.

2.1.2. Socio-Economic Context

2.1.2.1. Population

The Kimberley is a remote region with a low and dispersed population. The total resident population in 2015 was 38,801 (ABS, 2017a). Meanwhile, the total population of SWEK in 2015 was 8,663, or 22.3% of the total Kimberley population (ABS, 2017b). Aboriginal and Torres Strait Islander Peoples accounted for 34.8% of the EKRA population (ABS, 2017b). Similar to the Kimberley region, SWEK was also recorded as being sparsely populated in the 2011 Census.

On the Census night in 2011, the population of SWEK was 11,914, which was 53% greater than the 2011 residential population (SWEK, 2015). This indicates that the population number of SWEK largely varied depending on fly-in fly-out (FIFO) workers, seasonal farm workers and tourists (SWEK, 2015).

In 2015, the Western Australian Planning Commission forecasted the residential population of SWEK to grow at an annual average growth rate of -0.20% to 3.92% by 2016; 0.21% to 2.96% by 2021; and 0.36 to 2.53% by 2026. These rates reflect a population between 8,650 and 11,920 in 2026. Note that the lower end of each of these ranges indicates that there is a 90% chance that this figure will be exceeded while the upper end of each range indicates that there is only a 10% chance that this population will be exceeded. Figure 4 summarises these population growth rates.

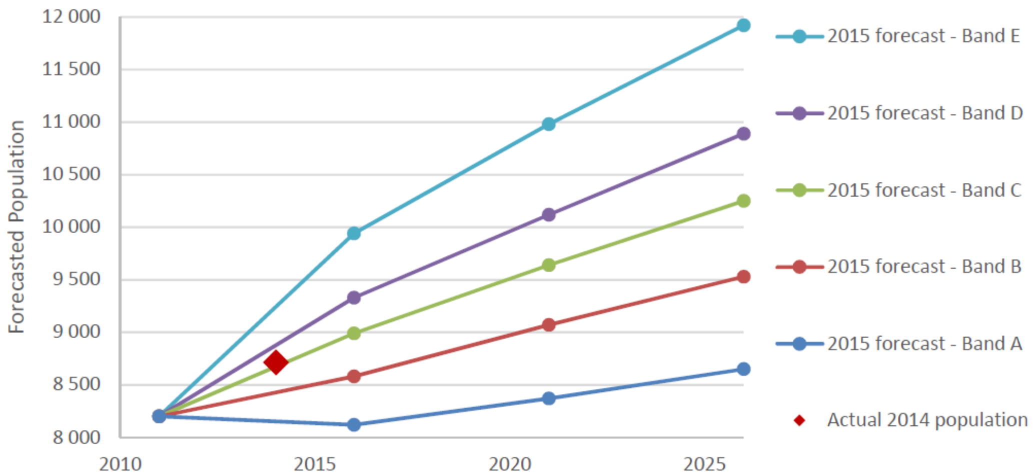


Figure 4: Population forecasts for the Shire of Wyndham-East Kimberley based on WA Tomorrow Population Report No. 10 (Western Australian Planning Commission, 2015b)[5]

[5] Band A: There is a 90% chance that this population will be exceeded; Band B: There is a 70% chance that this population will be exceeded; Band C: There is a 50% chance that this population will be exceeded; Band D: There is a 30% chance that this population will be exceeded; Band E: There is a 10% chance that this population will be exceeded.

2.1.2.2. Employment
The 2011 census determined that 3,743 people were employed in SWEK with the highest employing industry being health care and social assistance (11.3%). Meanwhile, mining employed 9.4% of the working population (ABS, 2017b).

2.1.2.3. Economy
The resource, tourism and agriculture industries make significant contributions to the economy of the region. In 2011-12, the Gross Regional Product (GRP) of the Kimberley region was $3.085 billion (Kimberley Development Commission, 2013). The mining industry made the largest contribution to the GRP, with that in 2011-12 being 35.7% of the total GRP (Kimberley Development Commission, 2013).

Resources

The resource industry is the dominant industry of SWEK. In 2011, it employed 9.4% of all employees in SWEK (ABS, 2017b). In 2012, the value of minerals from SWEK contributed $377 million to the economy of SWEK (Kimberley Development Commission, 2013).

Listed below are key resource projects in/near SWEK:

- The Argyle Diamond Mine
    - Operated by Rio Tinto, this is the world's largest supplier of natural coloured diamonds and one of the world's largest supplier of diamonds (Rio Tinto, 2017). It is located 110 km south of Kununurra and has been operational since 1983 (Rio Tinto, 2017). This mine has heavily influenced passenger and aircraft numbers at EKRA, with construction activities of the mine increasing the demand imposed on the airport. The mine is expected to cease operations in 2019 and this is expected to result in only a minor reduction of passenger numbers at EKRA (as majority of workers directly fly to Argyle Airport).

- Ridges Iron Ore Project
    - Owned by Kimberley Metals Group (KMG), this mine is located 150 km southwest of Kununurra. Following completion of mining of the high-grade direct shipping ore (DSO) reserve, this mine was placed into care and maintenance in February 2015 (KMG, 2017).

- Matsu Iron Ore Project
    - Also owned by KMG, this mine is located 10 km south of the Ridges Iron Ore Project. KMG states that this Project is well advanced and that mining leases and associated tenements were granted in 2014. It is reported that submissions to obtain the necessary approvals are currently being prepared (KMG, 2017).

- Sorby Hills Lead-Silver Project
    - This is a currently undeveloped project which is to be located approximately 50 km north of Kununurra. Environmental approval was obtained in 2014 to develop a silver, lead and zinc mine and processing facility. The expected mine life is 10 years (Environmental Protection Authority, 2013).

- Panoramic Resources Nickel Project
    - This Project is located 240 km south of Kununurra. It was placed on care and maintenance in May 2016 (Panoramic Resources Ltd, 2017).

In the short term, activities of the resource sector are not expected to increase FIFO operations at EKRA. This is because the only mine that is currently operational is the Argyle Diamond Mine which will cease operations in 2019 and receives direct flights.

Agriculture and Aquaculture

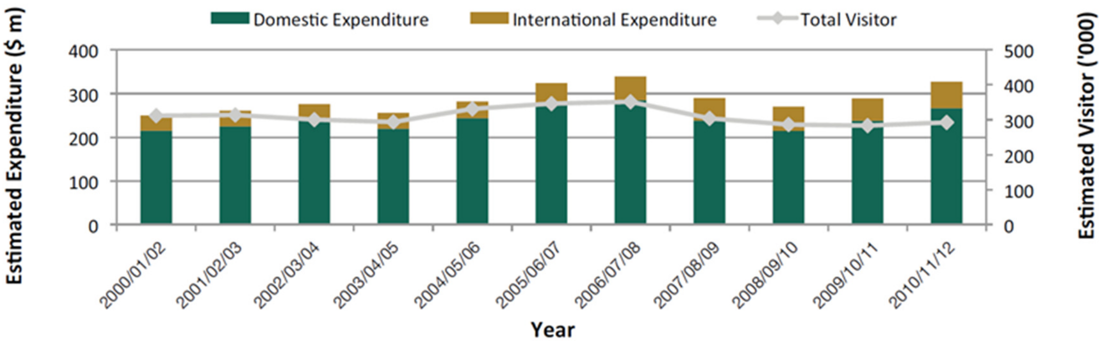
Agricultural production for the Kimberley region was valued at $230 million during 2011-12 (DRD, 2014a). The Ord River Irrigated Area (ORIA) near Kununurra was estimated to contribute $117 million to the economy in 2011-12. Of this, sandalwood accounted for 61% (or $72 million); field crops accounted for 13% ($15 million); horticulture accounted for 25% (or $29 million) and hybrid seeds accounted for 1% (or $1 million). Expansion of ORIA is currently underway, with a $322.5 million Royalties for Regions investment in key agricultural infrastructure aiming to double the size of the ORIA to 29,000 hectares (DRD, 2014b).

In 2011-12, the fishing and aquaculture industries of the Kimberley region contributed $7 million and $70 million, respectively (DRD, 2014a). These industries will be aided by Project Sea Dragon, a large-scale prawn farm that is to be located at the WA/NT border and has the potential to contribute significantly to Australian fishing and aquaculture operations. Processing and support services have been identified for Kununurra (estimated 500 jobs).

The gross value of agricultural production during 2015-16 was $64.9 million.

Tourism

The Kimberley region is home to the UNESCO World-Heritage listed Purnululu National Park. Hence, tourism forms a key industry, both of Kimberley and SWEK. As was shown in Figure 2, 69.8% of all visitors to the Kimberley region between 2009-10 and 2015-16 arrived for leisure purposes. Figure 5 shows the estimated expenditure and number of visitors to the region from 2000-2012. As can be seen, the estimated expenditure during the 2010/11/12 period was $327 million per annum (DRD, 2014a).



Source: Tourism Western Australia and Department of Regional Development.

Figure 5: Estimated expenditure and total visitor number (DRD, 2014a)

Tourism Western Australia[6] estimated that during the two calendar years of 2014 and 2015, SWEK attracted 107,900 visitors, of which 89.4% visitors were domestic visitors (Tourism Western Australia, 2016). Kununurra is approximately 290 km from the popular Bungle Bungle Range (located in the Purnululu National Park); 70 km from Lake Argyle and 7.5 km from Mitchell River National Park. Further, there are also a wide range of attractions closer to Kununurra such as the Mirimar National Park, Lily Creek Lagoon, El Questro, The Grotto and major events such as Kimberley Moon.

2.1.3. Climate

According to the Bureau of Meteorology (2017), the historical annual mean maximum temperature recorded for Kununurra was 38.8°C, with the hottest months being October to January. Meanwhile, the historical mean maximum monthly rainfall was recorded as 213.0 mm and being in February.

2.1.4. Legislative and Policy Context

In 2016, Kununurra was designated as a Regional Centre in the Western Australian Government's State Planning Strategy 2050. This recognises the importance of the town to its region and the state's

[6] Tourism Western Australia states that these estimates contain sampling variability, and thus may differ "from the results that would have been produced if all visitors had been interviewed in a census."

economic development. The Department of Regional Development has developed the Regional Centres Development Framework that "*supports action to strengthen the capability of strategic regional centres to attract investment and grow business and jobs. It provides a platform for these centres to work collaboratively with the private sector and to address network-wide challenges and opportunities*" (DRD, 2015).

EKRA plays a key role in the growth of Kununurra and aiding regional development. Thus, airport growth is important. Its planning process requires reference of the following:

- Manual of Standards (MOS) Part 139 – CASA
- Civil Aviation Safety Regulations (CASR) – CASA
- Local Planning Strategy and Local Planning Scheme 9 – SWEK
- Kimberley Regional Planning and Infrastructure Framework – West Australian Planning Commission
- Transport Security Program as per the Aviation Transport Security Act 2004 and Aviation Transport Security Regulations 2005 – Australian Government Department of Infrastructure and Regional Development

2.1.5. Previous Master Plan and Outcome

The previous Master Plan of EKRA was produced by Rehbein Airport Consulting in January 2013. It proposed key developments including a runway expansion to accommodate Code 4C aircraft operations (B737-800 and the A320-200). Following a Runway Extension Prefeasibility Study by GHD in August 2016 which assessed various runway expansion options, SWEK committed to a runway extension of 601 metres in length (while retaining the existing width of 30 metres) and associated works such as taxiway and lighting upgrades.

2.1.6. Key Stakeholders

Table 1 lists the key stakeholders of the airport. Internal stakeholders refer to the main decision-making parties regarding airport ownership and management. External stakeholders refer to airport users. Meanwhile, primary stakeholders refer to all those directly affected by changes made to the airport or directly influence airport operations. Secondary stakeholders refer to those who indirectly benefit from the growth of the airport. The preparation of the 2013 Master Plan involved consultation with numerous stakeholders. As a review document, the 2017 Master Plan consulted some of these key stakeholders.

Table 1: Key airport stakeholders

Stakeholder	Internal/External	Primary/Secondary	Description/Interest
Shire of Wyndham-East Kimberley	Internal	Primary	Owner/Operator
Airnorth	External	Primary	Airline operator
Virgin Australia	External	Primary	Airline operator
Aviair	External	Primary	Charter and RPT operator
Helispirit	External	Primary	Helicopter charter operator
Northern Airport Services	External	Primary	Ground Handling Agent

Kimberley Group Training	External	Primary	Airport café (leaseholder)
Avis, Budget, Thrifty	External	Primary	Rental car operators
Air BP	External	Primary	Aviation fuel supplier
Shell Aviation	External	Primary	Aviation fuel supplier
Airservices Australia	External	Primary	Air navigation service provider
Department of Defence	External	Primary	Leaseholder
CASA	External	Primary	Regulator
OTS	External	Primary	Regulator
WA Government	External	Primary	State Government
Federal Government	External	Primary	National Government
Local businesses	External	Secondary	Affected by growth

2.2. Current Situation

2.2.1. Ownership and Management

EKRA is owned and managed/operated by SWEK. The land is zoned for airport use. Of the total 275 hectares of airport land, the Shire owns 261.5 hectares of land freehold. In the past, a number of small parcels of land were subdivided and the freehold was sold to local aviation operators.

2.2.2. Site Description

The airport site is generally flat and has an elevation of approximately 44.2 metres (or 145 feet). It is located on a former riverbed (of Ord River). Further, it has a highly reactive clay content and is affected by Gilgai which are “repeated mounds and depressions formed on shrink-swell and cracking clay soils” (DEHP, 2013).

2.2.3. Surrounding Land

The land immediately surrounding EKRA has several uses. EKRA is bordered on the south by Victoria Highway and a golf course; on the west (and south) by Ord River; on the east by the Ord Irrigation Channel; and on the north and east by agricultural land. The agricultural land surrounding the airport is owned by a mixture of private parties, SWEK and the WA Government. The township of Kununurra is approximately 4 km east of EKRA.

2.2.4. Existing Activities

EKRA is currently serviced by Airnorth and Virgin Australia as its main airlines. Additionally, Aviair also provides weekly regional RPT services. The airport offers 46 scheduled RPT flights each week for passengers travelling to and from Perth, Darwin, Broome and Halls Creek. Being a Code 3C airport, aircraft typically used for these operations include the Fokker 100 and the Embraer 170.

There are also a number of general aviation (GA) users based at the airport, including both fixed and rotary wing operators. These operators are as follows:

- Aviair;
- Broome Air Services
- Helispirit;
- Kimberley Air Tours;
- Kingfisher Tours;
- Shoal Air; and
- Top End Mustering.

The Royal Flying Doctor Service and the WA Police also utilise the airport.

2.2.5. Existing Facilities

2.2.5.1. Airside Facilities

Figure 6 presents the EKRA Aerodrome Chart which highlights the key airside facilities:

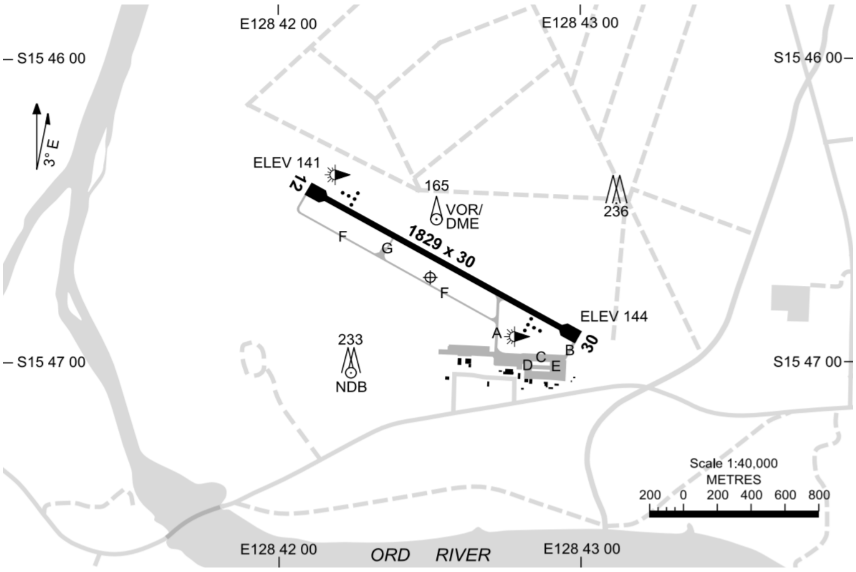


Figure 6: EKRA Aerodrome Chart (Airservices Australia, 2017b)

Runway

EKRA has a single sealed runway in the 12/30 designation as shown in Figure 6. This runway has a length of 1,829 metres and a width of 30 metres. It is within a runway strip which has a graded strip width of 150 metres and a length of 1,949 metres. The runway shoulders have a width of 3 metres. The runway is suitable for non-precision instrument approach operations by aircraft up to Code 3C. The Runway 30 threshold is shown in Figure 7.

Figure 7: The Runway 30 threshold

Pavement Strength
The runway has a flexible pavement with a current Pavement Classification Number (PCN) of 40 and a 'low strength' subgrade strength category. The maximum allowable tyre pressure is 1200 kPa (174 psi). According to the En-Route Supplement Australia (ERSA) for the airport, these pavement characteristics were identified by a technical evaluation. The runway underwent a major resealing/strengthening in 2015 and is in good condition. Although it has not yet been officially adopted, this recent asphalt overlay was rated with a PCN of 51. A higher rating requires strengthening of supporting infrastructure as explained further in Section 2.4.6.

Aprons
EKRA has three apron areas as explained below:

- RPT apron:
  - This is a sealed apron located in front of the passenger terminal building. It has a depth of 75 metres and a width of 165 metres. There are three aircraft parking bays. Of these, two bays can accommodate aircraft up to a Fokker 100 and the remaining bay can accommodate aircraft up to an Embraer E170.

- East GA apron:
  - This is a sealed apron located east of the passenger terminal building. It provides tie down parking and two main parking areas, each with a length of approximately 110 metres and a depth of 10 metres. This area can accommodate approximately 22 Code A aircraft. There are hangars which front this apron.
  - There is also a dedicated tie down parking area for visiting aircraft. This area has length of 100 metres and a depth of 20 metres. It can accommodate approximately sixteen Code A aircraft.
  - The western end of this east GA apron has an area of leased parking bays with tie down. It has a length of 65 metres and a depth of 20 metres. The northernmost bay provides informal parking for any large visiting aircraft. The remaining area can accommodate approximately four Code A aircraft.
  - Meanwhile, the eastern end of this apron provides access to the Air BP and Shell Aviation fuel facilities. A 24-hour AVGAS dispenser owned by Air BP located here. Furthermore, there is a parking bay in this area (and adjacent to the St. John's patient transfer facility) for an aircraft operated by the Royal Flying Doctor Service (RFDS).
  - There is also designated helicopter accommodation for three helicopters in the north-east corner of the Apron.

- West GA apron:
  - This apron is located west of the passenger terminal building. It has two areas for aircraft parking: the larger area has a length of 200 metres and a depth of 10 metres while the smaller area has a length of 150 metres and a depth of 9 metres. They can accommodate a total of 21 Code A aircraft. There are hangars which front this apron.
  - There is also designated helicopter accommodation west of this apron for four helicopters.

Taxiways
There are seven taxiways (labelled A-G as shown in Figure 6) at the airport.

- Taxiway A:
  - This taxiway serves as the main access between the RPT apron area and the runway. It has a sealed surface with a width of 15 metres and shoulders with a width of 3 metres. It is lit and can accommodate Code C aircraft with a wheelbase less than 18 metres.

- Taxiway B:
  - This taxiway provides access between the east GA apron area and the threshold of Runway 30. It has a sealed surface with a width of 15 metres and shoulders with a width of 3 metres. Further, it can accommodate Code C aircraft with a wheelbase less than 18 metres.

- Taxiway C:
  - This taxiway provides access across the north side of the RPT apron and the east GA apron. Despite being designated as a Taxiway, only Code C Taxilane clearances are provided.
  - There is an area of the disused runway to the east of the eastern GA apron and north of the fuel facilities which is used as a non-designated engine run-up bay.

- Taxiway D:
  - This taxiway provides Code B access from Taxiway C onto the east GA apron. Despite being designated as a Taxiway, only Taxilane clearances are provided.

- Taxiway E:
  - This taxiway provides Code A access from Taxiway C onto the east GA apron. Despite being designated as a Taxiway, only Taxilane clearances are provided.

- Taxiway F:
  - This taxiway runs parallel to the runway and provides access between the threshold of Runway 12 and Taxiway A. It has a width of 10.5 metres and shoulders with a width of 3 metres. Taxiway F cannot accommodate aircraft with a maximum take-off weight (MTOW) greater than 5,700 kg (i.e., it is limited to Code B aircraft with an MTOW less than 5,700 kg).

- Taxiway G:
  - This taxiway provides access between the runway and Taxiway F. It has a width of 10.5 metres and shoulders with a width of 3 metres. Similar to Taxiway F, this taxiway is also limited to Code B aircraft with an MTOW less than 5,700 kg. There are two engine run-up bays/passing bays incorporating a compass swing bay located adjacent to the intersection of Taxiways G and F.

