Central Coast Council

Ordinary Council Meeting

Attachments

Part 2 of 3

Monday, 27 November, 2017

Central Coast Council

Attachments to the

Ordinary Council Meeting

to be held in the Council Chamber,
2 Hely Street, Wyong
on Monday, 27 November 2017,
commencing at 6.30pm

Index

General Reports

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Central Coast Aviation Hub

Central Coast Airspace and Obstacle Limitation Surface (OLS) Assessment

CPA/291965

Aviation Consultants

to70

Central Coast Aviation Hub

Airspace and Obstacle Limitation Surface (OLS) Assessment

CPA/291965

Report

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Brisbane, November 2017

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Executive Summary

This report provides an analysis and evaluation of the current and prospective airspace design for Central Coast Aviation Hub (CCAH). This executive summary provides a brief consolidation of the findings drawn from our data gathering and assessment methodology described in Section 2 Methodology and Results.

Based on the airport configuration provided by the Central Coast Council (Council), we have developed a desktop model of the airspace configuration surrounding CCAH in 2024.

In relation to flight paths in 2024 and beyond and the confines of the existing civil airspace between Williamtown and Sydney/Bankstown, aircraft operated under visual flight rules (VFR) are not expected to change their tracking significantly by 2024. The commencement of operations at Western Sydney Airport (WSA) is not anticipated to alter visual tracking routes beyond 25 nm north of the airport and flight paths for aircraft operating under instrument flight rules (IFR) are not expected to significantly change as a result of clear direction in the WSA Airport Plan.

Results of the analysis indicate that Code 3C aircraft operations[1] at the proposed airport would not have any significant constraints relating to current airspace volume design, or existing routes.

The proximity of high density operations to the south within the Sydney Terminal Area (TMA) and to the west, north and east within military restricted areas will result in some delay to operations due to the expected higher priority of Sydney and Williamtown operations.

The orientation of Runway 02/20 aligns with prevailing weather conditions and is in accordance with the existing air traffic flows of the Central Coast area. The runway orientation facilitates integration with existing flight paths.

Changes proposed by a CASA review of Williamtown restricted areas are not likely to change the current level of equitable access to that airspace for VFR operations. The CASA review recommends some changes to airspace classification to accommodate civil IFR operations into the Newcastle Airport, but this is not expected to alter the accessibility of the airspace for users.

In relation to flight operations at CCAH, helicopter and fixed with flying training activities at CCAH are expected to continue current practice of conducting training over Tuggerah Lake. This location is well segregated approximately 3.5nm east of the aerodrome and would have minimal impact on passenger operations arriving and departing, due to the expected segregation of these flight paths.

Runway crossings by helicopters departing a Helicopter Landing Site (HLS) positioned southwest of Runway 02/20 to access the eastern training area over Tuggerah Lake may generate minor delays to the helicopter activity.

[1] Generally, these are regional jet and turbo-prop aircraft

Corporate and commercial helicopter services arriving and departing from a HLS positioned southwest of Runway 02/20 are unlikely to interact with IFR operations at CCAH.

To70 investigated the viability of a second parallel runway positioned to the west of runway 02/20 for use in visual conditions for VFR training operations clear of IFR operations. Our assessment of this option, based upon the draft master plan provided is that taxiing training aircraft across the main runway, and the complex circuit tracking are likely to generate more delay and complexity than use of a single runway.

The location and operation of the three functioning power stations in proximity to CCAH were reviewed with CASA and in relation to the instrument flight procedure (PANSOPS) assessment. CASA advises that overflights of the plume rises at Colongra and Vales Point should be avoided. While the plumes are relevant to aircraft overflying them, and their location and effects will be noted on aeronautical maps, CASA notes that Eraring is sufficiently distant from CCAH to be on no relevance to the aerodrome operation. Our draft procedures indicate that safe instrument flight procedures can be designed clear of these plume rises.

Our review of instrument flight procedure options has confirmed that the final approach path procedure offering the best opportunity for IFR aircraft to land in poor weather conditions for CCAH is a RNAV (GNSS) Instrument Flight Procedure (IFP), designed for approach to both ends of the runway. Our PANSOPS surface assessment suggests that aircraft using this procedure will be able to access the aerodrome with cloud bases of as low as 660ft and with inflight visibility of 3.5km. This compares favourably with the RNAV (GNSS) Instrument Flight Procedure approach at Gold Coast which has a minimum of 670ft. (1)

Our assessment of the obstacle limitation surfaces surrounding CCAH indicate that there are some terrain penetrations that may require referral to CASA. No significant intrusions to the designed PANSOPS surfaces including plume rises are expected.

In relation to the provision of Air Traffic Services (ATS) in the vicinity of CCAH, Council provided high side forecasting, CCAH may approach the trigger threshold for a CASA airspace risk assessment by 2025. Low side forecasting suggests the threshold will be approached in 2029. If, at that time, the CASA conducted risk based assessment supports a change, then this may alter the way that ATS are delivered in the airspace surrounding the aerodrome and on the aerodrome. A change from existing Class G airspace to Class D.

Class G services in the vicinity of CCAH are delivered by Airservices Australia from centres in Brisbane, Sydney and Melbourne. Class D services are generally delivered by Airservices at the airport site. Airservices currently delivers a Class D service from a control tower, but is currently reviewing other methods such as remote tower technology. There are other service models that may be explored prior to the introduction of Class D services discussed in the finding section.

In relation to Aviation Rescue and Fire Fighting Services, (ARFFS), our assessment is that CCAH may approach the trigger point of 350,000 annual passengers in 2027 based on high side forecasts and beyond 2030 based on low side. This service is provided by Airservices. Currently the Department of Infrastructure is conducting a policy review of the trigger points for ARFFS establishment. This review still has approximately 18 months to run. The recommendations within may lift the trigger point for the introduction of ARFFS higher than current levels. We recommend that Council continue to monitor traffic levels and review this requirement annually as the airport evolves and grows.

We have developed an OLS surface model for a 1200m Code 3C runway expected to be operational in 2024 which is included below in Annex A: Obstacle Limitation Surface.

We have also included an assessment of PANSOPS surfaces for RNAV (GNSS) approaches to both ends of an 1799m runway based on the existing runway design and orientation as a worst case scenario. It is important to note that the study is based on a 1799m runway length as Council intends the runway to remain as Code 3 classification. Our preliminary assessment of these surfaces is based on Airservices obstacle database data allows the surface to be "stepped down" allowing operations into the airport with a relatively low cloud base.

Based on the data provided by Council, our assessment finds no airspace or terrain obstacles to Code 3C operations at CCAH. At the Airspace change roadmap section below, we provide a simple list of steps to be followed in progressing changes to airspace and flight paths with CASA and Airservices.

1 Introduction

The Council is currently engaging with the General Aviation industry in relation to the possible establishment of an Aviation Hub to provide opportunities for general aviation development

The Council intends to upgrade Warnervale Airport, and re-badge the expanded aerodrome as CCAH. It is expected that over the next decade, CCAH will develop into a general aviation reliever aerodrome for the Sydney general aviation aerodromes. Preliminary master-planning by Council has developed around the concept of facilitating general aviation activity.

Council has engaged To70 to prepare an Obstacle Limitation Surface (OLS) model and airspace assessment to inform the Council's decisions regarding the future development of CCAH.

1.1 Background

Council expects CCAH will develop over the next six years to operate as a general aviation "reliever" aerodrome for Sydney general aviation aerodromes. This aligns with the timeline for the development and opening of Badgerys Creek due west of Bankstown Airport.

Council wishes to confirm that the proposed development of CCAH can safely accommodate expected flying activity within the surrounding aviation environment. At the same time, the Council also seeks to understand the possible effects on the surrounding community of new flight paths flown by commercial aircraft carrying up to 70 passengers.

The proposed future 2024 model of CCAH includes a 1200m non-precision Code 3C runway suitable for non-passenger jet operations.

2 Methodology and Results

To70 prepared a project plan which outlined the tasks, governance, reporting and structural project components which ensured that the project delivered a report that is fit for purpose and achieves its stated objective. The overarching methodology for this study involved the following steps:

1. Data collection
2. Develop a model of the current state of CCAH
3. Develop a model for the planned 2024 Stage 3 aerodrome configuration
4. Recommendations on the feasibility of future aerodrome

2.1 Data gathering

This section details the sources and data used for the study. To70 began by assembling the requisite data to support the assessment process. In order to understand and capture the current and future aerodrome layout, the following information was supplied by the Council:

- Central Coast Aviation Hub Master Plan 2017 draft
- Previous 2006 OLS study
- Drawings of aerodrome layout options for the 1200m runway
- Runway threshold and strip coordinates for the 1200m runway
- Elevation for the runway strip ends
- Warnervale Airport (CCAH) Fly Friendly Procedures document
- CAPA Development Strategy Review for Central Coast Regional Airport

As part of airspace design component of the project the following stakeholders were consulted:

- Civil Aviation Safety Authority (CASA)
- Eraring Power Station
- Vales Point Power Station
- Colongra Power Station
- Airservices Australia (Airservices)

Data Limitations

Assumptions have been made in place where data or information is absent. Notably, the following assumptions have been made regarding future airport development for the OLS and PANS-OPS preparation and assessment:

- Approach threshold elevations to be the same as runway strip ends
- 225m displaced threshold for Runway 20
- Aerodrome refence level to be 7.62m as per stated in En-route Supplement Australia (ERSA)

2.2 Existing model

A model of the existing aerodrome was developed using data and previous studies supplied by Council to capture the current operating landscape of CCAH. This involved carrying out a desktop study to capture

aspects of CCAH such as current flight tracks, airspace conditions, nearby routes, operations, aircraft types operating and interactions with nearby aerodromes. The final model is presented in Section 3.
An airport survey was conducted at CCAH. The survey was conducted on the current runway as well as one based upon a Code 3C non-precision configuration. the results of this survey are shown at Annex B: Airport survey.

2.3 Future Model

Data and assumptions based on the planned 2024 Stage 3 configuration of CCAH were used to develop the future model of CCAH. The model captures predicted airspace and operational aspects of the planned Stage 3 aerodrome configuration and details considerations and constraints for the planned development. The model describes the following aspects, based on the Stage 3 development plan:

- Future Regular Public Transport (RPT) operations and associated requirements
- Aerodrome certification requirements
- Future aircraft mix
- Instrument flight procedures and approaches
- Potential routes and destinations
- Prescribed airspace (i.e. OLS and PANS-OPS)
- Smoke plume stacks constraints

The RPT, future aircraft mix and certification requirements aspects of the model were developed primarily through a desktop study on data and assumptions provided by Council and publicly available information.

Airservices were consulted as part of the planning process for potential future routes and destinations, to develop an understanding of how the planned future operations would fit in the current airspace. In order to ensure the safety of these routes, CASA was also consulted in determining the impacts of nearby smoke plume stacks produced by three power stations identified during the desktop study.

The final stage in developing the model involved preparing an OLS and PANS-OPS assessment for the planned future runway layout of CCAH. The OLS was developed in accordance to CASA's Manual of Standards (MoS) 139 – Aerodromes and MoS 173 – Instrument flight procedure design.

Table 11 - Plume heights

Plume location	Plume height @6.1m/s (feet AGL*)	Plume height @10.6m/s (feet AGL)	Spot Height (feet AGL)
Eraring Power Station	1615	785	657
Vales Point Power Station	1173	653	584
Colongra Power Station	4367	497	511

*Above Ground Level (AGL)

The plume stack locations were also assessed for penetrations into the updated OLS developed for the Stage 3 configuration. Results of the assessment is detailed in Section 4.9.

4.6 Instrument approaches

The Council expects CCAH to be recognised as a CASA certified aerodrome before RPT services commences, as well as accommodate non-precision instrument approaches. Therefore, the aerodrome is required to adopt standards and regulations specified by CASA and Airservices. As CCAH is planned to support RPT services, the aerodrome will be required to operate under all weather conditions and will therefore require instrument approach procedures. This Section reviews the instrument flight procedures options available for CCAH and provides recommendations based on current and proposed rule-sets that align with the Council's future development plan. In particular, the following documents were taken into consideration to determine the type of Instrument Approach Landing Procedure (IAL):

- CASA Manual of Standards (MoS) Part 139 – Aerodromes (11)
- CASA Civil Aviation Safety Regulation 1998 (CASR) part 139 (Aerodromes), part 173 (Instrument Flight Procedure Design) and part 121 (Commercial Air Transport Operations – Airplanes), which is currently under development
- Airservices Aeronautical Information Circulars (AICs)
- CASA Methodology for Validation of Baro-VNAV Instrument Approaches

An IAL involves a series of predetermined manoeuvres for the orderly transfer of an aircraft by reference to night instruments, from the beginning of the initial approach to a landing or to a point from which a landing may be made visually by the pilot. There are three types of IAL which are general based on the level of guidance to an aircraft:

- Precision Approach
- Approach with vertical guidance (APV)
- Non-precision Approach (NPA)

A Precision Approach procedure generally offers both accurate vertical and horizontal guidance, unlike non-precision approaches which relies mainly on lateral guidance to aircraft. APV is a relatively new classification that involves lateral and vertical guidance to aircraft, but does not meet the requirements established for Precision Approach classification.

Due to the planned 150m wide runway strip width, the runway does not meet the required 300m runway strip width for precision approaches as detailed in MoS 139. This narrows down IAP options available at CCAH to APV and NPA procedures.

Following ICAO recommendations, Airservices is reviewing approaches with vertical guidance (APV) procedures based on Barometric vertical navigation (Baro-VNAV). (13). Airservices is implementing a three-year programme (started in March 2017) which results in changes relevant to RNAV (GNSS) charts and APV operations. Two lines of minima for APV were taken into consideration:

- Decision Altitude/Height (DA/H) for approach and associated visibility (LNAV/VNAV)
- Minimum Descent Altitude/Height (MDA/H) and associated visibility that is equivalent to existing Straight-In (S-I) minima or non-precision approaches (LNAV)

CASA determines the aerodrome's requirements for Baro-VNAV operations.
For CCAH to support aircraft operations in low cloud and poor visibility, Council would be expected to comply with the details outlined in the CASA MoS, which would require CCAH to facilitate the installation of an approved local barometric source, an Automated Weather Service (AWS) to allow precise setting of QNH in the aircraft. CCAH would need to provide an Aerodrome Weather Information Service (AWIS) with a VHF capability or through an Automatic Terminal Information Service (ATIS).
Presently, the aerodrome operates the VHF broadcast and the Bureau of Meteorology installs, operates and maintains AWSs and AWISs.

Finally, according to ICAO Resolution A37-11, Airservices supports the increasing of S-I LNAV approach, which reduce the risk of Controlled Flight Into Terrain (CFIT) with a circling approach.

The PANS-OPS described at Section 4.10 is based upon a satellite based RNAV (GNSS) Instrument Flight Procedure, Baro-VNAV Instrument Approach. The procedure can be designed, implemented and maintained by an independent CASA certified MOS Part 173 (14) provider. See Figure 9 - Sample GNSS Baro VNAV Approach

CASA regulations Part 173 (CASR Part 173) requires an aerodrome to have registration or certification for the implementation of IFPs. Further to this, the aerodrome requires a minimum runway strip of 90m.

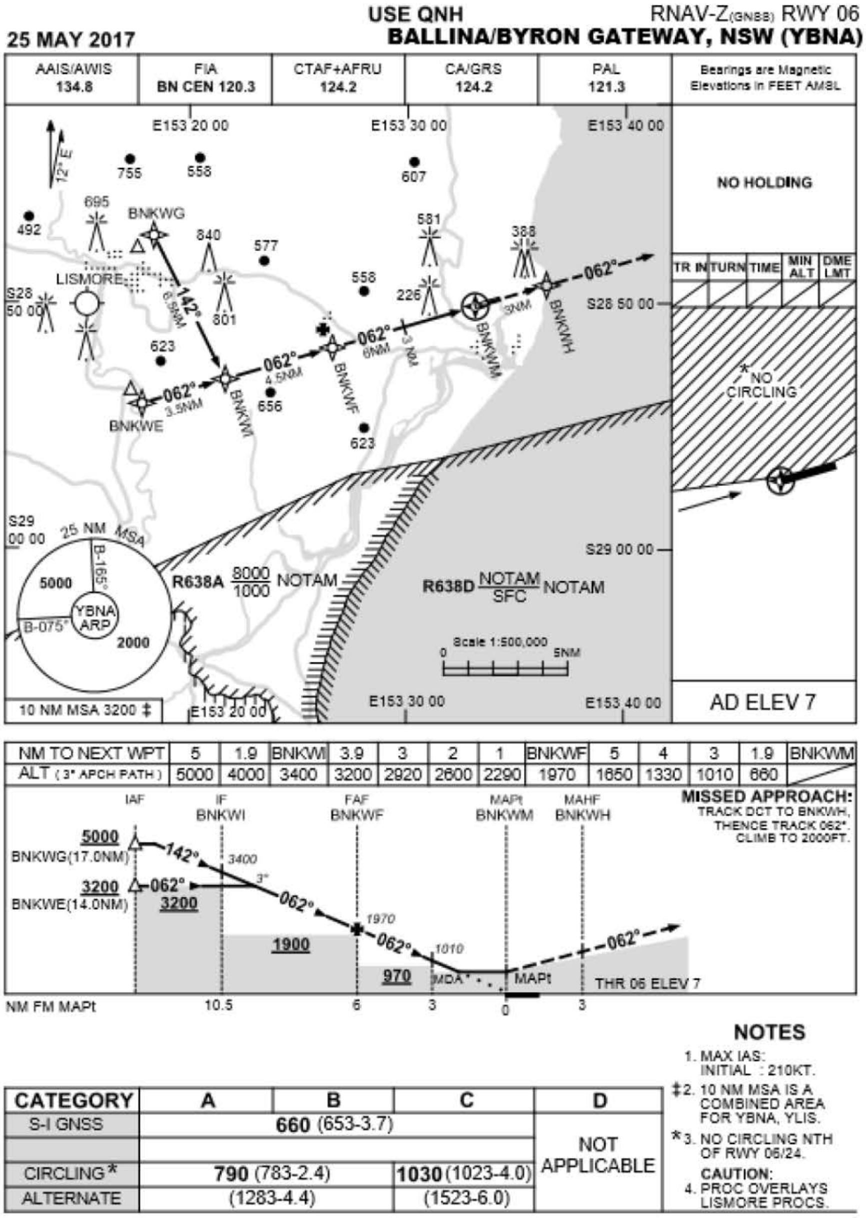


Figure 9 - Sample GNSS Baro VNAV Approach

Preliminary IAL designs indicate that waypoint KAMBA is suitable for direct entry to an Instrument procedure from the south to Runway 02- Table 5 - North Bound routes CB, ML, WG and AY- CCAH, while from the north, waypoints on the W220 MATLA-GUNTA track and on V140 route may also facilitate a direct entry to the Runway 20 procedure. See Table 7.

Minimum Safe Altitude

As start altitudes for procedures generally commence at an altitude based on calculations for obstacles within 25nm, these need to be compared to airspace altitudes. As the 25nm MSA (Minimum Safe Altitude) is less than 4500ft, it should be possible to have initial waypoints outside of Controlled Airspace. However, proximity to the north may require co-ordination with Military ATC.

For CCAH, the highest terrain is to the North West, although there is significant terrain to the west generally. By calculation, the NW sector of the 25nm MSA requires a minimum altitude of 3300ft, as does the omni-directional 10nm MSA. The remainder requires a height of 2500ft. This is illustrated in Figure 10 below.

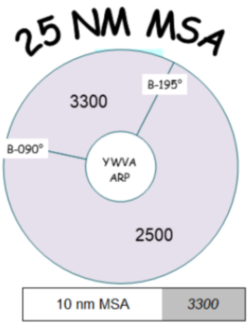


Figure 10 - 25NM MSA

Circling

Circling is an IFR procedure used only by aircraft after the end of an Instrument Approach to "circle" the airport to land on a different runway than that used by the approach procedure. The altitude is also used in flight planning, to determine the minimum fuel requirements.

Although the ICAO rules require circling to be calculated for each instrument approach procedure, it is generally considered preferable to have a single set of numbers for use at an aerodrome, and that the values are common to all procedures.

There is terrain to the west of the aerodrome which affects the lowest safe value available. In its most basic form, the circling altitudes will be:

Category	A	B	C
CIRCLING#‡	980 (941-2.4)		1400 (1361 – 4.0)

Figure 11 - Draft Circling all CCAH

If "No Circling" is allowed west of the field, then this will eliminate points 4 and 5 in the diagram from the calculations and become:

Category	A	B	C
CIRCLING#‡		910 (871 – 2.4)	1010 (971 – 4.0)

Figure 12 - Draft Circling no west CCAH

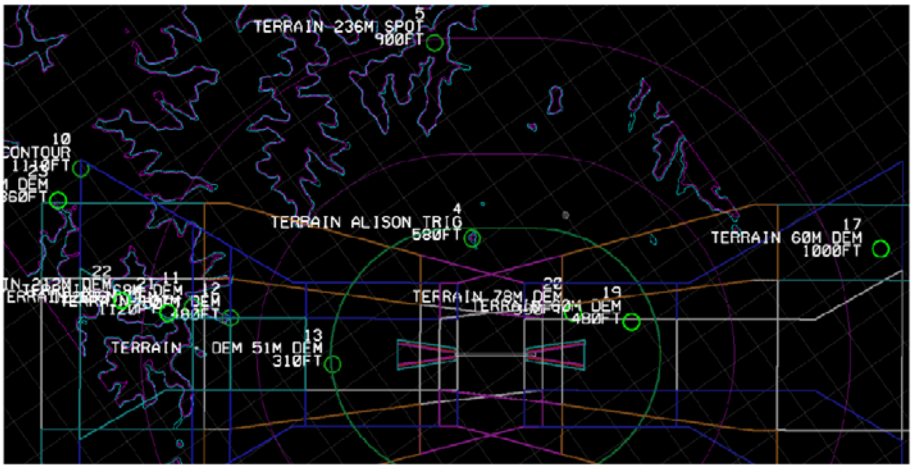


Figure 13 – Elimination of Circling Area to west of field (top) reduces altitudes

Runway 02 Draft Instrument Flight Procedure

The Runway 02 approach used is a standard 5nm leg Instrument Flight Procedure. The start altitude is based on a 25nm MSA of 3300ft, although it could have been lower using the sectorised 25MSA (possibly 2500ft).

There are generally no issues with the initial and intermediate legs.

The final approach from 5nm to touch down has some moderate terrain that is located close to the aerodrome. To ensure the lowest minima, the final segment has been "cut" at fixed distance positions at 3.5nm, 3.0nm and 2.0nm. This allows the segment heights to be adjusted to be below a nominal 3° gradient and ensure that an aircraft can be stepped over the terrain at a safe altitude. See Figure 14 - Final Approach Runway 02.

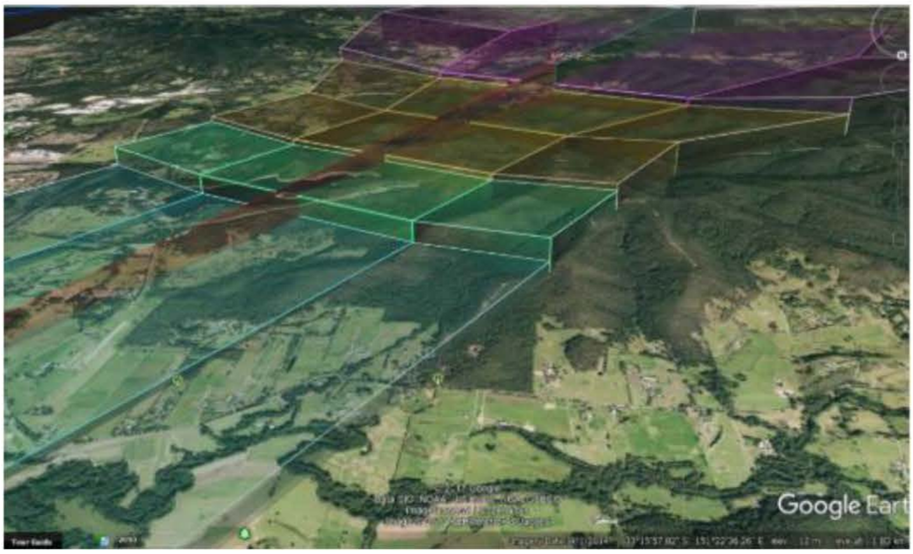


Figure 14- Final Approach Runway 02

For Runway 02, the draft minima are as per Table 12 - Runway 02 Minima.
These minima may be reduced to approximately 450ft AHD and 2.7km Visibility by employing a Baro-VNAV procedure as discussed above.

Table 12 - Runway 02 Minima

CATERGORY	A	B	C
LNAV ‡	660FT AHD (640 AGL) 3.5km visibility ‡		

Runway 20 Draft Instrument Flight Procedure

The Runway 20 approach used is a standard 5nm leg Instrument Flight Procedure. The start altitude is based on a 25nm MSA of 3300ft.

There are generally no issues with the initial and intermediate legs.

The final approach from 5nm to touch down a single step-down fix is used to ensure CASA data requirements can be met. There is no "difficult" terrain in final, however, the existing terrain is slightly taller than the comparative terrain to the south. See Figure 15.

Figure 15 - Final Approach Runway 20

For Runway 20, the draft minima are as perTable 13 - Runway 20 minima.

These minima may be reduced to approximately 480ft AHD and 2.8km Visibility by employing a Baro-VNAV procedure as discussed above.

Table 13 - Runway 20 minima

CATERGORY	A	B	C
LNAV ‡	730ft AHD (691 AGL) 3.5km visibility ‡		

By comparison, the RNAV (GNSS) Instrument Flight Procedure minima at Ballina aerodrome is 660ft and 3.7km. See Figure 9.

4.7 ATC Services

The Australian Airspace Policy Statement 2015 (AAPS) provides guidance for the determination of when changes to airspace classification may be required in the airspace immediately around an aerodrome, (referred to as the control zone at a controlled aerodrome).

The following criteria[2] will be used; annual passenger transport operations (PTO) aircraft movements, the annual number of passengers and total annual aircraft movements (see Table 14).

[2] Australia has not yet implemented Class B airspace but retains the criteria in the AAPS

Table 14 - Airspace criteria thresholds

	Class B	Class C	Class D
Service provided	ATC	ATC	ATC
Total annual aircraft movements	750,000	400,000	80,000
Total annual PTO aircraft movements	250,000	30,000	15,000
Total annual PTO passengers	25 million	1 million	350,000

The AAPS also provides guidance on the process for applying the criteria:

1. When annual traffic levels at an aerodrome meet a threshold of any one of the criteria CASA should complete an aeronautical risk review in consultation with the public, industry and other government agencies,
2. CASA will then make a determination to change the classification of airspace if necessary.

The Council has provided indicative high medium and low forecast data in relation to the future operations, shown at Table 15 and Table 16.

	Forecast annual aircraft movements					
Aircraft type	2018	2024	2025 low	2025 high	2029 low	2029 high
C150/PA28/ C172 (SGL)	20,000	42,000	45,600	46,000	48,000	50,000
PA44/B76/PA31 (Twin)	30	1,800	1,900	1,960	2,100	2,200
M500/TBM750/PC12/BE20	20	4,000	4,800	5,000	5,400	5,600
Cessna Citation	0	400	560	600	680	800
DH8-30/ATR72/FK50/SF34	0	0	11,680	17,400	14,600	26,280
Helicopters	170	800	950	1,100	1,080	1,320
Total annual	20,2220	49,000	63,490	72,060	71,860	86,200

Table 15 - Aircraft movement forecasts

	Forecast annual passengers		
	low	Med	high
2024			
2025	111,398	192,270	313,024
2026	114,740	202,356	341,196
2027	118,182	212,474	400,624
2028	121,728	223,097	436,680
2029	154,322	238,710	508,080

Table 16 - Passenger forecast

High side forecast data suggests that CCAH would approach the threshold for a CASA risk assessment (Class D) in 2025 on both aircraft movements and passenger numbers.
Low side forecast data suggests that CCAH would approach the threshold for a CASA risk assessment (Class D) in 2029 on forecast aircraft movements but not passenger numbers.

Class D services currently require the construction of an ATC Tower. It should be noted that Airservices, has indicated that they are exploring opportunities to deliver tower services using remote tower technology which may considerably alter the current service model moving forward.