Hangars

A number of hangars are located fronting the apron areas. All of these are privately owned.

Markers, markings, signals and signs

- As shown in Figure 6, there are two illuminated wind indicators (IWIs) on either end of the runway.
- The graded runway strip is marked with standard white gable markers. Compliant pavement markings are also provided.
- Taxiways F and G and the GA aprons are marked with 5,700 kg aircraft weight limit markings.
- The remainder of a disused runway is marked with unserviceability markers.

Lighting

- The runway has Low Intensity Runway Lighting (LIRL) which is pilot activated (PAL). There is standby power available. Both ends of the runway have an Abbreviated (Singled Sided) T pattern Visual Approach Slope Indicator System (AT-VASIS). The spacing of the runway edge lighting is 60 metres.
- Taxiway A, which provides the main access between the runway and the apron areas, has blue edge lighting.
- Additionally, the RPT apron is floodlit.

Radio Navigational Aids

The radio navigational aids at EKRA are also shown in Figure 6. These are owned and operated by Airservices Australia and are described below:

- A non-directional beacon (NDB) is located south of the runway and west of the terminal area.
- A Doppler VHF Omnidirectional Range (VOR)/Distance Measuring Equipment (DME) is located northeast of the runway.

Both the VOR and NDB have clearance zones which impose building and vehicle restrictions. Further details are given in Section 3.2.3 (within the Airport Master Plan).

Terminal Facilities

The passenger terminal has a total internal area of 1,680 square metres and a footprint of 2,480 square metres including external areas (Rehbein Airport Consulting, 2013). Its internal area permits the simultaneous operations of up to two Fokker 100 aircraft or one Boeing B737-800/Airbus A320- 200 aircraft. The facilities within the terminal include the following:

- A check-in hall with an approximate area of 200 square metres. It is located in the western end of the terminal and has five check-in desks and one service desk. Each check-in desk has a single-stage injector linked to a baggage conveyor. There is a separate area for a check-in queue. This is shown in Figure 8.
- An outbound make-up area including an enclosed room with an approximate area of 100 square metres. It accommodates a checked baggage screening (CBS) machine and an explosive trace detection (ETD) machine.
- A covered baggage make-up area with an approximate area of 270 square metres and housing an automated baggage conveyance system.
- Offices and a meeting room with a total area of approximately 200 square metres. The offices currently serve the airport manager, operations staff, CASA and the ground handling agent (who is currently Northern Airport Services).
- A landside waiting area with an approximate area of 300 square metres. This area includes a café and a retail area. Further, there is an external patio with an approximate area of 45 square metres.
- Five car hire desks (of which three are currently occupied by Avis, Budget and Thrifty).
- Male, female and disabled toilets including shower facilities and a baby change room. There are also separate toilet facilities provided for staff.
- A passenger security screening area with a search room totalling approximately 70 square metres.
- A departure lounge with an approximate area of 220 square metres. The corridor which is intended for use by international passengers in the future is currently used as an extension of the lounge.
- There is also a private lounge with an area of approximately 30 square metres. Male, female and disabled toilet facilities are also provided.
- A baggage reclaim hall with an approximate area of 250 square metres. It has a baggage reclaim conveyer/carousal that has a length of approximately 20 metres.
- An external baggage break-down delivery area with an approximate area of 90 square metres.

Figure 8: The check in area inside the passenger terminal

The passenger terminal was upgraded in 2011.

2.2.5.2. Aviation Support and Landside Facilities

The key aviation support and landside facilities at EKRA are shown in Figure 9.

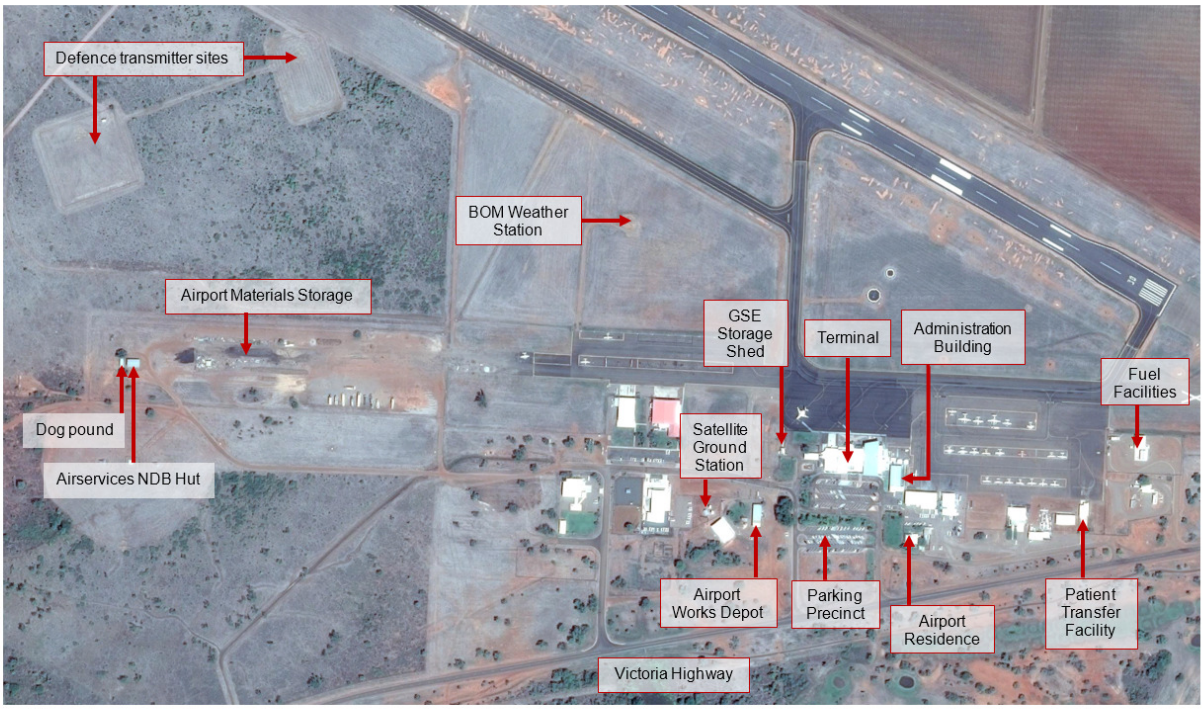


Figure 9: Aviation Support and Landside Facilities

Fuel facilities

Fuel facilities are provided by Air BP and Shell. Both fuel providers are located east of the east GA apron. Air BP provides Jet A1 and also has a 24-hour AVGAS dispenser. Shell also supplies AVGAS and Jet A1. There is a decommissioned Mobil fuel compound close to Victoria Highway with need for remediation.

Air Traffic Management
EKRA has no air traffic control tower. It falls within the flight information region managed by the Brisbane air traffic service centre.

As EKRA is a non-controlled airport, it has been allocated a Common Traffic Area Frequency (CTAF) for pilots within the vicinity of the airport to make positional broadcasts.

Meteorological Facilities
Bureau of Meteorology (BOM) has a weather station located between Taxiway F and the west GA apron. It provides the following services:

- An Automatic Weather Information Service (AWIS);
- Category C Terminal Aerodrome Forecasts (TAF); and
- An aerodrome weather report (METAR/SPECI).

The weather station has a radial clearance zone of 100 metres. There are also some height restrictions on structures within 100 to 200 metres of the station.

Ground Support Equipment (GSE) Storage Shed
A GSE storage shed is located west of the passenger terminal. It stores ground servicing equipment and airline flight catering supplies.

Patient Transfer Facility
There is a patient transfer facility in the eastern GA area that supports the operations of the Royal Flying Doctor Service (RFDS). The facility is maintained and operated by St John's Ambulance and owned by SWEK.

Satellite Ground Station
There is a satellite ground station (SGS) located east of the terminal and car park area. It is owned by Airservices Australia.

Defence Transmitter Sites
These are two adjoining facilities located south of the runway and west of BOM Weather Station. They are owned by the Department of Defence and is part of the Jindalee Operational Radar Network (JORN).

Airport Works Depot
This is located south west of the passenger terminal. The Workshop contains standby generators and switching gear for runway lighting, AT-VASIS and other airfield systems. Much of the plant for the runway lighting and navigational aids is also contained in the Airport Works Depot.

Further, the area has a staff room for airport maintenance personnel.

A substantial storage shed (for vehicles and equipment) is located to the south-west.

Administration Building
This building is located directly southeast of the passenger terminal. It was recently upgraded and currently serves airport staff. It is also temporarily used by SWEK for archiving purposes.

Airport Materials Storage
This is located west of the west GA apron. It contains a small shed and large storage area for materials and equipment. An asphalt mixing area is also located herewith.

Dog Pound
This adjoins the Airservices NBD hut and is west of the Airport Materials Storage.

Security Control and Airside Access
The airport airside area is surrounded by a fence which originally had a height of approximately 1.2 metres and is progressively being replaced with a 2.4-metre-high fence.

Airside access is provided via a number of gates on the southern side of security fencing. The main vehicular access to the airside is provided by an automatic gate located west of the passenger terminal building. There are additional gates at other locations, such as near the passenger terminal, beyond the Runway 30 threshold and beyond the west GA apron.

Airport Residence
This residential property is located in the east GA area. It currently houses a SWEK staff member and has previously been identified for future car parking.

2.2.6. Ground Transport Access and Parking

Road Access

- The main access to EKRA is from Victoria Highway via Laine Jones Drive.
- Laine Jones Drive is a one-way loop that serves the passenger terminal and car parks. This road also extends to the west providing access to those facilities located in the west (such as the western GA area).
- Cyril Kleinig Drive provides direct access from Victoria Highway to facilities located west of the passenger terminal (such as the western GA area).
- Dusty Rankin Drive provides direct access from Victoria Highway to the eastern GA area.

This road network is shown in Figure 10.

Figure 10: EKRA road network

Car Parking
EKRA has two main car parks located adjacent to the passenger terminal with 124 parking bays. Parking areas for rental cars, shuttle buses, trailers and staff are also provided, leading to a total of 204 parking spaces. This information is summarised in Table 2.

Table 2: Car parking facilities

Car park	Number of bays	Comments
Short-term car park	67	Includes one disabled bay. Reaches close to capacity during the tourist season (April-September) with at least two RPT flights arriving and departing concurrently.
Long-term car park	57	Reaches capacity during the tourist season and public holidays, and requires the overflow carpark during those times.
Overflow car park	30	Crushed rock finish with no markings, estimate number only
Rental car parking	18	6 bays per car rental company. High usage all year.
Shuttle bus parking	3	Low usage all year.
Bus/trailer parking	2	Low usage all year.
SWEK staff parking	7	Fully utilised.
Northern Airport Services staff parking	10	Estimate number only.
Total	**204**	

The car parking areas and associated roads are being upgraded in 2017. These works are to be followed by a further upgrade in 2019.

2.2.7. Utility Services

Electricity
The passenger terminal and associated facilities, hangers and other associated GA facility buildings are connected to the town electricity supply.

Back-up power is also provided via generators located in the Airport Works Depot.

The electricity supply to EKRA is at capacity, largely due to the upgraded passenger terminal with an augmented supply to be provided during 2017.

Water
EKRA is linked to the town water supply. There are also two water storage tanks located east of the passenger terminal which are used for firefighting purposes. The current water supply pressure is not adequate and a service upgrade is required. This impacts current development proposals.

Sewerage
EKRA has an on-site septic system with tanks located adjacent to the western side of the terminal that only services SWEK operations. Other hangars have separate on-site facilities whose operations will become more problematic as the density of development increases.

There is no reticulated sewer service to the airport. To facilitate further development of the airport an acceptable sewerage treatment system needs to be developed.

Communications
The town network provides copper-based telephone and internet connections to the airport. There is no National Broadband Network (NBN) fibre.

2.2.8. Current Lease Constraints

Table 3 presents an overview of the current lease agreements at the airport. These provide an important income although they could act as development constraints until their expiration.

Table 3: Details of Current Leases

Lessee	Purpose
Airservices	Portions of EKRA used for navigational aids (NDB and VOR/DME) and Satellite Station.
AirBP	Aviation fuel depot.
CASA	Terminal office space.
Department of Defence	Adjoining transmitter sites.
Mobil Oil	Vacant land awaiting remediation.
Northern Airport Services	Terminal office space, check in facilities and external baggage area.
Kimberley Group Training	Airport café.
Bradleigh Training	Terminal booth space (used in association with the Avis tenancy).
Budget	Terminal office space and six parking spaces.
Thrifty	Terminal office space and six parking spaces.
Avis	Terminal office space and six parking spaces.
Avis (car lot)	Enclosed car lot to the west of the Airport Works Depot.

2.3. Strategic Vision and Objectives

2.3.1. Strategic Vision

The vision of SWEK for the East Kimberley Regional Airport is

"To develop the East Kimberley Regional Airport as a premier facility that meets the regions evolving transportation needs. This will be done through the provision of competitive infrastructure and services to enable airlines together with other aviation and non-aviation groups to operate cost effectively while providing airport users with a convenient and welcoming service."

2.3.2. Objectives

The objectives of EKRA are as follows:

- Inform and engage with the community and private aviation interests in the planning and delivery of airport infrastructure and services.
- Ensure the Airport can accommodate forecast air traffic demands in terms of volume, range of destinations, mix of passengers, freight, training, tourism and charter services.
- Provide for the long-term viability of the Airport through the assessment of capital investments; achieving operating efficiencies; managing liabilities such as asset management; and reducing financial risks through a range of income streams.
- Ensure legislative requirements are considered and adhered across all strategic and operational areas.
- Broaden the contribution of the Airport to the region's economic development through the attraction of increased business and commercial activities and making best use of the land opportunities.
- Meet environmental sustainability expectations and standards across noise; air and water quality; impacts on neighbouring communities; bio-diversity; heritage; waste management; and energy consumption.
- Provide the highest standards in aircraft safety; airport security; public safety; occupational health and safety; and risk management.

2.4. Critical Airport Planning Parameters

A number of critical airport planning parameters are considered in the development of the 2017 Master Plan.

2.4.1. Forecast and Future Operations

2.4.1.1. Historical Aviation Activity

Figure 11 shows the annual passenger and RPT aircraft movements recorded at EKRA over the last thirty years.

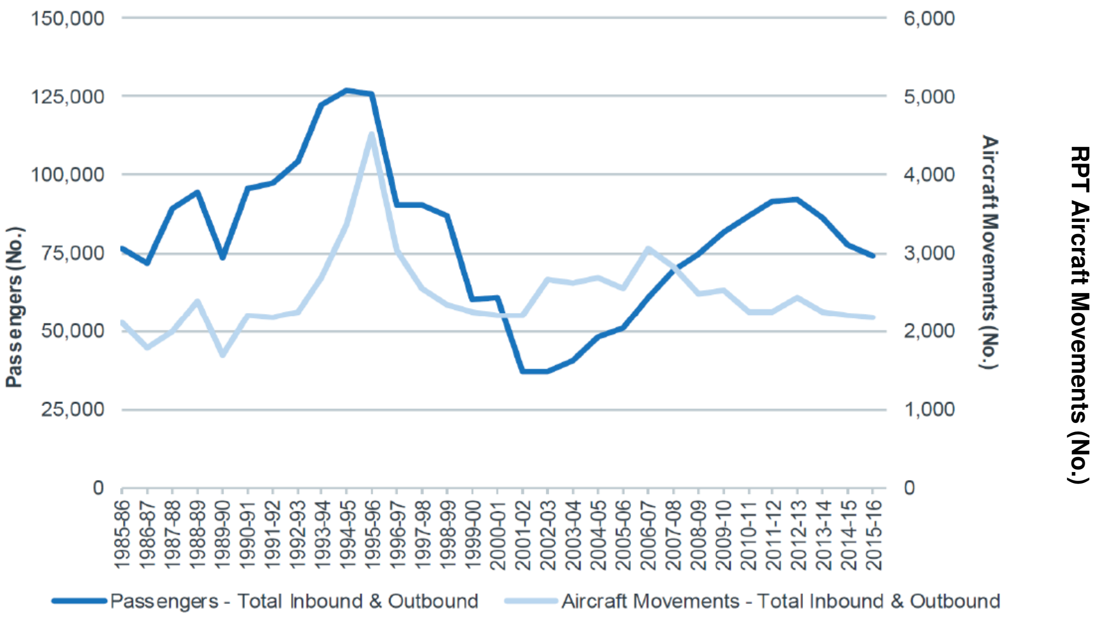


Figure 11: Historical passenger and RPT aircraft movements (BITRE, 2016)

The graph of passenger numbers in Figure 11 shows two noticeable peaks (in 1994-95 and 2012-13). Given below are notable events EKRA has experienced during the past three decades:

- 1989-90: A drop in passenger numbers due to the Australian Pilots' dispute in 1989
- 1993-96: A peak in passenger numbers driven by the Argyle Diamond Mine reaching a peak in its operations
- 1996-99: A significant decline in passenger numbers as the Argyle Diamond Mine decreased the number of charter operations
- 2001: A decline in passenger numbers driven by the Ansett collapse and September 11
- 2012-13: A second peak in passenger numbers driven by the mining boom in WA
- Post 2013: A decline in passenger numbers due to the slowing of the construction and operational phases of the resources sector and the Ord Irrigation Scheme

The corresponding compound annual growth rate (CAGR) of passenger movements between 1985- 86 and 1995-96 was 5.1% while it was 11.2% from 2001-02 to 2010-11. Meanwhile, the CAGR of aircraft movements for the period from 2002 to 2011 was 1.9% with almost 26,500 movements in 2011 (cumulative of both landings and takeoffs).

Figure 12 shows the number of aircraft movements recorded by the main operators since 2010 (both RPT and non-RPT). This figure only reflects landings. As can be seen, the total number of aircraft movements peaked in 2011 to 13,249 before reaching a trough of 9,126 in 2014. The number of aircraft movements has since increased. This figure shows that Airnorth is more prominent at EKRA compared to Virgin Australia. However, the highest number of aircraft movements was recorded by the local airlines (charter operators) based at the airport (as a collective). Note that general aviation refers to all other activity types which are not shown – the majority are small aircraft and helicopters.

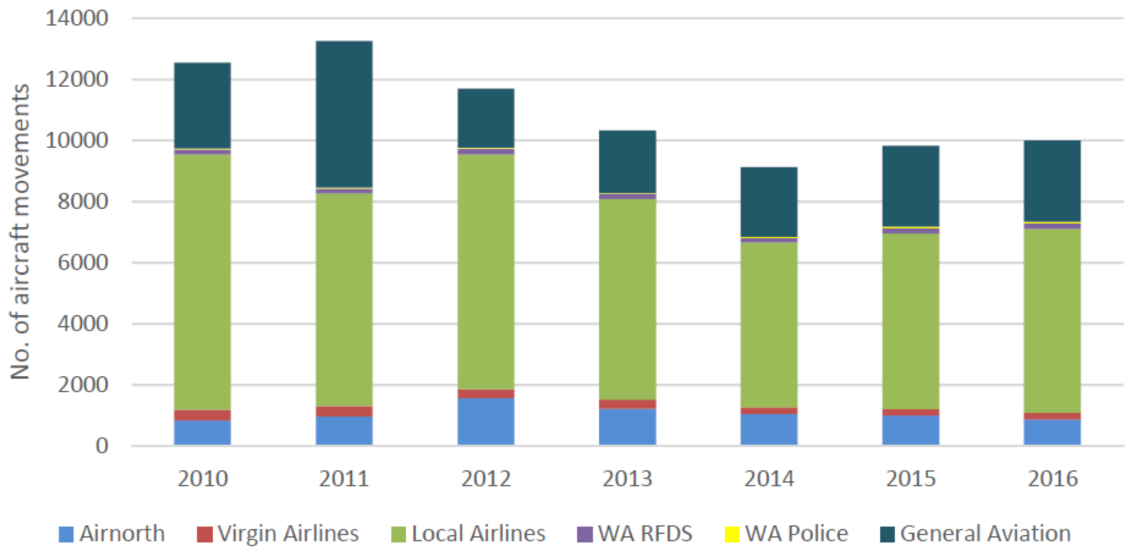


Figure 12: Aircraft movements (landings only) based on current operators[7]

In addition to the current RPT services by Airnorth and Virgin Australia, the charter operator Aviair commenced a subsidised RPT service between Kununurra and Halls Creek in 2017.

[7] Based on data provided by SWEK.

At the time of undertaking the Master Plan review there have been discussions with airlines to operate return interstate RPT services from Kununurra to the east coast of Australia. The trial proposal has been deferred to May 2018 and the service will likely operate for a maximum of six months in the dry season (May-October).

2.4.1.2. Forecasted Aviation Activity

Traffic forecasts form a crucial part in master planning and are integral to any proposed developments. However, actual future passenger and aircraft movements are dependent on numerous factors such as the future economy, population numbers, tourism activities, all of which involve uncertainty. Hence, accuracy poses a key challenge when forecasting. Thus, it is vital that several forecasts corresponding to different growth scenarios are produced.