As discussed in the Section on Flight Training . Ballina airport has recently introduced a CA/GRS. This service is a level lower than a full Air Traffic Services such as that delivered in Class D airspace, and operates under CASA MoS 139 (11) rather than the Air Traffic Control MOS172 (15).

Based on the example now demonstrated at Ballina Airport, the Council may consider the need for implementing a CA/GRS services prior to reaching the threshold for implementation of an ATC service under the CASA criteria above.

4.8 Aviation Rescue and Firefighting Services (ARFFS) requirements

The criteria for ARFF implementation are discussed in section Aviation Rescue and Firefighting Services (ARFFS) requirements.

Forecast data provided by the Council for future operations are shown at Table 15 and Table 16:

High side forecast data suggests that CCAH would reach the trigger point for ARFFS in 2027.
Medium forecast data suggests that CCAH would not reach the trigger point for ARFFS until beyond 2030.

Should CCAH passenger movements trigger an ARFFS requirement, based upon the forecast aircraft types accessing CCAH, the aerodrome would be considered an Aerodrome Category 6, as specified in Table 17: Aerodrome Category.

Table 17: Aerodrome Category

Aerodrome Category	Length of Aircraft	Maximum Fuselage Width
1	0 m up to but not including 9 m	2 m
2	9 m up to but not including 12 m	2 m
3	12 m up to but not including 18 m	3 m
4	18 m up to but not including 24 m	4 m
5	24 m up to but not including 28 m	4 m
6	28 m up to but not including 39 m	5 m
7	39 m up to but not including 49m	5 m
8	49 m up to but not including 61 m	7 m
9	61 m up to but not including 76 m	7 m
10	76 m up to but not including 90 m	8 m

Based on forecast traffic levels, CCAH potential aerodrome level and category, the aerodrome may require a minimum of 2 fire fighting vehicles, as described in Table 18. For comparison, Ballina Airport has an ARFFS established at Category 6.

Minimum Number of Vehicles	
Airport Category	**ARFFS Vehicles**
1 to 5	1
6 to 7	2 (min)
8 to 10	3 (min)

Table 18: Minimum number of vehicles

CASA specifies that fire vehicles must meet specifications in accordance with Australian Design Rules (ADR) and specific response time performance. Response time is defined as "the time between the initial call to ARFFS and the time when the first responding vehicles(s) is (are) in position at the aircraft or site of the incident or accident, and if required, produce foam at a rate of a least 50% of the discharge rate specified in the standards. ARFFS objectives is achieving a response time that does not exceed three minutes to the end of each runway in optimum visibility and surface conditions.

Minimum usable amounts of fire extinguishing agents for a category 6 aerodrome are defined in Table 19.

Minimum Usable Amounts of Extinguishing Agents				
Foam Meeting Performance Level A		**Foam Meeting Performance Level B**		**Foam Meeting Performance Level C**
Discharge rate foam solution (Water)		**Discharge rate foam solution (Water)**		**Dry Chemical Powder (DCP)**
11,800 litres	6,000 l/m	7,900 litres	4,000 l/m	225 Kg

Table 19: Extinguishing Agents Performance for Aerodrome Category 6

The Department of Infrastructure and Regional Development is currently conducting a Regulatory Policy Review of Aviation Rescue and Fire Fighting Services. (16) The outcomes of the review have yet to be actioned, but provide opportunities for airports to implement graduated "Fire Related Services at lower "trigger" points than currently described in the standard.

The review first two key agreed recommendations allow a risk based approach to aviation rescue and firefighting service establishment as follows:

- ARFFS be required to be established at a location where a relevant trigger event occurs and where the Civil Aviation Safety Authority (CASA) decides, following its conduct of a risk review, that ARFFS is required at that location.
- Two measures constitute a trigger event for the conduct of a risk review relating to the establishment of an ARFFS - the receipt of scheduled international passenger air services, or 500,000 passengers on scheduled commercial air services passing through the airport during a rolling twelve-month period.

When implemented, these changes may require a re-evaluation of the ARFF requirements for CCAH.

4.9 OLS

The OLS is a series of virtual surfaces associated with each runway at an aerodrome that defines the lower limits of airspace in which objects above this surface are defined as obstacles. The OLS is often used as a land planning tool to limit the height of structures, trees or other objects in the vicinity of aerodromes so that an aircraft may operate safely during the initial and final stages of flight and avoid collisions with obstacles.

As part of the planned 2024 Stage 3 development, the current 1194m runway is planned to be modified to 1200m.

The updated OLS is completed for the planned 2024 Stage 3 development, which involves a 1200m Code 3C non-precision runway with a runway strip of 150m and a displaced threshold of 225m on Runway 20. It is important to note that in the absence of aerodrome survey data, the elevations of Runway 02 and 20 are assumed to be 9.2m and 11m relative to the Australian Height Datum (AHD) respectively, as discussed in Section 2.1.

The OLS, as well as notable terrain intrusions can be seen in Annex A: Obstacle Limitation Surface.

4.10 PANS-OPS Surface

The Procedures for Air Navigation Services – Operations (PANS-OPS) surface is similar to the OLS in that they are described surfaces in space ensuring the protection of aircraft from colliding into obstacles. However, the PANS-OPS surface aims to protect aircraft guided solely by radio and satellite navigation aids, while flying in low visibility conditions. The PANS-OPS surface is generally situated above the OLS. Intrusions into the PANS-OPS surface are generally prohibited.

To70 used a 1799m runway which is intended to provide a worst-case assessment of the situation when it conducted the preliminary PANS-OPS assessment. We reviewed a database of obstacles obtained from Airservices, also known as the RAAF obstacle database. The database contains a list of obstacles which are significant to aircraft operations. Originally implemented by the RAAF, Airservices maintains the information through their Aeronautical Database Management System, known as Mercury.

For CCAH to proceed with non-precision operations in the future, it is recommended that a PANS-OPS surface chart be prepared by an independent CASA certified MOS Part 173 [13] as part of the final flight path and procedure design.

5 Airspace change roadmap

To70 has prepared an indicative "roadmap" of airspace activities for progression of the proposal through CASA, Office for Airspace Regulation and Airservices approvals. The list is not exhaustive but represents some of the key activities.

5.1 Preliminary Consultation

CCAH is in very close proximity to Airservices managed airspace, and most IFR operations at the aerodrome are conducted in with reference to and service from Airservices and Defence ATC. Prior to the commencement of any airspace change, preliminary consultation should be conducted with Airservices and Defence ATC. Where possible, this should be conducted in concert to ensure that all parties involved in the change process receive the same information.

5.2 Airport Safeguarding

Formal preparation of Obstacle Limitation Surfaces (OLS), (including Procedures for Air Navigation Services-Aircraft Operations (PANS-OPS) and Communication Navigation and Surveillance (CNS) Surfaces will be required during this stage to inform the National Airports Safeguarding Framework as outlined in Guidelines A-F. (17) Council has indicated that a Helicopter Landing Site (HLS) may be constructed at the southwest of Runway 02/20. An additional OLS would be required for this site to determine building setback and ensure that all published holding points will keep aircraft clear of operations at the HLS.

While New South Wales does not currently have standards for Public Safety Zones, in the absence of any nationally agreed guidance, a nominal 1000 m trapezoid shaped clearance off the end of each runway threshold is may be used and should be discussed with local planning authorities.

5.3 Airport Certification

With the expectation of RPT or frequent charter operations conducted with aircraft of more than 30 passengers, CCAH will require certification under CASA MoS Part 139 (11). While the airport certification process is outside the scope of this work, there is a significant interrelationship between the airspace and airport that must be aligned.

5.4 Instrument Approach Procedures

The introduction of an IAL at CCAH, will require a formal assessment of the aerodrome and its environment with respect to CASA MoS Part 139 (11), to confirm the suitability of the aerodrome to host flights under the IFR. Shortcomings will be identified, with recommendations to meet CASA compliance requirements. The aerodrome will also require certification or regulation in order for IAL to be implemented see above. A CASA MoS Part 173 certified designer will be required to design formal IAL procedures. As part of the process, the designer will coordinate with Airservices to ensure the designed procedures are integrated with existing and new routes as required.

Flight validation is required for:

1. Instrument approach procedures;
2. Revised instrument approach procedures where the final course has been re-aligned by 3° or more.

Validation of an instrument flight procedure comprises:

1. A review of the draft procedures from an operational perspective conducted by the validation pilot;
2. A validation flight check.

The process of instrument approach procedure design focuses on those controlling obstacles that affect the procedure. This focus is facilitated using various obstacle and terrain databases. The purpose of flight validation is to verify database information, to check all obstacles (including the identification of any unforeseen obstacles) that affect the safety of the procedure, and to assess the 'flyability' of the procedure.

5.5 Flight Path Authorisation

For flight paths to be implemented, Airservices is required to review proposed designs for adherence with pre-existing environmental work. Airservices will determine whether there is a requirement to refer any flight path change to the appropriate Minister under Section 160 of the EPBC act and where required, make a referral.

5.6 Aircraft Noise Exposure Forecast (ANEF)

To support the development of an Airport Master Plan or Major Development Plan, an ANEF based on the design assumptions would be required.

5.7 Consultation

It is recommended that prior to completion of an ACP and the creation of information for AIP, further consultation is conducted with Airservices and Defence ATC to ensure that data prepared is suitable to and supported by all parties.

5.8 Airspace Change Proposal Authorisation

Changes to airspace classification or new air routes published an Airspace Change Proposal (ACP) must be submitted to CASA for review. CASA will review and approve both the change and the environmental assessment. This work is described in CASA's Airspace Risk and Safety Management Manual (18)

5.9 Aeronautical Information Management

Aeronautical Information Circular (AIC) Advance notice

Once sufficient detail is known, an AIC can be published providing the aviation community with advance notice of intended changes being made to air routes and facilities. The content of the AIC can be simply an introduction, description of the change and expected timing of the change. AIC are published by Airservices.

Aeronautical Information Publication (AIP)

Final details for changes to the following items should be prepared and submitted for publication in AIP to Airservices and other Aeronautical Information Service (AIS) providers.

1. RWY dimensions, lighting, etc.
2. TWY, dimensions lighting, usage, etc.
3. Aprons, dimensions lighting, etc.

3 Review existing model 2017

3.1 VFR flight paths

Currently, CCAH aircraft operations follow basic, Class G airspace procedures as described in the Aeronautical AIP. the Council has a "Fly Friendly/ Neighbourly"" policy (2) that is circulated to all operators at the aerodrome. This policy was put in place to manage aircraft noise impacts on the community and to ensure the continued operation of CCAH Airport.

In relation to airborne operations and in line with CASA requirements, the policy asks pilots of fixed wing aircraft to note the following:

1. Runway 20 is the preferred runway direction when operationally acceptable in nil / light and variable wind conditions;
2. Where possible, adopt and maintain best rates of climb, to minimise noise over residential areas, as soon as possible after take-off;
3. Avoid overflight of residential areas, in particular Watanobbi residential area to the south, Bruce Crescent rural residential area to the north, and Jilliby rural residential area to the west;
4. Avoid flying over noise sensitive areas including hospitals and schools when possible and if this is not possible you should try to be above 1000ft AGL. Particular attention should be given to avoidance of Lakes Grammar School at the intersection of Sparks Road and Albert Warner Drive;
5. Maintain correct or ATC cleared tracks after take-off
6. Reduce engine revs as soon as possible;
7. Follow designated flight paths where defined;
8. Only conduct circuit training between 7.00am and 10.00pm Monday to Friday; and 7.00am and 8:00pm on Saturday and Sunday;
9. Keep circuits as compact as possible – don't fly wide circuits; and
10. When simulating engine failure and recovery this should occur over the airfield

The following diagrams depict the flight tracks at the aerodrome, specifically the circuit area (Figure 1 – Existing circuit tracks) , VFR Arrivals (Figure 2 - VFR Arrival tracks) and VFR Departures (Figure 3 - VFR Departure tracks).

Figure 1 – Existing circuit tracks

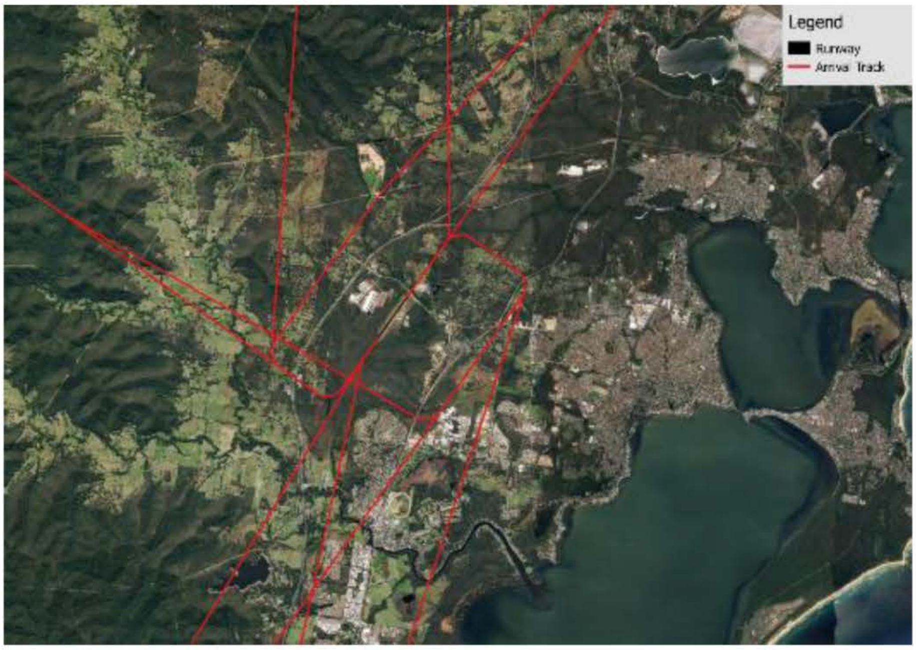


Figure 2 - VFR Arrival tracks

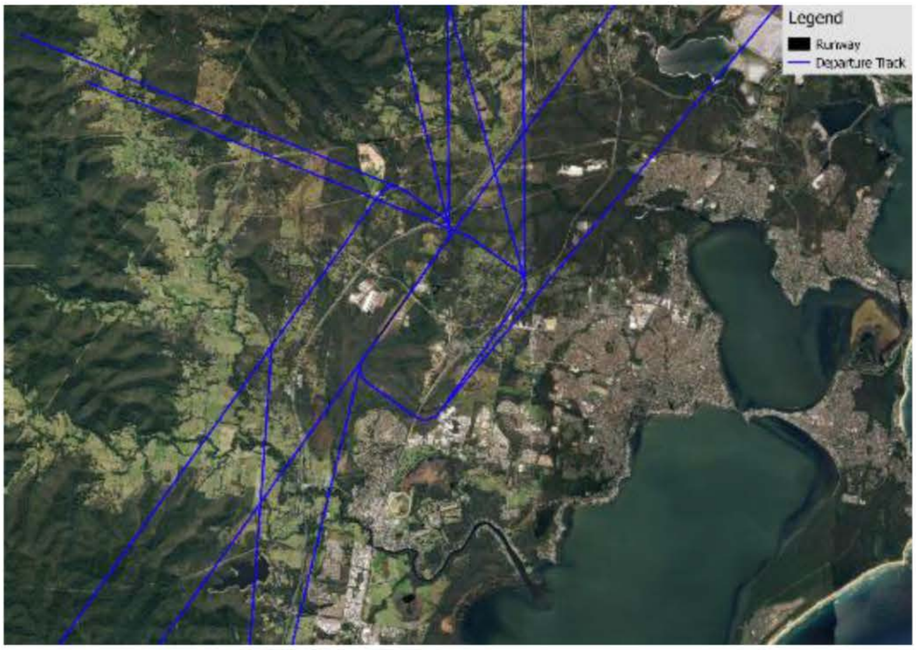


Figure 3 - VFR Departure tracks

Discussion with Airservices, as the provider of ATC services in Class G Airspace, and the local aeroclub confirm that northbound VFR transit flights in the vicinity CCAH generally track over CCAH towards Maitland and the IFR tracking point adjacent to Maitland called MATLO. Conversely, VFR transit flights southbound generally track coastal following coastal passage of the Williamtown Military Control Zone.

Due to the higher terrain to the west of CCAH, most aircraft operate to the north and south of the aerodrome, choosing to track west when established in the Hunter Valley or Sydney region.

The majority of CCAH aircraft operations are flight training involving light single and twin aircraft. Flight training is generally conducted over Tuggerah Lake which is situated to the east of the CCAH and measures 7nm long by 2.6nm wide.

Circuit operations at CCAH are standard left-hand circuits and the areas recommended to be avoided in the Council's Fly Friendly/Neighbourly advice represents no usual obstacle to these circuit operations.

There are no current regular helicopter operations at CCAH.

3.2 IFR flight paths

Flight paths for operations in the vicinity of CCAH are described in the Aeronautical Information Publication (AIP) The current flight paths are detailed in ERSA data and listed below:

1. Aircraft overflying the Sydney Terminal Area (TMA) within 30NM of Sydney should flight plan as per the detail in Table 1- Overflights of Sydney TMA

Table 1- Overflights of Sydney TMA

Flights below A100	
NORTH BOUND SOUTH BOUND	AKMIR W713 KADOM DCT MAKOR at A070 MAKOR DCT KADOM W713 AKMIR at A060
A100 and ABV EAST BOUND INTL via PKS	Plan via ERC route ABV FL280, PKS A576 TESAT then Oceanic Route
Flights from the South landing Williamtown	
Turbojets Non-turbojets	Via TESAT H185 Via TESAT V140
Flights from the North departing Williamtown	
Turbojets Non-turbojets (A100 and ABV)	via W284 DONIC W778 HOOKS then ERC route via W170 LOWEP W180 TESAT then ERC route

2. Non-Turbo jet aircraft arriving Sydney aerodrome from the north should flight plan as per the detail in Table 2- Sydney arrivals from the North

Table 2- Sydney arrivals from the North

Flights from the North	
Via OLTIN Via SCO Departing YWLM	OLTIN W180 SCO W551 YAKKA W180 (A100 and BLW) WLM W170 LOWEP W180; or WLM 603 MEPIL W180 (A075 and BLW)

3. Non-Turbo jet aircraft departing Sydney aerodrome to the north should flight plan as per the detail in Table 3 - Sydney departures non-turbo jet

Table 3 - Sydney departures non-turbo jet

Flights departing to the North	Via KAMBA W220 MATLA or KAMBA V140 WLM (Tracking via Williamtown subject to MIL traffic during Williamtown ATS HR).

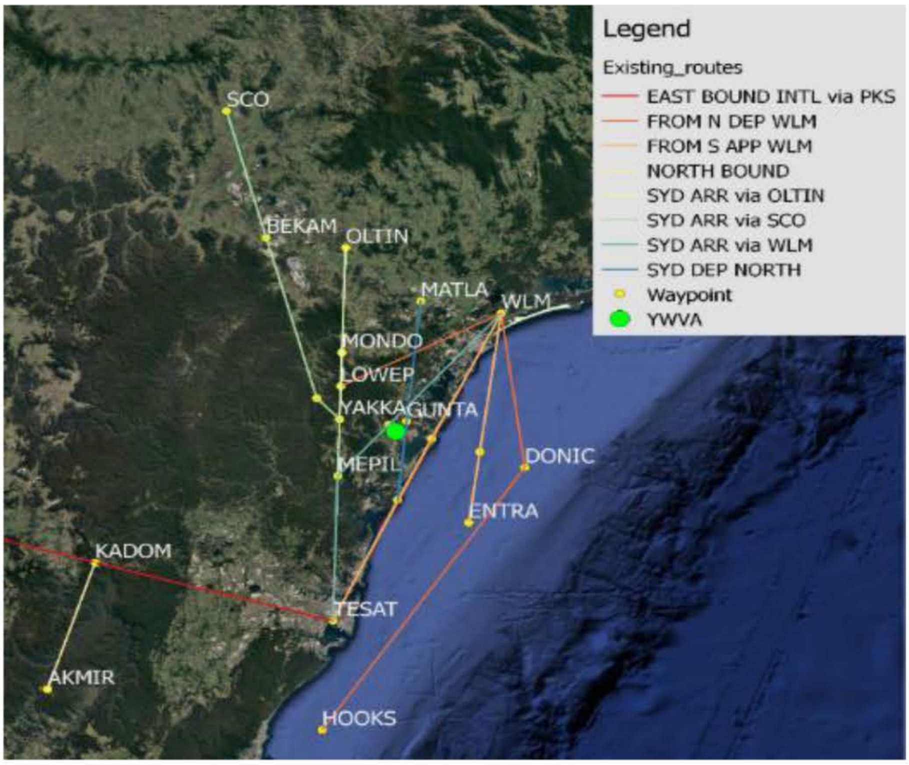


Figure 4 - Current nearby routes

3.3 Aircraft Mix

CCAH is currently an uncertified aerodrome and is generally limited to Aero Club flight training, private pilot operations, helicopter training and surveillance, as well as rural fire service training. As accurate records of current aircraft movements are not available, the 2006 ANEF and OLS study were used to identify current aircraft operations at CCAH. The current aircraft mix operating at CCAH include of the following aircraft:

- Cessna C-150
- Cessna C-172
- Cessna C-182
- Piper PA28
- Bellanca CH7B
- Piper PA31

3.4 Interactions with other airspace and aerodromes

CCAH is situated in Class G airspace which extends up to 7,500ft above the aerodrome. It is surrounded on all sides by high density aviation operations. Encircling CCAH to north, Williamtown military restricted airspace (West, (R559) North, (R578) and East (R587)) are designated for use by military fast jets for bombing, training, and tactical support of Australia's military capability. This military restricted airspace is generally active on weekdays.

The northern restricted area (R578) extends to cover the main northern route from CCAH, extending from 4,500ft to 8,500ft. R578 is designated RA1 which means that pilots may flight plan through the restricted area and under normal circumstances expect a clearance from ATC. All aircraft planning to depart CCAH northbound above 4,500ft require a clearance to transit this airspace when it is active.

The restricted areas west and east are designated RA2 which means that pilots must not flight plan through the restricted area unless on a route specified in ERSA GEN FPR or under agreement with the Department of Defence, however a clearance from ATC is not assured. Other tracking may be offered through the restricted area on a tactical basis.

In addition to the published military restricted areas, there are airspace reservations between 13,000 and 14,000 feet which cross the flight paths of aircraft departing northbound from CCAH. These airspace reservations do not preclude aircraft flight planning these routes. They are normally activated on week days at least twice in the morning and twice in the afternoon to facilitate the passage of military fast jets between the eastern Williamtown restricted areas (R587) and the western Williamtown restricted areas R559.

To the south, the terminal airspace surrounding Sydney, Bankstown and Richmond aerodromes are the busiest terminal operations in Australia.

Aircraft operating from CCAH requesting entry to the Sydney Class C terminal area are subject to the priority access system described in AIP:

> "For flights in Class C terminal control areas associated with Brisbane, Melbourne, Perth and Sydney, ATC will apply priorities in the following order;
>
> 1. with equal priority, flights compliant with their Air Traffic Flow Management (ATFM) requirements, flights exempt from ATFM measures and Medical Aircraft (HOSP) operations; and
> 2. flights not compliant with their ATFM requirements;
> 3. all other aircraft."

ATFM requirements are only complied with by aircraft landing in Sydney, Brisbane, Melbourne and Perth. In practise, aircraft operations at CCAH are generally not subject to ATFM requirements and would have the lowest priority.

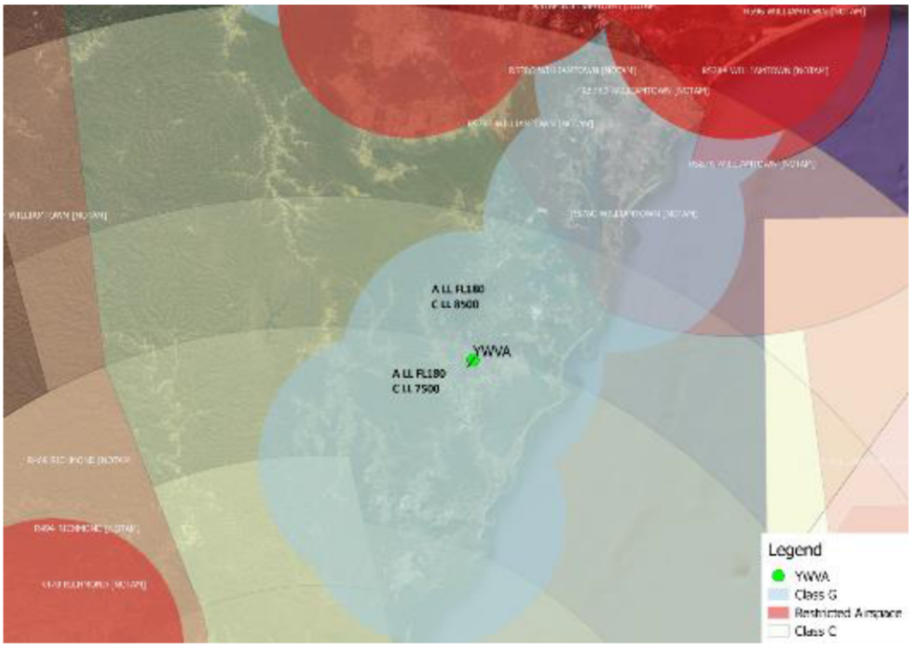


Figure 5 – Airspace in the vicinity of CCAH

3.5 Instrument approaches

The Australian aviation industry has embraced satellite technology as a primary source of data for aviation in Australia. Airservices has recently completed a program, removing aviation navigation aids (NAVAIDS) from service, leaving only a "Backbone" service, intended to support IFR operations across Australia in the event that GPS becomes unavailable.

CCAH has no backbone NAVAID and is not currently serviced by an instrument approach procedure. Aircraft arriving and departing CCAH operate visually below the route lowest safe altitude of approximately 3,400ft or as determined by the pilot.

CCAH is currently described as an Aircraft Landing Area (ALA). This indicates that it does not have either registration or certification as an aerodrome in accordance with CASA Part 139. CASA regulations Part 173 (CASR Part 173) requires an aerodrome to have registration or certification for the implementation of Instrument Flight Procedures (IFPs). Further to this, the aerodrome requires a minimum runway strip width of 90m

3.6 ATC Services

ATC services are based upon the category of the aircraft operation and the classification of the surrounding airspace. In the vicinity of CCAH the airspace is classified Class G.

In Class G airspace, IFR and Military Low Jets (MLJ) aircraft must be provided with traffic information on other conflicting IFR and MIL aircraft.

ATC provides a flight information service and a surveillance information services to VFR, workload permitting.

3.7 Aviation Rescue and Firefighting Services (ARFFS) requirements

The mandatory requirements for provision of Aviation Rescue and Firefighting (ARFFS) are stated in CASA's Manual of Standards Part 139H (3).

The mandatory requirements for provision of Aviation Rescue and Firefighting (ARFFS) are stated in CASA's Manual of Standards Part 139H (3). This document notes that:

> Level 1
> ARFFS is required at an aerodrome where:
>
> 1. International passenger services operate and
> 2. Any domestic aerodrome through which more than 350,000 passengers passed through on air transport flights during the previous financial year.
>
> Level 2
> Aerodromes where the number of annual passengers on air transport is less than 350,000 may provide a level of ARFFS. The ARFFS will be subject to audit if published in ERSA and form part of the Aerodrome Emergency Plan AEP. The AEP must be in accordance with ICAO Standards.

Passenger numbers are currently well below the Level 1 trigger point.

Airport fire services are currently provided by the Charmhaven NSW Rural Fire Service. The current Emergency Plan was last updated in November 2009. Rescue services response times are expected to be under 10 minutes.

4 Designed future model 2024

4.1 Flight Paths

In 2024, the airspace surrounding CCAH is not expected to change significantly from its existing structure.

Only one key infrastructure change has been announced at the time of this report. The Federal Government has confirmed that construction of Western Sydney Airport will be targeted for completion by 2024. Whilst the construction and operation of this aerodrome will have a large impact on operations within the Sydney terminal area, the Western Sydney Airport Plan (4) clearly states that there will be no changes to flight paths associated with Sydney aerodrome, commonly referred to as the Long-Term Operating Plan (LTOP) (5). Extrapolating from this, it is expected that Sydney aerodrome will continue to operate under its current structure and design.
Bankstown Airport will operate as presently, with some constraints to IFR traffic developing as Western Sydney Airport grows in operation.