Passenger Traffic

The planning horizon considered for the EKRA passenger forecasts is 20 years. The key drivers considered to affect passenger numbers and growth rates at EKRA over this planning horizon are as follows:

- Population growth;
- Local industry growth;
- Tourism growth; and
- Airline activity potential.

The forecasting procedure adopted for this Master Plan included a simple review of the historical data on passenger movements. Based on this data, four overall growth scenarios were developed in conjunction with annual population growth rates (2%-4.0%). The assumptions and methodology used for each growth scenario are outlined in Table 4.

Table 4: Forecasting procedure

Growth scenario	Methodology and assumptions
Low growth 1	Until 2020-21, EKRA's current decreasing passenger traffic rate of approximately CAGR 3% will continue. From 2020-21, the traffic will increase annually by 2.0% in line with population growth. No additional RPT services to EKRA will occur.
Low growth 2	Until 2020-21, the average of the current decreasing passenger traffic trend and population growth rate of 0.5% is maintained. From 2020-21, the traffic will increase annually by 2.0% in line with population growth. No additional RPT services to EKRA will occur.
Medium growth	Until 2022-23, the passenger traffic will increase annually by 3.5% in line with population growth and increased economic activity. In 2022-23, one B737-800 aircraft will commence weekly services at EKRA with an average load factor of 80%. It is assumed that the aircraft has 175 seats; therefore, there is an increase of 14,560 passengers in 2022-23 (175 x 0.8 x 2 x 52 = 14,560) in addition to the assumed increase in traffic resulting from population and economic growth. From 2023-24, the passenger traffic will continue to increase annually by 3.5%.
High growth	Until 2022-23, the passenger traffic will increase by 4.0% in line with population growth and increased economic and tourism activities. In 2022-23, one B737-800 aircraft will commence weekly services at EKRA with an average load factor of 80%. It is assumed that the aircraft has 175 seats. Therefore, there is an increase of 14,560 passengers in 2022-23 in addition

	to the assumed increase in traffic resulting from population and business growth. From 2023-24, the passenger traffic will continue to increase annually by 4.0%. In 2027-28, another B737-800 will commence weekly return services after which passenger traffic will increase annually by 4.0% as previously.

Table 5 presents the passenger traffic forecasts for each of the scenarios set out in Table 4.

Table 5: Passenger forecasts made using a simple forecasting methodology

Financial year	Low growth 1	Low growth 2	Medium growth	High growth
2015-16	74,334 (Actual)			
2016-17	72,104	73,962	76,936	77,307
2017-18	69,941	73,593	79,628	80,400
2018-19	67,843	73,225	82,415	83,616
2019-20	65,807	72,858	85,300	86,960
2020-21	67,124	74,316	88,285	90,439
2021-22	68,466	75,802	91,375	94,056
2022-23	69,835	77,318	109,134	112,378
2023-24	71,232	78,864	112,953	116,874
2024-25	72,657	80,442	116,907	121,549
2025-26	74,110	82,050	120,998	126,410
2026-27	75,592	83,691	125,233	131,467
2027-28	77,104	85,365	129,616	151,286
2028-29	78,646	87,073	134,153	157,337
2029-30	80,219	88,814	138,848	163,630
2030-31	81,823	90,590	143,708	170,176
2031-32	83,460	92,402	148,738	176,983
2032-33	85,129	94,250	153,944	184,062
2033-34	86,831	96,135	159,332	191,425
2034-35	88,568	98,058	164,908	199,082
2035-36	90,339	100,019	170,680	207,045
2036-37	92,146	102,019	176,654	215,327

Figure 13 presents the passenger forecast data graphically.

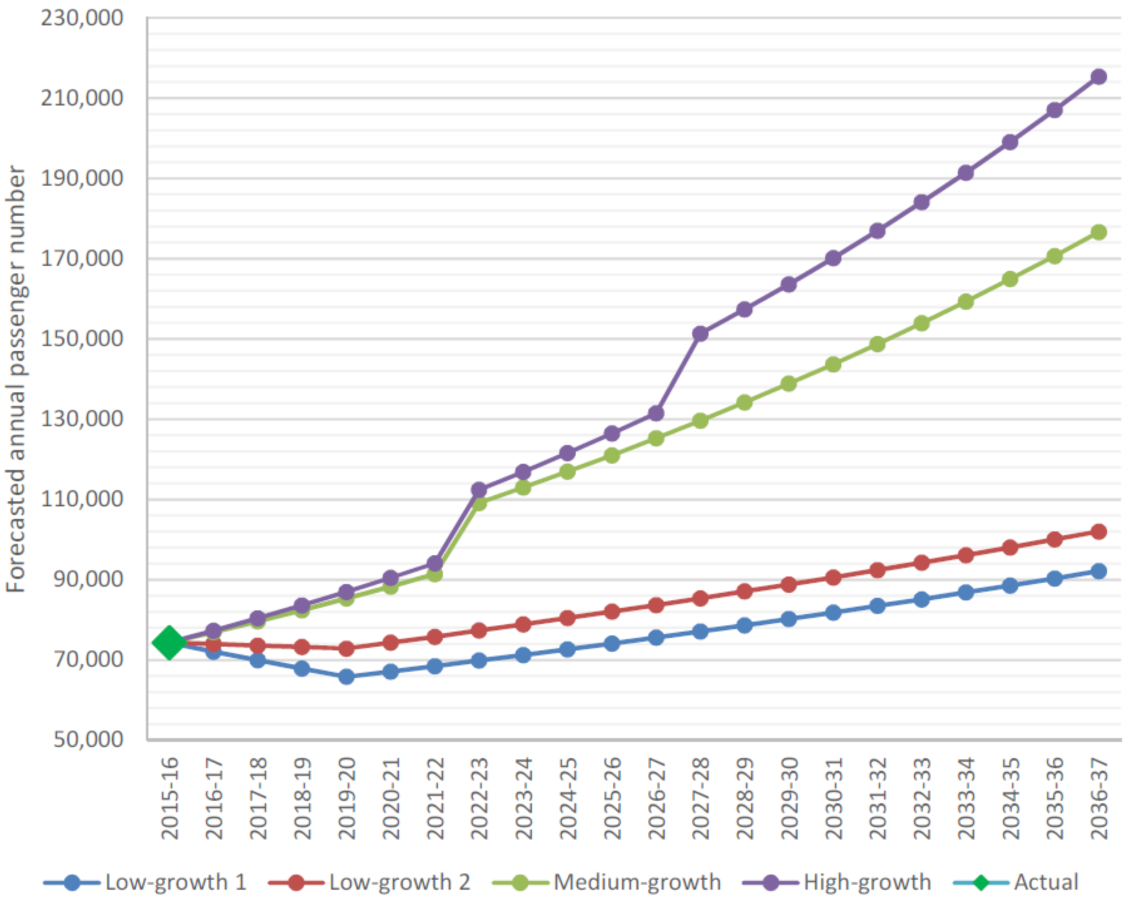


Figure 13: Forecasted passenger traffic over the 20-year planning horizon

As can be seen, there is an initial decrease in passenger traffic for both low-growth scenarios. This is due to the assumption that the decreasing trend experienced during the past few years as a result of the decline in the resources and construction sectors continues in the short term. This decrease is also assumed given the expected closure of the Argyle Diamond Mine in 2019. Meanwhile, the medium-growth scenario follows a slightly higher growth rate compared to the low-growth scenarios; however, there is no initial decrease in traffic assumed in this medium-growth scenario. Instead, it assumes the commencement of one return weekly B737-800 service. Finally, the high-growth scenario presents the impact of two B737-800 aircraft commencing services at two different times during the planning horizon. Following these immediate increases in passengers (shown by the step changes in Figure 10), the scenario assumes a higher growth rate than the other scenarios.

Note again that this 2017 Master Plan has not used an econometric model, which is usually industry best practice. Further, forecasting future growth at regional airports is challenging and subject to material step changes through the commencement of additional services as illustrated in the high growth scenario above. Thus, it is recommended that airport management closely monitor airline schedules, consult with airline operators on an ongoing basis, and be prepared to revise the forecast accordingly.

Nevertheless, from here-on-in, this Master Plan uses the high-growth scenario as the growth option for the purpose of planning critical airfield infrastructure. The high-growth scenario is based on expectations for continuing economic development (e.g. Ord Irrigation expansion, development of Project Sea Dragon and tourism) together with the availability of more cost-effective services/increased direct flights (e.g. accommodation of larger planes and proposed trial of Melbourne flights in 2018).

Aircraft Movements
The high-growth forecast assumes that during the planning horizon EKRA will serve both interstate and international destinations using B737-800/A320-200 twice each week (that is, four more aircraft movements each week or 208 annually). International operations are expected to be to and from South East Asia given the proximity of EKRA to the region.

2.4.2. Aerodrome Reference Code System

The Aerodrome Reference Code System is a system aimed at providing a uniform approach to determine the clearance and design standards which should be applied at an airport (AAA, 2014). It is further described in the Manual of Standards (MOS) Part 139 published by CASA as follows:

"*Australia has adopted the International Civil Aviation Organisation (ICAO) methodology of using a code system, known as the Aerodrome Reference Code, to specify the standards for individual aerodrome facilities which are suitable for use by aeroplanes within a range of performances and sizes. The Code is composed of two elements: element 1 is a number related to the aeroplane reference field length; and element 2 is a letter related to the aeroplane wingspan and outer main gear wheel span. A particular specification is related to the more appropriate of the two elements of the Code or to an appropriate combination of the two Code elements. The Code letter or number within an element selected for design purposes is related to the critical aeroplane characteristics for which the facility is provided. There could be more than one critical aeroplane, as the critical aeroplane for a particular facility, such as a runway, may not be the critical aeroplane for another facility, such as the taxiway."*

An Aerodrome Reference Code is then selected for an airport based on the characteristics of the design/critical aircraft (see Section 2.4.3 for further information) using Table 6.

Table 6: Aerodrome Reference Code (CASA, 2016)

Aerodrome Reference Code				
Code element 1		Code element 2		
Code number	Aeroplane reference field length	Code letter	Wing span	Outer main gear wheel span
1	Less than 800 m	A	Up to but not including 15 m	Up to but not including 4.5 m
2	800 m up to but not including 1200 m	B	15 m up to but not including 24 m	4.5 m up to but not including 6 m
3	1200 m up to but not including 1800 m	C	24 m up to but not including 36 m	6 m up to but not including 9 m
4	1800 m and over	D	36 m up to but not including 52 m	9 m up to but not including 14 m
		E	52 m up to but not including 65 m	9 m up to but not including 14 m
		F	65 m up to but not including 80 m	14 m up to but not including 16 m

Note that the Aeroplane Reference Field Length (ARFL) does not necessarily correspond to the runway length. ARFL is described in MOS Part 139 as follows:

"*The minimum field length required for take-off at maximum certificated take-off mass, sea level, standard atmospheric conditions, still air and zero runway slope, as shown in the appropriate aeroplane flight manual prescribed by the certificating authority or equivalent data from the aeroplane manufacturer. Field length means balanced field length for aeroplanes, if applicable, or take-off distance in other cases.*

The determination of the aeroplane reference field length is solely for the selection of a Code number and must not be confused with runway length requirements, which are influenced by other factors."

2.4.3. Selected Design Aircraft

The design aircraft is the most demanding aircraft that is expected to regularly use an airport in the future. This aircraft defines the maximum length, width and strength a runway should have in order to support its regular operations. Table 7 lists the aircraft expected to use EKRA in the future.

Table 7: Aircraft expected to serve EKRA (Rehbein Airport Consulting, 2013)

Aircraft Type	Wingspan (m)	Tail Height (m)	MTOW (kg)	ICAO Aerodrome Reference Code	ACN [(1)]	Typical Passenger Capacity (Pax)
Cessna 172	10.9	2.7	1,160	1A	< 5,700 kg	N/A
Cessna 310	11.3	3.3	2,495	1A	< 5,700 kg	N/A
Beech Super King Air 200	16.6	4.5	5,670	1B	< 5,700 kg	N/A
Pilatus PC-12	16.2	4.3	4,740	2B	< 5,700 kg	N/A
Bombardier Dash 8-100	25.9	7.5	15,650	2C	8	37
Embraer EMB-120 Brasilia	19.8	6.4	11,500	3C	6	30
Bombardier Global Express	28.7	7.6	44,500	3C	28	19
ATR 72	27.0	7.7	22,000	3C	12	66
Embraer E-170	26.0	9.7	37,200	3C	19	78
Fokker 100	28.0	8.5	45,810	3C	24	107
Embraer E-190	28.7	10.5	46,990	4C	28	106
Airbus A320-200	33.9	11.8	73,500	4C	37	150
Boeing B737-800	35.8	12.6	70,535	4C	40	175

(1) For flexible pavement on a medium (category B) sub-grade

In this figure, MTOW refers to the maximum take-off weight and ACN refers to the aircraft classification number. As can be seen, the B737-800 aircraft is the most demanding aircraft expected to use EKRA during the planning horizon. It has an Aerodrome Reference Code of 4C. Figure 14 shows the additional destinations enabled by the increased range of the B737-800 compared to the Fokker 100. General dimensions of the B737-800 are shown in Figure 15.

Figure 14: Range of existing Fokker 100 aircraft (red) vs proposed Boeing 737-800 (blue) from EKRA (GHD, 2016)

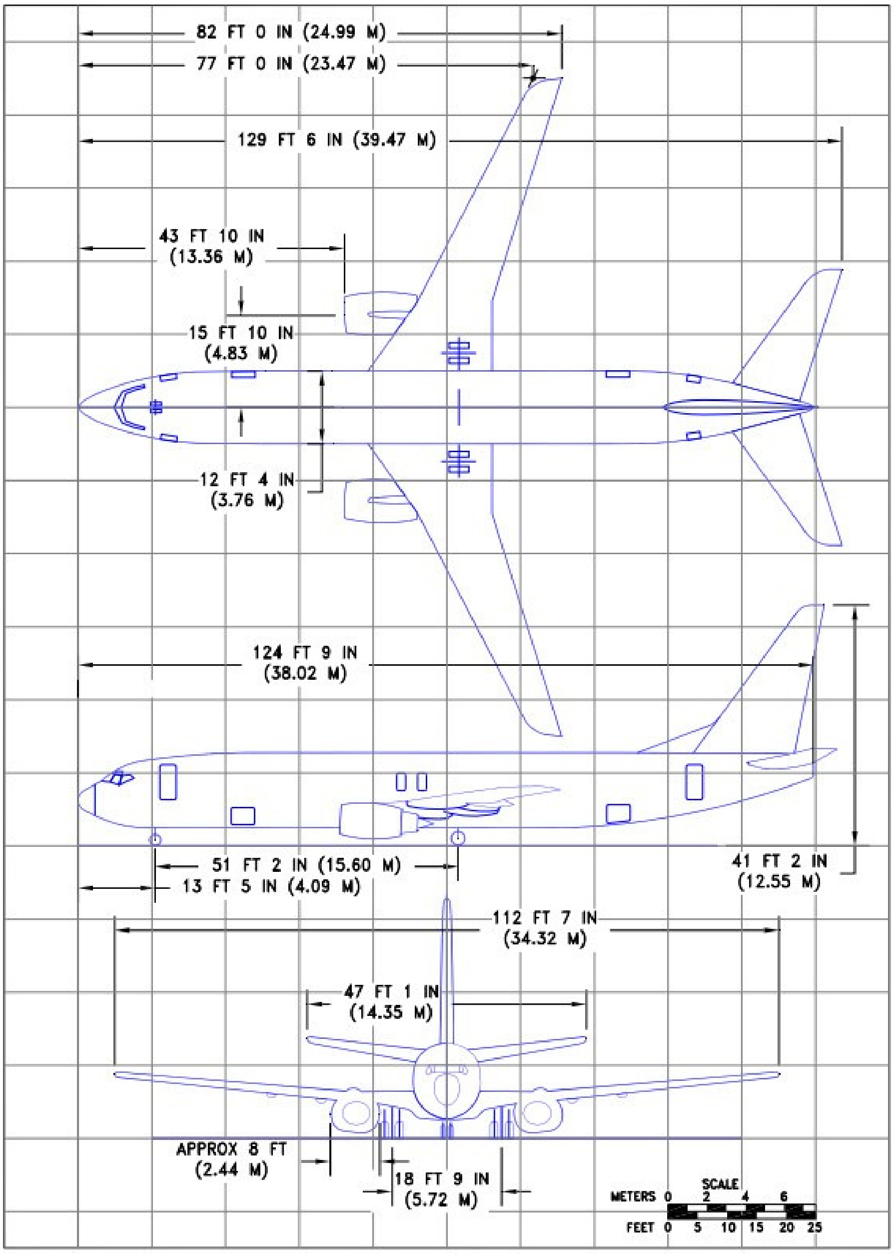


Figure 15: General dimensions of the B737-800 (Boeing, 2013)

2.4.4. Navigation Systems

The existing runway at EKRA is a non-precision approach instrument runway. Such a runway is defined in MOS Part 139 as follows:

"*An instrument runway served by visual aids and a non-visual aid providing at least directional guidance adequate for a straight-in approach.*"

Instrument runways have instrument approach procedures which are defined in MOS Part 139 as follows:

"The procedures to be followed by aircraft in letting down from cruising level and landing at an aerodrome. (A series of predetermined manoeuvres by reference to flight instruments for the orderly

transfer of an aircraft from the beginning of the initial approach to a landing, or to a point from which a landing may be made.)"

Navigation systems and approach procedures to be used at an airport must be considered during the planning process. This is because the standards required at an airport vary based on whether the runway is a non-instrument runway, an instrument, non-precision approach runway or an instrument, precision-approach runway (CAT I, II or III).

EKRA has five published instrument flight procedures, of which three use ground-based navigational aids (VOR, DME, NDB) located at the airport. The remaining two procedures use the Global Navigation Satellite System (GNSS).

In February 2016, CASA released a mandate which require aircraft to use the satellite-based system when possible. Airservices Australia (2016) state the following regarding the mandate:

"…*all aircraft operating under Instrument Flight Rules (IFR) are required to navigate primarily using satellite-based means within Australian airspace*."

Hence, as part of the Airservices Navigation Rationalisation Project (NRP), 179 ground-based navigation aids were switched off in May 2016. However, EKRA has been classified as being part of the Backup Navigation Network (BNN). This means that although aircraft are still required to land at EKRA without using the ground-based navigation systems, in the event that the satellite-based system cannot be accessed, the ground-based navigation systems can be used.

2.4.5. Aircraft Movement Area

The aircraft movement area is composed of the runways, taxiways and aprons and is the heart of any airport (AAA, 2014). Hence, it is the first area of an airport that should be designed. This area is designed upon consideration of the passenger and aircraft traffic forecasts and uses the Aerodrome Reference Code corresponding to the selected design aircraft and guidance in MOS Part 139.

Currently, EKRA is designed to accommodate up to Code C aircraft. As defined in the Runway Distance Supplement published by Airservices Australia, the Aerodrome Reference Code Number for the runway at EKRA is 3. Thus, the existing infrastructure have been designed for Code 3C operations. Given that the selected design aircraft is Code 4C, the existing aircraft movement area has to be upgraded in order for EKRA to accommodate this aircraft in the future. The developments proposed to this area are described in Section 3.

2.4.6. Pavement Strength

This critical planning parameter defines the pavement strength for a runway using the Aircraft Classification Number/Pavement Classification Number (ACN-PCN) pavement rating system. It defines the most demanding aircraft that can regularly use a runway.

The existing pavement strength of the runway at EKRA is defined as follows (Airservices Australia (2017a):

PCN 40 /F /C /1200 (174PSI) /T

This means the following:

- The runway has a bearing strength of PCN 40 as assessed by a technical evaluation;
- The runway has a flexible pavement built on a low strength subgrade; and
- The maximum allowable tire pressure that is permitted on the runway is 1,200 kPa (i.e., 174 PSI).

However, through research for the Runway Extension Prefeasibility Study the recent asphalt pavement overlay has been rated as follows:

PCN 51 / F / C / 1410 (205 PSI) / T

Once the RPT apron and main taxiways are strengthened then a higher rating can be adopted.

The ACN is determined by the manufacturer of an aircraft and for a certain aircraft to be deemed suitable for a runway, the PCN of the runway must match the ACN. The selected design aircraft (i.e., the B737-800) has an ACN of 40 as shown in Table 7.

2.4.7. Aviation Support and Landside Facilities

Aviation support and landside facilities comprise of those facilities which support airport operations and include the following (AAA, 2014):

- Control tower;
- Navigation aids;
- Aerodrome lighting;
- Meteorological facilities;
- Passenger terminals;
- Aircraft hangars;
- Cargo facilities;
- Rescue and fire-fighting facilities;
- Fuel facilities; and
- Access roads and car parks.