To70 has also reviewed Defence and Airservices future plans. Defence managed Williamtown restricted airspace was the subject of a 2015 CASA review of operations (6) which recommended changes to the classification and dimensions of airspace and flight paths around the base. Whilst all recommendations arising from the report have been accepted by Defence, and the implementation of change is still in development, there is an expectation that there will be an airspace re-classification and introduction of a stepped airspace structure within 25nm of Williamtown. This is may replace the existing restricted area which extends to the ground.

The Defence White Paper 2016 (7), and the Defence Integrated Investment Program 2016 (8), which are the key papers defining the intention of Government in relation to defence activities over the coming years. Defence installations surround the CCAH site of considerable significance to aviation are:

- Richmond Airbase has funding programmed for re-development works in FY2021-26. It is expected from this that Richmond will remain an active airbase beyond 2026.
- Williamtown Airbase has funding programmed for new infrastructure to support the Joint Strike Fighter (JSF) in FY2017 and beyond including a considerable Stage 2 base redevelopment. We infer from this and other discussions with Defence that Williamtown activity is expected to increase.

In practice, the available data indicates that the routes currently available for aircraft arriving, departing and transiting CCAH are likely to remain in place.

VFR Flight paths are not expected to change.

In relation to IFR operations; in developing this project, the Council provided To70 with sample airport city pairs as examples of the types of Regular Public Transport (RPT) operations they expect to see operating in 2024 from CCAH.
Airports proposed as viable by the Council were, Canberra, Melbourne, Brisbane, Sunshine Coast. Regional intrastate services to Wagga Wagga, Dubbo, Ballina and Albury were also referenced.

To70 reviewed all existing flight planning options for flights intending to operate into and out of CCAH in 2024 to and from these example aerodromes.
Building on this information and the data provided by the Council at Table 15 - Aircraft movement forecasts, To70 developed sample frequencies of operation

These options were then validated their viability with Airservices.
Feedback from Airservices, indicates that the following routes are expected to be viable in 2024.

Table 4 - South Bound routes CCAH - CB, ML, WG and AY

Aircraft type	Route
Turbojets/ DH8 etc Frequency= 6 per day	via DONIC W778 HOOKS then ERC route
Non-turbojets (A100 and ABV) Frequency = 7 per day	via MEPIL TESAT then ERC route

Table 5 - North Bound routes CB, ML, WG and AY- CCAH

Aircraft type	Route
All aircraft Frequency = 13 per day = total 1 per hour	Via TESAT V140 KAMBA DCT

Table 6 - North Bound routes CCAH - BN, SU, CG, BNA

Aircraft type	Route
All aircraft Frequency = 9 per day	MATLA then ERC route ATC clearance required to transit RA1 Restricted Area R578F

Table 7 - South Bound routes BN, SU, CG, BNA - CCAH

Aircraft type	Route
All aircraft Frequency = 9 per day	Via OLTIN DCT

Table 8 - South Bound routes CCAH/YWVA - DU/West

Aircraft type	Route
All aircraft	BOYSY/KADOM the ERC

Table 9 - South Bound routes DU/West- CCAH/YWVA

Aircraft type	Route
All aircraft	Via TESAT V140 KAMBA DCT

As per present day operations, aircraft operating from CCAH requesting entry to the Sydney terminal area will be subject to the priority access system described in AIP:

"For flights in Class C terminal control areas associated with Brisbane, Melbourne, Perth and Sydney, ATC will apply priorities in the following order; 1. with equal priority, flights compliant with their ATFM requirements, flights exempt from ATFM measures and Medical Aircraft (HOSP) operations; and 2. flights not compliant with their ATFM requirements; 3. all other aircraft."

ATFM requirements are only complied with by aircraft landing in Sydney, Brisbane, Melbourne and Perth. In practise, aircraft operations at CCAH are generally not subject to ATFM requirements and would have the lowest priority.

It is reasonable to expect that traffic within the Sydney TMA will increase. The Sydney Airport Master Plan 2033 (9) notes that:

> "Aircraft movement forecasts for scheduled passenger operations at Sydney Airport indicate growth from 292,852 movements in 2012 to 388,466 movements in 2033. This represents annual average growth rates of 2.3% and 1.0% for international and domestic (including regional) services respectively. Overall, this represents an average annual growth of 1.4% for passenger aircraft movements. "

With the LTOP requirement to cap Sydney Airport movement numbers at 80 per hour, a proportion of this growth will move into off-peak times driven by Low Cost Carrier maximisation of airframe capacity, and new origin and destinations within the Asian hubs.

Any increase in Sydney Airport traffic is likely to see an increase in delays for CCAH operations seeking to access the Sydney TMA.

4.2 Aircraft Mix

To70 has reviewed existing operations at CCAH as well as operations at a comparative aerodrome, Ballina, and at the busier Sunshine Coast Airport.

Advice from the Council is that by 2024, approximately 18-20% of total movements at CCAH would involve turboprops such as the ATR72-600s or DH-8. By 2029, this may increase to 30% of total movements.

A Code 3C runway up to 1,425m would be required to accommodate a Q400 at Maximum Take-off Weight (MTOW) and jet aircraft. Runway and taxiway pavement strength have not been considered in this review.

Section 6.3 provides detailed aircraft performance data for each of the runway development stages.

4.3 Interactions with other aerodromes

An investigation of aerodromes within a 30nm radius of Warnervale was undertaken. Five locations are indicated as aerodromes, heliports or ALA's.

Table 10 - Nearby aerodromes

Identity	Name	Latitude	Longitude	Comments
YSMB	Somersby (ALA)	-033°22'04.00"	151°17'59.00"	ALA
YXGS	Gosford Hospital	-033°26'39.91"	151°20'36.32"	Hospital helipad with IFP
YCNK	Cessnock Airport	-032°47'15.00"	151°20'30.00"	ALA
YXFV	Newcastle Lifesaver Base	-032°54'21.16"	151°42'09.88"	Hospital helipad with IFP
YLMQ	Lake Macquarie Airport	-033°03'58.00"	151°38'53.00"	ALA. IFP proposed. Previously known as Aeropelican, with IFPs.

4.4 Flight Operations

Helicopters

A helicopter landing site is planned to be conducted in the southwestern corner of the airfield. See. Figure 6 - Helicopter Apron.

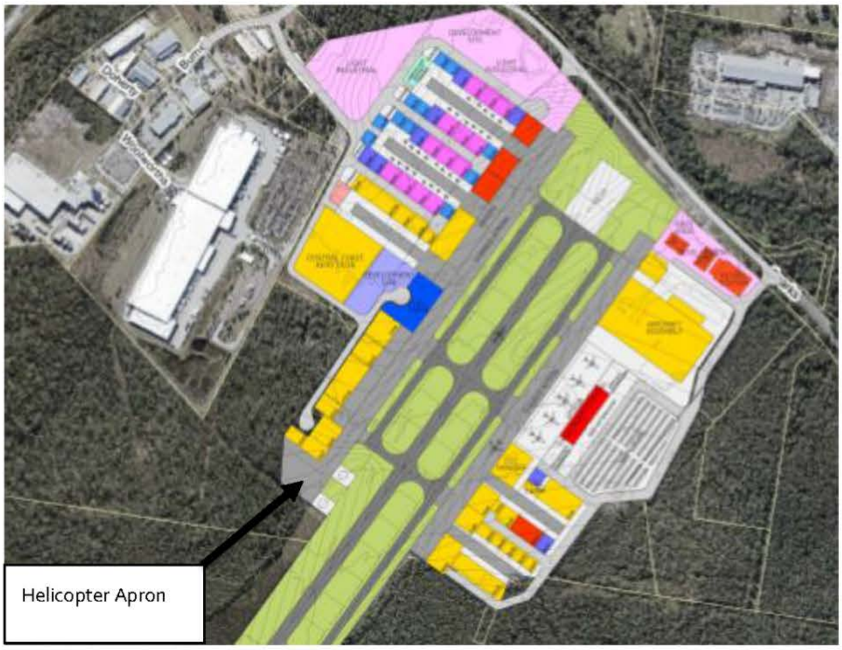


Figure 6 - Helicopter Apron

While future helicopter training areas are yet to be determined and will be dependent on the requirements of the training organisation, it is expected that they will train in similar locations to existing fixed wing operations. This will be over Tuggerah Lake to the east of CCAH.

In the event that helicopters are based on the same side of the aerodrome as the Central Coast Aeroclub the, use of a runway on the eastern side of the main runway 02/20 would require taxiing helicopters across the main runway, and create complex circuit tracking for them to access the training areas and eastern, coastal flight paths. This is likely to generate more delay and complexity than use of a single runway.

Flight Training

To70 reviewed flying training operations at Ballina Airport for comparison with the 2024 model at CCAH. Ballina Airport reports approximately 20,000 aircraft movements annually.

The Air Transportation Safety Board (ATSB) reports three incidents since December 2013 involving aircraft operating in proximity to each other.

In reviewing the latest incident at Ballina on 14 January 2016 (10), the ATSB found that despite an increase in passenger numbers and a mixture of traffic, Ballina/Byron Gateway Airport operated without the support of air traffic information and/or services. They went on to note that:

"While recognising that a direct comparison between aerodromes is difficult, Ballina also experienced a higher number of incidents relating to communication and separation issues compared to aerodromes with similar traffic levels."

Following a recommendation by the CASA, the operator of Ballina/Byron Gateway Airport has subsequently implemented a certified air/ground radio service (CA/GRS) to provide weather services and traffic information at the aerodrome. This service commenced in March 2017 and operates daily between 0800 and 1800 local time.

We note in the draft CCAH Master Plan, that airspace immediately to the west of the aerodrome has been identified as potentially suitable for use as flying training areas. Our review of the areas west of the airfield and clear of circuit operations is generally suitable for single engine operations due to the higher terrain.

Parallel Runway

To70 was asked to consider the viability of a small parallel runway placed to the west of the main strip for training operations to use, clear of other IFR operations

We reviewed CASA MoS 139 (11) in relation to the requirements for parallel runways.

Where parallel runways are to be provided, the aerodrome operator should consult with CASA and Airservices Australia on airspace and air traffic control procedures associated with the operation of the multiple runways. Where parallel, non-instrument runways are provided for simultaneous use, the minimum separation distance between the runway centrelines must not be less than:

- where General Aviation Aerodrome Procedures (GAAP) are in place — 213m. If this distance is not provided, dependent parallel procedures may need to be introduced;
- where the higher code number of the two runways is 3 or 4 — 210 m;
- where the higher code number of the two runways is 2 — 150 m;

- where the code number of the two runways is 1 — 120 m.

GAAP procedures are no longer in use in Australia.
The Council has indicated that they intend to design the aerodrome to Code 3C, thus requiring a minimum separation distance between centrelines of not less than 210M during Visual Meteorological Conditions (VMC)

The minimum spacing required for simultaneous independent use in Instrument Meteorological Conditions (IMC) is 1,035 m and both runways would need to be Instrument capable runways.

Detail provided in the CCAH Master plan, see Figure 7 - Central Coast aviation hub masterplan- draft layout, indicates that Aeroclub and other training organisations will continue to be located on the eastern side of the main runway 02/20. The Central Coast Aeroclub advise that their preferred location for training is over Tuggerah Lake where there are no noise issues. As per the use of Helicopter landing sites west of the main runway, use of a runway on the western side of the main runway 02/20 would require taxiing training aircraft across the main runway, and create complex circuit tracking for them to access the training areas and eastern, coastal flight paths. This is likely to generate more delay and complexity than use of a single runway.

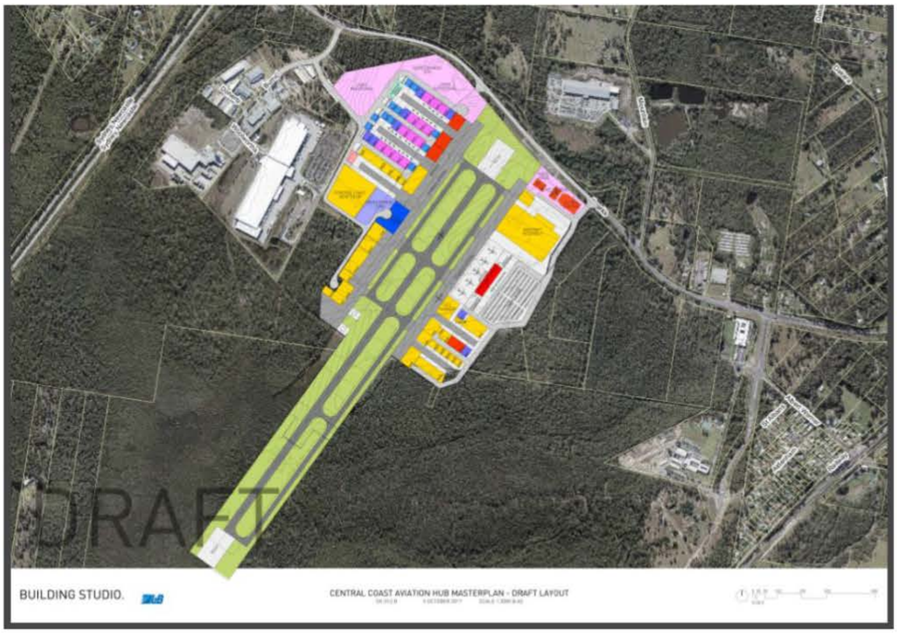


Figure 7 - Central Coast aviation hub masterplan- draft layout

In relation to the preferred circuit direction at CCAH, To70 has not identified any causal factors arising from the change of runway length or traffic mix which would require a change to the current standard left-hand circuit direction in use to both runways.

4.5 Power Station Stacks and Plumes

Exhaust plumes can originate from any number of sources. Aircraft operations in various stages of flight may be affected by an exhaust plume of significant vertical velocity (i.e. a plume rise). A light aircraft in approach configuration is more likely to be affected by a plume rise than a heavy aircraft cruising at altitude. In addition, helicopters and light recreational aircraft may be severely affected by a high temperature plume and the altered air mixture above an exhaust plume and should therefore avoid low flight over such facilities.

There are currently three power stations located nearby CCAH, which have plume stacks with the potential to create air safety hazards. The three power stations are Eraring operated by Origin Energy, Vales Point operated by Delta Energy and Colongra operated by Snowy Hydro. It is worthy to note that Munmorah Power Station is also located in the vicinity of CCAH, however, it was recently demolished and is no longer operating. Figure 8 illustrates the locations of the plume stacks from the associated power stations.

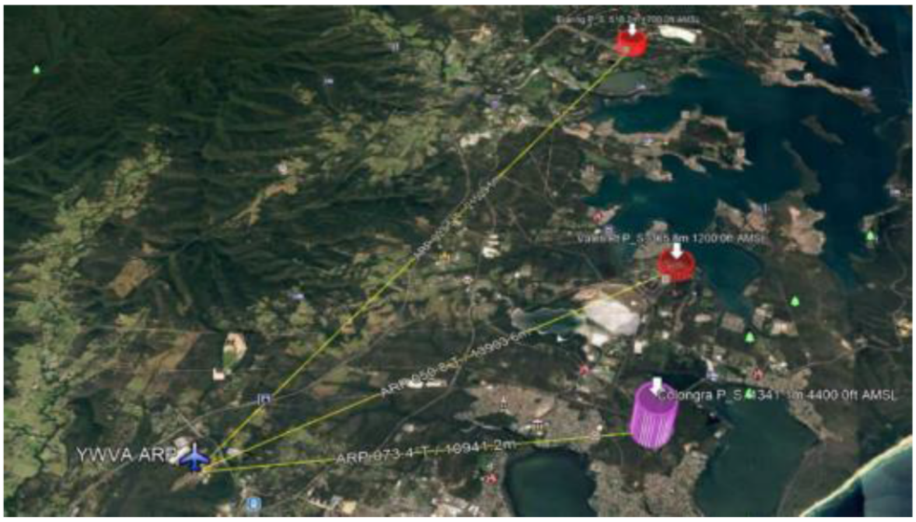


Figure 8 - Plume stack locations

A CASA review of the plume rises from the three identified power stations was used determine the plume heights close to CCAH. The review was based on the "CASA screening tool", which used the benchmark velocities of 6.1m/s and 10.6m/s for determining the plume heights. In addition, the spot heights for the plumes are derived from the Visual Terminal Charts (VTC), which are detailed in Table 11 along with the plume heights provided by CASA. (12)

Table 11 - Plume heights

Plume location	Plume height @6.1m/s (feet AGL*)	Plume height @10.6m/s (feet AGL)	Spot Height (feet AGL)
Eraring Power Station	1615	785	657
Vales Point Power Station	1173	653	584
Colongra Power Station	4367	497	511

*Above Ground Level (AGL)

The plume stack locations were also assessed for penetrations into the updated OLS developed for the Stage 3 configuration. Results of the assessment is detailed in Section 4.9.

4.6 Instrument approaches

The Council expects CCAH to be recognised as a CASA certified aerodrome before RPT services commences, as well as accommodate non-precision instrument approaches. Therefore, the aerodrome is required to adopt standards and regulations specified by CASA and Airservices. As CCAH is planned to support RPT services, the aerodrome will be required to operate under all weather conditions and will therefore require instrument approach procedures. This Section reviews the instrument flight procedures options available for CCAH and provides recommendations based on current and proposed rule-sets that align with the Council's future development plan. In particular, the following documents were taken into consideration to determine the type of Instrument Approach Landing Procedure (IAL):

- CASA Manual of Standards (MoS) Part 139 – Aerodromes (11)
- CASA Civil Aviation Safety Regulation 1998 (CASR) part 139 (Aerodromes), part 173 (Instrument Flight Procedure Design) and part 121 (Commercial Air Transport Operations – Airplanes), which is currently under development
- Airservices Aeronautical Information Circulars (AICs)
- CASA Methodology for Validation of Baro-VNAV Instrument Approaches

An IAL involves a series of predetermined manoeuvres for the orderly transfer of an aircraft by reference to night instruments, from the beginning of the initial approach to a landing or to a point from which a landing may be made visually by the pilot. There are three types of IAL which are general based on the level of guidance to an aircraft:

- Precision Approach
- Approach with vertical guidance (APV)
- Non-precision Approach (NPA)

A Precision Approach procedure generally offers both accurate vertical and horizontal guidance, unlike non-precision approaches which relies mainly on lateral guidance to aircraft. APV is a relatively new classification that involves lateral and vertical guidance to aircraft, but does not meet the requirements established for Precision Approach classification.

Due to the planned 150m wide runway strip width, the runway does not meet the required 300m runway strip width for precision approaches as detailed in MoS 139. This narrows down IAP options available at CCAH to APV and NPA procedures.

Following ICAO recommendations, Airservices is reviewing approaches with vertical guidance (APV) procedures based on Barometric vertical navigation (Baro-VNAV). (13). Airservices is implementing a three-year programme (started in March 2017) which results in changes relevant to RNAV (GNSS) charts and APV operations. Two lines of minima for APV were taken into consideration:

- Decision Altitude/Height (DA/H) for approach and associated visibility (LNAV/VNAV)
- Minimum Descent Altitude/Height (MDA/H) and associated visibility that is equivalent to existing Straight-In (S-I) minima or non-precision approaches (LNAV)

CASA determines the aerodrome's requirements for Baro-VNAV operations.
For CCAH to support aircraft operations in low cloud and poor visibility, Council would be expected to comply with the details outlined in the CASA MoS, which would require CCAH to facilitate the installation of an approved local barometric source, an Automated Weather Service (AWS) to allow precise setting of QNH in the aircraft. CCAH would need to provide an Aerodrome Weather Information Service (AWIS) with a VHF capability or through an Automatic Terminal Information Service (ATIS).
Presently, the aerodrome operates the VHF broadcast and the Bureau of Meteorology installs, operates and maintains AWSs and AWISs.

Finally, according to ICAO Resolution A37-11, Airservices supports the increasing of S-I LNAV approach, which reduce the risk of Controlled Flight Into Terrain (CFIT) with a circling approach.

The PANS-OPS described at Section 4.10 is based upon a satellite based RNAV (GNSS) Instrument Flight Procedure, Baro-VNAV Instrument Approach. The procedure can be designed, implemented and maintained by an independent CASA certified MOS Part 173 (14) provider. See Figure 9 - Sample GNSS Baro VNAV Approach

CASA regulations Part 173 (CASR Part 173) requires an aerodrome to have registration or certification for the implementation of IFPs. Further to this, the aerodrome requires a minimum runway strip of 90m.

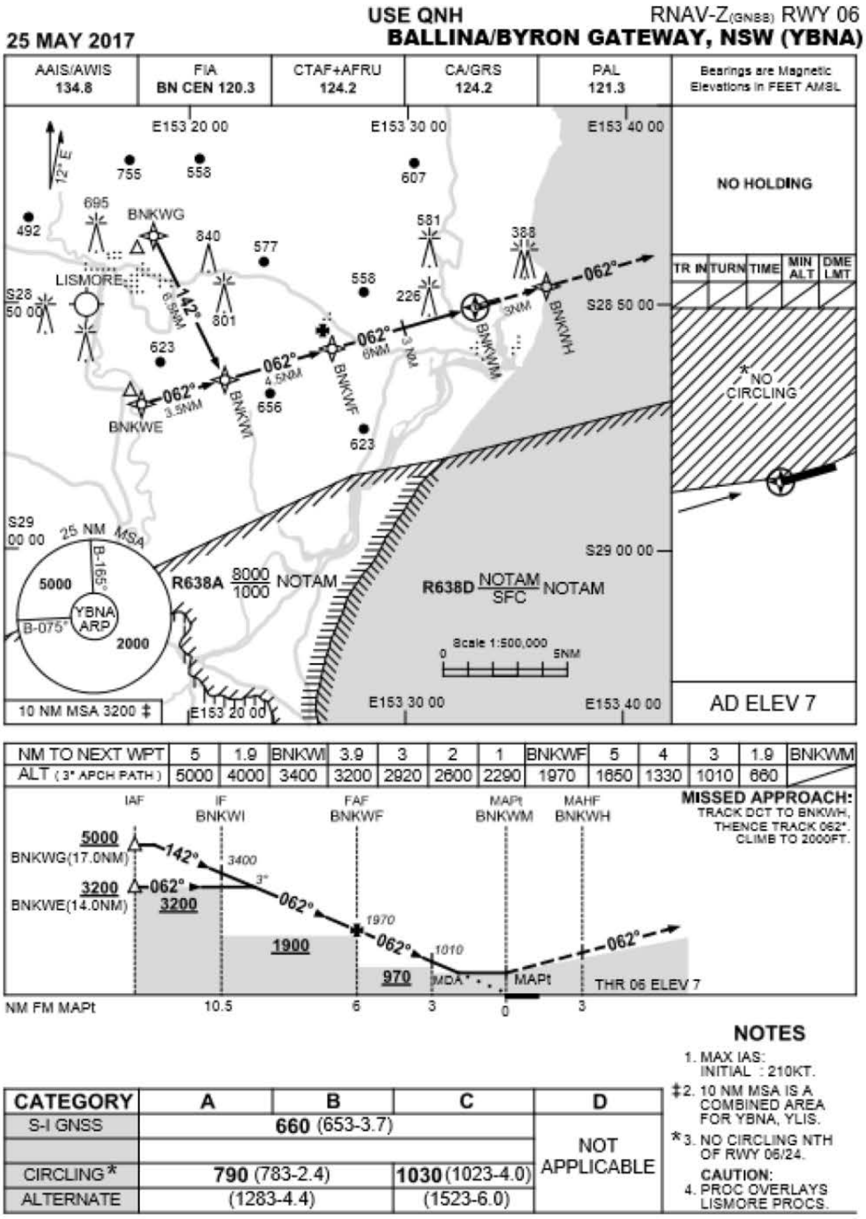


Figure 9 - Sample GNSS Baro VNAV Approach

Preliminary IAL designs indicate that waypoint KAMBA is suitable for direct entry to an Instrument procedure from the south to Runway 02- Table 5 - North Bound routes CB, ML, WG and AY- CCAH, while from the north, waypoints on the W220 MATLA-GUNTA track and on V140 route may also facilitate a direct entry to the Runway 20 procedure. See Table 7.

Minimum Safe Altitude

As start altitudes for procedures generally commence at an altitude based on calculations for obstacles within 25nm, these need to be compared to airspace altitudes. As the 25nm MSA (Minimum Safe Altitude) is less than 4500ft, it should be possible to have initial waypoints outside of Controlled Airspace. However, proximity to the north may require co-ordination with Military ATC.

For CCAH, the highest terrain is to the North West, although there is significant terrain to the west generally. By calculation, the NW sector of the 25nm MSA requires a minimum altitude of 3300ft, as does the omni-directional 10nm MSA. The remainder requires a height of 2500ft. This is illustrated in Figure 10 below.

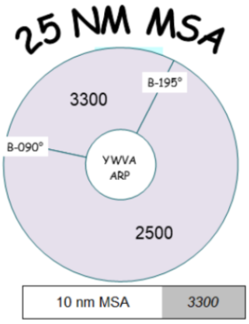


Figure 10 - 25NM MSA

Circling

Circling is an IFR procedure used only by aircraft after the end of an Instrument Approach to "circle" the airport to land on a different runway than that used by the approach procedure. The altitude is also used in flight planning, to determine the minimum fuel requirements.

Although the ICAO rules require circling to be calculated for each instrument approach procedure, it is generally considered preferable to have a single set of numbers for use at an aerodrome, and that the values are common to all procedures.

There is terrain to the west of the aerodrome which affects the lowest safe value available. In its most basic form, the circling altitudes will be:

Category	A	B	C
CIRCLING#‡	980 (941-2.4)		1400 (1361 – 4.0)

Figure 11 - Draft Circling all CCAH

If "No Circling" is allowed west of the field, then this will eliminate points 4 and 5 in the diagram from the calculations and become:

Category	A	B	C
CIRCLING#‡		910 (871 – 2.4)	1010 (971 – 4.0)

Figure 12 - Draft Circling no west CCAH

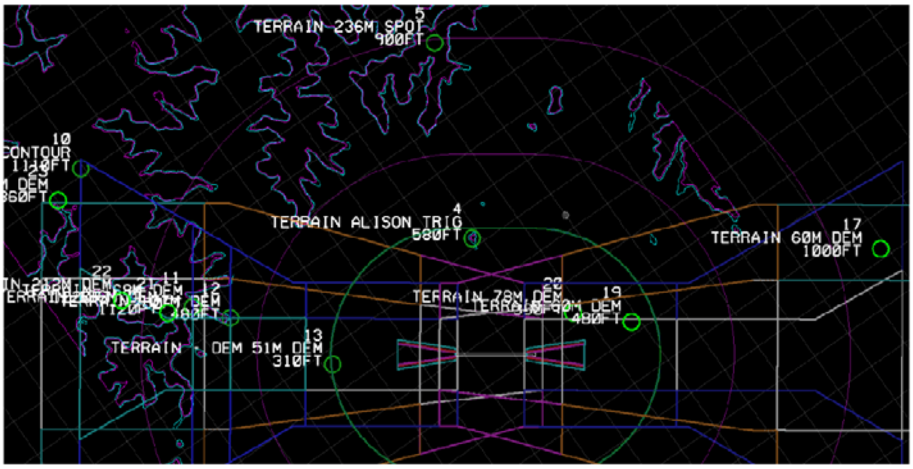


Figure 13 – Elimination of Circling Area to west of field (top) reduces altitudes

Runway 02 Draft Instrument Flight Procedure

The Runway 02 approach used is a standard 5nm leg Instrument Flight Procedure. The start altitude is based on a 25nm MSA of 3300ft, although it could have been lower using the sectorised 25MSA (possibly 2500ft).

There are generally no issues with the initial and intermediate legs.

The final approach from 5nm to touch down has some moderate terrain that is located close to the aerodrome. To ensure the lowest minima, the final segment has been "cut" at fixed distance positions at 3.5nm, 3.0nm and 2.0nm. This allows the segment heights to be adjusted to be below a nominal 3° gradient and ensure that an aircraft can be stepped over the terrain at a safe altitude. See Figure 14 - Final Approach Runway 02.

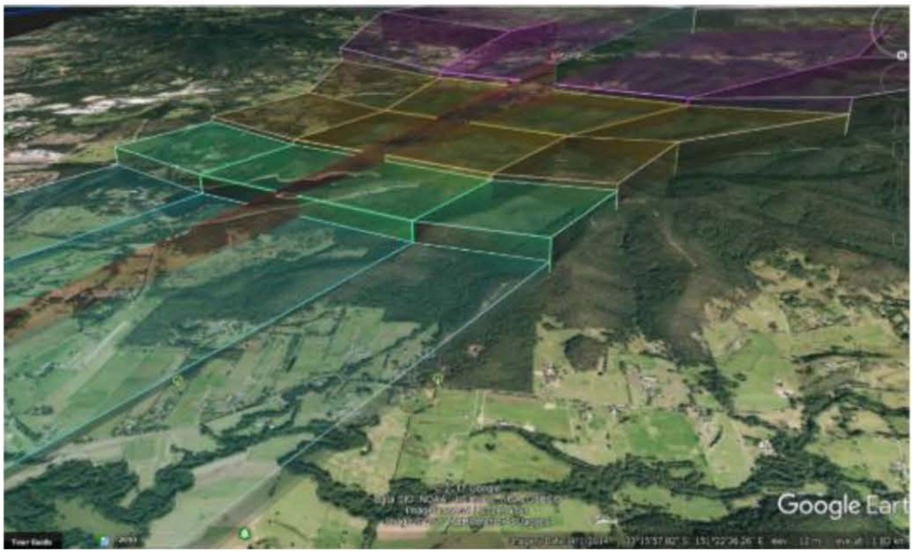


Figure 14- Final Approach Runway 02

For Runway 02, the draft minima are as per Table 12 - Runway 02 Minima.
These minima may be reduced to approximately 450ft AHD and 2.7km Visibility by employing a Baro-VNAV procedure as discussed above.

Table 12 - Runway 02 Minima

CATERGORY	A	B	C
LNAV ‡	660FT AHD (640 AGL) 3.5km visibility ‡		

Runway 20 Draft Instrument Flight Procedure

The Runway 20 approach used is a standard 5nm leg Instrument Flight Procedure. The start altitude is based on a 25nm MSA of 3300ft.

There are generally no issues with the initial and intermediate legs.

The final approach from 5nm to touch down a single step-down fix is used to ensure CASA data requirements can be met. There is no "difficult" terrain in final, however, the existing terrain is slightly taller than the comparative terrain to the south. See Figure 15.

Figure 15 - Final Approach Runway 20

For Runway 20, the draft minima are as perTable 13 - Runway 20 minima.

These minima may be reduced to approximately 480ft AHD and 2.8km Visibility by employing a Baro-VNAV procedure as discussed above.

Table 13 - Runway 20 minima

CATERGORY	A	B	C
LNAV ‡	730ft AHD (691 AGL) 3.5km visibility ‡		

By comparison, the RNAV (GNSS) Instrument Flight Procedure minima at Ballina aerodrome is 660ft and 3.7km. See Figure 9.

4.7 ATC Services

The Australian Airspace Policy Statement 2015 (AAPS) provides guidance for the determination of when changes to airspace classification may be required in the airspace immediately around an aerodrome, (referred to as the control zone at a controlled aerodrome).

The following criteria[2] will be used; annual passenger transport operations (PTO) aircraft movements, the annual number of passengers and total annual aircraft movements (see Table 14).

[2] Australia has not yet implemented Class B airspace but retains the criteria in the AAPS

Table 14 - Airspace criteria thresholds

	Class B	Class C	Class D
Service provided	ATC	ATC	ATC
Total annual aircraft movements	750,000	400,000	80,000
Total annual PTO aircraft movements	250,000	30,000	15,000
Total annual PTO passengers	25 million	1 million	350,000

The AAPS also provides guidance on the process for applying the criteria:

1. When annual traffic levels at an aerodrome meet a threshold of any one of the criteria CASA should complete an aeronautical risk review in consultation with the public, industry and other government agencies,
2. CASA will then make a determination to change the classification of airspace if necessary.

The Council has provided indicative high medium and low forecast data in relation to the future operations, shown at Table 15 and Table 16.

	Forecast annual aircraft movements					
Aircraft type	2018	2024	2025 low	2025 high	2029 low	2029 high
C150/PA28/ C172 (SGL)	20,000	42,000	45,600	46,000	48,000	50,000
PA44/B76/PA31 (Twin)	30	1,800	1,900	1,960	2,100	2,200
M500/TBM750/PC12/BE20	20	4,000	4,800	5,000	5,400	5,600
Cessna Citation	0	400	560	600	680	800
DH8-30/ATR72/FK50/SF34	0	0	11,680	17,400	14,600	26,280
Helicopters	170	800	950	1,100	1,080	1,320
Total annual	20,2220	49,000	63,490	72,060	71,860	86,200

Table 15 - Aircraft movement forecasts

	Forecast annual passengers		
	low	Med	high
2024			
2025	111,398	192,270	313,024
2026	114,740	202,356	341,196
2027	118,182	212,474	400,624
2028	121,728	223,097	436,680
2029	154,322	238,710	508,080

Table 16 - Passenger forecast

High side forecast data suggests that CCAH would approach the threshold for a CASA risk assessment (Class D) in 2025 on both aircraft movements and passenger numbers.
Low side forecast data suggests that CCAH would approach the threshold for a CASA risk assessment (Class D) in 2029 on forecast aircraft movements but not passenger numbers.

Class D services currently require the construction of an ATC Tower. It should be noted that Airservices, has indicated that they are exploring opportunities to deliver tower services using remote tower technology which may considerably alter the current service model moving forward.

As discussed in the Section on Flight Training . Ballina airport has recently introduced a CA/GRS. This service is a level lower than a full Air Traffic Services such as that delivered in Class D airspace, and operates under CASA MoS 139 (11) rather than the Air Traffic Control MOS172 (15).

Based on the example now demonstrated at Ballina Airport, the Council may consider the need for implementing a CA/GRS services prior to reaching the threshold for implementation of an ATC service under the CASA criteria above.

4.8 Aviation Rescue and Firefighting Services (ARFFS) requirements

The criteria for ARFF implementation are discussed in section Aviation Rescue and Firefighting Services (ARFFS) requirements.

Forecast data provided by the Council for future operations are shown at Table 15 and Table 16:

High side forecast data suggests that CCAH would reach the trigger point for ARFFS in 2027.
Medium forecast data suggests that CCAH would not reach the trigger point for ARFFS until beyond 2030.

Should CCAH passenger movements trigger an ARFFS requirement, based upon the forecast aircraft types accessing CCAH, the aerodrome would be considered an Aerodrome Category 6, as specified in Table 17: Aerodrome Category.

Table 17: Aerodrome Category

Aerodrome Category	Length of Aircraft	Maximum Fuselage Width
1	0 m up to but not including 9 m	2 m
2	9 m up to but not including 12 m	2 m
3	12 m up to but not including 18 m	3 m
4	18 m up to but not including 24 m	4 m
5	24 m up to but not including 28 m	4 m
6	28 m up to but not including 39 m	5 m
7	39 m up to but not including 49m	5 m
8	49 m up to but not including 61 m	7 m
9	61 m up to but not including 76 m	7 m
10	76 m up to but not including 90 m	8 m

Based on forecast traffic levels, CCAH potential aerodrome level and category, the aerodrome may require a minimum of 2 fire fighting vehicles, as described in Table 18. For comparison, Ballina Airport has an ARFFS established at Category 6.

Minimum Number of Vehicles	
Airport Category	**ARFFS Vehicles**
1 to 5	1
6 to 7	2 (min)
8 to 10	3 (min)

Table 18: Minimum number of vehicles

CASA specifies that fire vehicles must meet specifications in accordance with Australian Design Rules (ADR) and specific response time performance. Response time is defined as "the time between the initial call to ARFFS and the time when the first responding vehicles(s) is (are) in position at the aircraft or site of the incident or accident, and if required, produce foam at a rate of a least 50% of the discharge rate specified in the standards. ARFFS objectives is achieving a response time that does not exceed three minutes to the end of each runway in optimum visibility and surface conditions.

Minimum usable amounts of fire extinguishing agents for a category 6 aerodrome are defined in Table 19.

Minimum Usable Amounts of Extinguishing Agents				
Foam Meeting Performance Level A		**Foam Meeting Performance Level B**		**Foam Meeting Performance Level C**
Discharge rate foam solution (Water)		**Discharge rate foam solution (Water)**		**Dry Chemical Powder (DCP)**
11,800 litres	6,000 l/m	7,900 litres	4,000 l/m	225 Kg

Table 19: Extinguishing Agents Performance for Aerodrome Category 6

The Department of Infrastructure and Regional Development is currently conducting a Regulatory Policy Review of Aviation Rescue and Fire Fighting Services. (16) The outcomes of the review have yet to be actioned, but provide opportunities for airports to implement graduated "Fire Related Services at lower "trigger" points than currently described in the standard.

The review first two key agreed recommendations allow a risk based approach to aviation rescue and firefighting service establishment as follows:

- ARFFS be required to be established at a location where a relevant trigger event occurs and where the Civil Aviation Safety Authority (CASA) decides, following its conduct of a risk review, that ARFFS is required at that location.
- Two measures constitute a trigger event for the conduct of a risk review relating to the establishment of an ARFFS - the receipt of scheduled international passenger air services, or 500,000 passengers on scheduled commercial air services passing through the airport during a rolling twelve-month period.

When implemented, these changes may require a re-evaluation of the ARFF requirements for CCAH.

4.9 OLS

The OLS is a series of virtual surfaces associated with each runway at an aerodrome that defines the lower limits of airspace in which objects above this surface are defined as obstacles. The OLS is often used as a land planning tool to limit the height of structures, trees or other objects in the vicinity of aerodromes so that an aircraft may operate safely during the initial and final stages of flight and avoid collisions with obstacles.

As part of the planned 2024 Stage 3 development, the current 1194m runway is planned to be modified to 1200m.

The updated OLS is completed for the planned 2024 Stage 3 development, which involves a 1200m Code 3C non-precision runway with a runway strip of 150m and a displaced threshold of 225m on Runway 20. It is important to note that in the absence of aerodrome survey data, the elevations of Runway 02 and 20 are assumed to be 9.2m and 11m relative to the Australian Height Datum (AHD) respectively, as discussed in Section 2.1.

The OLS, as well as notable terrain intrusions can be seen in Annex A: Obstacle Limitation Surface.

4.10 PANS-OPS Surface

The Procedures for Air Navigation Services – Operations (PANS-OPS) surface is similar to the OLS in that they are described surfaces in space ensuring the protection of aircraft from colliding into obstacles. However, the PANS-OPS surface aims to protect aircraft guided solely by radio and satellite navigation aids, while flying in low visibility conditions. The PANS-OPS surface is generally situated above the OLS. Intrusions into the PANS-OPS surface are generally prohibited.

To70 used a 1799m runway which is intended to provide a worst-case assessment of the situation when it conducted the preliminary PANS-OPS assessment. We reviewed a database of obstacles obtained from Airservices, also known as the RAAF obstacle database. The database contains a list of obstacles which are significant to aircraft operations. Originally implemented by the RAAF, Airservices maintains the information through their Aeronautical Database Management System, known as Mercury.

For CCAH to proceed with non-precision operations in the future, it is recommended that a PANS-OPS surface chart be prepared by an independent CASA certified MOS Part 173 [13] as part of the final flight path and procedure design.

5 Airspace change roadmap

To70 has prepared an indicative "roadmap" of airspace activities for progression of the proposal through CASA, Office for Airspace Regulation and Airservices approvals. The list is not exhaustive but represents some of the key activities.

5.1 Preliminary Consultation

CCAH is in very close proximity to Airservices managed airspace, and most IFR operations at the aerodrome are conducted in with reference to and service from Airservices and Defence ATC. Prior to the commencement of any airspace change, preliminary consultation should be conducted with Airservices and Defence ATC. Where possible, this should be conducted in concert to ensure that all parties involved in the change process receive the same information.

5.2 Airport Safeguarding

Formal preparation of Obstacle Limitation Surfaces (OLS), (including Procedures for Air Navigation Services-Aircraft Operations (PANS-OPS) and Communication Navigation and Surveillance (CNS) Surfaces will be required during this stage to inform the National Airports Safeguarding Framework as outlined in Guidelines A-F. (17) Council has indicated that a Helicopter Landing Site (HLS) may be constructed at the southwest of Runway 02/20. An additional OLS would be required for this site to determine building setback and ensure that all published holding points will keep aircraft clear of operations at the HLS.

While New South Wales does not currently have standards for Public Safety Zones, in the absence of any nationally agreed guidance, a nominal 1000 m trapezoid shaped clearance off the end of each runway threshold is may be used and should be discussed with local planning authorities.

5.3 Airport Certification

With the expectation of RPT or frequent charter operations conducted with aircraft of more than 30 passengers, CCAH will require certification under CASA MoS Part 139 (11). While the airport certification process is outside the scope of this work, there is a significant interrelationship between the airspace and airport that must be aligned.

5.4 Instrument Approach Procedures

The introduction of an IAL at CCAH, will require a formal assessment of the aerodrome and its environment with respect to CASA MoS Part 139 (11), to confirm the suitability of the aerodrome to host flights under the IFR. Shortcomings will be identified, with recommendations to meet CASA compliance requirements. The aerodrome will also require certification or regulation in order for IAL to be implemented see above. A CASA MoS Part 173 certified designer will be required to design formal IAL procedures. As part of the process, the designer will coordinate with Airservices to ensure the designed procedures are integrated with existing and new routes as required.

Flight validation is required for:

1. Instrument approach procedures;
2. Revised instrument approach procedures where the final course has been re-aligned by 3° or more.

Validation of an instrument flight procedure comprises:

1. A review of the draft procedures from an operational perspective conducted by the validation pilot;
2. A validation flight check.

The process of instrument approach procedure design focuses on those controlling obstacles that affect the procedure. This focus is facilitated using various obstacle and terrain databases. The purpose of flight validation is to verify database information, to check all obstacles (including the identification of any unforeseen obstacles) that affect the safety of the procedure, and to assess the 'flyability' of the procedure.

5.5 Flight Path Authorisation

For flight paths to be implemented, Airservices is required to review proposed designs for adherence with pre-existing environmental work. Airservices will determine whether there is a requirement to refer any flight path change to the appropriate Minister under Section 160 of the EPBC act and where required, make a referral.

5.6 Aircraft Noise Exposure Forecast (ANEF)

To support the development of an Airport Master Plan or Major Development Plan, an ANEF based on the design assumptions would be required.

5.7 Consultation

It is recommended that prior to completion of an ACP and the creation of information for AIP, further consultation is conducted with Airservices and Defence ATC to ensure that data prepared is suitable to and supported by all parties.

5.8 Airspace Change Proposal Authorisation

Changes to airspace classification or new air routes published an Airspace Change Proposal (ACP) must be submitted to CASA for review. CASA will review and approve both the change and the environmental assessment. This work is described in CASA's Airspace Risk and Safety Management Manual (18)

5.9 Aeronautical Information Management

Aeronautical Information Circular (AIC) Advance notice

Once sufficient detail is known, an AIC can be published providing the aviation community with advance notice of intended changes being made to air routes and facilities. The content of the AIC can be simply an introduction, description of the change and expected timing of the change. AIC are published by Airservices.

Aeronautical Information Publication (AIP)

Final details for changes to the following items should be prepared and submitted for publication in AIP to Airservices and other Aeronautical Information Service (AIS) providers.

1. RWY dimensions, lighting, etc.
2. TWY, dimensions lighting, usage, etc.
3. Aprons, dimensions lighting, etc.

4. HLS, dimensions, lighting, etc.
5. IAL, full suite
6. Communication Frequencies, location, frequency, etc.
7. Facilities
8. Procedures
    a. NAP
    b. Low vis
9. Charts
    c. Aerodrome
    d. Apron
    e. Procedure
    f. Obstacle
    g. Runway distance supplement
    h. Waypoints list
    i. Flight Planning requirements where amended for overflying or helicopter activity
    j. Maps- amended as required:
        i. Visual Terminal Charts (VTC) provide both aeronautical and topographical information at a scale of 1:250,000 for VFR operations in the vicinity of major aerodromes.
        ii. Enroute Charts (ERC) Low and High, are drawn to various scales to accommodate significant air traffic route areas and show controlled airspace, prohibited, restricted and danger areas, air routes, ATS and radio-navigation services.
        iii. Terminal Area Charts (TAC) provide airspace, air-routes, prohibited, restricted, and danger areas, navigation aids and radio frequencies. They are designed to display aeronautical information at a larger scale for easier use in congested areas.
        iv. Visual Navigation Charts (VNC) are used to plan flight in relation to controlled airspace, transition from the WAC to the VTC when operating around terminal areas, and navigate when nearing controlled Airspace or Restricted and Danger Areas.

6 Data

6.1 BITRE Data

The following statistics below are taken from The Bureau of Infrastructure, Transport and Regional Economics (BITRE).

General Aviation Activity

The following table shows the number of hours flown in General Aviation throughout Australia.

Table 20 - Hours flown in General Aviation years ended December

General Aviation (000's of hrs)										
Year	**Private**	**Business**	**Training**	**Test & Ferry**	**Aerial Work**	**Agriculture**	**Charter**	**Sub total**	**Regional Airline**	**Total**
2010	241.9	140.0	436.3	18.2	400.3	103.8	507.3	1847.7	228.1	2075.9
2011	237.4	144.8	386.8	17.9	398.8	100.4	485.2	1771.4	216.7	1988.1
2012	232.6	130.4	360.9	20.8	369.4	59.1	501.7	1704.9	204.4	1909.3
2013	231.2	130.8	378.9	23.8	411.5	79.8	485.9	1741.8	268.3	2010.1

Table 21 - Domestic aviation activity

	Year End Apr 2016	Year End Apr 2017	Growth
Total Passengers carried	58.12 million	59.1 million	1.7%
Revenue Passenger Kilometres	68.53 billion	69.41 million	1.3%
Available Seats	77.41 million	77.02 million	-0.5%
Available seat kilometres	89.31 billion	88.58 million	-0.8
Load Factor	76.7%	78.4%	1.6* (percentage point difference)
Aircraft Trips	638100	636000	-0.3

Table 22 - Domestic airfares

Survey Month	Business	Restricted Economy	Best Discount
Jun 2016	95.3	79.6	58.5
Jul 2016	94.2	78.9	57.4
Aug 2016	94.4	79.1	57.5
Sep 2016	94.9	80.4	73.6
Oct 2016	93.9	79.6	61.6
Nov 2016	94.2	79.8	61.2
Dec 2016	96.9	81.2	84.4
Jan 2017	94.2	79.3	58.9
Feb 2017	94.3	79.7	59.6
Mar 2017	95.4	80.4	81.7
Apr 2017	93.8	80.2	59.7
May 2017	96.0	80.3	64.6
Jun 2017	95.1	80.9	61.5

Aviation Turbine Fuel Sales

The following table show the trend in increasing fuel prices for aviation.

Quarter	Turbine Fuel Sales (ML)	Gasoline Fuel Sales (ML)
Jun 2012	1827	21.5
Sep 2012	1928	21.0
Dec 2012	1979	20.5
Mar 2013	1916	18.2
Jun 2013	1950	21.3
Sep 2013	2073	19.8
Dec 2013	2089	18.5
Mar 2014	1968	16.2
Jun 2014	2038	18.1
Sep 2014	2041	17.6
Dec 2014	2075	16.9
Mar 2015	2010	15.8
Jun 2015	2017	17.9
Sep 2015	2105	17.2

6.2 Wind Data from Bureau of Meteorology (BoM)

Approximately 15 years' worth of climate statistics were obtained for the three closest weather stations from Central Coast. These stations are Mangrove Mountain and Norah Head. The Figure 16 shows the prevalent winds for the area surrounding Central Coast are mainly from the South, North-East during the afternoon and West during the morning.

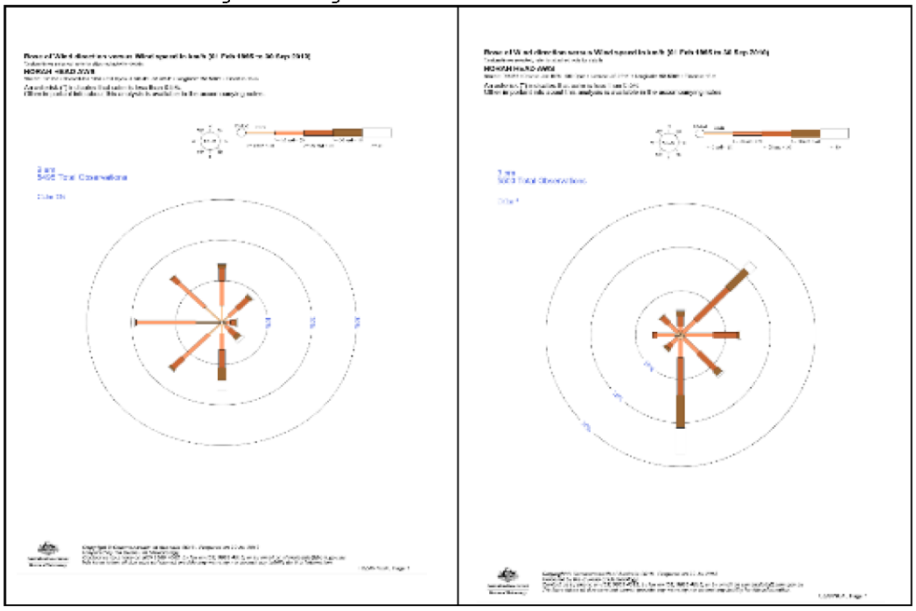


Figure 16 - Norah Head wind rose (9am and 3pm)

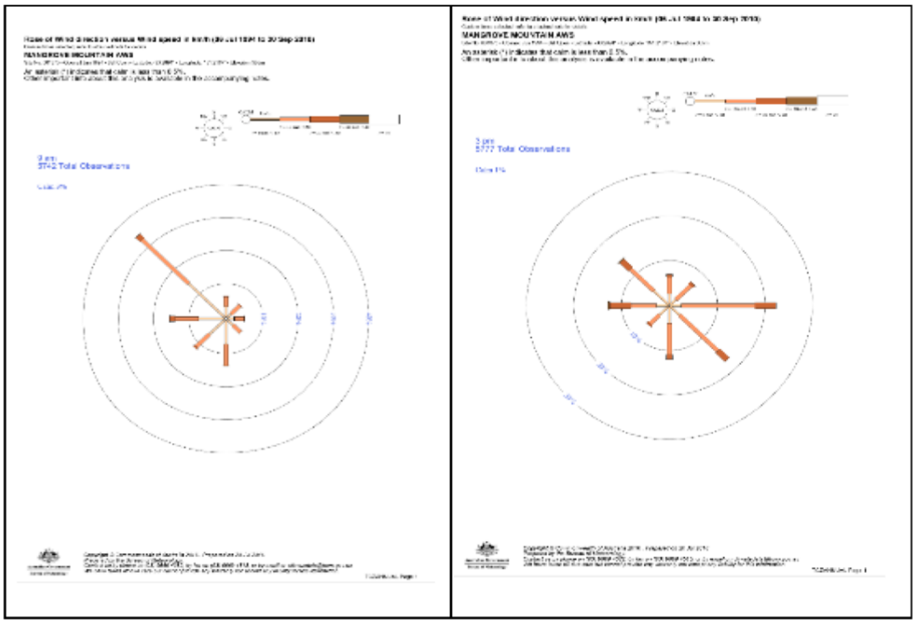


Figure 17 – Mangrove Mountain wind rose (9am and 3pm)

6.3 Aircraft performance

This section contains details of the aircraft performance specifications listed according to their airfield capability:

Aircraft capable of operating with minimal constraint to 1200m x 30m runway

Table 23 – Q300 Specifications

	**Performance Specifications Q300** Operators in Australia: **QantasLink** Image courtesy Bombardier
Passenger Typical	50
Runway requirement	
Max Take-off field length (MTOW, SL, ISA) (m)	1,180
Max Landing field length (MLW, SL) (m)	1,040
High speed cruise (km/h)	532
Ceiling (ft)	25,000
Range (km)	1,711
Weight	
Max Takeoff (kg)	19,500
Max landing (kg)	19,050
Max zero fuel (kg)	17,920

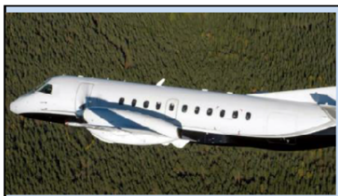
Source: (19)

Table 24 – FK50 Specifications

	**Performance Specifications FK50** Operators in Australia: **Alliance Airlines** **Image courtesy Fokker**
Passenger Typical	50
Runway requirement	
Max Take-off field length (MTOW, SL, ISA) (m)	1,000
High speed cruise (km/h)	500
Ceiling (ft)	25,000
Range (km)	13,00
Weight	
Max Takeoff (kg)	20,820
Max landing (kg)	20,030
Max zero fuel (kg)	12,250

Source: (20)

Table 25 – SF340 Specifications

	**Performance Specifications SF340** Operators in Australia: **Regional Express** Image courtesy ATR Aircraft
Passenger Typical	33
Runway requirement	
Max Take-off field length (MTOW, SL, ISA) (m)	1200
High speed cruise (km/h)	524
Ceiling (ft)	25,000
Range (km)	1,851
Weight	
Max Takeoff (kg)	13,154
Max landing (kg)	12,927
Max zero fuel (kg)	12,020

Source: (21)

7 Consulted parties

NSW Rural Fire Service Charmhaven

Queensland Rescue and Firefighting Services Acacia Ridge

CASA -ARFFS section

CASA - OAR Plume Rises

Airservices ATC- Sydney and Brisbane Centre

Airservices ARFFS –Chief Fire Officer

Defence ATC- Williamtown

Ballina Airport CA/GRS

Central Coast Aero Club

8 Terms and abbreviations

Abbreviation	Name	Description
AIC	Aeronautical Information Circular	An AIC contains explanatory or advisory information concerning technical, legislative or administrative matters, as well as information on the long-term forecast of major changes in legislation, regulations, procedures or facilities liable to affect flight safety
AIM	Aeronautical Information Management	ICAO defines AIM as encompasses the origination, management and distribution of time-sensitive, digital aeronautical information in a safe secure and efficient manner.
AIP	Aeronautical Information Publication	The AIP is defined by the International Civil Aviation Organization as a publication issued by or with the authority of a state and containing aeronautical information of a lasting character essential to air navigation.
AIRAC	Aeronautical Information Regulation and Control	Aeronautical Information Services (AIS) document and defines a series of common dates and an associated standard aeronautical information publication procedure for States.
Airservices	Airservices Australia	Airservices is a corporate Commonwealth entity providing safe, secure, efficient and environmentally responsible air traffic control services to the aviation industry in Australian controlled airspace.
Airspace	Airspace	That portion of the earth's atmosphere over which a nation exercises jurisdiction over aircraft in flight. The continental division of airspace usually coincides with the national boundaries and the oceanic division is determined by mutual agreement of the nations concerned.
AIS	Aeronautical Information Service	The AIS is a service established in support of international civil aviation, whose objective is to ensure the flow of information necessary for the safety, regularity, and efficiency of international air navigation.
ANSP	Air Navigation Service Provider	A company that delivers Air Traffic Services (ATS)
APV	Approach with Vertical Guidance	Instrument approach procedure that involves lateral and vertical guidance to aircraft, but does not meet the requirements established for Precision Approach classification.
ASMGCS	Advanced Surface Movement Guidance and Control System	This tool provides ATC with a plan view of aerodromes deriving data from surveillance and ADSB data. In Australia, it also provides data to the Aerobahn product.
ATC	Air Traffic Control	Tower (TWR) ATC Terminal Manoeuvring Area (TMA) ATC Enroute (ENR) ATC
ATM	Air Traffic Management	ATM consists of three basic elements; Air Traffic Control, Air Traffic Flow Management and Aeronautical Information Services
CASA	Civil Aviation Safety Authority	CASA has the primary responsibility for the maintenance, enhancement and promotion of the safety of civil aviation in Australia.
DAH	Designated Airspace Handbook	The DAH is a publication issued on an alternating approximate 24/28-week cycle. The DAH lists, in tabular form, the lateral and vertical limits and other pertinent details of the airspace types as listed
DIRD	Department of Infrastructure and Regional Development	Federal Government agency
DOE	Department of Environment	Federal Government agency

Abbreviation	Name	Description
GA	General Aviation	General aviation commonly refers to that part of the aviation industry that engages in activity other than commercial air transport activity
HLS	Helicopter Lift off and Landing Site	A location used by helicopters to land and lift off
IAP/IAL	Instrument Approach Procedure	The approved procedure to be allowed by aircraft in descending from cruising level and landing at an aerodrome. It involves a series of predetermined manoeuvres for the orderly transfer of an aircraft by reference to night instruments, from the beginning of the initial approach to a landing or to a point from which a landing may be made visually.
ICAO	International Civil Aviation Authority	ICAO is a United Nations specialized agency formed by the signing of the Chicago Convention (1944) responsible for working with the Convention's 191 Member States and global aviation organizations to develop international Standards and Recommended Practices (SARPs) which States reference when developing their legally-enforceable national civil aviation regulations.
ILS	Instrument Landing System	A system of radio navigation intended to assist aircraft in landing which provides lateral and vertical guidance, which may include indications of distance from the optimum point of landing
IMC	Instrument Meteorological Condition	A flight classification
Maneuvering Area	Manoeuvring Area	A manoeuvring area is that part of an aerodrome to be used by aircraft for take-off, landing, and taxiing, excluding aprons and areas designed for maintenance of an aircraft.
MDP	Major Development Plan	All leased federal airports (except for Tennant Creek and Mount Isa Airports) are required to develop a Major Development Plan for major airport developments on the airport site. A draft version of the Major Development Plan must undergo public consultation before being submitted to the Minister for Infrastructure and Regional Development for a decision
Movement	Movement	Either a take-off or a landing by an aircraft.
Movement Area	Movement Area	A movement area, as defined by ICAO, is "That part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, consisting of the manoeuvring area and the apron(s)."
NAP	Noise Abatement Procedures	Includes the ICAO Noise Abatement Departure Procedures (NADP)
NOTAM	Notice to Airmen	A NOTAM is a notice filed with an aviation authority to alert aircraft pilots of potential hazards along a flight path or at a location that could affect the safety of the flight.
NPA	Non-Precision Approach	An instrument approach procedure involving the use of instruments that provide lateral guidance.
OLS	Obstacle Limitation Surface	A series of surfaces that set the height limits of objects, around an aerodrome.
PANS-OPS	Procedures for Air Navigation Services – Operations	Similar to an OLS, with the purpose of protecting aircraft operating in Instrument Meteorological Condition (IMC) conditions.
RAPAC	Regional Airspace and Procedures Advisory Committee	Regional airspace and procedures advisory committees (RAPACs) are primarily state-based forums for discussion of all matters relating to airspace and related procedures in Australia, and specifically in their areas of responsibility.
SME	Subject Matter Expert	An experienced specialist with subject matter expertise in one or more fields.