Each of these facilities has particular requirements as stated in MOS Part 139 and must be considered when any changes to the aircraft movement area (i.e., runway, taxiways and aprons) are being proposed.

Of the facilities aforementioned, EKRA does not have a control tower, cargo facilities or rescue and fire-fighting facilities. Nevertheless, the changes to the aircraft movement area which are envisaged in order to accommodate Code 4C aircraft require consideration of these facilities. These considerations are presented in Section 3.

2.4.8. Passenger Terminal

The passenger terminal is the interface which links the landside and airside functions of an airport. As such, it houses a range of facilities for passenger processing. Some of these facilities include the following (AAA, 2014):

- Landside interface facilities;
- Passenger processing areas (including security screening);
- Passenger holding areas (including commercial facilities);
- Internal circulation;
- Airside interface facilities;
- Airline and support areas; and
- Rental car booths.

Planning must ensure that the terminal has adequate capacity to accommodate forecasted traffic while providing a suitable level of service to passengers. The level of service is a key factor as it influences how pleasant the passenger experience is at an airport. The following three-step process is used in planning terminal requirements for the future (AAA, 2014):

1. Estimate passenger demand levels;
2. Estimate demand for particular facilities; and
3. Determine space requirements.

Aviation bodies such as the International Air Transport Association (IATA) and the Federal Aviation Administration (FAA) have publications pertaining to space standards and terminal planning guidelines. These are typically used in the industry in planning passenger terminals.

The existing passenger terminal at EKRA was completed in 2011 and has a footprint (including external areas) of 2,480 square metres. This terminal size is not adequate for two design aircraft operating simultaneously.

2.4.9. Security Requirements

EKRA has an approved Transport Security Program (TSP) in place and any future alterations to security controls should be implemented and maintained in accordance with the TSP and the *Aviation Transport Security Act 2004 (ATSA)* and the *Aviation Transport Security Regulations 2005*.

The larger aircraft that currently service EKRA have a MTOW greater than 20,000 kg. Hence, as per regulatory requirements, EKRA provides passenger screening. Additionally, the airside interface of the airport is bound by a security fence.

Changes to security requirements are not expected in the short term. However, it is expected that in the long term, security will need to become tighter if international services are commenced.

2.4.10. Airspace Protection Surfaces

Airspace protection surfaces are invisible surfaces above the ground around an airport. The airspace above these surfaces is defined as the airport's protected airspace (AAA, 2014). There are two sets of such surfaces aimed at safeguarding an airport. These are as follows:

- Obstacle Limitation Surfaces (OLS)
  - These surfaces are a series of planes associated with each airport runway. They define the maximum height limits to which objects may project into the airspace around the airport to ensure safe aircraft operations (MOS Part 139).
  - According to MOS Part 139, a non-instrument runway and a non-precision instrument runway must have the following OLS:
    - conical surface;
    - inner horizontal surface;
    - approach surface;
    - transitional surface; and
    - take-off climb surface.
- Procedures for Air Navigational Services – Aircraft Operations (PANS-OPS) surfaces
  - These surfaces provide protection for aircraft that may be guided only by instruments in the event of poor visibility (AAA, 2014).

These surfaces typically influence the development of landside facilities (both within and outside an airport site) by imposing height and location restrictions. Building height restrictions ease as the distance away from the runway increases.

Details of the existing and future airspace requirements at EKRA are given in Appendix C and are consistent with the 2013 Master Plan.

2.4.11. Aircraft Noise Contours

Aircraft noise contours are maps that show the aircraft noise levels around an airport. Assessing aircraft noise effects is important for reasons such as the following (AAA, 2014):

- Position sensitive land uses away from areas which are subjected to unacceptable aircraft noise; and
- Provide long-term protection for airport operations against conflicts arising from the encroachments of inappropriate development into areas that are affected by noise.

There are two types of contours as explained below:

- Australian Noise Exposure Forecast (ANEF) System
  - This shows the aircraft noise levels forecasted around an airport in the future.
  - Permitted land uses within the ANEF contours are given in the *Australian Standard AS2021-2000 'Acoustics-Aircraft Noise Intrusion – Building Siting and Construction'*. This standard affects planning both within and outside the airport site.

- N-Contours System
  - This aircraft noise metric is a complimentary system to the ANEF system. It shows the potential number of aircraft noise events above 60 db(A), 65 db(A) or 70 db(A) per day.
  - Compared to the ANEF system, N-contours show noise in a way that people perceive it.

Details of the existing and forecasted aircraft noise contours at EKRA are given in Appendix C and are consistent with the 2013 Master Plan.

2.4.12. Safety Areas

Public Safety Areas (PSA)
A Public Safety Area (PSA) or a Public Safety Zone (PSZ) is an area at each runway end where development is restricted in order to protect people and property on the ground if an aircraft accident occurred during landing or take-off (DILP, 2016). It has the shape of an isosceles trapezoid with dimensions of 1000 metres x 350 metres as shown in Figure 16.

Figure 16: Public Safety Area (DILP, 2016)

The State Planning Policy (SPP) of the Queensland Government further justifies the use of PSAs as follows (DILP, 2016):

"*The probability of an accident occurring during any single aviation operation is very low. However, an analysis of aircraft accidents reported to the International Civil Aviation Organisation since 1970 suggests that most accidents that do occur, occur immediately beyond the ends of a runway—up to 1000 metres before the runway during landing or up to 500 metres beyond the runway end on take- off. During this time the aircraft is aligned with the extended runway centerline and is relatively close to the ground. PSAs define the area in which development should be restricted in order to protect the safety of both aircraft passengers, property and people on the ground in the event of an aircraft accident during landing or take-off.*"

While there are no national regulations making PSAs mandatory at Australian or West Australian airports, the Queensland Government has enacted a SPP relating to the provision of PSAs at Queensland airports. The inclusion of PSAs in this report is as a means of future proofing the airport given the increased acknowledgement of PSAs at airports across Australia. This should be a consideration at EKRA when considering any potential runway expansion projects.

The Queensland SPP guides the acceptable use of land that falls within PSAs.

Runway End Safety Area (RESA)

A Runway End Safety Area (RESA) is an area provided at the end of a runway strip to protect an aircraft if it undershoots or overruns the runway. RESAs with a length of 90 metres are required for Code 3 or 4 aircraft. This length requirement increases to 240 metres for international airports. According to the new Australian standard, the RESA must be measured from the end of the runway strip. Meanwhile, the width of a RESA must not be less than twice the width of the associated runway.

MOS Part 139 states that if it is not practicable for the full length of a RESA to be provided, an engineering solution such as enhancing aeroplane deceleration which achieves the objective of a RESA is permitted.

3. AIRPORT MASTER PLAN FOR 2017 – 2037

3.1. Land Use Plan

This section presents the land use precincts and guidelines proposed for EKRA. Unless otherwise agreed upon, all developments stated in this Plan must abide by the relevant Local, State and Federal regulations and planning policies. The Land Use Plan is shown in Appendix A and is a conceptual drawing only. Hence, prior to undertaking any proposed development, relevant professional advice must be sought to ensure feasibility.

EKRA has an area of 275 hectares. Of this, there is a significant amount of land that is unused and can be utilised for triggering economic benefits to both the airport and the community.

Terminal Precinct

This Precinct contains the current passenger terminal and has a sizeable piece of land (principally to west) allocated for long-term terminal development without being spatially constrained. The terminal design must conform to the building height restrictions (shown in Table 14) imposed by the OLS contours for the runway. This Precinct should be dedicated for the provision of terminal facilities and any supporting infrastructure required by regulations.

Commercial Precincts

EKRA has a large amount of land that is not envisaged in the planning horizon as being required to provide aeronautical infrastructure. This offers EKRA a significant opportunity (assuming that demand exists) to diversify its revenue streams and support wider economic development).

Two separate pieces of land are identified to house the Commercial Precincts, one north of the runway and one south of the runway. It is suggested that land within these Precincts is used for a range of both aviation and non-aviation activities which shall aid in the growth of the airport and support the wider community. Some suggested activities include the following:

- Aircraft maintenance facilities;
- General warehousing and bulky goods;
- Retail fuel sales;
- A roadhouse (may require land acquisition – see Section 3.2.6);
- Hotels and other short-term accommodation;
- Private hangars;
- Businesses, such as those related to the oil and gas industries which would use the airport to transport important high-value components and equipment;
- Manufacturing and services that are consistent with airport activities and meet environmental standards; and
- Interim storage.

The majority of the Southern Commercial Precinct has road access and must be developed as outlined in the Land Use Plan (Appendix A). This Precinct can be accessed either via the current road network within the airport site itself as shown on the Plan, or by upgrading the existing unsealed road (which is outside the airport site) and also services the neighbouring speedway track quarry. Two parcels of land for acquisition are shown on the Plan that would improve the opportunities this Precinct could offer to EKRA. More information on these land acquisitions are given in Section 3.2.6.

Meanwhile, the Northern Commercial Precinct does not currently have road access. However, it offers the opportunity to develop hangars and operate a range of businesses. This Precinct also has the potential for a significant Defence presence given the strategic position of EKRA in northern Australia and separation of Darwin and Derby (Curtin) airports.

Of the two precincts, it is suggested that the Southern Commercial Precinct is developed first due to existing road access and proximity to utilities. However, if there is sufficient demand for the Northern Precinct, road access linking this Precinct to the highway must be arranged as suggested in the Land Use Plan.

Solar power generating facility (Solar Farm)
A solar farm was suggested during stakeholder engagement as a potential strategy to solve the existing constraints with the electricity supply. Such solar farms have been successfully implemented at other Australian airports such as Alice Springs and Darwin airports. Case studies containing more information of the two solar farms are given in Appendix B.

This Master Plan recommends the development of a solar farm to provide additional capacity to the electricity grid at EKRA. The location of this facility is expected to be near the Terminal Precinct; however, its optimum location should be determined from feasibility studies which balance site location with system efficiency. Hence, the location of the solar farm is not shown on the Master Plan.

Freight Precincts
Two freight precincts fronting the RPT apron on the north and Laine Jones Drive on the south are shown in the Land Use Plan. The first precinct is a smaller express freight zone located adjacent to the Terminal Precinct. The parking area immediately to its south can be used to park freight vehicles. Meanwhile, the second Precinct is a larger site located further west. It has ample area to house a dedicated freight facility including space for manoeuvring and parking trucks. Of the two precincts, the express facility should be developed first. The design of any structures within these Precincts must conform to the building height restrictions (shown in Table 14) imposed by the OLS contours for the runway.

Aviation Precincts
These Precincts are two land parcels and should be used to house aviation-related facilities such as hangars. Sites in these precincts should only be offered with leasehold tenure. Further, the design of any structures within these precincts must conform to the building height restrictions (shown in Table 14) imposed by the OLS contours for the runway.

The smaller land parcel is bounded by Taxiway F and the airport boundary and is referred to as the Northern Aviation Precinct. It can house hangars requiring direct airside access. Meanwhile, the Southern Aviation Precinct is adjacent to the Southern Commercial Precinct. The development of the Southern Aviation Precinct would require the development of a new taxiway (see *Taxiway Expansion Area* below).

Taxiway Expansion Area
This area is allocated for the development of a main taxiway and parallel taxilanes to serve the Southern Aviation Precinct. Development of this precinct hence determines the development of the Taxiway Expansion Area, which is to be developed west and north as required.

Apron Expansion Area
This area is allocated for the long-term development of the apron as traffic to the airport increases or new GA hangars are required.

Car Park Expansion Areas
These two areas are dedicated for the expansion of the existing car parking facilities at the airport. There is sufficient space to provide long-term and short-term parking as well as staff, freight, bus and rental car parking. The two areas are fragmented by Laine Jones Drive. The existing Airport Works Depot within the left expansion area will require relocation in the medium to long term as more car parking bays are required in the future. A potential relocation site for the Airport Works Depot is the Southern Commercial Precinct. The most suitable location for the relocation should be determined from feasibility studies and hence, is not shown on the Plan.

3.2. Facilities Development Plan

The high-growth scenario introduced in Section 2.4.1.2 is used as the planning scenario for the development of airport facilities.

3.2.1. Movement Area Facilities

The runway, taxiway and aprons stated in this section must comply with the standards and regulations stated in MOS Part 139.

3.2.1.1. Runway

Planning the runway to accommodate the design aircraft means that the existing 12/30 runway must be expanded from a Code 3C runway to a Code 4C runway.

Runway length

As determined by the Runway 12/30 Extension Prefeasibility Study (GHD, 2016), this Master Plan recognises that the runway should be extended from either end to accommodate Code 4C aircraft forecasted in the high-growth scenario. Hence, the additional 601 metres would be made up of a 540-metre west extension and a 61-metre east extension to achieve a total runway length of 2,430 metres.

Note the following physical constraints which were considered in the Prefeasibility Study in determining details of the runway extensions on either end (GHD, 2016):

- Ord River, which is approximately 1,200 metres west of the existing Runway 12 threshold;
- A borrow pit site, which is approximately 640 metres west of the existing Runway 12 threshold;
- Ord River Irrigation Channel, which is approximately 500 metres east of the existing Runway 30 threshold;
- Victoria Highway, which is south of the airport site boundary;
- A private property lot, which is north east of the airport site boundary; and
- An open unlined drain east of the existing Runway 30 threshold.

According to the Prefeasibility Study, the borrow pit site presents a major constraint due to the volume of fill that is required to provide a suitable surface for runway pavement and associated runway strip and RESA areas (GHD, 2016).

Furthermore, the Prefeasibility Study stated that 2,430 metres is the maximum possible length achievable on the airport site with a RESA of 90 metres (GHD, 2016).

Runway width and runway shoulders

Table 8 lists the runway width requirements for different Aerodrome Reference Code Numbers. As can be seen, a width of 45 metres is required to accommodate Code 4C aircraft operations.

Table 8: Minimum Runway Widths (CASA, 2016)

Code number	Code letter					
	A	B	C	D	E	F
1	18 m	18 m	23 m	–	–	–
2	23 m	23 m	30 m	–	–	–
3	30 m	30 m	30 m	45 m	–	–
4	–	–	45 m	45 m	45 m	60 m

According to a Narrow Runway Supplement published by CASA in 2014 and specified in CAAP 235A-1(0), certain Code 4C aircraft operations are allowed on a runway with a width of 30 metres (CASA, 2014). The Prefeasibility Study stated that this reduced width was supported by Qantas and Virgin Australia if the design aircraft (B737-800) operated in and out of EKRA (GHD, 2016). Nevertheless, this Master Plan makes an allowance for the runway width to be increased to 45 metres for purposes of safeguarding EKRA for the future. The runway widening would also require an increase of the runway shoulders to 7.5 metres on either side.

Runway turn pad

A runway turn pad should be investigated on the western runway end after the runway is extended by 540 metres if Taxiway F is not extended/upgraded for Code 4C aircraft to the west at the same time. Figure 17 shows the turn pad dimensions required for a Code C aircraft as per ICAO.

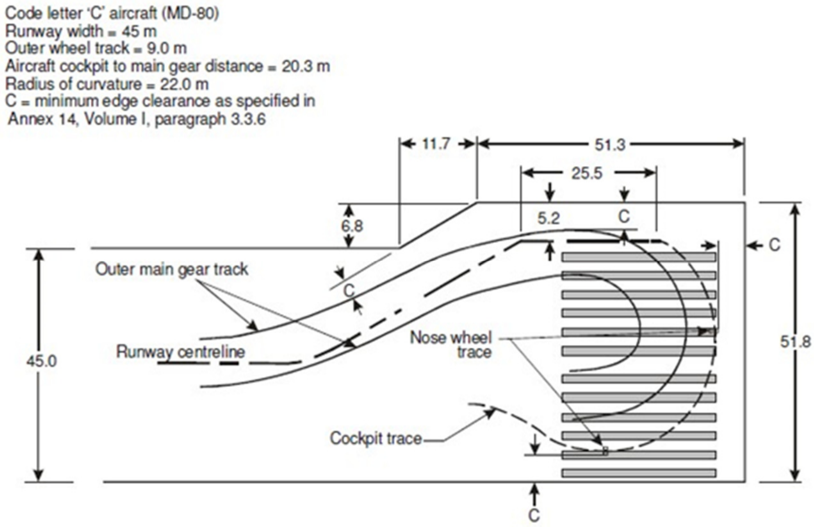


Figure 17: Runway turn pad dimensions for Code C aircraft (ICAO, 2006)

Pavement strength

As outlined in Section 2.4.6, the Prefeasibility Study identified that the 2015 asphalt pavement overlay of the existing runway has a PCN of 51. The PCN of the extension must be consistent with this rating.

Runway strip width

The existing runway is within a 150-metre wide runway strip. However, as per MOS Part 139 the runway strip width required to accommodate Code 4C aircraft is 300 metres (or 150 metres perpendicular from the runway centreline on either direction). As shown in Figure 18, the required 300 metre width gives a runway strip that reaches the edge of Taxiway F and straddles the airport site boundary. Although strip width requirements are met, for airport safeguarding purposes it is proposed that the land immediately north comprising that between the airport boundary and the agricultural land as shown in the Land Use Plan (see Appendix A) be acquired. Land acquisition is also required as the Illuminated Wind Indicator at the Runway 12 threshold would need to be relocated outside the runway strip.

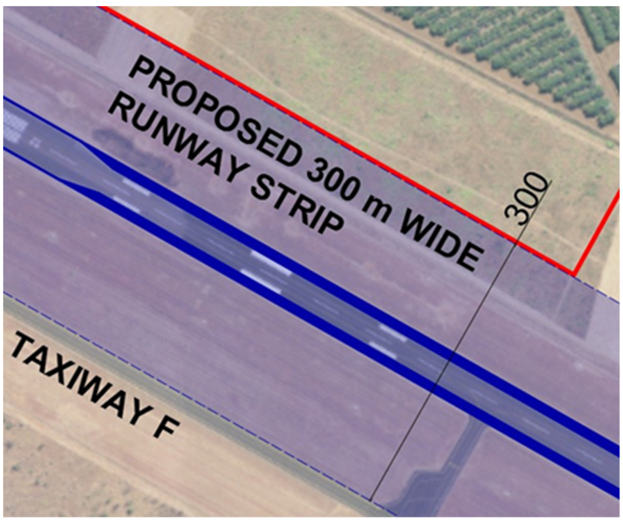


Figure 18: Proposed runway strip width

Runway End Safety Areas
As defined in MOS Part 139, a runway end safety area (RESA) has to be provided on either end of the extended runway. The Land Use Plan shows two RESAs on either end, one enveloping the other. The smaller area on either end corresponds to the minimum RESA length of 90 metres for Code 3 and 4 aircraft. Meanwhile, the larger area corresponds to the recommended RESA length of 240 metres.
As shown in the Land Use Plan (see Appendix A) both small RESAs on either runway end fall within the airport site and should be included once the runway is extended.

The larger RESA on the western runway end extends out to sit just at the airport boundary. However, the borrow pit site which would need a large volume of fill poses a constraint for the longer RESA (GHD, 2016). When international flights commence from EKRA, the length of the RESA should be 240 metres. Given the constraint, the Prefeasibility Study stated that the total runway length would have to be reduced to accommodate the longer RESA.

This Master Plan proposes that the RESA length initially be 90 metres until international flights commence. While a reduction of the runway length as suggested by the Prefeasibility Study may constraint aircraft operations (e.g., MTOW), this Master Plan proposes that a feasibility study be undertaken which assesses the cost of filling the borrow pit site (which would then enable a 240-metre length RESA) versus the cost implications on a business standpoint resulting from having a reduced runway length.

Meanwhile, on the eastern runway end, a minor portion of the corresponding larger RESA falls outside the airport site. Hence, it is proposed that EKRA acquires the land parcels shown in the Land Use Plan (see Appendix A).

Public Safety Area/Public Safety Zone
This Master Plan proposes adopting the Public Safety Zone (PSZ) provisions outlined in Section 2.4.12 as good practice for long-term airport safeguarding. A PSZ at each runway end is shown in the Land Use Plan. The PSZ of both runway ends falls outside the airport boundary. It is recommended that SWEK works with neighbouring land occupants to institute appropriate land use controls within the notional PSZ at both runway ends.

Land uses recommended to be permitted under the PSZ are activities that do not attract the assembly of a large number of people such as the following:

- Golf courses (not club houses);
- Agricultural operations (other than forestry or livestock);
- Plant and machinery buildings;
- Low occupancy warehousing; and
- Car parking.

Land uses recommended to be discouraged, avoided or prohibited are activities that may attract the assembly of large number of people or that have the potential to be highly hazardous in the event of an incident involving an aircraft, such as the following:

- Residences and public places of assembly (churches, schools, hospitals, office buildings, and shopping malls);
- Playgrounds, sports grounds; and
- Fuel storage facilities.