Abbreviation	Name	Description
TCU	Terminal Control Unit	A unit responsible for delivering an ATC Approach service
TMA	Terminal Manoeuvring Area	TMA is used to describe a designated area of controlled airspace surrounding a major airport where there is a high volume of traffic.
VFR	Visual Flight Rules	A category of flight
VMC	Visual Meteorological Condition	The conditions required for VFR
VSA	Visual Approach	An approach by an aircraft to a runway executed by a visual reference to terrain.

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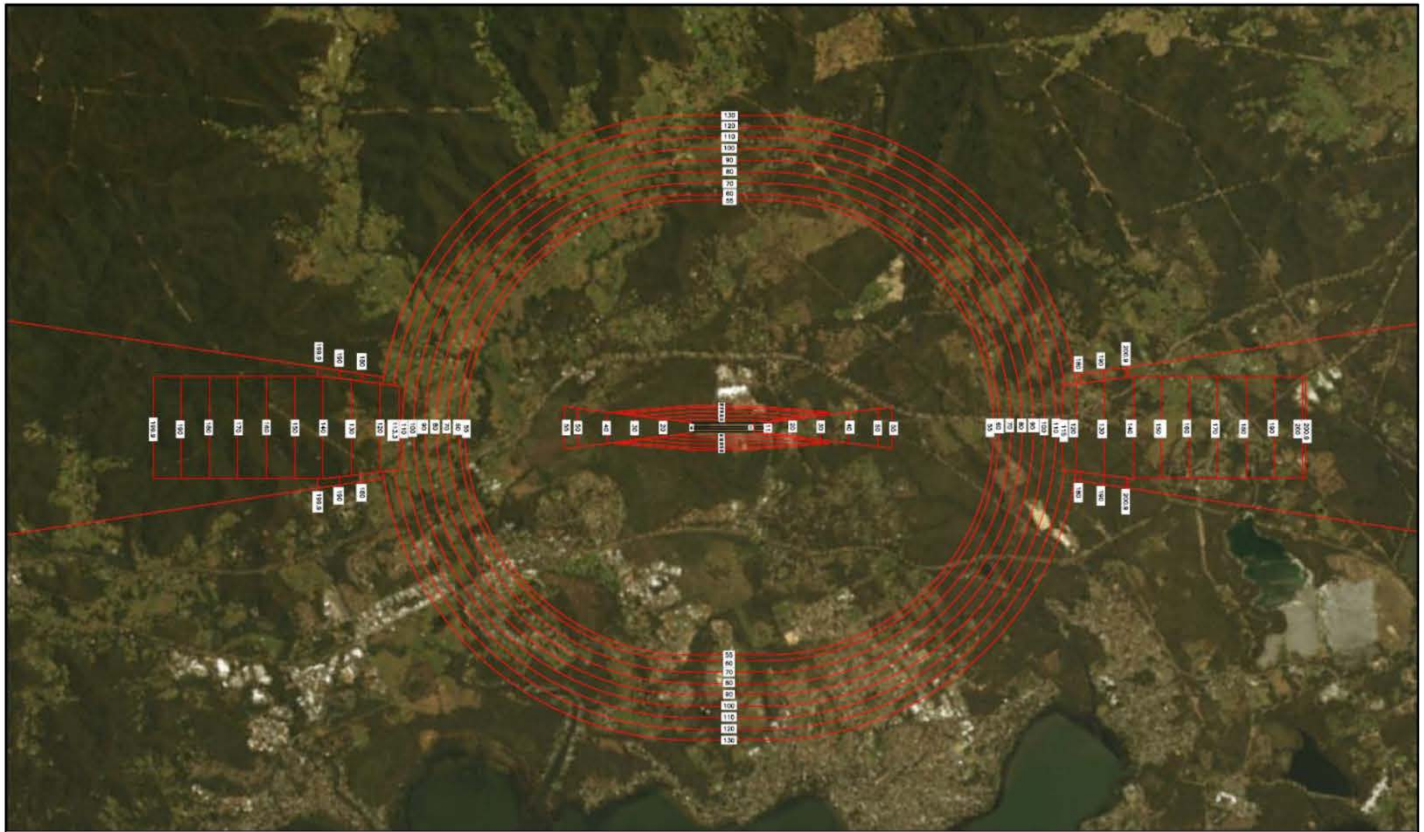
Annex A: Obstacle Limitation Surface



Central Coast Airport Obstacle Limitation Surfaces

Runway Specification: 1200m Instrument Non-Precision Code 3C

Approach Surfaces

Direction	Length of inner edge	Height of inner edge	Distance to inner edge	Divergence	Slope 1st section	Length 1st section	Slope 2nd section	Length 2nd section	Length 3rd section	Overall Length
02	150m	10m AHD	60m	15%	3.33%	3000m	2.5%	3600m	8400m	15000m
20	150m	11m AHD	60m	15%	3.33%	3000m	2.5%	3600m	8400m	15000m

Take-off Surfaces

Direction	Length of inner edge	Height of inner edge	Distance to inner edge	Divergence	Slope	Final width	Overall Length
02	180m	10m AHD	60m	12.5%	2%	1800m	15000m
20	180m	11m AHD	60m	12.5%	2%	1800m	15000m

Transitional Surfaces

Slope	14.3%

Notes:

1. ALL ELEVATIONS ARE TO AUSTRALIAN HEIGHT DATUM
2. ASSUMED AERODROME REFERENCE LEVEL – 10m AHD
3. ASSUMED 225M DISPLACED THRESHOLD ON RUNWAY 20
4. THIS DRAWING IS A DRAFT AND IS FOR PRELIMINARY HIGH-LEVEL ASSESSMENTS ONLY

DRAFT

0 2000 4000 Meters

1:70,000

Date: 30/10/17

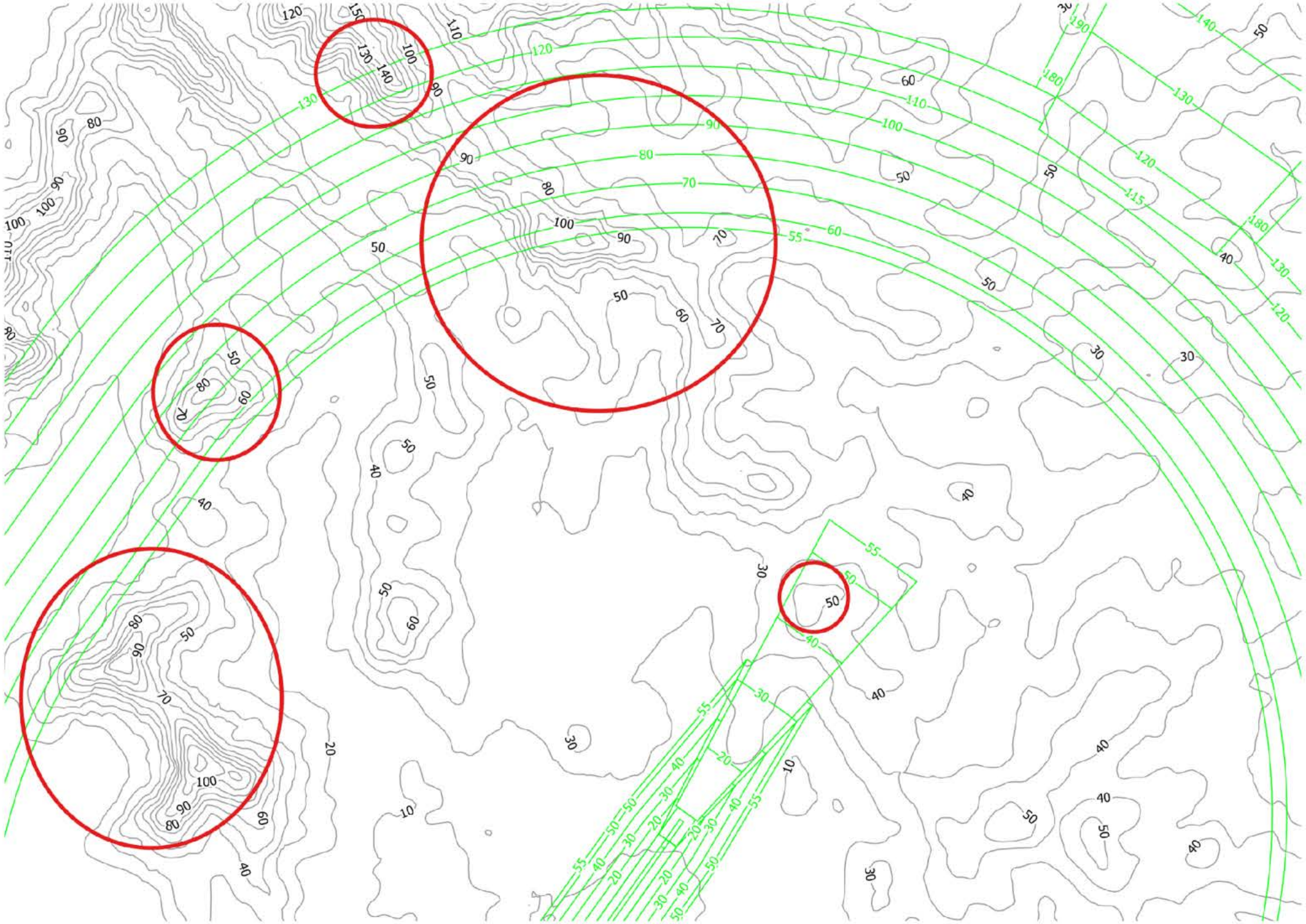


Figure 18 - Northern terrain intrusions

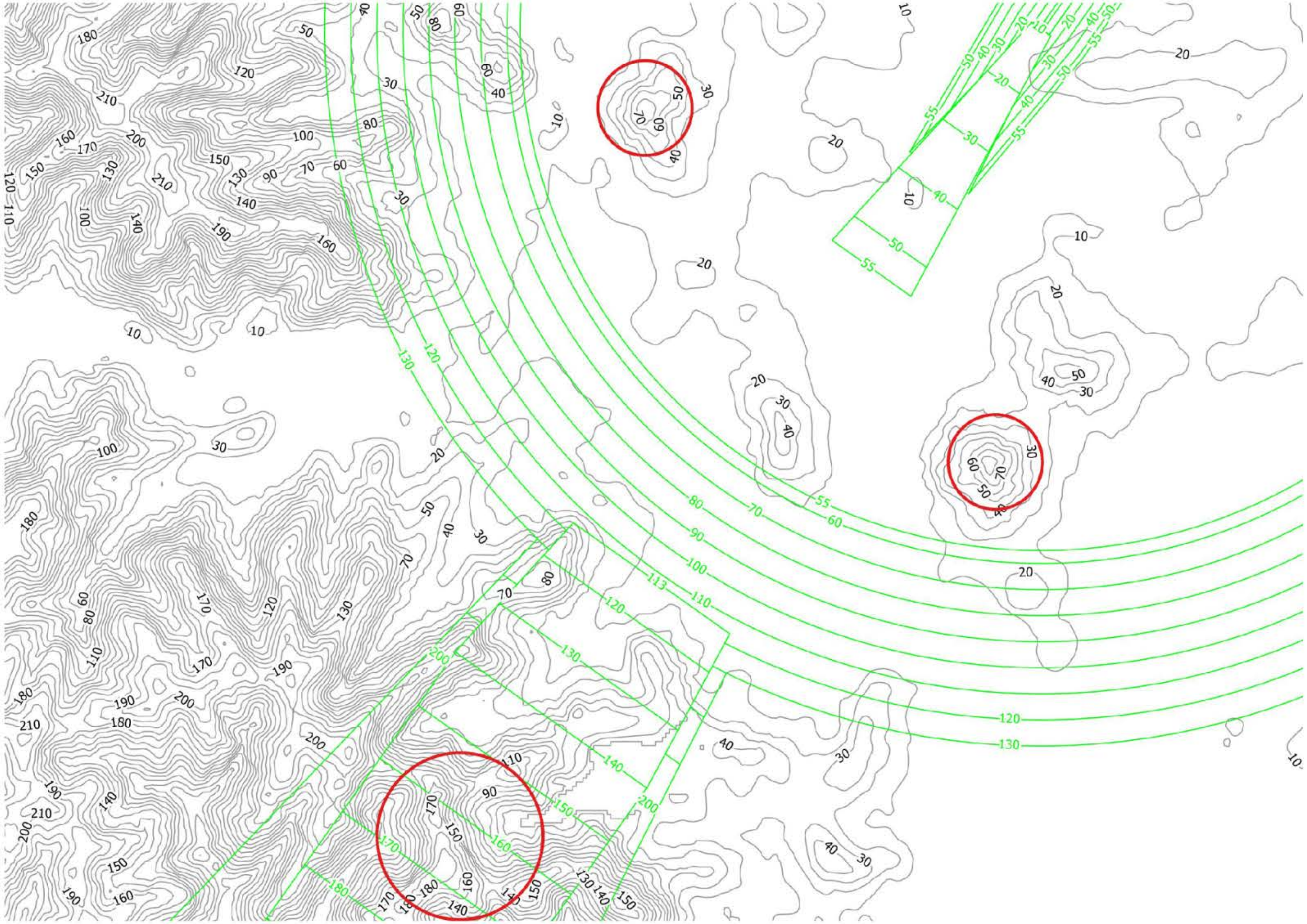


Figure 19 – Southern terrain intrusions

Annex B: Airport survey

An airport survey was conducted at Central Coast Aviation Hub. The survey process involved producing a baseline survey on Code 2 parameters as well as a survey of the airport based on Code 3C parameters.

The results are produced below:

WARNERVALE AERODROME

RUNWAY : 02/20
(CODE 3 RUNWAY)

Surveyor : Bryan Fitzgerald
Date of Survey : 25/10/2017

AIRPORT SURVEYS

Runway Length : 1194 metres
Runway Strip Width : 150 metres

RWY 02	RWY 20
TODA : 1254 metres	TODA : 1254 metres
Take Off SFC Origin RL : 11.41 AHD	Take Off SFC Origin RL : 5.26 AHD
20 Threshold RL : 10.68 AHD	02 Threshold RL : 5.26 AHD
20 Threshold Displaced : 210m	02 Threshold Displaced : 0m

APPROACH / TAKE OFF SPECIFICATIONS USED FOR SURVEY

TAKE OFF SURFACES:	
180m	INNER EDGE
12.5%	DIVERGENCE
15000m	LENGTH
2%	GRADIENT

APPROACH SURFACES:	RWY 02	RWY 20
	(Non-Precision Inst Apch)	(Non- Precision Inst Apch)
INNER EDGE	150m	150m
DIVERGENCE	15%	15%
LENGTH	15000m	15000m
GRADIENT	3.33%	3.33%
TRANSITIONAL SLOPE	1 in 7	1 in 7

TAKE-OFF RUNWAY No.	Surveyed Point No.	DESCRIPTION	DIST. FROM END OF CLEARWAY	HEIGHT OF OBSTACLE ABOVE CWY END	TAKE-OFF GRADIENT TO OBST.	OBST. R.L.	DIST. FROM START OF TAKE OFF	OFFSET FROM RWY C/L	RELATIONSHIP TO OBSTACLE LIMITATION SURFACES: 2% Take Off grade	3.33% Apch grade	Transitional Surfaces (Positive figures - Above / Negative figures - Below.)
02	1	EUC. TREE	121.4	26.65	21.96%	38.06	1374.9	59.0 R	24.2	16.3	*Obstructs the Apch SFC*
02	2	POWER POLE	109.5	10.82	9.89%	22.23	1363.0	50.2 R	8.6	0.9	*Obstructs the Apch SFC*
02	3	EUC. TREE	165.7	27.65	16.69%	39.06	1419.2	49.8 L	24.3	15.9	*Obstructs the Apch SFC*
02	4	EUC. TREE	12.1	19.94	N/A	31.35	1265.6	107.3 L	OUTSIDE	13.3	*Obstructs the Apch SFC*
02	5	EUC. TREE	-90.0	22.59	N/A	34.00	1163.5	123.7 L	OUTSIDE		*Obstructs Trans SFC by 14.9m*
02	6	FENCE	3.3	1.54	46.67%	12.95	1256.8	80.6 L	1.5	-4.8	Obstructs the Take off SFC
02	7	FENCE	57.2	1.91	3.34%	13.32	1310.7	5.0 L	0.8	-6.3	Obstructs the Take off SFC
02	8	FENCE	40.2	2.19	5.45%	13.60	1293.7	83.2 R	1.4	-5.4	Obstructs the Take off SFC
02	9	EUC. TREE	1610.5	69.37	4.31%	80.78	2864.0	160.0 L	37.2	9.5	*Obstructs the Apch SFC*
02	10	EUC. TREE	1440.8	61.31	4.26%	72.72	2694.3	355.2 R	OUTSIDE		*Obstructs Trans SFC by 2.4m*
02	11	LEVEE BANK	25.7	1.37	5.34%	12.78	1279.2	58.5 R	0.9	-5.7	Obstructs the Take off SFC
02	12	ROAD - 4.5m HIGH	93.9	5.81	6.19%	17.22	1347.4	1.0 L	3.9	-3.6	Obstructs the Take off SFC
02	13	ROAD - 4.5m HIGH	81.1	5.71	7.05%	17.12	1334.6	47.1 R	4.1	-3.3	Obstructs the Take off SFC
02	14	ROAD - 4.5m HIGH	70.9	5.60	7.90%	17.01	1324.4	94.0 R	4.2	-3.0	Obstructs the Take off SFC
02	15	BUILDING	324.6	11.76	3.63%	23.17	1578.1	56.0 R	5.3	-5.3	Obstructs the Take off SFC
02	16	BUILDING	348.5	15.24	4.38%	26.65	1602.0	43.6 R	8.3	-2.6	Obstructs the Take off SFC
02	17	AERIAL ON SHED	394.4	27.88	7.07%	39.29	1647.9	133.5 R	20.0	8.5	*Obstructs the Apch SFC*

TAKE-OFF RUNWAY No.	Surveyed Point No.	DESCRIPTION	DIST. FROM END OF CLEARWAY	HEIGHT OF OBSTACLE ABOVE CWY END	TAKE-OFF GRADIENT TO OBST.	OBST. R.L.	DIST. FROM START OF TAKE OFF	OFFSET FROM RWY C/L	RELATIONSHIP TO OBSTACLE LIMITATION SURFACES: 2% Take Off grade	3.33% Apch grade	Transitional Surfaces (Positive figures - Above / Negative figures - Below.)
20	1	EUC. TREE	120.9	14.64	12.11%	19.90	1374.4	4.8 R	12.2	10.6	*Obstructs the Apch SFC*
20	2	EUC. TREE	134.0	16.72	12.48%	21.98	1387.5	16.6 L	14.0	12.3	*Obstructs the Apch SFC*
20	3	EUC. TREE	97.4	13.98	14.36%	19.24	1350.9	30.4 L	12.0	10.7	*Obstructs the Apch SFC*
20	4	EUC. TREE	89.4	20.96	23.45%	26.22	1342.9	73.9 L	19.2	18.0	*Obstructs the Apch SFC*
20	5	EUC. TREE	123.2	24.36	N/A	29.62	1376.7	112.7 L	OUTSIDE		*Obstructs Trans SFC by 17.5m*
20	6	EUC. TREE	66.4	24.19	N/A	29.45	1319.9	108.3 L	OUTSIDE		*Obstructs Trans SFC by 18.6m*
20	7	EUC. TREE	-85.1	19.36	N/A	24.62	1168.4	109.9 L	OUTSIDE		*Obstructs Trans SFC by 14.4m*
20	8	EUC. TREE	-25.2	12.32	N/A	17.58	1228.3	151.9 R	OUTSIDE		*Obstructs Trans SFC by 1.3m*
20	9	POWER PYLON	7353.9	205.05	2.79%	210.31	8607.4	445.4 R	58.0	46.7	*Obstructs the 3rd Section of Apch*
20	10	RADIO MAST	7638.4	283.27	3.71%	288.53	8891.9	1164.2 R	OUTSIDE	124.9	*Obstructs the 3rd Section of Apch*
20	11	EUC. TREE	3659.8	77.66	2.13%	82.92	4913.3	75.1 L	4.5	-44.2	Obstructs the Take off SFC

WARNERVALE AERODROME

RUNWAY : 02/20
(CODE 3 RUNWAY)

Surveyor : Bryan Fitzgerald
Date of Survey : 25/10/2017

AIRPORT SURVEYS

TRANSITIONAL SURFACE

NOTE: Calculations are based on a 1:7 Transitional Surface from the edge of the 150 metres wide Runway Strip.

RUNWAY No.	Surveyed Point No.	DESCRIPTION	PERP. DIST FROM 20 RWS END	OFFSET FROM C/L	HEIGHT ABOVE C/L	HEIGHT OF Trans SFC	HEIGHT DIFF. + Above - Below	NOTES
02 - 20	1	Office Bldg - East Side	512	82.0	4.89	1.00	3.89	*Obstructs the Transitional Surface*
02 - 20	2	Palm Tree - East Side	499	96.5	8.43	3.07	5.36	*Obstructs the Transitional Surface*
02 - 20	3	Aerial - East Side	513	81.8	6.01	0.97	5.04	*Obstructs the Transitional Surface*
02 - 20	4	Shed - East Side	585	115.6	5.18	5.80	-0.62	
02 - 20	5	Hangar - East Side	571	135.6	6.41	8.66	-2.25	
02 - 20	6	Tree - West Side	649	136.3	11.84	8.76	3.08	*Obstructs the Transitional Surface*
02 - 20	7	Euc. Tree - West Side	541	158.5	22.13	11.93	10.20	*Obstructs the Transitional Surface*
02 - 20	8	Euc. Tree - West Side	311	120.1	14.82	6.44	8.38	*Obstructs the Transitional Surface*

Table 26: Code 3 Runway

WARNERVALE AERODROME

RUNWAY : 02/20
(CODE 2 RUNWAY)

Surveyor : Bryan Fitzgerald
Date of Survey : 25/10/2017

AIRPORT SURVEYS

Runway Length : 1194 metres
Runway Strip Width : 80 metres

RWY 02	RWY 20
TODA : 1254 metres	TODA : 1254 metres
Take Off SFC Origin RL : 11.41 AHD	Take Off SFC Origin RL : 5.26 AHD
20 Threshold RL : 10.68 AHD	02 Threshold RL : 5.26 AHD
20 Threshold Displaced : 210m	02 Threshold Displaced : 0m

APPROACH / TAKE OFF SPECIFICATIONS USED FOR SURVEY

TAKE OFF SURFACES:	
80m	INNER EDGE
10%	DIVERGENCE
2500m	LENGTH
4%	GRADIENT

APPROACH SURFACES:	RWY 02 (Non-Precision Inst Apch)	RWY 20 (Non- Precision Inst Apch)
INNER EDGE	90m	90m
DIVERGENCE	15%	15%
LENGTH	2500m	2500m
GRADIENT	3.33%	3.33%
TRANSITIONAL SLOPE	1 in 5	1 in 5

TAKE-OFF RUNWAY No.	Surveyed Point No.	DESCRIPTION	DIST. FROM END OF CLEARWAY	HEIGHT OF OBSTACLE ABOVE CWY END	TAKE-OFF GRADIENT TO OBST.	OBST. R.L.	DIST. FROM START OF TAKE OFF	OFFSET FROM RWY C/L	RELATIONSHIP TO OBSTACLE LIMITATION SURFACES: 4% Take Off grade	3.33% Apch grade	Transitional Surfaces (Positive figures - Above / Negative figures - Below.)
02	1	EUC. TREE	121.4	26.65	21.96%	38.06	1374.9	59.0 R	OUTSIDE	16.3	*Obstructs the Apch SFC*
02	2	POWER POLE	109.5	10.82	9.89%	22.23	1363.0	50.2 R	6.4	0.9	*Obstructs the Apch SFC*
02	3	EUC. TREE	165.7	27.65	16.69%	39.06	1419.2	49.8 L	21.0	15.9	*Obstructs the Apch SFC*
02	4	EUC. TREE	12.1	19.94	N/A	31.35	1265.6	107.3 L	OUTSIDE		*Obstructs Trans SFC by 7.5m*
02	5	EUC. TREE	-90.0	22.59	N/A	34.00	1163.5	123.7 L	OUTSIDE		*Obstructs Trans SFC by 7.2m*
02	6	FENCE	3.3	1.54	N/A	12.95	1256.8	80.6 L	OUTSIDE		Below Trans SFC by 5.6m
02	7	FENCE	57.2	1.91	3.34%	13.32	1310.7	5.0 L	-0.4	-6.3	
02	8	FENCE	40.2	2.19	5.45%	13.60	1293.7	83.2 R	OUTSIDE		Below Trans SFC by 5.5m
02	9	EUC. TREE	1610.5	69.37	4.31%	80.78	2864.0	160.0 L	5.0	9.5	*Obstructs the Apch SFC*
02	10	EUC. TREE	1440.8	61.31	4.26%	72.72	2694.3	355.2 R	OUTSIDE		Below Trans SFC by 5.4m
02	11	LEVEE BANK	25.7	1.37	5.34%	12.78	1279.2	58.5 R	OUTSIDE	-5.7	
02	12	ROAD - 4.5m HIGH	93.9	5.81	6.19%	17.22	1347.4	1.0 L	2.1	-3.6	Obstructs the Take off SFC
02	13	ROAD - 4.5m HIGH	81.1	5.71	7.05%	17.12	1334.6	47.1 R	2.5	-3.3	Obstructs the Take off SFC
02	14	ROAD - 4.5m HIGH	70.9	5.60	7.90%	17.01	1324.4	94.0 R	OUTSIDE		Below Trans SFC by 4.4m
02	15	BUILDING	324.6	11.76	3.63%	23.17	1578.1	56.0 R	-1.2	-5.3	
02	16	BUILDING	348.5	15.24	4.38%	26.65	1602.0	43.6 R	1.3	-2.6	Obstructs the Take off SFC
02	17	AERIAL ON SHED	394.4	27.88	7.07%	39.29	1647.9	133.5 R	OUTSIDE	8.5	*Obstructs the Apch SFC*

TAKE-OFF RUNWAY No.	Surveyed Point No.	DESCRIPTION	DIST. FROM END OF CLEARWAY	HEIGHT OF OBSTACLE ABOVE CWY END	TAKE-OFF GRADIENT TO OBST.	OBST. R.L.	DIST. FROM START OF TAKE OFF	OFFSET FROM RWY C/L	RELATIONSHIP TO OBSTACLE LIMITATION SURFACES: 4% Take Off grade	3.33% Apch grade	Transitional Surfaces (Positive figures - Above / Negative figures - Below.)
20	1	EUC. TREE	120.9	14.64	12.11%	19.90	1374.4	4.8 R	9.8	10.6	*Obstructs the Apch SFC*
20	2	EUC. TREE	134.0	16.72	12.48%	21.98	1387.5	16.6 L	11.4	12.3	*Obstructs the Apch SFC*
20	3	EUC. TREE	97.4	13.98	14.36%	19.24	1350.9	30.4 L	10.1	10.7	*Obstructs the Apch SFC*
20	4	EUC. TREE	89.4	20.96	N/A	26.22	1342.9	73.9 L	OUTSIDE		*Obstructs Trans SFC by 14.9m*
20	5	EUC. TREE	123.2	24.36	N/A	29.62	1376.7	112.7 L	OUTSIDE		*Obstructs Trans SFC by 10.4m*
20	6	EUC. TREE	66.4	24.19	N/A	29.45	1319.9	108.3 L	OUTSIDE		*Obstructs Trans SFC by 11.3m*
20	7	EUC. TREE	-85.1	19.36	N/A	24.62	1168.4	109.9 L	OUTSIDE		*Obstructs Trans SFC by 5.4m*
20	8	EUC. TREE	-25.2	12.32	N/A	17.58	1228.3	151.9 R	OUTSIDE		Below Trans SFC by 10.1m
20	9	POWER PYLON	7353.9	205.05	2.79%	210.31	8607.4	445.4 R	OUTSIDE	OUTSIDE	
20	10	RADIO MAST	7638.4	283.27	3.71%	288.53	8891.9	1164.2 R	OUTSIDE	OUTSIDE	
20	11	EUC. TREE	3659.8	77.66	2.13%	82.92	4913.3	75.1 L	OUTSIDE	OUTSIDE	

Page 1 of 2

WARNERVALE AERODROME

RUNWAY : 02/20
(CODE 2 RUNWAY)

Surveyor : Bryan Fitzgerald
Date of Survey : 25/10/2017

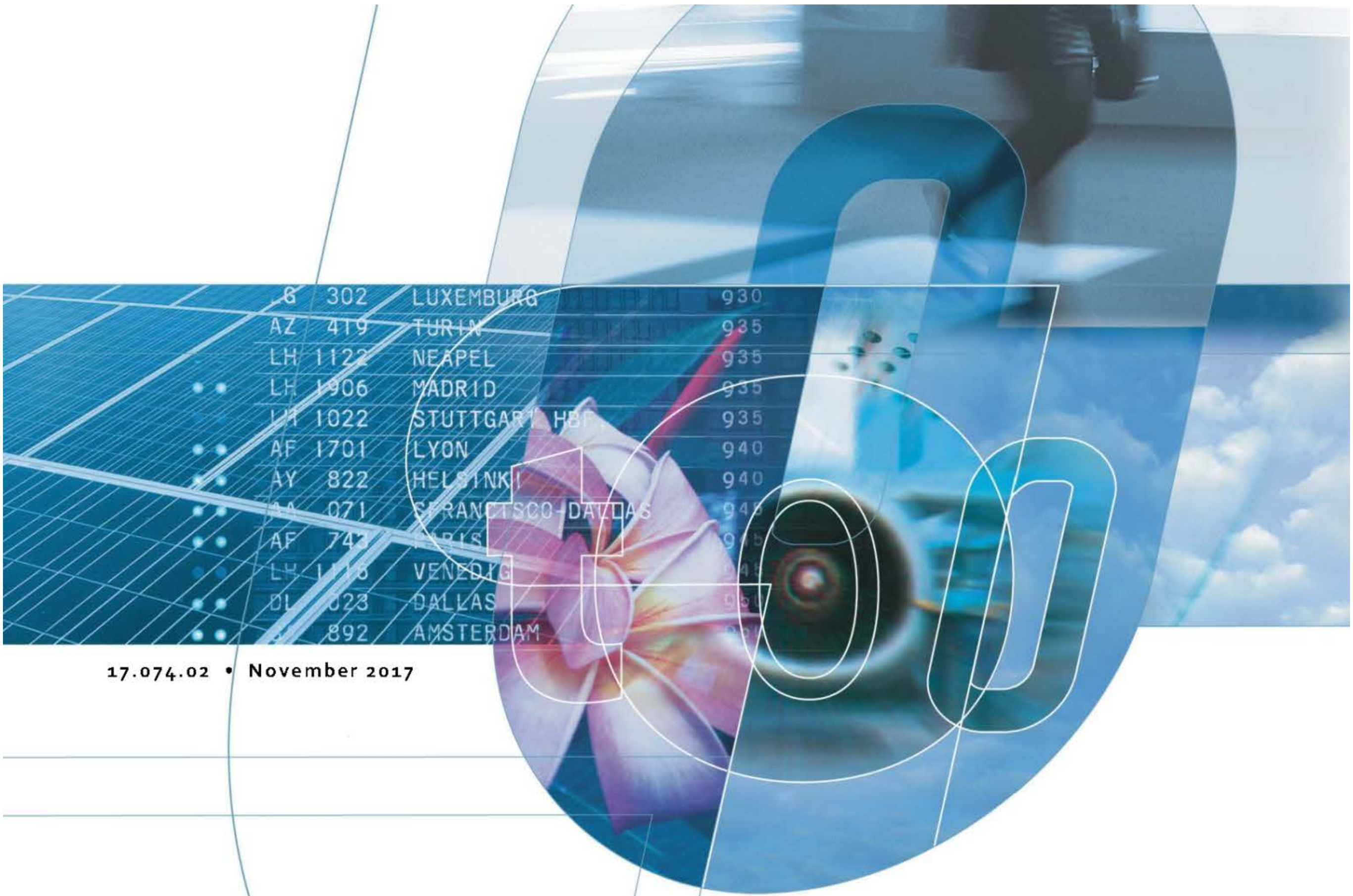
AIRPORT SURVEYS

TRANSITIONAL SURFACE

NOTE: Calculations are based on a 1:5 Transitional Surface from the edge of the 80 metres wide Runway Strip.

RUNWAY No.	Surveyed Point No.	DESCRIPTION	PERP. DIST FROM 20 RWS END	OFFSET FROM C/L	HEIGHT ABOVE C/L	HEIGHT OF Trans SFC	HEIGHT DIFF. + Above - Below	NOTES
02 - 20	1	Office Bldg - East Side	512	82.0	4.89	8.40	-3.51	
02 - 20	2	Palm Tree - East Side	499	96.5	8.43	11.30	-2.87	
02 - 20	3	Aerial - East Side	513	81.8	6.01	8.36	-2.35	
02 - 20	4	Shed - East Side	585	115.6	5.18	15.12	-9.94	
02 - 20	5	Hangar - East Side	571	135.6	6.41	19.12	-12.71	
02 - 20	6	Tree - West Side	649	136.3	11.84	19.26	-7.42	
02 - 20	7	Euc. Tree - West Side	941	158.5	22.13	23.70	-1.57	
02 - 20	8	Euc. Tree - West Side	311	120.1	14.82	16.02	-1.20	

Table 27- Code 2 Runway



17.074.02 • November 2017

Central Coast Aviation Hub

Central Coast Airspace and Obstacle Limitation Surface (OLS) Assessment

CPA/291965

Aviation Consultants

to70

Central Coast Aviation Hub

Airspace and Obstacle Limitation Surface (OLS) Assessment

CPA/291965

Report

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By:
Matt Shepherd

Brisbane, November 2017

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Executive Summary

This report provides an analysis and evaluation of the current and prospective airspace design for Central Coast Aviation Hub (CCAH). This executive summary provides a brief consolidation of the findings drawn from our data gathering and assessment methodology described in Section 2 Methodology and Results.

Based on the airport configuration provided by the Central Coast Council (Council), we have developed a desktop model of the airspace configuration surrounding CCAH in 2024 and beyond.

In relation to flight paths in 2024 and beyond, the confines of the existing civil airspace between Williamtown and Sydney/Bankstown, aircraft operated under visual flight rules (VFR) are not expected to change their tracking significantly by 2024. The commencement of operations at Western Sydney Airport (WSA) is not anticipated to alter visual tracking routes beyond 25 nm north of the airport and flight paths for aircraft operating under instrument flight rules (IFR) are not expected to significantly change as a result of clear direction in the WSA Airport Plan.

Results of the analysis indicate that Code 3C aircraft operations[1] at the proposed airport would not have any significant constraints relating to current airspace volume design, existing routes.

The proximity of high density operations to the south within the Sydney Terminal Area (TMA) and to the west, north and east within military restricted areas will result in some delay to operations due to the expected higher priority of Sydney and Williamtown operations.

The orientation of Runway 02/20 aligns with prevailing weather conditions and is in accordance with the existing air traffic flows of the Central Coast area. The runway orientation facilitates integration with existing flight paths.

Changes proposed by a CASA review of Williamtown restricted areas are not likely to change the current level of equitable access to that airspace for VFR operations. The CASA review recommends some changes to airspace classification to accommodate civil IFR operations into the Newcastle Airport, but this is not expected to alter the accessibility of the airspace for users.

In relation to flight operations at CCAH, helicopter and fixed with flying training activities at CCAH are expected to continue current practice of conducting training over Tuggerah Lake. This location is well segregated approximately 3.5nm east of the aerodrome and would have minimal impact on passenger operations arriving and departing, due to the expected segregation of these flight paths.

Runway crossings by helicopters departing a Helicopter Landing Site (HLS) positioned southwest of Runway 02/20 to access the eastern training area over Tuggerah Lake may generate minor delays to the helicopter activity.

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[1] Generally, these are regional jet and turbo-prop aircraft

Corporate and commercial helicopter services arriving and departing from a HLS positioned southwest of Runway 02/20 are unlikely to interact with IFR operations at CCAH.

To70 investigated the viability of a second parallel runway positioned to the west of runway 02/20 for use in visual conditions for VFR training operations clear of IFR operations. Our assessment of this option, based upon the draft master plan provided is that taxiing training aircraft across the main runway, and the complex circuit tracking are likely to generate more delay and complexity than use of a single runway.

The location and operation of the three functioning power stations in proximity to CCAH were reviewed with CASA and in relation to the instrument flight procedure (PANSOPS) assessment. CASA advises that overflights of the plume rises at Colongra and Vales Point should be avoided. While the plumes are relevant to aircraft overflying them, and their location and effects will be noted on aeronautical maps, CASA notes that Eraring is sufficiently distant from CCAH to be on no relevance to the aerodrome operation. Our draft procedures indicate that safe instrument flight procedures can be designed clear of these plume rises.

Our review of instrument flight procedure options has confirmed that the final approach path procedure offering the best opportunity for IFR aircraft to land in poor weather conditions for CCAH is a RNAV (GNSS) Instrument Flight Procedure (IFP), designed for approach to both ends of the runway. Our PANSOPS surface assessment suggests that aircraft using this procedure will be able to access the aerodrome with cloud bases of as low as 660ft and with inflight visibility of 3.5km. This compares favourably with the RNAV (GNSS) Instrument Flight Procedure approach at Gold Coast which has a minimum of 670ft. (1)

Our assessment of the obstacle limitation surfaces surrounding CCAH indicate that there are some terrain penetrations that may require referral to CASA.No significant intrusions to the designed PANSOPS surfaces including plume rises are expected.

In relation to the provision of Air Traffic Services (ATS) in the vicinity of CCAH, Council provided high side forecasting, CCAH may approach the trigger threshold for a CASA airspace risk assessment by 2025. Low side forecasting suggests the threshold will be approached in 2029. If, at that time, the CASA conducted risk based assessment supports a change, then this may alter the way that ATS are delivered in the airspace surrounding the aerodrome and on the aerodrome. A change from existing Class G airspace to Class D.

Class G services in the vicinity of CCAH are delivered by Airservices Australia from centres in Brisbane, Sydney and Melbourne. Class D services are generally delivered by Airservices at the airport site. Airservices currently delivers a Class D service from a control tower, but is currently reviewing other methods such as remote tower technology. There are other service models that may be explored prior to the introduction of Class D services discussed in the finding section.

In relation to Aviation Rescue and Fire Fighting Services, (ARFFS), our assessment is that CCAH may approach the trigger point of 350,000 annual passengers in 2027 based on high side forecasts and beyond 2030 based on low side. This service is provided by Airservices. Currently the Department of Infrastructure is conducting a policy review of the trigger points for ARFFS establishment. This review still has approximately 18 months to run. The recommendations within may lift the trigger point for the introduction of ARFFS higher than current levels. We recommend that Council continue to monitor traffic levels and review this requirement annually as the airport evolves and grows.

We have developed an OLS surface model for a 1200m Code 3C runway expected to be operational in 2024 which is included below in Annex A: Obstacle Limitation Surface.

We have also included an assessment of PANSOPS surfaces for RNAV (GNSS) approaches to both ends of an 1799m runway based on the existing runway design and orientation as a worst case scenario. It is important to note that the study is based on a 1799m runway length as Council intends the runway to remain as Code 3 classification. An 1800m runway would require a Code 4 classification. Our preliminary assessment of these surfaces based on Airservices obstacle database data allows the surface to be "stepped down" allowing operations into the airport with a relatively low cloud base.

Based on the data provided by Council, our assessment finds no airspace or terrain obstacles to Code 3C operations at CCAH. At the Airspace change roadmap section below, we provide a simple list of steps to be followed in progressing changes to airspace and flight paths with CASA and Airservices.

1 Introduction

The Council is currently engaging with the General Aviation industry in relation to the possible establishment of an Aviation Hub to provide opportunities for general aviation development

The Council intends to upgrade Warnervale Airport, and re-badge the expanded aerodrome as CCAH. It is expected that over the next decade, CCAH will develop into a general aviation reliever aerodrome for the Sydney general aviation aerodromes. Preliminary master-planning by Council has developed around the concept of facilitating general aviation activity.

Council has engaged To70 to prepare Obstacle Limitation Surface (OLS) models and an airspace assessment to inform the Council's decisions regarding the future development of CCAH.

1.1 Background

Council expects CCAH will develop over the next six years to operate as a general aviation "reliever" aerodrome for Sydney general aviation aerodromes. This aligns with the timeline for the development and opening of Badgerys Creek due west of Bankstown Airport.

Council wishes to confirm that the proposed development of CCAH can safely accommodate expected flying activity within the surrounding aviation environment. At the same time, the Council also seeks to understand the possible effects on the surrounding community of new flight paths flown by commercial aircraft carrying up to 70 passengers.

The proposed future 2024 model of CCAH includes a 1200m non-precision Code 3C runway suitable for non-passenger jet operations. The council may later choose to extend the non-precision Code 3C runway length beyond 1200m.

2 Methodology and Results

To70 prepared a project plan which outlined the tasks, governance, reporting and structural project components which ensured that the project delivered a report that is fit for purpose and achieves its stated objective. The overarching methodology for this study involved the following steps:

1. Data collection
2. Develop a model of the current state of CCAH
3. Develop a model for the planned 2024 Stage 3 aerodrome configuration
4. Recommendations on the feasibility of future aerodrome

2.1 Data gathering

This section details the sources and data used for the study. To70 began by assembling the requisite data to support the assessment process. In order to understand and capture the current and future aerodrome layout, the following information was supplied by the Council:

- Central Coast Aviation Hub Master Plan 2017 draft
- Previous 2006 OLS study
- Drawings of aerodrome layout options for the 1200m runway
- Runway threshold and strip coordinates for the 1200m runway
- Elevation for the runway strip ends
- Warnervale Airport (CCAH) Fly Friendly Procedures document
- CAPA Development Strategy Review for Central Coast Regional Airport
- Briefings provided by CCAH staff.

As part of airspace design component of the project the following stakeholders were consulted:

- Civil Aviation Safety Authority (CASA)
- Eraring Power Station
- Vales Point Power Station
- Colongra Power Station
- Airservices Australia (Airservices)

Data Limitations

Assumptions have been made in place where data or information is absent. Notably, the following assumptions have been made regarding future airport development for the OLS and PANS-OPS preparation and assessment:

- Approach threshold elevations to be the same as runway strip ends
- 225m displaced threshold for Runway 20
- Aerodrome refence level to be 7.62m as per stated in En-route Supplement Australia (ERSA)

2.2 Existing model

A model of the existing aerodrome was developed using data and previous studies supplied by Council to capture the current operating landscape of CCAH. This involved carrying out a desktop study to capture

aspects of CCAH such as current flight tracks, airspace conditions, nearby routes, operations, aircraft types operating and interactions with nearby aerodromes. The final model is presented in Section 3.
An airport survey was conducted at CCAH. The survey was conducted on the current runway as well as one based upon a Code 3C non-precision configuration. the results of this survey are shown at Annex B: Airport survey.

2.3 Future Model

Data and assumptions based on the planned 2024 Stage 3 configuration of CCAH were used to develop the future model of CCAH. The model captures predicted airspace and operational aspects of the planned Stage 3 aerodrome configuration and details considerations and constraints for the planned development. The model describes the following aspects, based on the Stage 3 development plan:

- Future Regular Public Transport (RPT) operations and associated requirements
- Aerodrome certification requirements
- Future aircraft mix
- Instrument flight procedures and approaches
- Potential routes and destinations
- Prescribed airspace (i.e. OLS and PANS-OPS)
- Smoke plume stacks constraints

The RPT, future aircraft mix and certification requirements aspects of the model were developed primarily through a desktop study on data and assumptions provided by Council and publicly available information.

Airservices were consulted as part of the planning process for potential future routes and destinations, to develop an understanding of how the planned future operations would fit in the current airspace. In order to ensure the safety of these routes, CASA was also consulted in determining the impacts of nearby smoke plume stacks produced by three power stations identified during the desktop study.

The final stage in developing the model involved preparing an OLS and PANS-OPS assessment for the planned future runway layout of CCAH. The OLS was developed in accordance to CASA's Manual of Standards (MoS) 139 – Aerodromes and MoS 173 – Instrument flight procedure design.

3 Review existing model 2017

3.1 VFR flight paths

Currently, CCAH aircraft operations follow basic, Class G airspace procedures as described in the Aeronautical AIP. the Council has a "Fly Friendly/ Neighbourly"" policy (2) that is circulated to all operators at the aerodrome. This policy was put in place to manage aircraft noise impacts on the community and to ensure the continued operation of CCAH Airport.

In relation to airborne operations and in line with CASA requirements, the policy asks pilots of fixed wing aircraft to note the following:

1. Runway 20 is the preferred runway direction when operationally acceptable in nil / light and variable wind conditions;
2. Where possible, adopt and maintain best rates of climb, to minimise noise over residential areas, as soon as possible after take-off;
3. Avoid overflight of residential areas, in particular Watanobbi residential area to the south, Bruce Crescent rural residential area to the north, and Jilliby rural residential area to the west;
4. Avoid flying over noise sensitive areas including hospitals and schools when possible and if this is not possible you should try to be above 1000ft AGL. Particular attention should be given to avoidance of Lakes Grammar School at the intersection of Sparks Road and Albert Warner Drive;
5. Maintain correct or ATC cleared tracks after take-off
6. Reduce engine revs as soon as possible;
7. Follow designated flight paths where defined;
8. Only conduct circuit training between 7.00am and 10.00pm Monday to Friday; and 7.00am and 8:00pm on Saturday and Sunday;
9. Keep circuits as compact as possible – don't fly wide circuits; and
10. When simulating engine failure and recovery this should occur over the airfield

The following diagrams depict the flight tracks at the aerodrome, specifically the circuit area (Figure 1 – Existing circuit tracks) , VFR Arrivals (Figure 2 - VFR Arrival tracks) and VFR Departures (Figure 3 - VFR Departure tracks).

Figure 1 – Existing circuit tracks

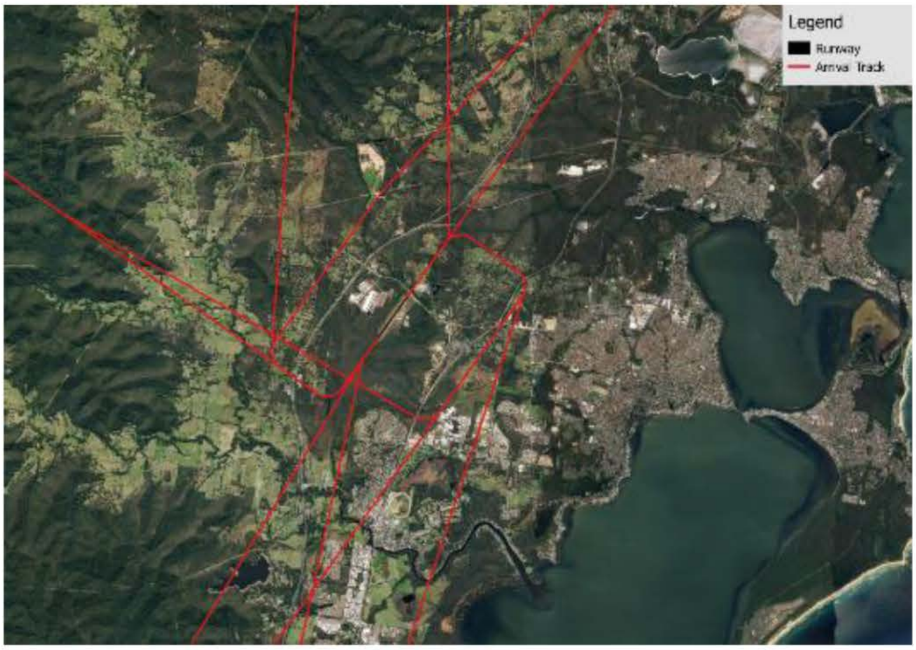


Figure 2 - VFR Arrival tracks

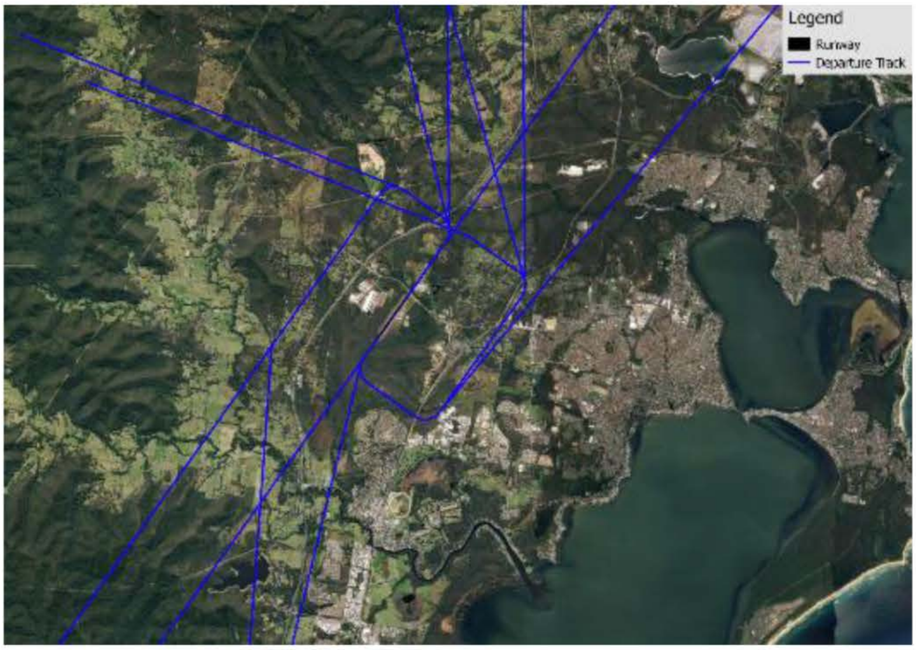


Figure 3 - VFR Departure tracks

Discussion with Airservices, as the provider of ATC services in Class G Airspace, and the local aeroclub confirm that northbound VFR transit flights in the vicinity CCAH generally track over CCAH towards Maitland and the IFR tracking point adjacent to Maitland called MATLO. Conversely, VFR transit flights southbound generally track coastal following coastal passage of the Williamtown Military Control Zone.

Due to the higher terrain to the west of CCAH, most aircraft operate to the north and south of the aerodrome, choosing to track west when established in the Hunter Valley or Sydney region.

The majority of CCAH aircraft operations are flight training involving light single and twin aircraft. Flight training is generally conducted over Tuggerah Lake which is situated to the east of the CCAH and measures 7nm long by 2.6nm wide.

Circuit operations at CCAH are standard left-hand circuits and the areas recommended to be avoided in the Council's Fly Friendly/Neighbourly advice represents no usual obstacle to these circuit operations.

There are no current regular helicopter operations at CCAH.

3.2 IFR flight paths

Flight paths for operations in the vicinity of CCAH are described in the Aeronautical Information Publication (AIP) The current flight paths are detailed in ERSA data and listed below:

1. Aircraft overflying the Sydney Terminal Area (TMA) within 30NM of Sydney should flight plan as per the detail in Table 1- Overflights of Sydney TMA

Table 1- Overflights of Sydney TMA

Flights below A100	
NORTH BOUND SOUTH BOUND	AKMIR W713 KADOM DCT MAKOR at A070 MAKOR DCT KADOM W713 AKMIR at A060
A100 and ABV EAST BOUND INTL via PKS	Plan via ERC route ABV FL280, PKS A576 TESAT then Oceanic Route
Flights from the South landing Williamtown	
Turbojets Non-turbojets	Via TESAT H185 Via TESAT V140
Flights from the North departing Williamtown	
Turbojets Non-turbojets (A100 and ABV)	via W284 DONIC W778 HOOKS then ERC route via W170 LOWEP W180 TESAT then ERC route

2. Non-Turbo jet aircraft arriving Sydney aerodrome from the north should flight plan as per the detail in Table 2- Sydney arrivals from the North

Table 2- Sydney arrivals from the North

Flights from the North	
Via OLTIN Via SCO Departing YWLM	OLTIN W180 SCO W551 YAKKA W180 (A100 and BLW) WLM W170 LOWEP W180; or WLM 603 MEPIL W180 (A075 and BLW)

3. Non-Turbo jet aircraft departing Sydney aerodrome to the north should flight plan as per the detail in Table 3 - Sydney departures non-turbo jet

Table 3 - Sydney departures non-turbo jet

Flights departing to the North	Via KAMBA W220 MATLA or KAMBA V140 WLM (Tracking via Williamtown subject to MIL traffic during Williamtown ATS HR).