Further, the Queensland Government SPP dictates that local planning instruments should prohibit the following types of development within a PSZ:

- Accommodation activities;
- The manufacture or bulk storage of flammable, explosive or noxious materials;

- Uses that attract large numbers of people (e.g., sports stadia, shopping centres, industrial and commercial uses involving large numbers of workers or customers); and
- Institutional uses (e.g., education establishments, hospitals).

Runway Lighting
The runway expansion would require the existing runway lighting to be relocated and/or upgraded. The following changes are specifically proposed:

- Relocate the runway edge lighting after widening the runway. Place new runway edge lights along the additional 601-metre runway length.
- Replace the existing AT-VASIS approach guidance system with a new Precision Approach Path Indicator (PAPI) system at each runway end.
- Relocate the Illuminated Wind Indicator found at the existing Runway 12 threshold to the new threshold (upon the 540-metre western end runway extension).

Final key characteristics
Table 9 shows the key characteristics of the final runway that is proposed.

Table 9: Proposed runway dimensions for EKRA

Runway Characteristic	Existing	Ultimate Development	Change required
Runway length	1,829 metres	2,430 metres	+ 601 metres
Runway width	30 metres	45 metres	+ 15 metres
Runway strip width	150 metres	300 metres	+ 150 metres
Pavement strength	PCN 40	PCN 51	TBA

This runway expansion would enable the operation of Code 4C aircraft such as the B737-800 and A320-200 in order to link EKRA with destinations on the east coast of Australia and certain other destinations in South-East Asia. Although according to CAAP 235A-1(0) a width of 30 metres is sufficient for the design aircraft, a width of 45 metres is what is operationally preferred by airlines. However, as this is not required by airlines (as was identified during the Prefeasibility Study), increasing the width to 45 metres during the long-term planning horizon is a better strategy.

3.2.1.2. Taxiways

Table 10 shows the minimum taxiway widths (straight sections) and taxiway shoulder widths stated in MOS Part 139 for aircraft up to Code C.

Table 10: Minimum taxiway widths (CASA, 2016)

Code letter of aircraft	Minimum taxiway width of straight sections (metres)	Taxiway shoulder width (metres)
A	7.5	-
B	10.5	-
C	18	3.5

It is also stated in MOS Part 139 that for taxiways intended to serve Code C aircraft, the taxiway width may be 15 metres (instead of 18 metres) if the wheelbase of the design Code C aircraft is less than 18 metres. Correspondingly, the minimum edge clearance is reduced 3 metres.

This is the case with the three taxiways at EKRA which can accommodate Code C aircraft. The dimensions of the existing taxiways at EKRA are given in Table 11 along with the dimensions they should be upgraded to accommodate the design aircraft. Note that the wheelbase of the B737-800 is 15.6 metres as was shown in Figure 15.

Table 11: Overview of current and proposed width changes to taxiways at EKRA

Taxiway Name	Code letter of aircraft currently suitable	Current (metres)		Proposed (metres)	
		Width	Shoulder width	Width	Shoulder width
Taxiway A	C	15	3	15	3.5
Taxiway B	C	15	3	15	3.5
Taxiway C	C	Only Code C Taxilane clearances provided		15	3.5
Taxiway D	B	Only Code C Taxilane clearances provided		No change	
Taxiway E	A	Only Code C Taxilane clearances provided		Upgrade to provide Code B Taxilane clearances	
Taxiway F	B	10.5	3	15	3.5
Taxiway G	B	10.5	3	15	3.5

As shown, Taxiway A and B have the required width; however, their shoulder widths must be increased from 3 to 3.5 metres. Furthermore, Taxiways F and G must be widened to the same specifications as Taxiways A and B. This upgrade can be done in the medium or long term as RPT traffic increases.

Taxiway F, which is the (existing partial) parallel taxiway, should be extended along with the runway on the west. Further, it should also be extended on the east from Taxiway A to Taxiway B. This east extension will allow GA aircraft to directly access the GA apron without going over the RPT apron. These extensions are shown in the Land Use Plan. The pavement strengths of these taxiways must be such that they can accommodate the design aircraft. Taxiways A, B and C must be strengthened.

Initially, aircraft should use the runway turn pads to turn and back track to Taxiway A and then arrive at the terminal. As EKRA gets busier, Taxiway F should be upgraded to a Code C taxiway. Taxiway F should be extended in the long term to meet the new runway thresholds.

The action plan is outlined as follows:

- Short term:
  - Upgrade taxiways A, B and C as detailed in the Prefeasibility Study (GHD, 2016). Aircraft will use the runway turn pads to turn and then will backtrack on the runway and use taxiway A to access the terminal.

- Medium term:
  - Upgrade taxiways F and G to accommodate code C aircraft.

- Long term:
  - Extend Taxiway F to the east and west until the taxiway joins the runway thresholds. This is to be a code C taxiway. When Taxiway F is extended, Taxiway C can be consolidated as part of the east GA apron.

3.2.1.3. Aprons
The planning of the apron areas within the 20-year planning horizon require consideration of the high-growth scenario.

RPT Apron
This apron currently has three parking bays and the existing capacity is deemed sufficient for the following aircraft combinations:

- Three Code 3C aircraft – Two Fokker 100 or similar aircraft and one Embraer 170 or similar aircraft; and
- Two Code 3C aircraft and one Code 4C aircraft – Two Fokker 100/Embraer 170 aircraft and one Boeing 737 or similar aircraft

Meanwhile, the following must be noted for future operations:

- The apron pavement must be strengthened (the Master Plan recognises the 60 mm asphalt overlay recommended during the Prefeasibility Study); and
- Any expansion of the existing area would require the installation of additional flood lighting.

East GA Apron
The existing capacity is deemed sufficient for current operations. However, this apron has a poor-quality asphalt pavement and area for expansion is constrained by fuelling facilities on the east and the RPT apron on the west. The following are proposed for the future:

- Base any new developments at the west GA apron;
- Retain the RFDS aircraft parking position at the current location which is adjacent to the patient transfer facility; and
- Provide future aircraft access to this apron from the runway either via Taxiway F or Taxiway B.

West GA Apron
The existing capacity is deemed sufficient for current operations. However, this apron has a poor-quality asphalt pavement and its expansion area to north-west is limited by the 100-metre clearance zone surrounding the BOM weather station. The following are proposed for the future:

- Expand this apron to accommodate new developments and Code A and B aircraft;
- Provide future aircraft access to this apron from the runway via Taxiway A; and
- Develop a private jet apron (if demand exists) on the eastern edge.

3.2.2. Passenger Terminal Facilities

3.2.2.1. Passenger Terminal
Currently, the busy hour occurs on Fridays between 3 pm – 4 pm during the dry season. The aircraft mix is composed of one F100 and one E170 and the busy hour passenger number is estimated to be 212. The existing passenger terminal has an internal area of 1,680 square metres and reaches capacity during the busy hour. Table 12 shows the estimated busy hour passenger number over the planning horizon during which the existing terminal capacity will be insufficient. Hence, the terminal would require expansion based on the forecasted demand. Note that the commencement of any international services to and from EKRA would require international passenger processing facilities (e.g., customs, immigration and quarantine).

Table 12: Terminal space requirements during the planning horizon

Year	Expected busy hour aircraft mix	Estimated busy hour passenger number	Estimated internal terminal space requirement (square metres)
2023-24	• One F100 • One B737-800	246	2,460
2036-37	• One F100 • Two B737-800	301	3,010

There is potential for EKRA to reduce the scale of a required terminal expansion project and operating costs through demand management. This would see EKRA managing the timing of arriving and departing RPT aircraft to be within the operating capacity of the terminal. This would relieve some of the pressure of the forecasted busy hour passenger number, even if aircraft frequenting the airport have more passengers than the existing scenario.

EKRA should consider consulting with stakeholders and airlines about the viability of such a demand management program to create a RPT schedule that better utilises existing terminal facilities and capacity.

3.2.2.2. Passenger and Checked Baggage Screening

EKRA currently provides passenger and checked baggage screening. The existing terminal is deemed as adequate for the increased level of screening activities expected during the planning horizon.

3.2.3. Aviation Support Facilities

BOM Weather Station

The location of this weather station does not pose a limitation to airport operations or immediate (short term) development. However, the weather station should be relocated once its clearance zone becomes a hard constraint for either expanding the west GA apron or developing the hangars fronting it.

Aerodrome Rescue and Fire Fighting Services

Given the forecasted passenger numbers, it is unlikely that Aerodrome Rescue and Fire Fighting Services (ARFFS) will be provided at EKRA by Airservices Australia at any point within the planning horizon. However, current regulations state that an airport will be assessed for risk upon the commencement of scheduled international RPT services. Then, based on the findings from this risk review, ARFFS may be provided at the airport. Hence, if EKRA was to commence international RPT services, a risk review may determine the need for ARFFS at EKRA. In this case, any required facilities can be located at the Southern Aviation Precinct shown in the Land Use Plan.

In the meantime, the existing water tanks located on site to provide fire-fighting services may require an upgrade depending on the aircraft and traffic that EKRA receives.

Visual and Navigational Aids

EKRA has been classified as part of the Backup Navigation Network (BNN). This means that its ground-based navigational aids (VOR, DME, NDB) will be maintained for at least a period in case aircraft are unable to access the satellite-based navigation network.

According to MOS Part 139, unauthorised personnel and any vehicle movements are not permitted within a 300-metre radius of the VOR. Furthermore, any structure that extends above an elevation angle of one degree as seen from the VOR site is not permitted within a 600-metre radius. This consequently imposes limitations on the level of commercial activity that can take place in this clearance zone.

Similarly, the NDB has a clearance zone defined by a 150-metre radius. This zone has building, vegetation height and vehicle movement restrictions. While the NDB does constrain airport development, its relocation is not proposed during the planning horizon for two reasons: (1) ground-based navigational aids are being phased out by Airservices Australia and so it may be a matter of time before the NDB at EKRA (which is part of the BNN) is removed altogether; and (2) a relocation will make the existing instrument flight procedure using the NDB invalid. Further, a new instrument flight procedure will likely not be possible using the relocated NDB due to the surrounding terrain. The existing Airservices Australia lease will expire in 2022 and any needs may be better managed on renewal.

The current clearance zones at EKRA are shown in Figure 19.

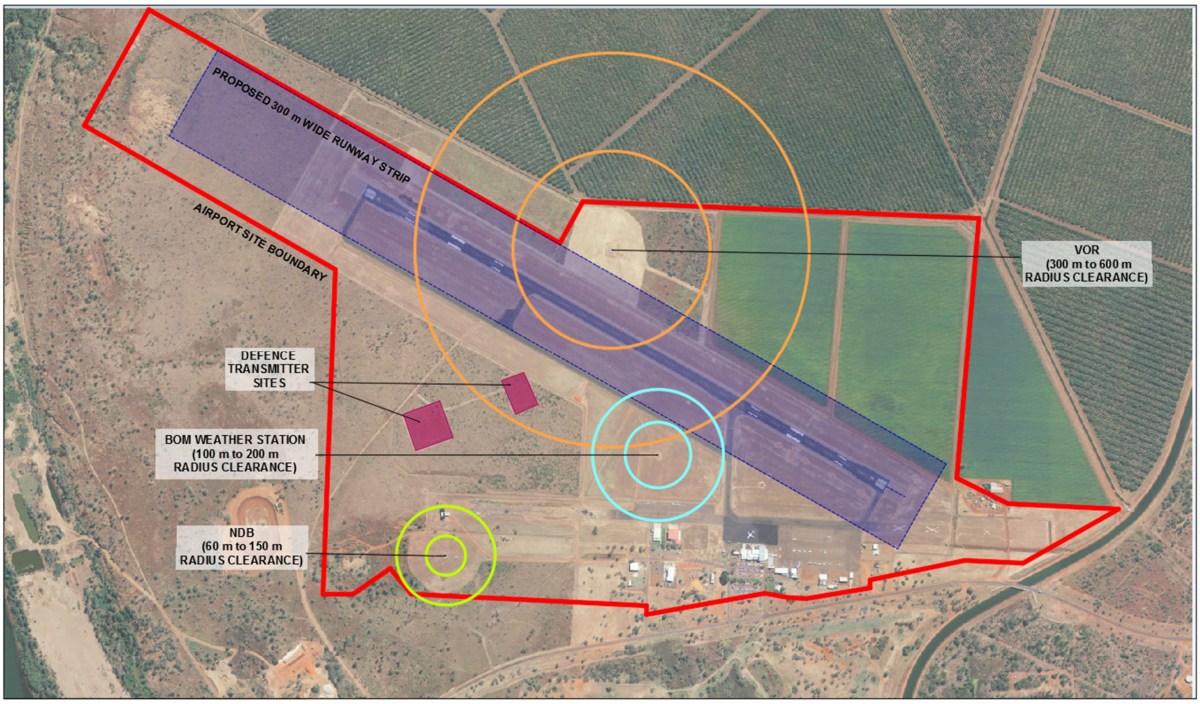


Figure 19: Current clearance zones at EKRA

MOS Part 139 states the following with regard to ground-based navigational aids which apply to EKRA:

VOR:

- "*Vehicle movements: Aerodrome roadways, taxiways, public roads, tramways and railways shall not be closer than a 300 m radius. Vehicles used by aerodrome maintenance staff are not to be parked within a 300 m radius.*

- *Restricted area: All unauthorised personnel and vehicles must be kept clear of the facility within a 300 m radius. Wooden signs or wooden fencing only may be used to clearly define the restricted area. The movement of vehicles between the VOR building and VOR antenna is prohibited.*

- *Site maintenance. Grass and scrub within 150 m of the site must be mown or cut regularly. Grass cutting equipment is not to be parked within a 300 m radius of the VOR building.*

- *Services. All cables (e.g. power and telephone) are to be placed underground within 300 m radius of a VOR facility. Cables can be run above the ground from 300 m to 600 m radius from a VOR, if they are aligned radially to the VOR.*

- *Clearance zone. No structure, building, trees, fences, towers or power lines is permitted within 600 m radius of the VOR if they will extend above an elevation angle of one degree as seen from the VOR site.*"

DME:

- "*Vehicle movements: No restriction.*

- *Restricted area: No restricted areas.*

- *Site maintenance: There is no requirement for grass or scrub clearing, however, trees within a radius of 300 m must not be allowed to grow above the height of the DME antenna mounting point on the DME mast.*

- *Clearance zone: Small structures, small buildings, overhead lines and fences are allowable adjacent to the DME antenna location within a 600 m radius, providing that they do not project above the mounting point of the DME antenna to the DME mast.*

- *Larger obstructions such as multi-storey buildings, hangers, bridges, etc., may interfere with DME system performance and any proposal to erect large structures above a one degree elevation angle as seen from the DME antenna within a 5 km radius from the DME antenna location may affect the performance of the system."*

NDB:

- "*Obstructions: The immediate surrounding area within a radius of 150 m of the antenna should be free of buildings exceeding 2.5 m in any dimension, vegetation should be kept below a height of 0.6 m. Small buildings of substantially non-metallic construction extending less than 2.5 m in any dimension may be erected no closer than 60 m to the antenna.*

- *Overhead power and telephone lines serving the NDB should be kept at least 150 m clear of the antenna. Steel towers and masts should subtend elevation angles less than 3 degrees measured from ground level at the centre of the NDB antenna system.*

- *Vehicular movements: With the exception of authorised vehicles no vehicle shall approach the antenna within a distance closer than 60 m.*

- *Services: Power and telephone cables should be underground to a depth of 0.45 m within 150 m of the antenna.*

- *Restricted area: No special requirements. Where necessary, fencing should be provided to keep cattle and horses clear of the earthmat area.*"

Further details pertaining to each navigational aid can be found in MOS Part 139. Note that any work inside a building restricted area, which are not necessarily prohibited, are to be assessed by a technical authority.

Fuelling facilities
Expansion of the existing fuel facilities east of the east GA apron is not expected within the planning horizon. However, in the long term new fuel facilities (both AVGAS and Jet A1) may be required near the west GA apron depending on its activity level.

Fencing and Airside Access Gates
The existing security fencing and airside gates should be maintained to ensure functionality. Any inefficiencies of the existing fencing and gates must be eliminated to increase security as well as improving airline satisfaction.

There is a fencing initiative in the EKRA Works Program to progressively provide a 2.4-metre-high fence with gates. There are six to eight stages that remain.

The land acquisitions proposed will require modification of the airport boundary and consequently, will require new security fencing.

3.2.4. Engineering Services

Electricity
The current electricity supply at the passenger terminal is at capacity. Thus, the capacity must be increased to accommodate the forecasted growth. A solar power plant is an option to feed into the electricity supply.

Water
The existing water supply is constraining the growth of the airport. The supply is deemed to be insufficient to meet the needs of the passenger terminal and the future development of the airport. This inadequacy must be resolved within the short term.

Sewerage
The sewerage treatment systems across the airport needs to be upgraded to provide capacity to support development. This can be done in the short term by increasing capacity to the existing septic systems and in the long term by connecting a reticulated trunk service to the town network.

Terminal development, when required, will require the relocation of the adjacent septic system. The capacity of this system should also be increased in the future to accommodate the forecasted passenger growth.

EKRA does not currently provide a sewerage facility for disposing aircraft waste. Hence, such a facility should be developed for overnight RPT and charter aircraft operating at the airport.

Non-aeronautical precincts on the airport site should be provided access to adequate waste facilities.

The installation of a new reticulated trunk service or the relocation of septic systems must be in accordance with the Local Planning Scheme. Adequate separation to the high water table in the region, existing buildings and water supplies (creeks, dams and bores) must be ensured. A detailed study should be undertaken to determine the most appropriate location for the new system to ensure that it will not impair any future development on the airport site.

It is recommended that an airport services strategy plan be developed as a high-priority project. This plan should investigate and determine a range of outcomes including the potential of the airport being connected to the town's sewerage system.

Communications
Communications are crucial for the safe operation of EKRA and wider commercial activities. Outcomes should be investigated to achieve a significant short-term improvement in infrastructure.

3.2.5. Other Facilities

Electricity Supply - Solar Farm
A solar farm is proposed as a short-term development, particularly to increase the capacity of the electricity system of the passenger terminal. Aspects such as the best location on site, size of the plant and costs must be determined by a prefeasibility study.

Roadhouse
Stakeholder consultation revealed the opportunity for a modern full-service roadhouse located at the airport directly accessible off the Victoria Highway. One siting option for the facility requires acquisition of the land parcel south of the Southern Commercial Precinct and north of Victoria Highway as shown in the Land Use Plan. This land parcel provides sufficient area for a roadhouse. Another siting option for a roadhouse is the land parcel containing the former Mobil Depot. The most appropriate location must be determined by a prefeasibility study.

Car Parking
Ample land has been allocated for expansion of the car parking areas as required. EKRA is currently upgrading its terminal car park through a reseal and providing improved circulation.

Private Hangars
Stakeholder consultation has raised the need for private hangars at EKRA. These would increase revenue opportunities for the airport. They can be located within the Aviation Precincts, ideally with airside and landside access. Note that residential hangars are not recommended to be located within the airport site as they are noise-sensitive land uses. They are also likely to constrain future airport growth.

A scoping study should be undertaken to determine the feasibility and market demand for either developing GA hangars to be available for leasehold at EKRA or offering vacant land for lease that is zoned for hangar development. This study should also consider the most appropriate location for the hangars as well as their layout and size.

Figure 20 shows two GA hangars at Mildura Airport. These images offer an example of hangars that EKRA could consider developing within the Aviation Precinct.

Figure 20: General aviation hangars at Mildura Airport (CPMS Commercial, 2017)

Aircraft maintenance/heavy engineering base
This is to be housed within the Southern Aviation Precinct.

GA facilities
The Aviation Precincts should be developed based on demand to promote the airport for charter operators.

Freight Facility
A dedicated freight facility could be developed in response to market demand. This Master Plan has identified the appropriate location for such a facility. The location for an express freight facility has also been identified.

Airport and Shire Works Depots
This facility is to be located within its current area in the short term. In the medium to long term, relocation to the Southern Commercial Precinct may be necessary as more area is required for car parking. The Shire Depot in Kununurra could also be relocated to this Precinct.

Department of Defence
The transmitter sites owned by the Department of Defence are to be maintained at their current locations for the duration of the planning horizon.

Due to the strategic location of EKRA between Darwin and Broome together with the availability of airside land, SWEK believes that EKRA would be an ideal location to establish a Defence facility.

Customs & Border Control
This would be required when EKRA commences international flights.

Aerodrome Rescue & Fire Fighting Services
These may be required when EKRA commences international flights.

3.2.6. Land Acquisition

The Land Use Plan shows five pieces of land parcels which EKRA should acquire during the planning horizon. These are detailed in Table 13.

Table 13: Details of recommended land acquisitions

Land acquisition location	Reasons for acquisition	Trigger point
North of the runway	• To place the new (after the 540-metre extension) Runway 12 threshold Illuminated Wind Indicator (IWI). • To improve airport operations (e.g. meet the 300-metre runway strip width requirement and reduce aircraft minimum approach descent altitudes). • For airport safeguarding purposes.	Immediate.
North-east of the Runway 30 threshold	• To improve airport operations (e.g. improve the fly-over area and reduce aircraft minimum approach descent altitudes). • For airport safeguarding purposes.	Immediate.
South-east of the Runway 30 threshold	• To ensure that the 240-metre length RESA east of the Runway 30 threshold is within the airport site. • For airport safeguarding purposes.	Once international flights are guaranteed to operate from EKRA.
South of the airport site boundary (Highway frontage)	• To accommodate increased activities, in particular those that can benefit from passing traffic. For instance, a roadhouse (or another facility requiring Highway frontage) can be built on this land parcel, allowing EKRA to diversify its revenue sources and support local economic activity.	Market research identifies a sound need for a roadhouse (or another facility that requires Highway frontage).
South-west of the airport site	• To form part of the Southern Commercial Precinct and safeguard the airport.	Market research identifies demand for this site.

3.3. Ground Transport Plan

The existing road configuration at the airport forms the basis for the ground transport plan. The following is proposed for the future:

- Extend Dusty Rankin Drive west to the western arm of Laine Jones Drive. This will allow traffic travelling between the east and west hangars to bypass the car park;
- Upgrade (i.e., seal) Laine Jones Drive to the west and the external roads which can be used to access the Southern Commercial Precinct and the Aviation Precincts; and
- Add additional roads to service the two Commercial Precincts and the two Aviation Precincts.

These changes are shown in the Land Use Plan. They are contingent on market demand governing the development of the Commercial and Aviation Precincts.

3.4. Airport Safeguarding Plan

This section presents strategies aimed at safeguarding EKRA for future development. Specifically, the National Airports Safeguarding Framework (NASF) must be used as guidance for purposes of airport safeguarding.

3.4.1. National Airports Safeguarding Framework

The NASF is a national land use planning framework aimed at providing guidance on development that affects or is in close proximity to aviation operations. According to DIRD (2016), the aims of the NASF are to:

- Improve community amenity by minimising aircraft noise-sensitive developments near airports;
- Improve safety outcomes by ensuring aviation safety requirements are recognised in land use planning decisions; and
- Improve aircraft noise disclosure mechanisms.

The framework is composed of the following:

- Principles for National Airports Safeguarding Framework;
- Guideline A: Measures for Managing Impacts of Aircraft Noise;
- Guideline B: Managing the Risk of Building Generated Windshear and Turbulence at Airports;
- Guideline C: Managing the Risk of Wildlife Strikes in the Vicinity of Airports;
- Guideline D: Managing the Risk of Wind Turbine Farms as Physical Obstacles to Air Navigation;
- Guideline E: Managing the Risk of Distractions to Pilots from Lighting in the Vicinity;
- Guideline F: Managing the Risk of Intrusions into the Protected Airspace of Airports; and
- Guideline G: Protecting Aviation Facilities – Communication, Navigation and Surveillance (CNS).

3.4.2. Airspace Protection Surfaces

The OLS and PANS-OPS for EKRA were prepared as part of the 2013 Master Plan. New surfaces have not been provided in this 2017 Master Plan. It is recommended that new OLS and PANS-OPS be produced that align with the runway extension dimensions proposed in this Master Plan. The surfaces given in the 2013 Master Plan are shown in Appendix C.

Table 14 shows the increase in the building height permitted as the OLS contour height increases. The building site ground level is assumed to be the highest runway end elevation which is 145 feet (44.20 metres). The building height restriction is the difference between the OLS contour height and the building site ground level.

Table 14: Building height restrictions imposed by the OLS

OLS contour (metres)	Building site ground level (metres)	Building height restriction (metres)
50	44.20	5.80
60	44.20	15.80
70	44.20	25.80
80	44.20	35.80

The ultimate height of the plantation trees to the north would also be restricted by the OLS. The tree heights would have building height restrictions shown in Table 14.

3.4.3. Aircraft Noise Contours

ANEF contours and N-system contours for EKRA are expected to be similar to those provided in the 2013 Master Plan. It is recommended that new noise contours be produced that align with the runway extension proposed in this Master Plan. Appendix C contains the material presented in the 2013 Master Plan.

3.5. Implementation Plan

Table 15 presents the implementation plan along with the capital expenditure (CAPEX) forecasts for the developments proposed within this Master Plan.

Table 15: Implementation Plan and CAPEX forecasts

Short term (0 – 5 years or until 2021/22)		
Airside Development	**Trigger point**	**CAPEX**
Extend the runway by 601 metres and complete all associated works (e.g., taxiway upgrades, runway lighting) and upgrade Taxiways A, B and C as per the Runway Extension Prefeasibility Study.	Immediate.	$21 million.
Develop private hangars and taxiway access.	Sound market demand identified and a feasibility analysis undertaken.	To be determined by a prefeasibility study.
Landside Development	**Trigger point**	**CAPEX**
Develop a solar farm to feed into the electricity grid of the passenger terminal.	Immediate.	To be determined by a prefeasibility study.
Lay pipework needed to increase the water supply to the airport site and implement measures to eliminate water constraint issues.	Immediate.	To be determined by a prefeasibility study. Investment by stakeholders in addition to SWEK expected.

Acquire the land parcels north of the runway and north-east of the Runway 30 threshold.	Immediate.	Included in the $21 million estimate as part of the runway extension project.
Acquire the land parcel bounded by the Southern Commercial Precinct and Victoria Highway.	Sound market demand for a roadhouse/other relevant activity benefiting from Highway frontage identified. Feasibility analysis undertaken.	To be determined by market prices.
Develop a roadhouse.	Sound market demand identified and land parcel consolidated.	To be determined by a prefeasibility study.
Develop an express freight facility.	Sound market demand identified and a feasibility analysis undertaken.	To be determined by a prefeasibility study.
Medium term (6 – 10 years or until 2026/27)		
Airside Development	**Trigger point**	**CAPEX**
Expand the west GA apron.	East GA apron reaches full capacity and the west GA apron reaches half its capacity.	To be determined by a prefeasibility study.
Terminal/Landside Development	**Trigger point**	**CAPEX**
Expand the terminal (estimated internal area of 2,500 square metres).	Airlines make serious commitments to operate B737-800 aircraft into EKRA.	To be determined by a prefeasibility study/consultation with terminal planners.
Acquire the land parcel south-east of the Runway 30 threshold.	Airlines make serious commitments to operate B737-800 aircraft into EKRA.	To be determined by market prices.
Expand car parking facilities.	Existing car parking facilities reach 80% of their capacity during the terminal busy hour and supplementary opportunities such as use of on-street or temporary parking options have been exhausted. Further, demand management approaches confirm requirement for expansion.	To be determined by a prefeasibility study.
Acquire the land parcel south-west of the runway.	Sound market demand for facilities identified. Feasibility analysis undertaken.	To be determined by market prices.
Develop a reticulated or similar standard sewerage system.	Provision of funding agreement across land owners/developers.	To be determined by a prefeasibility study.

Develop a sewerage system for overnight RPT aircraft and charter aircraft.	There is enough demand to justify the cost of this development.	To be determined by a prefeasibility study.
Upgrade roads.	Sound demand for upgrading identified and a feasibility analysis undertaken.	To be determined by a prefeasibility study.
Long term (10+ years or until 2037/38)		
Airside Development	**Trigger point**	**CAPEX**
Widen runway to 45 metres and complete all associated works.	Regulatory provisions and/or airline operators require runway widening.	$8.8 million + (estimate by GHD).
Partner with operators on development of new fuel facilities in the Southern Aviation Precinct and closer to the west GA apron.	Crossovers of GA aircraft over the RPT apron to the fuelling facilities adjacent to the east GA apron reaches a point that is deemed too high.	Cost may be able to be transferred to operator (e.g., BP or Shell).
Extend Taxiway F to the west.	RPT traffic increases to a point such that extending Taxiway F provides increased convenience than using a runway turn pad.	To be determined by a prefeasibility study.
Extend Taxiway F to the east (and incorporate Taxiway C into the east GA Apron).	Traffic increases to a point such that the crossover of GA aircraft over the RPT apron is not desired.	To be determined by a prefeasibility study.
Terminal/Landside Development	**Trigger point**	**CAPEX**
Further expand the passenger terminal and provide any further parking required.	Capacity of the terminal during airport busy hour reaches 80% and demand management approaches confirm requirement for expansion.	To be determined by a prefeasibility study.
Build a dedicated freight facility within the larger Freight Precinct.	Freight capabilities of the express freight facility reach maximum capacity and the project is financially viable.	To be determined by a prefeasibility study.

Runway Development

The key development proposed is the staged extension of the runway with lengthening in short term and widening to 45 metres in the long term. The widening in particular will require careful investigation to ensure the existing runway remains operational. This could be achieved by reducing the operational runway length and working closely with airline operators to utilise smaller aircraft and weight-restricted flights. This strategy has been used successfully at other Australian regional ports. A case study of the runway extension project of Gladstone Airport is given in Appendix B.

Table 16 outlines the key land needs/concerns and implementation factors involved with the runway expansion project during the 20-year planning horizon.

Table 16: Factors of consideration

Land needs/concerns	• Runway widening will require land acquisition adjacent to the northern airport boundary to place the Illuminated Wind Indicator outside the required 300-metre runway strip. • There are no obvious physical constraints to widening the runway to 45 metres. • There are physical constraints both on the east and the west to extending the runway beyond the proposed 601 metres.
Implementation factors	• Airport closure required to at least large RPT aircraft for between 3-6 months if the runway is widened to 45 metres. • Smaller aircraft could operate at the airport if the widening project was carried out in stages.

4. RECOMMENDATIONS FOR A DETAILED IMPLEMENTATION PLAN

This 2017 Master Plan provides a 20-year planning framework for the development of EKRA based on the current airport situation and operations. This Master Plan is the first stage of the planning and development of the airport. It has identified a number of important airport development projects that need to be defined and assessed in the next phase which is the preparation of a comprehensive implementation plan.

A summary of key airport development projects that have been identified in this Master Plan and key actions regarding them are outlined below:

- Establish a runway development team to oversee the preparation of a construction plan.
- Pursue opportunities to obtain funding for the runway extension project as a matter of priority.
- Engage relevant consultants to prepare an airport utility services development strategy, including a needs analysis, project schedule, project scope and development cost and benefits.
- Work with industry experts to identify steps for marketing and attracting commercial tenants to the airport site.
- Undertake preliminary analysis of a site for the roadhouse and then seek agreements from relevant operators and developers.
- Establish and maintain a long-term financial plan that guides long-term asset management, operations and return from investments.
- Engage the relevant consultants to conduct an environmental survey of the site to identify any environmental constraints.
- Engage relevant consultants to conduct a heritage survey of the site to identify any heritage constraints.
- Engage airspace specialists to produce revised airspace protection surfaces and instrument flight procedures to align with the runway development project proposed.
- Engage relevant consultants to undertake detailed terminal planning.

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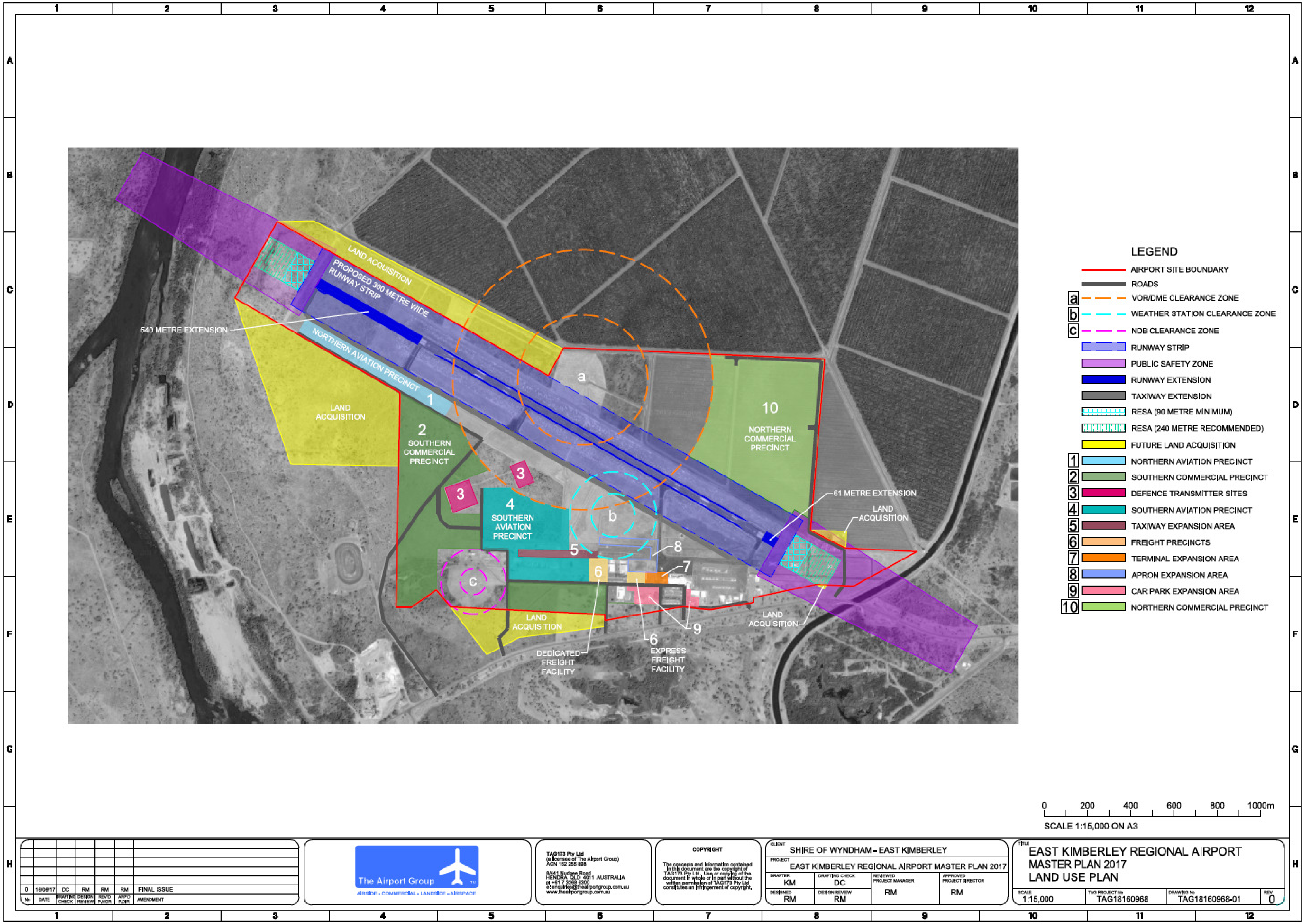
APPENDIX A: LAND USE PLAN


LEGEND
AIRPORT SITE BOUNDARY
ROADS
a VOR/DME CLEARANCE ZONE
b WEATHER STATION CLEARANCE ZONE
c NDB CLEARANCE ZONE
RUNWAY STRIP
PUBLIC SAFETY ZONE
RUNWAY EXTENSION
TAXIWAY EXTENSION
RESA (90 METRE MINIMUM)
RESA (240 METRE RECOMMENDED)
FUTURE LAND ACQUISITION
1 NORTHERN AVIATION PRECINCT
2 SOUTHERN COMMERCIAL PRECINCT
3 DEFENCE TRANSMITTER SITES
4 SOUTHERN AVIATION PRECINCT
5 TAXIWAY EXPANSION AREA
6 FREIGHT PRECINCTS
7 TERMINAL EXPANSION AREA
8 APRON EXPANSION AREA
9 CAR PARK EXPANSION AREA
10 NORTHERN COMMERCIAL PRECINCT
LAND ACQUISITION
PROPOSED 300 METRE WIDE RUNWAY STRIP
540 METRE EXTENSION
NORTHERN AVIATION PRECINCT
2 SOUTHERN COMMERCIAL PRECINCT
10 NORTHERN COMMERCIAL PRECINCT
4 SOUTHERN AVIATION PRECINCT
61 METRE EXTENSION
DEDICATED FREIGHT FACILITY
EXPRESS FREIGHT FACILITY
0 200 400 600 800 1000m
SCALE 1:15,000 ON A3
0 16/06/17 DC RM RM RM FINAL ISSUE
No DATE DRAFTING CHECK DESIGN REVIEW REVD P.MGR APPD P.DIR AMENDMENT
The Airport Group
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TAG173 Pty Ltd
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CLIENT SHIRE OF WYNDHAM - EAST KIMBERLEY
PROJECT EAST KIMBERLEY REGIONAL AIRPORT MASTER PLAN 2017
DRAFTER KM
DRAFTING CHECK DC
DESIGNED RM
DESIGN REVIEW RM
REVIEWED PROJECT MANAGER RM
APPROVED PROJECT DIRECTOR RM
TITLE EAST KIMBERLEY REGIONAL AIRPORT
MASTER PLAN 2017
LAND USE PLAN
SCALE 1:15,000
TAG PROJECT No TAG18160968
DRAWING No TAG18160968-01
REV 0

APPENDIX B: CASE STUDIES

Solar Farm at Alice Springs Airport

Alice Springs Airport was the first airport in Australia to implement a solar farm that fed into its internal electricity grid. The system began operating in 2010 and initially produced 235 kilowatts of power, supplying a quarter or the airport's electricity requirements (Alice Springs Airport, 2010). Following recent upgrades, the solar farm currently produces more than 600 kilowatts annually and is able to meet at least 50% of its energy needs (Alice Springs Airport, 2014). The most recent expansion combines premium parking with renewable energy. It involves 996 panels mounted onto steel structures to create shaded parking bays whilst producing energy.

Solar Farm at Darwin International Airport

In 2016, Darwin International Airport completed stage 1 of their Solar Project with a new 4 megawatt photovoltaic solar array. This is the largest airside solar system in the world. The system comprises of 15,000 solar panels spanning an area of 6 hectares. The amount of electricity the system is expected to produce will be equivalent to the power requirements of 1,000 households. The solar system has been predicted to satisfy nearly all of the airport's peak energy demand in the middle of the day and produce 25% of the airport's overall energy needs (Darwin International Airport, 2016).

Gladstone Airport Runway Extension

Background

• The runway at Gladstone Airport was suffering considerable pavement failures as a result of the heavier Q400 aircraft operations, which were introduced in April 2006 to accommodate increasing passenger numbers.

• Growth in passenger numbers from 2004 to 2008 was calculated at 44.2 percent and it was forecasted that passenger numbers would increase significantly in the future due to growth in tourism and industrial development.

• Consideration was given to the fact that medical air evacuations occurred through Gladstone Airport on an average of every 36 hours.

Upgrade Plans

• The preferred plan of the Council was to utilise the parallel taxiway as a temporary runway while completing construction works on the main runway. However, this plan was not approved by CASA.

• The second option of the Council was to reconstruct and extend the runway in sections while it remained open for operation. This was the only viable option.

The total capital expenditure (CAPEX) was $65m.

Works

In May 2009 reconstruction of the Gladstone Airport runway commenced. The reconstruction project took approximately 15 months. The runway reconstruction was undertaken in four distinct stages, to allow the project to be undertaken whilst the runway remained operational throughout the project. A minimum runway length of 1000 metres was provided.

The project was complex and included the following works:

- A significant hydraulic structure to allow for the extension of the runway across Briffney Creek;
- Diversion of Callemondah Drive with a bridge crossing of the main northern railway line, also to accommodate the extension.
- Reconstruction of the aircraft apron adjacent to the terminal building;
- A major leveling of the runway; and
- Approximately 400,000 m^3 of fill material was required for the project.

Project Staging

Stage 1A

- Construction ran from May to August 2009
- Operational runway length was approximately 1400 metres

Stage 2A

- Critical stage involving night construction
- 4 to 6 weeks of night work (7pm to 7am)
- Aircraft were only able to operate during the day
- Operational runway length was approximately 1000 metres

Stage 2B

- Construction ran from mid-August to September 2009
- Operational runway length was approximately 1000 metres
- Qantaslink operated Dash 8-200 aircraft

Stage 3

- Construction ran from September 2009 to March 2010
- Operational runway length was approximately 1300 metres – 1500 metres

Stage 4

- Construction ran from March to June 2010
- Operational runway length was approximately 1500 metres

These four stages are shown in Figure 21.