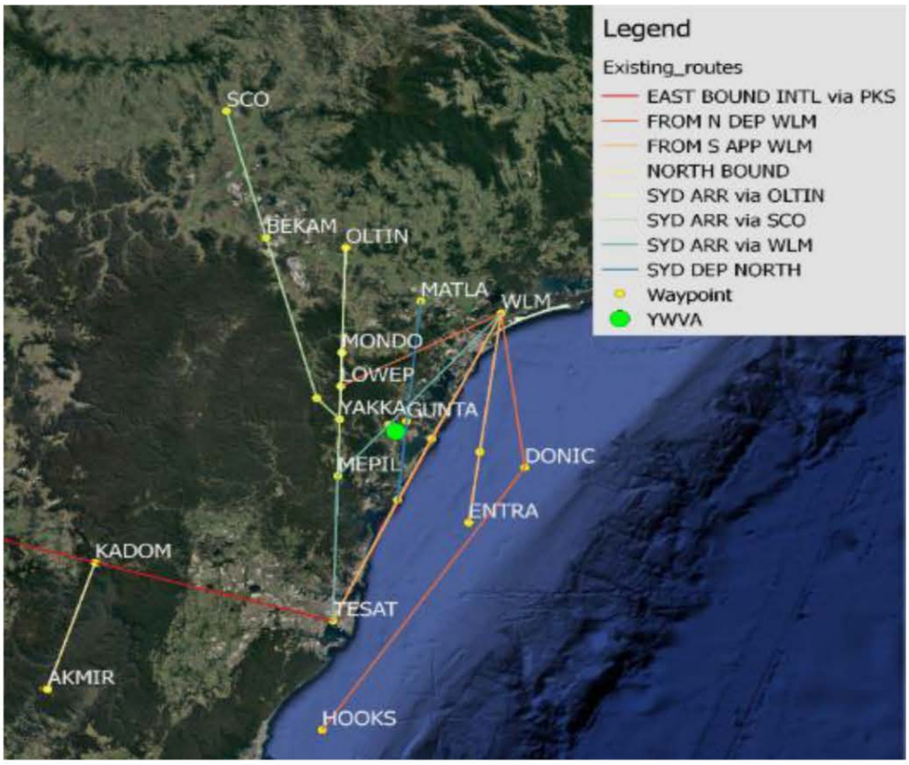


Figure 4 - Current nearby routes

3.3 Aircraft Mix

CCAH is currently an uncertified aerodrome and is generally limited to Aero Club flight training, private pilot operations, helicopter training and surveillance, as well as rural fire service training. As accurate records of current aircraft movements are not available, the 2006 ANEF and OLS study were used to identify current aircraft operations at CCAH. The current aircraft mix operating at CCAH include of the following aircraft:

- Cessna C-150
- Cessna C-172
- Cessna C-182
- Piper PA28
- Bellanca CH7B
- Piper PA31

3.4 Interactions with other airspace and aerodromes

CCAH is situated in Class G airspace which extends up to 7,500ft above the aerodrome. It is surrounded on all sides by high density aviation operations. Encircling CCAH to north, Williamtown military restricted airspace (West, (R559) North, (R578) and East (R587)) are designated for use by military fast jets for bombing, training, and tactical support of Australia's military capability. This military restricted airspace is generally active on weekdays.

The northern restricted area (R578) extends to cover the main northern route from CCAH, extending from 4,500ft to 8,500ft. R578 is designated RA1 which means that pilots may flight plan through the restricted area and under normal circumstances expect a clearance from ATC. All aircraft planning to depart CCAH northbound above 4,500ft require a clearance to transit this airspace when it is active.

The restricted areas west and east are designated RA2 which means that pilots must not flight plan through the restricted area unless on a route specified in ERSA GEN FPR or under agreement with the Department of Defence, however a clearance from ATC is not assured. Other tracking may be offered through the restricted area on a tactical basis.

In addition to the published military restricted areas, there are airspace reservations between 13,000 and 14,000 feet which cross the flight paths of aircraft departing northbound from CCAH. These airspace reservations do not preclude aircraft flight planning these routes. They are normally activated on week days at least twice in the morning and twice in the afternoon to facilitate the passage of military fast jets between the eastern Williamtown restricted areas (R587) and the western Williamtown restricted areas R559.

To the south, the terminal airspace surrounding Sydney, Bankstown and Richmond aerodromes are the busiest terminal operations in Australia.

Aircraft operating from CCAH requesting entry to the Sydney Class C terminal area are subject to the priority access system described in AIP:

> "For flights in Class C terminal control areas associated with Brisbane, Melbourne, Perth and Sydney, ATC will apply priorities in the following order;
>
> 1. with equal priority, flights compliant with their Air Traffic Flow Management (ATFM) requirements, flights exempt from ATFM measures and Medical Aircraft (HOSP) operations; and
> 2. flights not compliant with their ATFM requirements;
> 3. all other aircraft."

ATFM requirements are only complied with by aircraft landing in Sydney, Brisbane, Melbourne and Perth. In practise, aircraft operations at CCAH are generally not subject to ATFM requirements and would have the lowest priority.

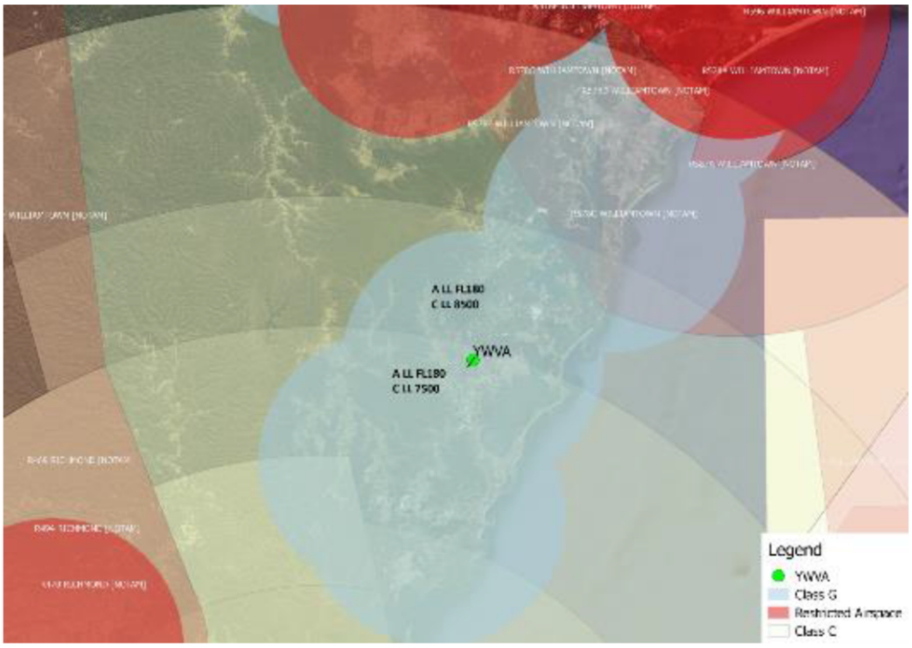


Figure 5 – Airspace in the vicinity of CCAH

3.5 Instrument approaches

The Australian aviation industry has embraced satellite technology as a primary source of data for aviation in Australia. Airservices has recently completed a program, removing aviation navigation aids (NAVAIDS) from service, leaving only a "Backbone" service, intended to support IFR operations across Australia in the event that GPS becomes unavailable.

CCAH has no backbone NAVAID and is not currently serviced by an instrument approach procedure. Aircraft arriving and departing CCAH operate visually below the route lowest safe altitude of approximately 3,400ft or as determined by the pilot.

CCAH is currently described as an Aircraft Landing Area (ALA). This indicates that it does not have either registration or certification as an aerodrome in accordance with CASA Part 139. CASA regulations Part 173 (CASR Part 173) requires an aerodrome to have registration or certification for the implementation of Instrument Flight Procedures (IFPs). Further to this, the aerodrome requires a minimum runway strip width of 90m

3.6 ATC Services

ATC services are based upon the category of the aircraft operation and the classification of the surrounding airspace. In the vicinity of CCAH the airspace is classified Class G.

In Class G airspace, IFR and Military Low Jets (MLJ) aircraft must be provided with traffic information on other conflicting IFR and MIL aircraft.

ATC provides a flight information service and a surveillance information services to VFR, workload permitting.

3.7 Aviation Rescue and Firefighting Services (ARFFS) requirements

The mandatory requirements for provision of Aviation Rescue and Firefighting (ARFFS) are stated in CASA's Manual of Standards Part 139H (3).

The mandatory requirements for provision of Aviation Rescue and Firefighting (ARFFS) are stated in CASA's Manual of Standards Part 139H (3). This document notes that:

Level 1
ARFFS is required at an aerodrome where:

1. International passenger services operate and
2. Any domestic aerodrome through which more than 350,000 passengers passed through on air transport flights during the previous financial year.

Level 2
Aerodromes where the number of annual passengers on air transport is less than 350,000 may provide a level of ARFFS. The ARFFS will be subject to audit if published in ERSA and form part of the Aerodrome Emergency Plan AEP. The AEP must be in accordance with ICAO Standards.

Passenger numbers are currently well below the Level 1 trigger point.

Airport fire services are currently provided by the Charmhaven NSW Rural Fire Service. The current Emergency Plan was last updated in November 2009. Rescue services response times are expected to be under 10 minutes.

4 Designed future model 2024 and beyond

4.1 Flight Paths

In 2024, the airspace surrounding CCAH is not expected to change significantly from its existing structure.

Only one key infrastructure change has been announced at the time of this report. The Federal Government has confirmed that construction of Western Sydney Airport will be targeted for completion by 2024. Whilst the construction and operation of this aerodrome will have a large impact on operations within the Sydney terminal area, the Western Sydney Airport Plan (4) clearly states that there will be no changes to flight paths associated with Sydney aerodrome, commonly referred to as the Long-Term Operating Plan (LTOP) (5). Extrapolating from this, it is expected that Sydney aerodrome will continue to operate under its current structure and design.
Bankstown Airport will operate as presently, with some constraints to IFR traffic developing as Western Sydney Airport grows in operation.

To70 has also reviewed Defence and Airservices future plans. Defence managed Williamtown restricted airspace was the subject of a 2015 CASA review of operations (6) which recommended changes to the classification and dimensions of airspace and flight paths around the base. Whilst all recommendations arising from the report have been accepted by Defence, and the implementation of change is still in development, there is an expectation that there will be an airspace re-classification and introduction of a stepped airspace structure within 25nm of Williamtown. This is may replace the existing restricted area which extends to the ground.

The Defence White Paper 2016 (7), and the Defence Integrated Investment Program 2016 (8), which are the key papers defining the intention of Government in relation to defence activities over the coming years. Defence installations surround the CCAH site of considerable significance to aviation are:

- Richmond Airbase has funding programmed for re-development works in FY2021-26. It is expected from this that Richmond will remain an active airbase beyond 2026.
- Williamtown Airbase has funding programmed for new infrastructure to support the Joint Strike Fighter (JSF) in FY2017 and beyond including a considerable Stage 2 base redevelopment. We infer from this and other discussions with Defence that Williamtown activity is expected to increase.

In practice, the available data indicates that the routes currently available for aircraft arriving, departing and transiting CCAH are likely to remain in place.

VFR Flight paths are not expected to change.

In relation to IFR operations; in developing this project, the Council provided To70 with sample airport city pairs as examples of the types of Regular Public Transport (RPT) operations they expect to see operating in 2024 from CCAH.
Airports proposed as viable by the Council were, Canberra, Melbourne, Brisbane, Sunshine Coast. Regional intrastate services to Wagga Wagga, Dubbo, Ballina and Albury were also referenced.

To70 reviewed all existing flight planning options for flights intending to operate into and out of CCAH in 2024 to and from these example aerodromes.
Building on this information and the data provided by the Council at Table 15 - Aircraft movement forecasts, To70 developed sample frequencies of operation

These options were then validated their viability with Airservices.
Feedback from Airservices, indicates that the following routes are expected to be viable in 2024.

Table 4 - South Bound routes CCAH - CB, ML, WG and AY

Aircraft type	Route
Turbojets/ DH8 etc Frequency= 6 per day	via DONIC W778 HOOKS then ERC route
Non-turbojets (A100 and ABV) Frequency = 7 per day	via MEPIL TESAT then ERC route

Table 5 - North Bound routes CB, ML, WG and AY- CCAH

Aircraft type	Route
All aircraft Frequency = 13 per day = total 1 per hour	Via TESAT V140 KAMBA DCT

Table 6 - North Bound routes CCAH - BN, SU, CG, BNA

Aircraft type	Route
All aircraft Frequency = 9 per day	MATLA then ERC route ATC clearance required to transit RA1 Restricted Area R578F

Table 7 - South Bound routes BN, SU, CG, BNA - CCAH

Aircraft type	Route
All aircraft Frequency = 9 per day	Via OLTIN DCT

Table 8 - South Bound routes CCAH/YWVA - DU/West

Aircraft type	Route
All aircraft	BOYSY/KADOM the ERC

Table 9 - South Bound routes DU/West- CCAH/YWVA

Aircraft type	Route
All aircraft	Via TESAT V140 KAMBA DCT

As per present day operations, aircraft operating from CCAH requesting entry to the Sydney terminal area will be subject to the priority access system described in AIP:

"For flights in Class C terminal control areas associated with Brisbane, Melbourne, Perth and Sydney, ATC will apply priorities in the following order; 1. with equal priority, flights compliant with their ATFM requirements, flights exempt from ATFM measures and Medical Aircraft (HOSP) operations; and 2. flights not compliant with their ATFM requirements; 3. all other aircraft."

ATFM requirements are only complied with by aircraft landing in Sydney, Brisbane, Melbourne and Perth. In practise, aircraft operations at CCAH are generally not subject to ATFM requirements and would have the lowest priority.

It is reasonable to expect that traffic within the Sydney TMA will increase. The Sydney Airport Master Plan 2033 (9) notes that:

> "Aircraft movement forecasts for scheduled passenger operations at Sydney Airport indicate growth from 292,852 movements in 2012 to 388,466 movements in 2033. This represents annual average growth rates of 2.3% and 1.0% for international and domestic (including regional) services respectively. Overall, this represents an average annual growth of 1.4% for passenger aircraft movements. "

With the LTOP requirement to cap Sydney Airport movement numbers at 80 per hour, a proportion of this growth will move into off-peak times driven by Low Cost Carrier maximisation of airframe capacity, and new origin and destinations within the Asian hubs.

Any increase in Sydney Airport traffic is likely to see an increase in delays for CCAH operations seeking to access the Sydney TMA.

4.2 Aircraft Mix

To70 has reviewed existing operations at CCAH as well as operations at a comparative aerodrome, Ballina, and at the busier Sunshine Coast Airport.

Advice from the Council is that by 2024, 18-20% of total movements at CCAH would involve turboprops such as the ATR72 or DH-8. By 2029, this may increase to 30% of total movements.

A Code 3 C runway up to 1,425m would be required to accommodate a Q400 at Maximum Take-off Weight (MTOW) and medium jet aircraft- see section 6.3 . Runway and taxiway pavement strength have not been considered in this review.

Section 6.3 provides detailed aircraft performance data for each of the runway development stages.

4.3 Interactions with other aerodromes

An investigation of aerodromes within a 30nm radius of Warnervale was undertaken. Five locations are indicated as aerodromes, heliports or ALA's.

Table 10 - Nearby aerodromes

Identity	Name	Latitude	Longitude	Comments
YSMB	Somersby (ALA)	-033°22'04.00"	151°17'59.00"	ALA
YXGS	Gosford Hospital	-033°26'39.91"	151°20'36.32"	Hospital helipad with IFP
YCNK	Cessnock Airport	-032°47'15.00"	151°20'30.00"	ALA
YXFV	Newcastle Lifesaver Base	-032°54'21.16"	151°42'09.88"	Hospital helipad with IFP
YLMQ	Lake Macquarie Airport	-033°03'58.00"	151°38'53.00"	ALA. IFP proposed. Previously known as Aeropelican, with IFPs.

4.4 Flight Operations

Helicopters

A helicopter landing site is planned to be conducted in the southwestern corner of the airfield. See. Figure 6 - Helicopter Apron.

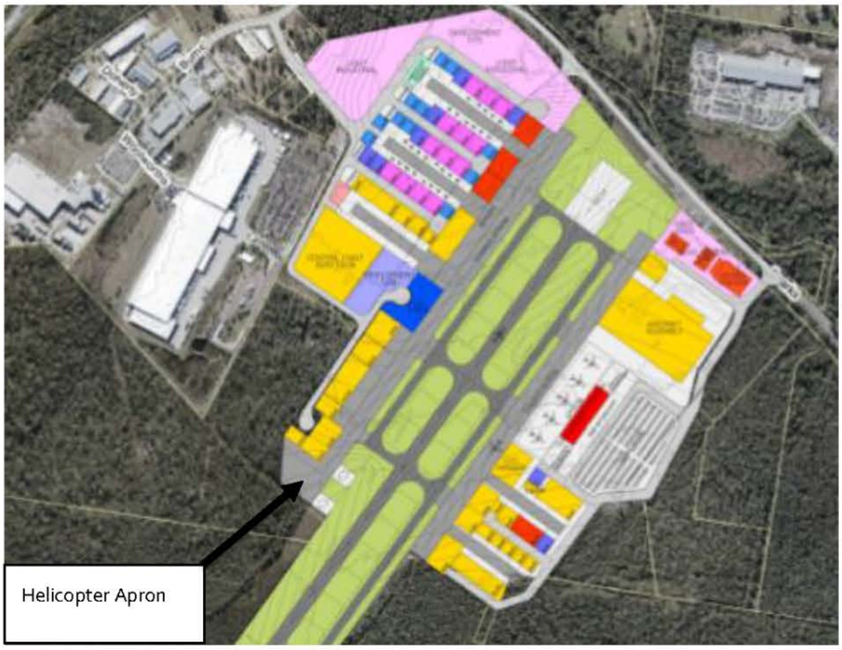


Figure 6 - Helicopter Apron

While future helicopter training areas are yet to be determined and will be dependent on the requirements of the training organisation, it is expected that they will train in similar locations to existing fixed wing operations. This will be over Tuggerah Lake to the east of CCAH.

In the event that helicopters are based on the same side of the aerodrome as the Central Coast Aeroclub the, use of a runway on the eastern side of the main runway 02/20 would require taxiing helicopters across the main runway, and create complex circuit tracking for them to access the training areas and eastern, coastal flight paths. This is likely to generate more delay and complexity than use of a single runway.

Flight Training

To70 reviewed flying training operations at Ballina Airport for comparison with the 2024 model at CCAH. Ballina Airport reports approximately 20,000 aircraft movements annually.

The Air Transportation Safety Board (ATSB) reports three incidents since December 2013 involving aircraft operating in proximity to each other.

In reviewing the latest incident at Ballina on 14 January 2016 (10), the ATSB found that despite an increase in passenger numbers and a mixture of traffic, Ballina/Byron Gateway Airport operated without the support of air traffic information and/or services. They went on to note that:

"While recognising that a direct comparison between aerodromes is difficult, Ballina also experienced a higher number of incidents relating to communication and separation issues compared to aerodromes with similar traffic levels."

Following a recommendation by the CASA, the operator of Ballina/Byron Gateway Airport has subsequently implemented a certified air/ground radio service (CA/GRS) to provide weather services and traffic information at the aerodrome. This service commenced in March 2017 and operates daily between 0800 and 1800 local time.

We note in the draft CCAH Master Plan, that airspace immediately to the west of the aerodrome has been identified as potentially suitable for use as flying training areas. Our review of the areas west of the airfield and clear of circuit operations is generally suitable for single engine operations due to the higher terrain.

Parallel Runway

To70 was asked to consider the viability of a small parallel runway placed to the west of the main strip for training operations to use, clear of other IFR operations

We reviewed CASA MoS 139 (11) in relation to the requirements for parallel runways.

Where parallel runways are to be provided, the aerodrome operator should consult with CASA and Airservices Australia on airspace and air traffic control procedures associated with the operation of the multiple runways. Where parallel, non-instrument runways are provided for simultaneous use, the minimum separation distance between the runway centrelines must not be less than:

- where General Aviation Aerodrome Procedures (GAAP) are in place — 213m. If this distance is not provided, dependent parallel procedures may need to be introduced;
- where the higher code number of the two runways is 3 or 4 — 210 m;
- where the higher code number of the two runways is 2 — 150 m;

- where the code number of the two runways is 1 — 120 m.

GAAP procedures are no longer in use in Australia.
The Council has indicated that they intend to design the aerodrome to Code 3C, thus requiring a minimum separation distance between centrelines of not less than 210M during Visual Meteorological Conditions (VMC)

The minimum spacing required for simultaneous independent use in Instrument Meteorological Conditions (IMC) is 1,035 m and both runways would need to be Instrument capable runways.

Detail provided in the CCAH Master plan, see Figure 7 - Central Coast aviation hub masterplan- draft layout, indicates that Aeroclub and other training organisations will continue to be located on the eastern side of the main runway 02/20. The Central Coast Aeroclub advise that their preferred location for training is over Tuggerah Lake where there are no noise issues. As per the use of Helicopter landing sites west of the main runway, use of a runway on the western side of the main runway 02/20 would require taxiing training aircraft across the main runway, and create complex circuit tracking for them to access the training areas and eastern, coastal flight paths. This is likely to generate more delay and complexity than use of a single runway.

Figure 7 - Central Coast aviation hub masterplan- draft layout

In relation to the preferred circuit direction at CCAH, To70 has not identified any causal factors arising from the change of runway length or traffic mix which would require a change to the current standard left-hand circuit direction in use to both runways.

4.5 Power Station Stacks and Plumes

Exhaust plumes can originate from any number of sources. Aircraft operations in various stages of flight may be affected by an exhaust plume of significant vertical velocity (i.e. a plume rise). A light aircraft in approach configuration is more likely to be affected by a plume rise than a heavy aircraft cruising at altitude. In addition, helicopters and light recreational aircraft may be severely affected by a high temperature plume and the altered air mixture above an exhaust plume and should therefore avoid low flight over such facilities.

There are currently three power stations located nearby CCAH, which have plume stacks with the potential to create air safety hazards. The three power stations are Eraring operated by Origin Energy, Vales Point operated by Delta Energy and Colongra operated by Snowy Hydro. It is worthy to note that Munmorah Power Station is also located in the vicinity of CCAH, however, it was recently demolished and is no longer operating. Figure 8 illustrates the locations of the plume stacks from the associated power stations.

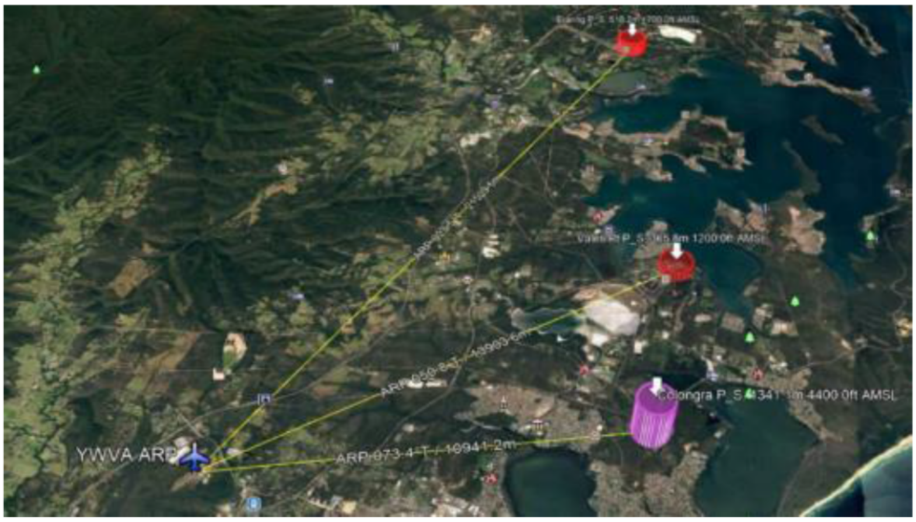


Figure 8 - Plume stack locations

A CASA review of the plume rises from the three identified power stations was used determine the plume heights close to CCAH. The review was based on the "CASA screening tool", which used the benchmark velocities of 6.1m/s and 10.6m/s for determining the plume heights. In addition, the spot heights for the plumes are derived from the Visual Terminal Charts (VTC), which are detailed in Table 11 along with the plume heights provided by CASA. (12)

Table 11 - Plume heights

Plume location	Plume height @6.1m/s (feet AGL*)	Plume height @10.6m/s (feet AGL)	Spot Height (feet AGL)
Eraring Power Station	1615	785	657
Vales Point Power Station	1173	653	584
Colongra Power Station	4367	497	511

*Above Ground Level (AGL)

The plume stack locations were also assessed for penetrations into the updated OLS developed for the Stage 3 configuration. Results of the assessment is detailed in Section 4.9.

4.6 Instrument approaches

The Council expects CCAH to be recognised as a CASA certified aerodrome before RPT services commences, as well as accommodate non-precision instrument approaches. Therefore, the aerodrome is required to adopt standards and regulations specified by CASA and Airservices. As CCAH is planned to support RPT services, the aerodrome will be required to operate under all weather conditions and will therefore require instrument approach procedures. This Section reviews the instrument flight procedures options available for CCAH and provides recommendations based on current and proposed rule-sets that align with the Council's future development plan. In particular, the following documents were taken into consideration to determine the type of Instrument Approach Landing Procedure (IAL):

- CASA Manual of Standards (MoS) Part 139 – Aerodromes (11)
- CASA Civil Aviation Safety Regulation 1998 (CASR) part 139 (Aerodromes), part 173 (Instrument Flight Procedure Design) and part 121 (Commercial Air Transport Operations – Airplanes), which is currently under development
- Airservices Aeronautical Information Circulars (AICs)
- CASA Methodology for Validation of Baro-VNAV Instrument Approaches

An IAL involves a series of predetermined manoeuvres for the orderly transfer of an aircraft by reference to night instruments, from the beginning of the initial approach to a landing or to a point from which a landing may be made visually by the pilot. There are three types of IAL which are general based on the level of guidance to an aircraft:

- Precision Approach
- Approach with vertical guidance (APV)
- Non-precision Approach (NPA)

A Precision Approach procedure generally offers both accurate vertical and horizontal guidance, unlike non-precision approaches which relies mainly on lateral guidance to aircraft. APV is a relatively new classification that involves lateral and vertical guidance to aircraft, but does not meet the requirements established for Precision Approach classification.

Due to the planned 150m wide runway strip width, the runway does not meet the required 300m runway strip width for precision approaches as detailed in MoS 139. This narrows down IAP options available at CCAH to APV and NPA procedures.

Following ICAO recommendations, Airservices is reviewing approaches with vertical guidance (APV) procedures based on Barometric vertical navigation (Baro-VNAV). (13). Airservices is implementing a three-year programme (started in March 2017) which results in changes relevant to RNAV (GNSS) charts and APV operations. Two lines of minima for APV were taken into consideration:

- Decision Altitude/Height (DA/H) for approach and associated visibility (LNAV/VNAV)
- Minimum Descent Altitude/Height (MDA/H) and associated visibility that is equivalent to existing Straight-In (S-I) minima or non-precision approaches (LNAV)

CASA determines the aerodrome's requirements for Baro-VNAV operations.
For CCAH to support aircraft operations in low cloud and poor visibility, Council would be expected to comply with the details outlined in the CASA MoS, which would require CCAH to facilitate the installation of an approved local barometric source, an Automated Weather Service (AWS) to allow precise setting of QNH in the aircraft. CCAH would need to provide an Aerodrome Weather Information Service (AWIS) with a VHF capability or through an Automatic Terminal Information Service (ATIS).
Presently, the aerodrome operates the VHF broadcast and the Bureau of Meteorology installs, operates and maintains AWSs and AWISs.

Finally, according to ICAO Resolution A37-11, Airservices supports the increasing of S-I LNAV approach, which reduce the risk of Controlled Flight Into Terrain (CFIT) with a circling approach.

The PANS-OPS described at Section 4.10 is based upon a satellite based RNAV (GNSS) Instrument Flight Procedure, Baro-VNAV Instrument Approach. The procedure can be designed, implemented and maintained by an independent CASA certified MOS Part 173 (14) provider. See Figure 9 - Sample GNSS Baro VNAV Approach

CASA regulations Part 173 (CASR Part 173) requires an aerodrome to have registration or certification for the implementation of IFPs. Further to this, the aerodrome requires a minimum runway strip of 90m.