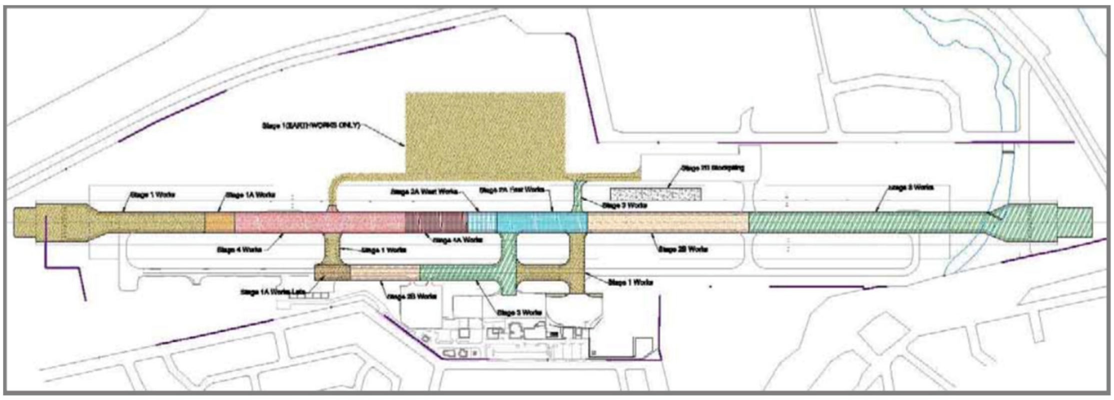


Figure 21: Project staging - Gladstone Airport runway development project

APPENDIX C: AIRSPACE & AIRCRAFT NOISE (EXTRACTS FROM THE 2013 MASTER PLAN)

6.0 AIRSPACE

6.1 SURROUNDING TERRAIN

The airport elevation is approximately 44 metres (145 feet) AHD. The airport site is relatively flat. The elevation at the threshold of Runway 12 is 43 metres and at Runway 30 threshold it is 44 metres.

The terrain surrounding the airport site penetrates the existing Obstacle Limitation Surfaces (OLS) at several locations. To the northeast, approximately 3.5 kilometres from the airport, the inner horizontal and conical obstacle limitation surfaces (See **Section 6.2**) are penetrated by a ridge. Kelly's Knob is a significant feature of this section of the terrain at approximately 148 metres AHD, located within the inner horizontal. A hazard beacon is located on top of Kelly's Knob.

To the south east, approximately 6 kilometres from the airport, another ridge running approximately north south along the eastern edge of the Ord River penetrates the conical surface. Approximately, 3.4 kilometres to the west of the airport, terrain also penetrates both the inner horizontal and conical OLS surfaces. A lit mast is located within this area at a height of 112 metres.

As well as the two lit masts mentioned above there is also one located approximately 3.2 kilometres from the aerodrome to the north east, at a height of 132 metres.

6.2 OBSTACLE LIMITATION SURFACES

Obstacles on or in the vicinity of an airport, whether natural features or man-made structures, may prevent its optimal utilisation by aircraft through:

- Reducing the runway distances available for take-off or landing;
- Reducing the authorised take-off and landing weights for some aircraft;
- Restricting certain types of aircraft; and/or
- Limiting the range of weather conditions in which aircraft can operate.

The shape and dimensions of the OLS for an airport are determined on a case by case basis and needs to be assessed by CASA to determine its operational impact. No structure located on airport should be allowed to exceed the vertical limits of the OLS unless required to do so to serve its operational purpose.

6.2.1 EXISTING OLS

Runway 12/30 is a Code 3 non-precision instrument runway with a width of 30 metres within a 150 metre wide runway strip. Obstacle limitation surfaces protect take-off and landing and visual circling for this runway. The existing OLS applicable to current operations at EKRA is shown in **Drawing B11337A006** in **Appendix B**.

As mentioned in **Section 6.1** the inner horizontal and conical surfaces are penetrated by terrain in a number of locations as well as the lit masts located at the following locations and with the following heights, as included within the AIP ERSA:

- 195 metres (639 feet), 65 degrees and 4000 metres from the ARP;
- 132 metres (433 feet), 57 degrees and 3200 metres from the ARP; and
- 112 metres (368 feet), 265 degrees and 3400 metres from the ARP.

6.2.2 FUTURE OLS

With respect to the future OLS, both runway options, including the extension of the existing and the construction of a new runway, will be very similar in terms of the impact of the OLS as they are both on the same alignment and the new runway centreline is located just 105 metres from the existing runway. However, provision is made for the development of Runway Option 1 with respect to the OLS. Therefore provision has been made for an extension to Runway 12/30, with a total length of 2,350 metres capable of accommodating Code 4 precision approach operations. The future OLS is shown in **B11337A007** in **Appendix B**. Once a runway option has been selected the future OLS may need to be revisited.

The existing structure currently located approximately 315m southeast of the existing Runway 30 threshold will penetrate the approach and take-off climb surfaces of both runway options. This structure will require removal to allow the development of either of the runway options. The areas beneath the approach and take-off climb surfaces, as indicated on **Drawing B11337A007**, are proposed remain development free to protect the OLS surfaces within this area.

The terrain that currently penetrates the inner horizontal and conical surface to the north east, south east and west of the airport will continue to do so, however, these penetrations are not likely to unduly effect operations by the anticipated larger aircraft including the B737-800 or A320-200.

6.3 INSTRUMENT PROCEDURES

6.3.1 EXISTING PROCEDURES

Current published instrument approach procedures for Kununurra include Distance Measuring Equipment (DME) or Global Positioning System (GPS) Arrivals; a VHF Omni-directional Range (VOR) approach to runway 30; a VOR or Non-Directional Beacon (NDB) approach to circling minima; and Area Navigation (RNAV) non-precision runway approaches based on the Global Navigation Satellite System (GNSS). Published approach minimum descent altitudes (MDA) may be reduced by 100 feet if an accurate altimeter setting is available. The published approach procedures are authorised for use by category A, B C and D aircraft except for the NDB-A or VOR-A procedure and the DME of GPS Arrival procedures which are not available to category D aircraft.

DME or GPS Arrivals are published for inbound tracks of 209 degrees magnetic from waypoint JULUP and Darwin, 070 degrees magnetic from Gibb River, and 113 degrees magnetic from Wyndham. These procedures provide the approach minima set out in **Table 7**.

Table 7: Existing Procedure Approach Minima

Arrival Track	Minima Cat A & B		Minima Cat C	
	MDA (ft)	Visibility (km)	MDA (ft)	Visibility (km)
209 °M JULUP – Kununurra	1260	2.4	1290	4.0
070 °M Gibb River – Kununurra	1720	2.4	1720	4.0
113 °M Wyndham – Kununurra	1570	2.4	1570	4.0

Two sectors are also published for DME or GPS arrival procedures. The northern sector includes inbound tracks from the north of Kununurra between 110 degrees magnetic clockwise to 290 degrees magnetic, while the southern sector covers inbound tracks south of Kununurra from 290 degrees magnetic clockwise to 110 degrees magnetic. Circling MDA for both sectors is 1,850 feet and minimum visibility 2.4 kilometres for category A and B aircraft, and 1,850 feet and 4 kilometres for category C aircraft.

The VOR RWY 30 procedure provides a straight-in approach to runway 30 with MDA 750 feet and 3.4 kilometres visibility for category A, B, C and D aircraft.

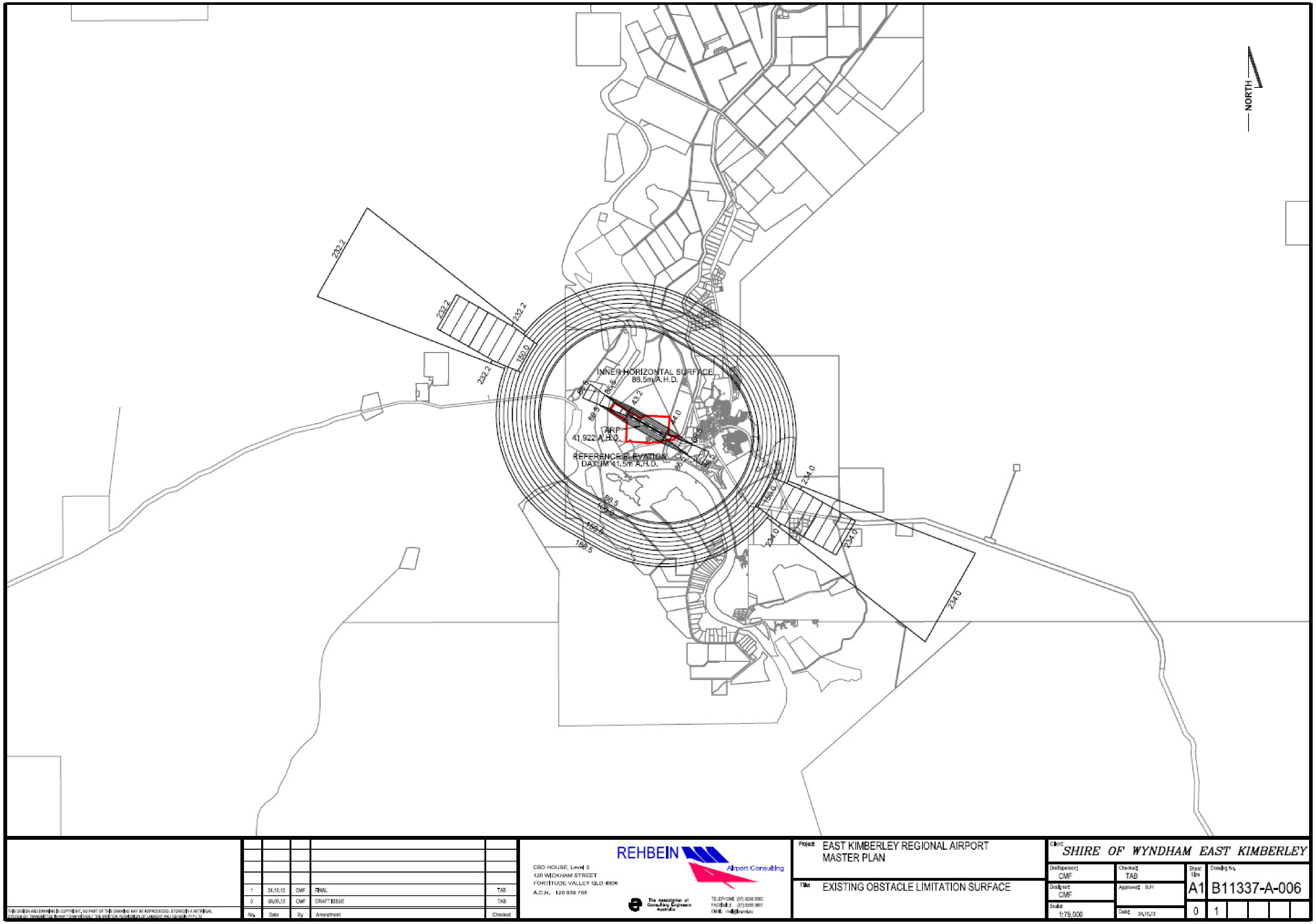
The Non-Directional Beacon (NDB) – A or VOR-A approach procedure provides for descent to circling minima of 1190 feet and 2.4 km visibility for category A and B aircraft; and 1290 feet and 4.0 km visibility for category C aircraft.

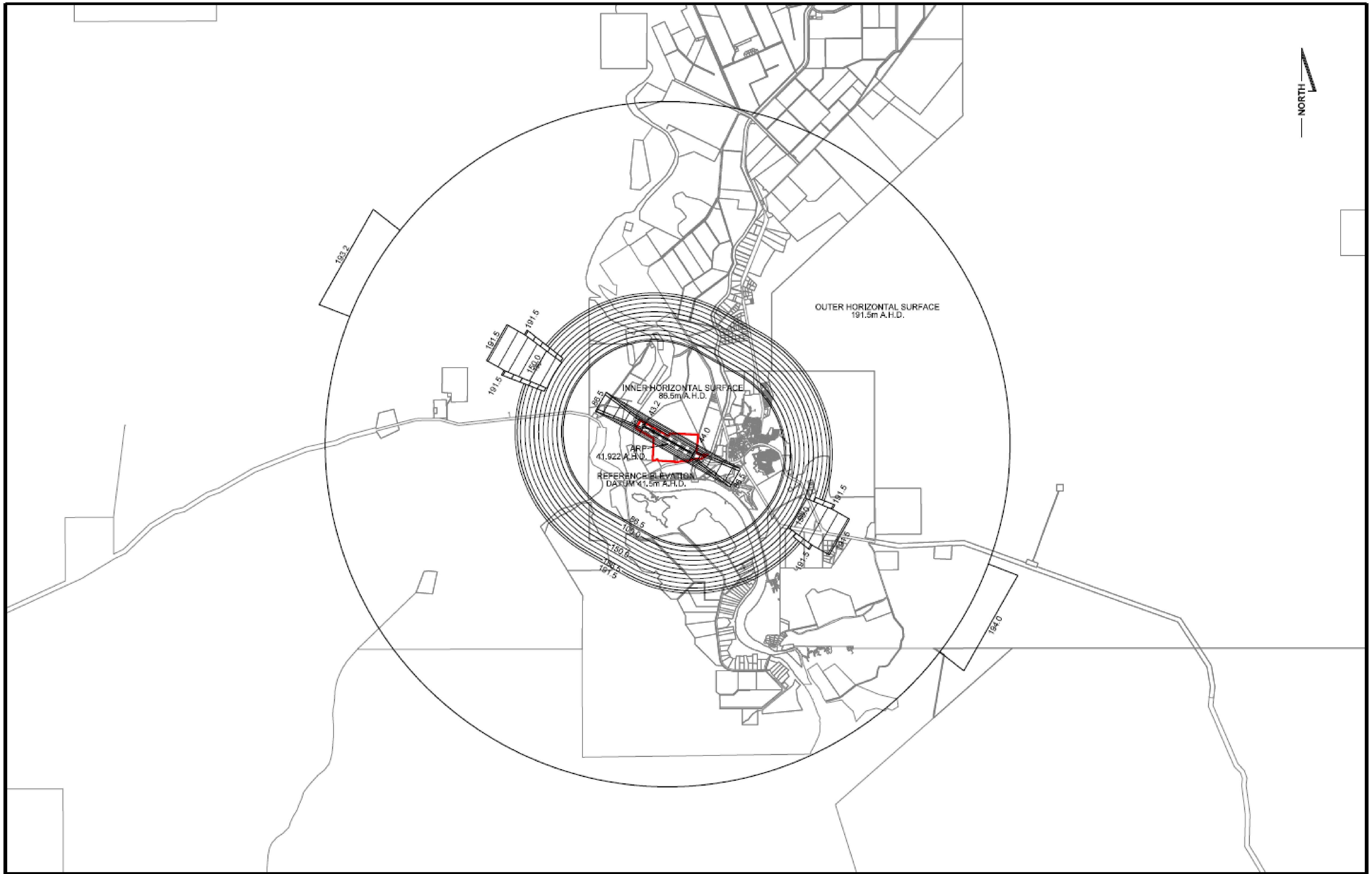
The RNAV (GNSS) RWY 12 and 30 procedures provide a straight-in approach MDA of 750 feet with minimum visibility 3.4 km for category A and B aircraft, 4.0 km for category C aircraft and 5.0 km for category D aircraft.

The published approach procedures are adequate for transient weather conditions such as the passage of frontal weather where cloud ceiling and visibility are reduced for relatively short periods. However, the operational benefit of these procedures is limited where reduced ceiling and visibility conditions persist for longer periods.

6.3.2 FUTURE PROCEDURES

No specific allowance has been made within this Master Plan for the development of new instrument procedures. However, extension of the existing runway or the construction of a new parallel runway will require review or redesign of all published instrument approach procedures. In order to ensure that future development in the vicinity of the airport does not introduce unacceptable constraints on future instrument procedures that may include precision approaches, it is recommended that suitable future PANS-OPS (Procedures for Air Navigation Services - Aircraft Operations protection surfaces) be developed. Proposed developments can then be reviewed against these surfaces as well as the OLS to ensure future airport operations remain protected.


NORTH
INNER HORIZONTAL SURFACE
86.5m A.H.D.
ARP
41.922 A.H.D.
REFERENCE ELEVATION
DATUM 41.5m A.H.D.
232.2
232.2
232.2
232.2
150.0
234.0
234.0
234.0
234.0
150.0
86.5
43.2
86.5
156.5
REHBEIN
Airport Consulting
CBD HOUSE, Level 3
120 WICKHAM STREET
FORTITUDE VALLEY QLD 4006
A.C.N. 120 939 768
Project EAST KIMBERLEY REGIONAL AIRPORT
MASTER PLAN
Title EXISTING OBSTACLE LIMITATION SURFACE
Client SHIRE OF WYNDHAM EAST KIMBERLEY
Draftsperson: CMF
Checked: TAB
Designer: CMF
Approved: BJH
Scale 1:75,000
Date 24.10.12
Sheet Size A1
Drawing No. B11337-A-006
1 24.10.12 CMF FINAL TAB
0 08.06.12 CMF DRAFT ISSUE TAB
No. Date By Amendment Checked



No.	Date	By	Amendment	Checked
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0	08.06.12	CMF	DRAFT ISSUE	TAB

REHBEIN Airport Consulting
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Project: EAST KIMBERLEY REGIONAL AIRPORT MASTER PLAN

Title: FUTURE OBSTACLE LIMITATION SURFACE

Client: SHIRE OF WYNDHAM EAST KIMBERLEY

Draftsperson: CMF | Checked: TAB | Designer: CMF | Approved: BJH | Scale: 1:75,000 | Date: 24.10.12 | Sheet Size: A1 | Drawing No. B11337-A-007 | Rev: 0 1

7.0 AIRCRAFT NOISE

The consideration of the impact of aircraft noise is an important factor in the development of individual Airport Master Plans. An understanding of the noise impact on land adjoining the airport provides valuable information to local government authorities for planning of adjacent land uses. A thorough understanding of both existing and future noise impacts from airport operations is essential to the development of compatible land use zoning in planning schemes around airports. It is also important for the general public to be able to understand possible future noise impacts in a wider sense, to assist individuals in making their own assessment for their acceptability.

The provision, in this section of the Master Plan, of information on projected noise impacts for EKRA, is intended to enable Council to make informed decisions for the development and implementation of future Airport Master Plans and Local Environmental Plans to ensure that:

- Sensitive receptors are located in areas of acceptable aircraft noise;
- The amenity of other surrounding developments is not adversely affected by aircraft noise; and
- Airport operations are protected, in the long-term, from stakeholder conflicts due to the encroachment of inappropriate development into noise affected zones.

7.1 THE ANEF SYSTEM

The principal means of assessment of potential aircraft noise exposure at a given site in Australia is based on the Australian Noise Exposure Forecast (ANEF) system. The ANEF system was developed in the early 1980s based on a social survey of the reaction of people around several Australian airports to noise from aircraft. The ANEF combines the effects of the intensity, duration and number of noise events as well as incorporating a penalty for events at night which is illustrated by contours.

The ANEF is intended to be used to guide the long-term decisions of land-use planners about types of compatible development in areas that may be subject to significant levels of aircraft noise in the future. Additionally, the ANEF system is the basis of *Australian Standard AS 2021-2000 Acoustics – Aircraft noise intrusion – Building siting and construction* (AS2021-2000) which provides guidance on the protection of new buildings against aircraft noise intrusion and on the acoustical adequacy of existing buildings in areas near aerodromes.

Although the ANEF system is considered suitable for land-use planning purposes it is not without limitations. The ANEF system is a 'one size fits all' approach to land use planning. The ANEF criteria for acceptable land use are the same whether the land is in the vicinity of a major international airport or a small regional aerodrome without jet aircraft. The system does not take into consideration local conditions, for example an airport on a Greenfield site is treated as one which has already been developed.

The ANEF is a complex metric which combines the effects of loudness, duration and frequency of noise events to develop a measure of the cumulative noise dose. Although a technically complete measure of noise impacts, it does not illustrate noise in a way to which the non-expert can easily relate. Nevertheless, the ANEF remains the only aircraft noise metric for which land use planning guidelines and requirements (as set out in AS2021:2000) have been developed .

7.2 NOISE MODELLING SOFTWARE

7.2.1 INTEGRATED NOISE MODEL

The ANEF noise contours for EKRA were prepared using the Integrated Noise Model (INM) version 7.0(b). The INM software has been developed and progressively refined by the United States Federal Aviation Administration to enable the estimation of noise impacts around airports resulting from aircraft operations.

The INM calculates noise impacts by applying standard or user defined aircraft flight profiles, performance data and noise curves to the specific runway configuration and flight tracks. Under the ANEF system, the time of day at which operations take place is also factored into the noise computation. This allows for varying sensitivity in people's reaction to noise.

In interpreting the output of the model it should be noted that:

- Aircraft movements are allocated as a day or night operation, defined as being the hours between 7.00 am to 7.00 pm and 7.00 pm to 7.00 am respectively;
- The number of approach and departure operations modelled relate directly to the actual number of approach and departure movements; and
- The INM requires touch and go (TGO) training to be modelled as a circuit, the initial take-off coupled with the final landing, in conjunction with a number of TGO operations (i.e. each INM circuit or TGO corresponds to two aircraft movements).

The model has been constructed to produce the Australian Noise Exposure Forecast (ANEF) metric defined in AS2021:2000.

INM only considers noise from aircraft taking off, landing and in-flight. Ground-based noise, such as that from taxiing aircraft or engine run-ups or that from ground vehicles or equipment is not included in the model, and therefore cannot be represented in the ANEF. Individual developments which have the potential to generate significant ground-based noise, such as engine run-up facilities or the development of a new RPT terminal and apron, should incorporate further, more detailed, studies to provide an assessment of the noise impacts of these proposals. Airport operational matters influencing noise from ground-based sources should be managed in consultation with local residents through a community consultation strategy.

7.2.2 TNIP

The Transparent Noise Information Package (TNIP) has been produced by the Department of Infrastructure, Transport, Regional Development and Local Government (DITRDLG) to enable aircraft noise disclosure information to be rapidly produced for individual airports. The software takes data outputs from INM (discussed in **Section 7.2.1**) to produce a range of flight path and aircraft movement based noise descriptors or to produce and manipulate conventional noise contours. The 'Number Above' noise contours are produced using TNIP.

7.3 AUSTRALIAN NOISE EXPOSURE FORECAST

The ANEF is a contour map based on forecast aircraft movements and is the only contour map under the ANEF system which is intended to have status in land-use planning decisions.

The ANEF has been prepared based on the forecast number of movements to 2036-37 as presented in **Section 4.2.2**. Overall, the 2036-37 forecast has been estimated to reach approximately 50,000 movements per annum.

As it is currently unknown which runway development option will be selected a composite ANEF has been developed, in agreement with Airservices Australia, to represent a worst case scenario. To develop the composite ANEF noise contours for the longer Runway Option 2 were produced and then duplicated for Runway Option 1. Both were then merged together.

The EKRA ANEF contours developed as part of this Master Plan and shown in **Drawing B11337A008** included at **Appendix B**. The EKRA 2036-37 composite ANEF noise contours were endorsed for technical accuracy by Airservices Australia in the manner of endorsement approved by the Minister for Infrastructure, Transport, Regional Development and Local Government on the 20 December 2012.

The ANEF shows the significant contours including the 20, 25 and 30 ANEF. In terms of the ANEF contours that are significant under AS2021-2000:

- The 30 ANEF contour extends beyond the airport boundary in the following places:
  - To the south and south east, largely over land that is proposed to be acquired by this Master Plan for airport use;
  - To the north over agricultural land which is currently uninhabited; and
  - To the northwest, over a small southerly corner of a section of land identified for rural residential development in the Kununurra Strategic Directions (KSD) plan.
- The 25 ANEF contour extends beyond the airport boundary in the following places:
  - To the south and southwest, largely over land that is proposed to be acquired by this Master Plan for airport use;
  - The south easterly tip of the contour extends beyond the main irrigation channel and slightly onto land that is currently occupied by the existing waste water treatment plant and identified for mixed business and future urban development in the KSD plan;
  - The contour also extends beyond the airport boundary to the north of the runway over currently uninhabited land;

  - To the northwest over a small southerly corner of a section of land identified for rural residential development in the Kununurra Strategic Directions (KSD) plan; and
  - To the west, the contour also extends beyond the airport boundary over foreshore reserve land and the Ord River itself.
- The 20 ANEF contour extends beyond the airport boundary in the following places:
  - To the south of the airport over land on the south of the highway, over the existing golf course and further to the east over land which accommodates an existing bore field, and is identified for potential tourism/residential purposes in the KSD plan;
  - To the east, beyond the main irrigation channel and onto land that is currently occupied by the existing waste water treatment plant and identified for mixed business and future urban development in the KSD plan;
  - To the north over currently uninhabited land;
  - To the northwest (but east of the Ord River) over land that is proposed as rural residential development and foreshore reserve in the KSD plan; and
  - To the west over currently uninhabited land on the west side of the river which is also proposed as rural residential development in the Kununurra Future Directions plan.

AS2021-2000 classifies the construction of residential development between 25 and 30 ANEF to be unacceptable, however, the development of hotels, motels and other short-term residential facilities are classified as conditionally acceptable. For construction of new residential developments between 20 and 25 ANEF, AS2021-2000 classifies it as conditionally acceptable, however some people may find that this land is not compatible with residential or educational uses. 'Conditionally Acceptable' means that the relevant aircraft and the required noise reduction should be determined and the aircraft noise attenuation to be expected from the proposed construction should be in accordance with the construction guidelines set out in the document.

Council should incorporate the ANEF contours into their local planning scheme to ensure future development is aligned with airport's forecast development.

7.4 N60 AND N70 CONTOURS

The ANEF system is generally recognised as being the most technically complete description of aircraft noise in use in the Australian context and the ANEF is the only metric recognised under AS2021:2000. However, it is also widely recognised that the ANEF system is not easily translated into the important factors which affect how individuals react to aircraft noise: the number of over flights and the loudness of individual events. This is due to the way the ANEF combines the effects of loudness, duration and frequency of noise events to develop a measure of the cumulative noise dose.

'Number above', or 'N', contours illustrate the average number of events per day louder than a certain sound level. In the case of the N60, this level is 60 Db(A). The single event level of 60

Db(A) is specified in Australian Standard AS2021:2000 as the indoor design sound level for normal domestic areas in dwellings and 70 Db(A) is the noise level at which conversation is disturbed within a house with the windows open.

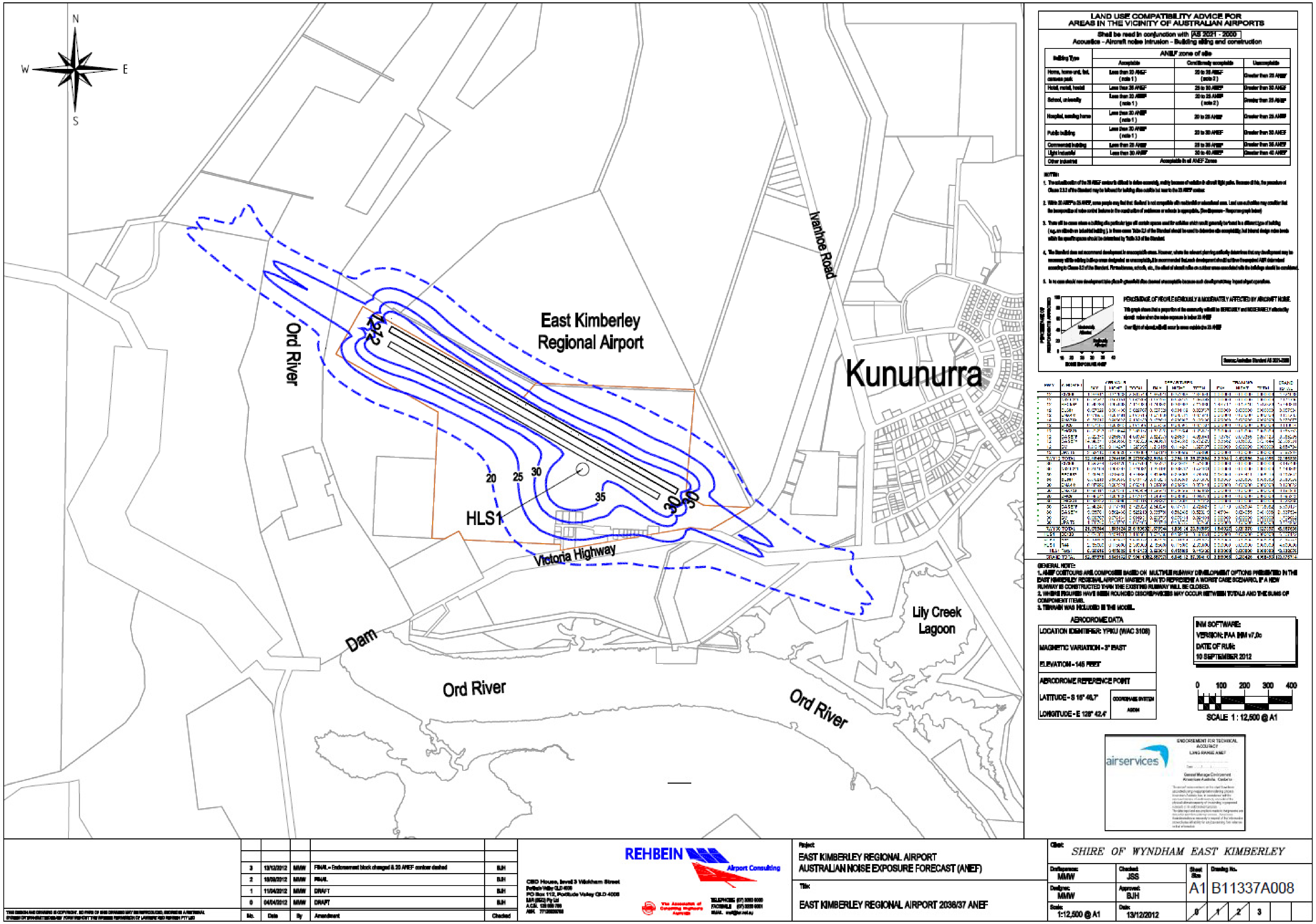
Contours such as the N60s and N70s assist the community to better understand the impacts of aircraft noise by giving individuals the ability to interpret aircraft noise based on actual counts of aircraft with a noise profile greater than a certain level over a range of flight paths. The provision of 'Number Above' contours has been recently recommended by Department of Infrastructure, Transport, Regional Development and Local Government (previously the Department of Transport and Regional Services) in a discussion paper entitled *Guidance Material for Selecting and Providing Aircraft Noise Information*.

The Western Australia Environmental Protection Agency recognises this and 'number above' noise contours (N60 and N70 contours) are generally requested by them in relation to any potential rezoning of surrounding land. They have also proven to be a good way to produce a 'whole of airport' picture of single event aircraft noise patterns which is easy for the general public to understand.

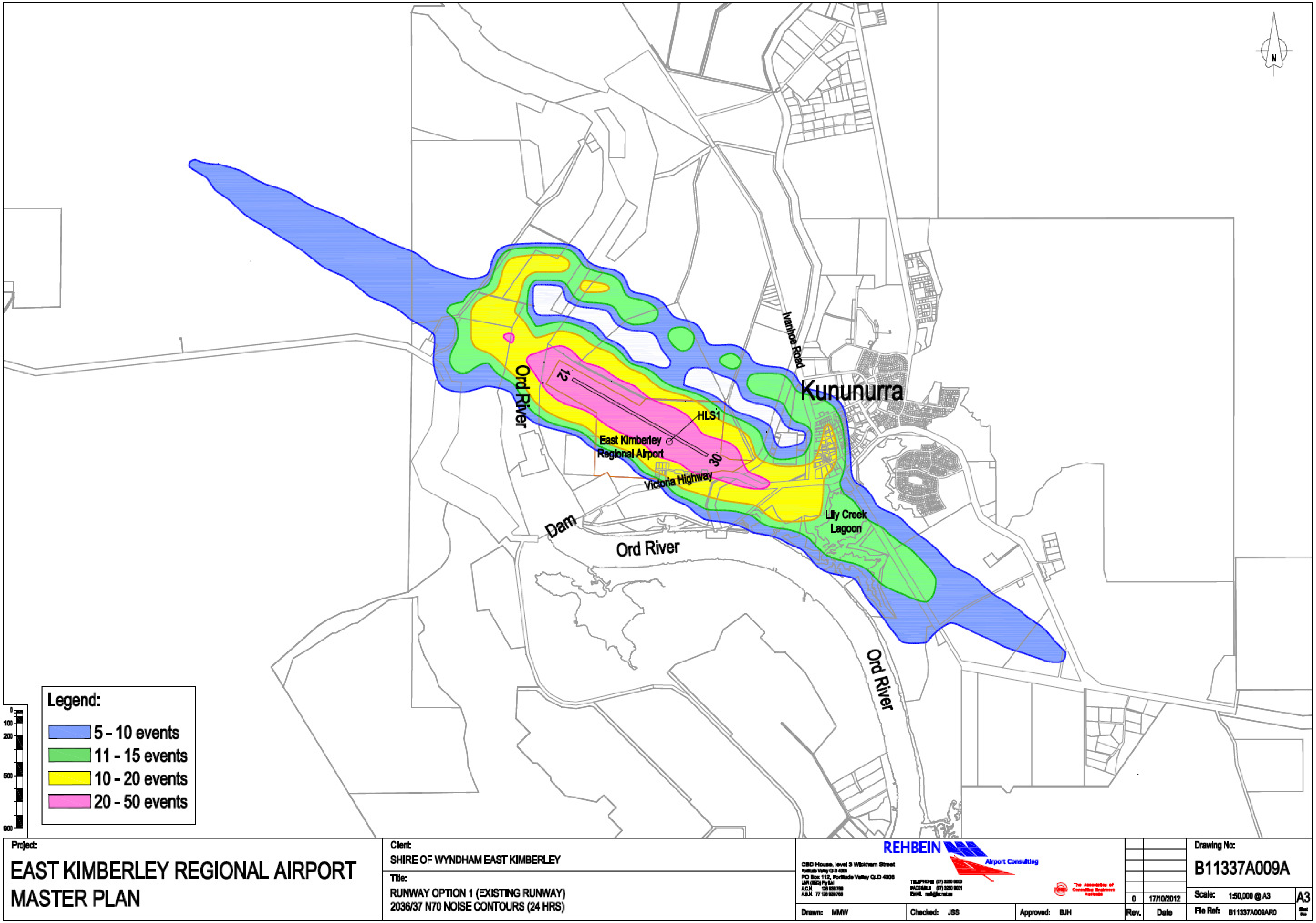
N70 and N60 maps for EKRA have therefore been produced based on the 2036/37 forecast traffic, as set out in **Section 4.2.2** and both Runway Option 1 and Runway Option 2. N70 noise contour maps for Runway Option 1 and Runway Option 2 are shown in **Drawing B11337A009A** and **Drawing B11337A009B** included in **Appendix B** respectively. N60 noise contour maps for Runway Option 1 and Runway Option 2 are shown in **Drawing B11337A010A** and **Drawing B11337A010B** included in **Appendix B** respectively.

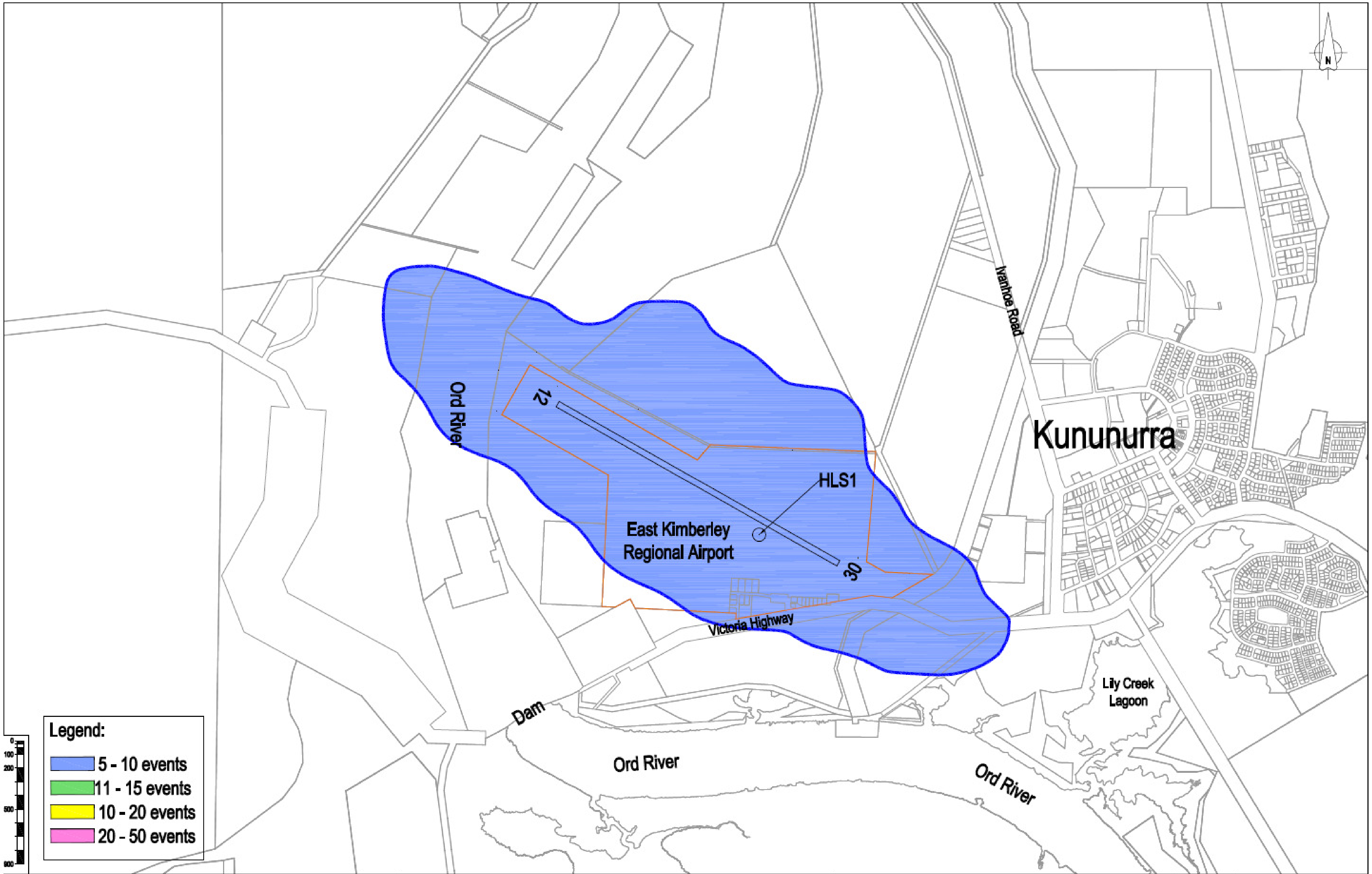
Drawing B11337A009A and **Drawing B11337A009B** show that areas outside of the airport boundary are expected to experience up to 20 events over 70 Db(A) on an average day (over 24 hours). The majority of this land is currently undeveloped and uninhabited with the exception of an area of the western side of Kununurra town centre which is largely occupied by commercial development. The KSD plan however, proposes a range of land uses for this area including potential residential, medium-density residential, tourism and mixed business. Some consideration should be given to this development in relation to this contour plan.

The single contours on **Drawing B11337A010A** and **Drawing B11337A010B** show that the area within each contour, immediately surrounding EKRA, is expected to experience 5 events of 60 Db(A) or greater during an average night (19:00 – 07:00). This area is currently largely undeveloped and unpopulated land, however, the KSD plan proposes a range of land uses including, rural residential and tourism-related which should be given some consideration in relation to this contour.



East Kimberley Regional Airport
Kununurra
Ord River
Ivanhoe Road
Victoria Highway
HLS1
Dam
Lily Creek Lagoon
20
25
30
35
LAND USE COMPATIBILITY ADVICE FOR AREAS IN THE VICINITY OF AUSTRALIAN AIRPORTS
AERODROME DATA
LOCATION IDENTIFIER: YPKU (WAC 3108)
MAGNETIC VARIATION - 3° EAST
ELEVATION - 145 FEET
AERODROME REFERENCE POINT
INM SOFTWARE:
VERSION: FAA INM v7.0c
DATE OF RUN:
10 SEPTEMBER 2012
SCALE 1 : 12,500 @ A1
airservices
REHBEIN Airport Consulting
EAST KIMBERLEY REGIONAL AIRPORT
AUSTRALIAN NOISE EXPOSURE FORECAST (ANEF)
EAST KIMBERLEY REGIONAL AIRPORT 2036/37 ANEF
SHIRE OF WYNDHAM EAST KIMBERLEY
A1 B11337A008


N
Kununurra
Ivanhoe Road
Ord River
12
30
HLS1
East Kimberley Regional Airport
Victoria Highway
Dam
Ord River
Lily Creek Lagoon
Ord River
Legend:
5 - 10 events
11 - 15 events
10 - 20 events
20 - 50 events
0
100
200
500
900
Project:
EAST KIMBERLEY REGIONAL AIRPORT MASTER PLAN
Client:
SHIRE OF WYNDHAM EAST KIMBERLEY
Title:
RUNWAY OPTION 1 (EXISTING RUNWAY)
2036/37 N70 NOISE CONTOURS (24 HRS)
REHBEIN
Airport Consulting
Drawn: MMW
Checked: JSS
Approved: BJH
0
17/10/2012
Rev.
Date
Drawing No:
B11337A009A
Scale: 1:50,000 @ A3
A3
File Ref: B11337A009AR0



Project: EAST KIMBERLEY REGIONAL AIRPORT MASTER PLAN

Client: SHIRE OF WYNDHAM EAST KIMBERLEY

Title: RUNWAY OPTION 1 (EXISTING RUNWAY)
2036/37 N60 NOISE CONTOURS (19:00 - 07:00)

REHBEIN Airport Consulting

Drawn: MMW | Checked: JSS | Approved: BJH

Rev. 0 | Date 17/10/2012

Drawing No: B11337A010A

Scale: 1:25,000 @ A3 | A3

File Ref: B11337A010AR0