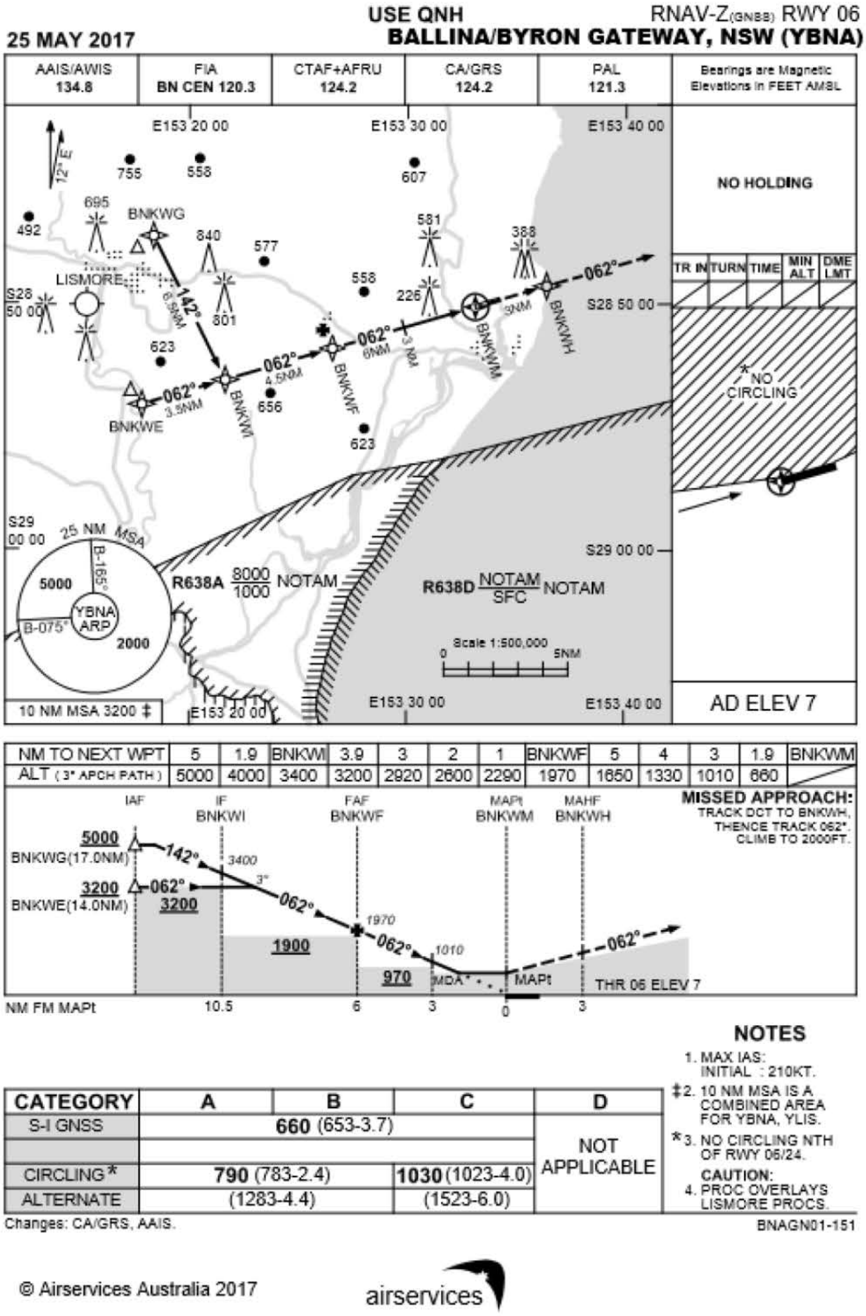


Figure 9 - Sample GNSS Baro VNAV Approach

Preliminary IAL designs indicate that waypoint KAMBA is suitable for direct entry to an Instrument procedure from the south to Runway 02- Table 5 - North Bound routes CB, ML, WG and AY- CCAH, while from the north, waypoints on the W220 MATLA-GUNTA track and on V140 route may also facilitate a direct entry to the Runway 20 procedure. See Table 7.

Minimum Safe Altitude

As start altitudes for procedures generally commence at an altitude based on calculations for obstacles within 25nm, these need to be compared to airspace altitudes. As the 25nm MSA (Minimum Safe Altitude) is less than 4500ft, it should be possible to have initial waypoints outside of Controlled Airspace. However, proximity to the north may require co-ordination with Military ATC.

For CCAH, the highest terrain is to the North West, although there is significant terrain to the west generally. By calculation, the NW sector of the 25nm MSA requires a minimum altitude of 3300ft, as does the omni-directional 10nm MSA. The remainder requires a height of 2500ft. This is illustrated in Figure 10 below.

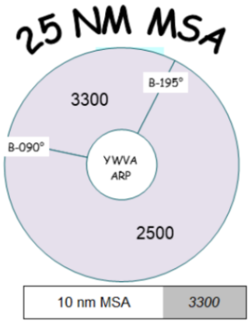


Figure 10 - 25NM MSA

Circling

Circling is an IFR procedure used only by aircraft after the end of an Instrument Approach to "circle" the airport to land on a different runway than that used by the approach procedure. The altitude is also used in flight planning, to determine the minimum fuel requirements.

Although the ICAO rules require circling to be calculated for each instrument approach procedure, it is generally considered preferable to have a single set of numbers for use at an aerodrome, and that the values are common to all procedures.

There is terrain to the west of the aerodrome which affects the lowest safe value available. In its most basic form, the circling altitudes will be:

Category	A	B	C
CIRCLING#‡	980 (941-2.4)		1400 (1361 – 4.0)

Figure 11 - Draft Circling all CCAH

If "No Circling" is allowed west of the field, then this will eliminate points 4 and 5 in the diagram from the calculations and become:

Category	A	B	C
CIRCLING#‡		910 (871 – 2.4)	1010 (971 – 4.0)

Figure 12 - Draft Circling no west CCAH

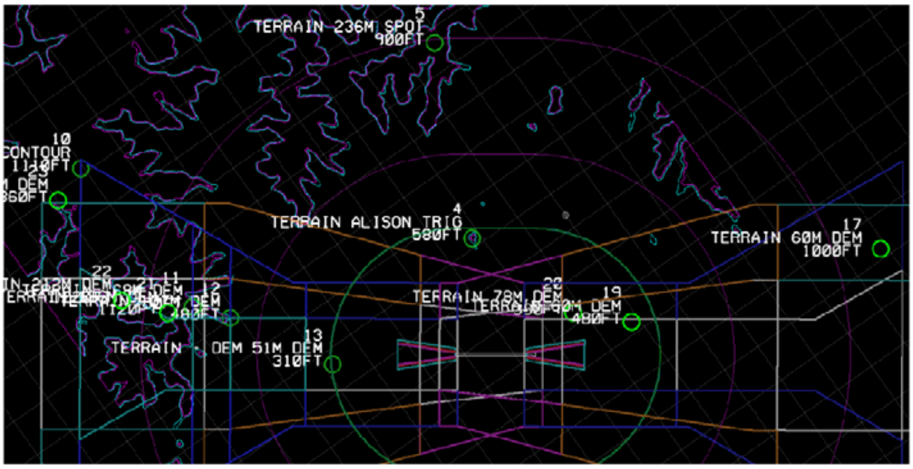


Figure 13 – Elimination of Circling Area to west of field (top) reduces altitudes

Runway 02 Draft Instrument Flight Procedure

The Runway 02 approach used is a standard 5nm leg Instrument Flight Procedure. The start altitude is based on a 25nm MSA of 3300ft, although it could have been lower using the sectorised 25MSA (possibly 2500ft).

There are generally no issues with the initial and intermediate legs.

The final approach from 5nm to touch down has some moderate terrain that is located close to the aerodrome. To ensure the lowest minima, the final segment has been "cut" at fixed distance positions at 3.5nm, 3.0nm and 2.0nm. This allows the segment heights to be adjusted to be below a nominal 3° gradient and ensure that an aircraft can be stepped over the terrain at a safe altitude. See Figure 14 - Final Approach Runway 02.

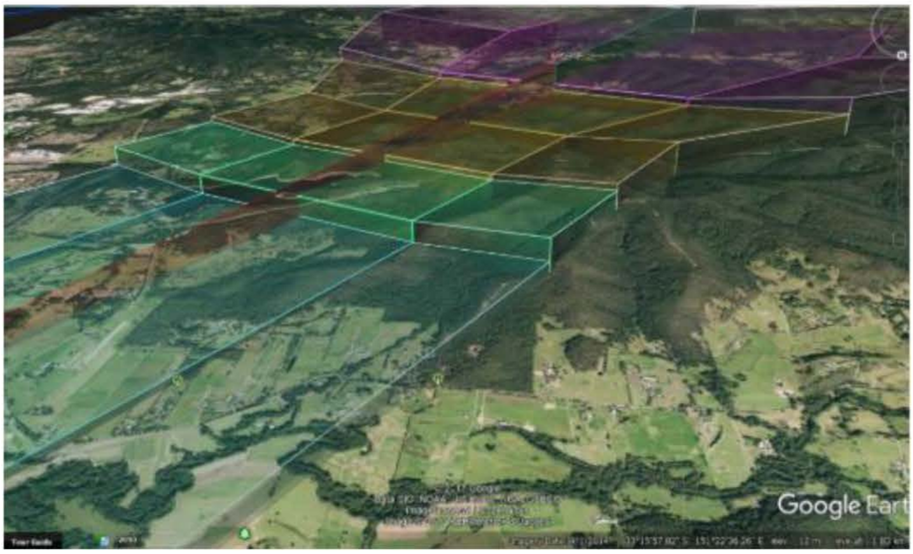


Figure 14- Final Approach Runway 02

For Runway 02, the draft minima are as per Table 12 - Runway 02 Minima.
These minima may be reduced to approximately 450ft AHD and 2.7km Visibility by employing a Baro-VNAV procedure as discussed above.

Table 12 - Runway 02 Minima

CATERGORY	A	B	C
LNAV ‡	660FT AHD (640 AGL) 3.5km visibility ‡		

Runway 20 Draft Instrument Flight Procedure
The Runway 20 approach used is a standard 5nm leg Instrument Flight Procedure. The start altitude is based on a 25nm MSA of 3300ft.

There are generally no issues with the initial and intermediate legs.

The final approach from 5nm to touch down a single step-down fix is used to ensure CASA data requirements can be met. There is no "difficult" terrain in final, however, the existing terrain is slightly taller than the comparative terrain to the south. See Figure 15.

Figure 15 - Final Approach Runway 20

For Runway 20, the draft minima are as perTable 13 - Runway 20 minima.

These minima may be reduced to approximately 480ft AHD and 2.8km Visibility by employing a Baro-VNAV procedure as discussed above.

Table 13 - Runway 20 minima

CATERGORY	A	B	C
LNAV ‡	730ft AHD (691 AGL) 3.5km visibility ‡		

By comparison, the RNAV (GNSS) Instrument Flight Procedure minima at Ballina aerodrome is 660ft and 3.7km. See Figure 9.

4.7 ATC Services

The Australian Airspace Policy Statement 2015 (AAPS) provides guidance for the determination of when changes to airspace classification may be required in the airspace immediately around an aerodrome, (referred to as the control zone at a controlled aerodrome).

The following criteria[2] will be used; annual passenger transport operations (PTO) aircraft movements, the annual number of passengers and total annual aircraft movements (see Table 14).

[2] Australia has not yet implemented Class B airspace but retains the criteria in the AAPS

Table 14 - Airspace criteria thresholds

	Class B	Class C	Class D
Service provided	ATC	ATC	ATC
Total annual aircraft movements	750,000	400,000	80,000
Total annual PTO aircraft movements	250,000	30,000	15,000
Total annual PTO passengers	25 million	1 million	350,000

The AAPS also provides guidance on the process for applying the criteria:

1. When annual traffic levels at an aerodrome meet a threshold of any one of the criteria CASA should complete an aeronautical risk review in consultation with the public, industry and other government agencies,
2. CASA will then make a determination to change the classification of airspace if necessary.

The Council has provided indicative high, medium and low forecast data in relation to the future operations, shown at Table 15 - Aircraft movement forecasts and Table 16 - Passenger forecast.

	Forecast annual aircraft movements					
Aircraft type	2018	2024	2025 low	2025 high	2029 low	2029 high
C150/PA28/ C172 (SGL)	20,000	42,000	45,600	46,000	48,000	50,000
PA44/B76/PA31 (Twin)	30	1,800	1,900	1,960	2,100	2,200
M500/TBM750/PC12/BE20	20	4,000	4,800	5,000	5,400	5,600
LR35-LR45/C500-C600	0	400	560	600	680	800
DH8-30/ATR72/FK50/SF34	0	0	11,680	17,400	14,600	26,280
Helicopters	170	800	950	1,100	1,080	1,320
Total annual	20,2220	49,000	63,490	72,060	71,860	86,200

Table 15 - Aircraft movement forecasts

	Forecast annual passengers		
Year	low	Med	high
2024			
2025	111,398	192,270	313,024
2026	114,740	202,356	341,196
2027	118,182	212,474	400,624
2028	121,728	223,097	436,680
2029	154,322	238,710	508,080

Table 16 - Passenger forecast

High side forecast data suggests that CCAH would approach the threshold for a CASA risk assessment (Class D) in 2025 on both aircraft movements and passenger numbers.
Low side forecast data suggests that CCAH would approach the threshold for a CASA risk assessment (Class D) in 2029 on forecast aircraft movements but not passenger numbers.

Class D services currently require the construction of an ATC Tower. It should be noted that Airservices, has indicated that they are exploring opportunities to deliver tower services using remote tower technology which may considerably alter the current service model moving forward.

As discussed in the Section on Flight Training . Ballina airport has recently introduced a CA/GRS. This service is a level lower than a full Air Traffic Services such as that delivered in Class D airspace, and operates under CASA MoS 139 (11) rather than the Air Traffic Control MOS172 (15).

Based on the example now demonstrated at Ballina Airport, the Council may consider the need for implementing a CA/GRS services prior to reaching the threshold for implementation of an ATC service under the CASA criteria above.

4.8 Aviation Rescue and Firefighting Services (ARFFS) requirements

The criteria for ARFF implementation are discussed in section Aviation Rescue and Firefighting Services (ARFFS) requirements.

Forecast data provided by the Council for future operations are shown at Table 15 and Table 16:

High side forecast data suggests that CCAH would reach the trigger point for ARFFS in 2027.
Medium forecast data suggests that CCAH would not reach the trigger point for ARFFS until beyond 2030.

Should CCAH passenger movements trigger an ARFFS requirement, based upon the forecast aircraft types accessing CCAH, the aerodrome would be considered an Aerodrome Category 6, as specified in Table 17: Aerodrome Category.

Table 17: Aerodrome Category

Aerodrome Category	Length of Aircraft	Maximum Fuselage Width
1	0 m up to but not including 9 m	2 m
2	9 m up to but not including 12 m	2 m
3	12 m up to but not including 18 m	3 m
4	18 m up to but not including 24 m	4 m
5	24 m up to but not including 28 m	4 m
6	28 m up to but not including 39 m	5 m
7	39 m up to but not including 49m	5 m
8	49 m up to but not including 61 m	7 m
9	61 m up to but not including 76 m	7 m
10	76 m up to but not including 90 m	8 m

Based on forecast traffic levels, CCAH potential aerodrome level and category, the aerodrome may require a minimum of 2 fire fighting vehicles, as described in Table 18. For comparison, Ballina Airport has an ARFFS established at Category 6.

Minimum Number of Vehicles	
Airport Category	**ARFFS Vehicles**
1 to 5	1
6 to 7	2 (min)
8 to 10	3 (min)

Table 18: Minimum number of vehicles

CASA specifies that fire vehicles must meet specifications in accordance with Australian Design Rules (ADR) and specific response time performance. Response time is defined as "the time between the initial call to ARFFS and the time when the first responding vehicles(s) is (are) in position at the aircraft or site of the incident or accident, and if required, produce foam at a rate of a least 50% of the discharge rate specified in the standards. ARFFS objectives is achieving a response time that does not exceed three minutes to the end of each runway in optimum visibility and surface conditions.

Minimum usable amounts of fire extinguishing agents for a category 6 aerodrome are defined in Table 19.

Minimum Usable Amounts of Extinguishing Agents				
Foam Meeting Performance Level A		**Foam Meeting Performance Level B**		**Foam Meeting Performance Level C**
Discharge rate foam solution (Water)		**Discharge rate foam solution (Water)**		**Dry Chemical Powder (DCP)**
11,800 litres	6,000 l/m	7,900 litres	4,000 l/m	225 Kg

Table 19: Extinguishing Agents Performance for Aerodrome Category 6

The Department of Infrastructure and Regional Development is currently conducting a Regulatory Policy Review of Aviation Rescue and Fire Fighting Services. (16) The outcomes of the review have yet to be actioned, but provide opportunities for airports to implement graduated "Fire Related Services at lower "trigger" points than currently described in the standard.

The review first two key agreed recommendations allow a risk based approach to aviation rescue and firefighting service establishment as follows:

- ARFFS be required to be established at a location where a relevant trigger event occurs and where the Civil Aviation Safety Authority (CASA) decides, following its conduct of a risk review, that ARFFS is required at that location.
- Two measures constitute a trigger event for the conduct of a risk review relating to the establishment of an ARFFS - the receipt of scheduled international passenger air services, or 500,000 passengers on scheduled commercial air services passing through the airport during a rolling twelve-month period.

When implemented, these changes may require a re-evaluation of the ARFF requirements for CCAH.

4.9 OLS

The OLS is a series of virtual surfaces associated with each runway at an aerodrome that defines the lower limits of airspace in which objects above this surface are defined as obstacles. The OLS is often used as a land planning tool to limit the height of structures, trees or other objects in the vicinity of aerodromes so that an aircraft may operate safely during the initial and final stages of flight and avoid collisions with obstacles.

As part of the planned 2024 Stage 3 development, the current 1194m runway is planned to be modified to 1200m.

Three OLS have been completed for this report:

- One for the planned 2024 Stage 3 development, which involves a 1200m Code 3C non-precision runway with a runway strip of 150m and a displaced threshold of 225m on Runway 20.
- Two others have been developed for 1600m and 1799m Code 3C non-precision runways. Both have a runway strip of 150m and a displaced threshold of 225m on runway 20.

It is important to note that in the absence of aerodrome survey data, the elevations of Runway 02 and 20 are assumed as discussed in Section 2.1.

The three OLS, as well as associated terrain penetrations for the 1200m and 1799m runway are shown in Annex A: Obstacle Limitation Surfaces.

4.10 PANS-OPS Surface

The Procedures for Air Navigation Services – Operations (PANS-OPS) surface is similar to the OLS in that they are described surfaces in space ensuring the protection of aircraft from colliding into obstacles. However, the PANS-OPS surface aims to protect aircraft guided solely by radio and satellite navigation aids, while flying in low visibility conditions. The PANS-OPS surface is generally situated above the OLS. Intrusions into the PANS-OPS surface are generally prohibited.

T070 used a 1799m runway which is intended to provide a "worst-case" assessment of the situation when it conducted the preliminary PANS-OPS assessment. We reviewed a database of obstacles obtained from Airservices, also known as the RAAF obstacle database. The database contains a list of obstacles which are significant to aircraft operations. Originally implemented by the RAAF, Airservices maintains the information through their Aeronautical Database Management System, known as Mercury.

For CCAH to proceed with non-precision operations in the future, it is recommended that a PANS-OPS surface chart be prepared by an independent CASA certified MOS Part 173 [13] as part of the final flight path and procedure design.

5 Airspace change roadmap

To70 has prepared an indicative "roadmap" of airspace activities for progression of the proposal through CASA, Office for Airspace Regulation and Airservices approvals. The list is not exhaustive but represents some of the key activities.

5.1 Preliminary Consultation

CCAH is in very close proximity to Airservices managed airspace, and most IFR operations at the aerodrome are conducted in with reference to and service from Airservices and Defence ATC. Prior to the commencement of any airspace change, preliminary consultation should be conducted with Airservices and Defence ATC. Where possible, this should be conducted in concert to ensure that all parties involved in the change process receive the same information.

5.2 Airport Safeguarding

Formal preparation of Obstacle Limitation Surfaces (OLS), (including Procedures for Air Navigation Services-Aircraft Operations (PANS-OPS) and Communication Navigation and Surveillance (CNS) Surfaces will be required during this stage to inform the National Airports Safeguarding Framework as outlined in Guidelines A-F. (17) CCC has indicated that a Helicopter Landing Site (HLS) may be constructed at the southwest of Runway 02/20. An additional OLS would be required for this site to determine building setback and ensure that all published holding points will keep aircraft clear of operations at the HLS.

While New South Wales does not currently have standards for Public Safety Zones, in the absence of any nationally agreed guidance, a nominal 1000 m trapezoid shaped clearance off the end of each runway threshold is may be used and should be discussed with local planning authorities.

5.3 Airport Certification

With the expectation of RPT or frequent charter operations conducted with aircraft of more than 30 passengers, CCAH will require certification under CASA MoS Part 139 (11). While the airport certification process is outside the scope of this work, there is a significant interrelationship between the airspace and airport that must be aligned.

5.4 Instrument Approach Procedures

The introduction of an IAL at CCAH, will require a formal assessment of the aerodrome and its environment with respect to CASA MoS Part 139 (11), to confirm the suitability of the aerodrome to host flights under the IFR. Shortcomings will be identified, with recommendations to meet CASA compliance requirements. The aerodrome will also require certification or regulation in order for IAL to be implemented see above. A CASA MoS Part 173 certified designer will be required to design formal IAL procedures. As part of the process, the designer will coordinate with Airservices to ensure the designed procedures are integrated with existing and new routes as required.

Flight validation is required for:

1. Instrument approach procedures;
2. Revised instrument approach procedures where the final course has been re-aligned by 3° or more.

Validation of an instrument flight procedure comprises:

1. A review of the draft procedures from an operational perspective conducted by the validation pilot;
2. A validation flight check.

The process of instrument approach procedure design focuses on those controlling obstacles that affect the procedure. This focus is facilitated using various obstacle and terrain databases. The purpose of flight validation is to verify database information, to check all obstacles (including the identification of any unforeseen obstacles) that affect the safety of the procedure, and to assess the 'flyability' of the procedure.

5.5 Flight Path Authorisation

For flight paths to be implemented, Airservices is required to review proposed designs for adherence with pre-existing environmental work. Airservices will determine whether there is a requirement to refer any flight path change to the appropriate Minister under Section 160 of the EPBC act and where required, make a referral.

5.6 Aircraft Noise Exposure Forecast (ANEF)

To support the development of an Airport Master Plan or Major Development Plan, an ANEF based on the design assumptions would be required.

5.7 Consultation

It is recommended that prior to completion of an ACP and the creation of information for AIP, further consultation is conducted with Airservices and Defence ATC to ensure that data prepared is suitable to and supported by all parties.

5.8 Airspace Change Proposal Authorisation

Changes to airspace classification or new air routes published an Airspace Change Proposal (ACP) must be submitted to CASA for review. CASA will review and approve both the change and the environmental assessment. This work is described in CASA's Airspace Risk and Safety Management Manual (18)

5.9 Aeronautical Information Management

Aeronautical Information Circular (AIC) Advance notice

Once sufficient detail is known, an AIC can be published providing the aviation community with advance notice of intended changes being made to air routes and facilities. The content of the AIC can be simply an introduction, description of the change and expected timing of the change. AIC are published by Airservices.

Aeronautical Information Publication (AIP)

Final details for changes to the following items should be prepared and submitted for publication in AIP to Airservices and other Aeronautical Information Service (AIS) providers.

1. RWY dimensions, lighting, etc.
2. TWY, dimensions lighting, usage, etc.
3. Aprons, dimensions lighting, etc.

4. HLS, dimensions, lighting, etc.
5. IAL, full suite
6. Communication Frequencies, location, frequency, etc.
7. Facilities
8. Procedures
    a. NAP
    b. Low vis
9. Charts
    c. Aerodrome
    d. Apron
    e. Procedure
    f. Obstacle
    g. Runway distance supplement
    h. Waypoints list
    i. Flight Planning requirements where amended for overflying or helicopter activity
    j. Maps- amended as required:
        i. Visual Terminal Charts (VTC) provide both aeronautical and topographical information at a scale of 1:250,000 for VFR operations in the vicinity of major aerodromes.
        ii. Enroute Charts (ERC) Low and High, are drawn to various scales to accommodate significant air traffic route areas and show controlled airspace, prohibited, restricted and danger areas, air routes, ATS and radio-navigation services.
        iii. Terminal Area Charts (TAC) provide airspace, air-routes, prohibited, restricted, and danger areas, navigation aids and radio frequencies. They are designed to display aeronautical information at a larger scale for easier use in congested areas.
        iv. Visual Navigation Charts (VNC) are used to plan flight in relation to controlled airspace, transition from the WAC to the VTC when operating around terminal areas, and navigate when nearing controlled Airspace or Restricted and Danger Areas.

6 Data

6.1 BITRE Data

The following statistics below are taken from The Bureau of Infrastructure, Transport and Regional Economics (BITRE).

General Aviation Activity

The following table shows the number of hours flown in General Aviation throughout Australia.

Table 20 - Hours flown in General Aviation years ended December

General Aviation (000's of hrs)										
Year	Private	Business	Training	Test & Ferry	Aerial Work	Agriculture	Charter	Sub total	Regional Airline	Total
2010	241.9	140.0	436.3	18.2	400.3	103.8	507.3	1847.7	228.1	2075.9
2011	237.4	144.8	386.8	17.9	398.8	100.4	485.2	1771.4	216.7	1988.1
2012	232.6	130.4	360.9	20.8	369.4	59.1	501.7	1704.9	204.4	1909.3
2013	231.2	130.8	378.9	23.8	411.5	79.8	485.9	1741.8	268.3	2010.1

Table 21 - Domestic aviation activity

	Year End Apr 2016	Year End Apr 2017	Growth
Total Passengers carried	58.12 million	59.1 million	1.7%
Revenue Passenger Kilometres	68.53 billion	69.41 million	1.3%
Available Seats	77.41 million	77.02 million	-0.5%
Available seat kilometres	89.31 billion	88.58 million	-0.8
Load Factor	76.7%	78.4%	1.6* (percentage point difference)
Aircraft Trips	638100	636000	-0.3

Table 22 - Domestic airfares

Survey Month	Business	Restricted Economy	Best Discount
Jun 2016	95.3	79.6	58.5
Jul 2016	94.2	78.9	57.4
Aug 2016	94.4	79.1	57.5
Sep 2016	94.9	80.4	73.6
Oct 2016	93.9	79.6	61.6
Nov 2016	94.2	79.8	61.2
Dec 2016	96.9	81.2	84.4
Jan 2017	94.2	79.3	58.9

Feb 2017	94.3	79.7	59.6
Mar 2017	95.4	80.4	81.7
Apr 2017	93.8	80.2	59.7
May 2017	96.0	80.3	64.6
Jun 2017	95.1	80.9	61.5

Aviation Turbine Fuel Sales

The following graphs show the trend in increasing fuel prices for aviation.

Quarter	Turbine Fuel Sales (ML)	Gasoline Fuel Sales (ML)
Jun 2012	1827	21.5
Sep 2012	1928	21.0
Dec 2012	1979	20.5
Mar 2013	1916	18.2
Jun 2013	1950	21.3
Sep 2013	2073	19.8
Dec 2013	2089	18.5
Mar 2014	1968	16.2
Jun 2014	2038	18.1
Sep 2014	2041	17.6
Dec 2014	2075	16.9
Mar 2015	2010	15.8
Jun 2015	2017	17.9
Sep 2015	2105	17.2

6.2 Wind Data from Bureau of Meteorology (BoM)

Approximately 15 years' worth of climate statistics were obtained for the three closest weather stations from Central Coast. These stations are Mangrove Mountain and Norah Head. The Figure 16 shows the prevalent winds for the area surrounding Central Coast are mainly from the South, North-East during the afternoon and West during the morning.

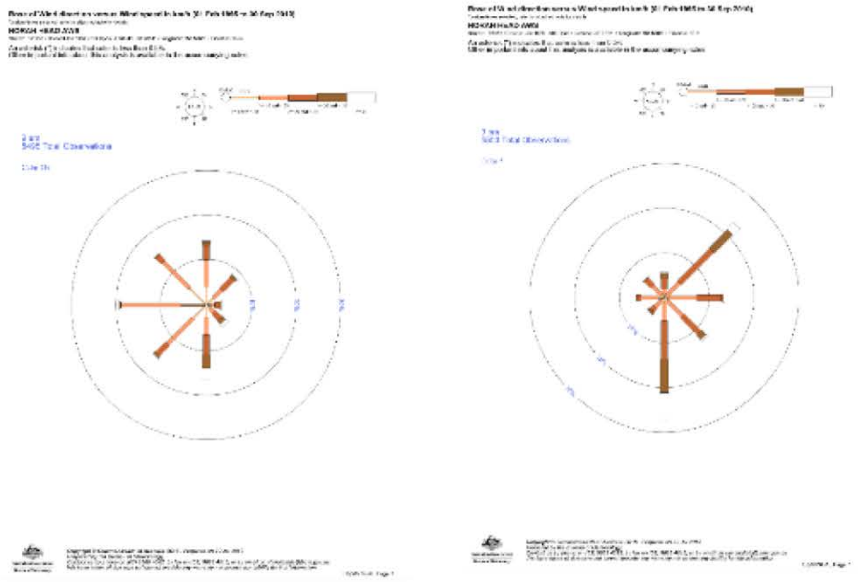


Figure 16 - Norah Head wind rose (9am and 3pm)

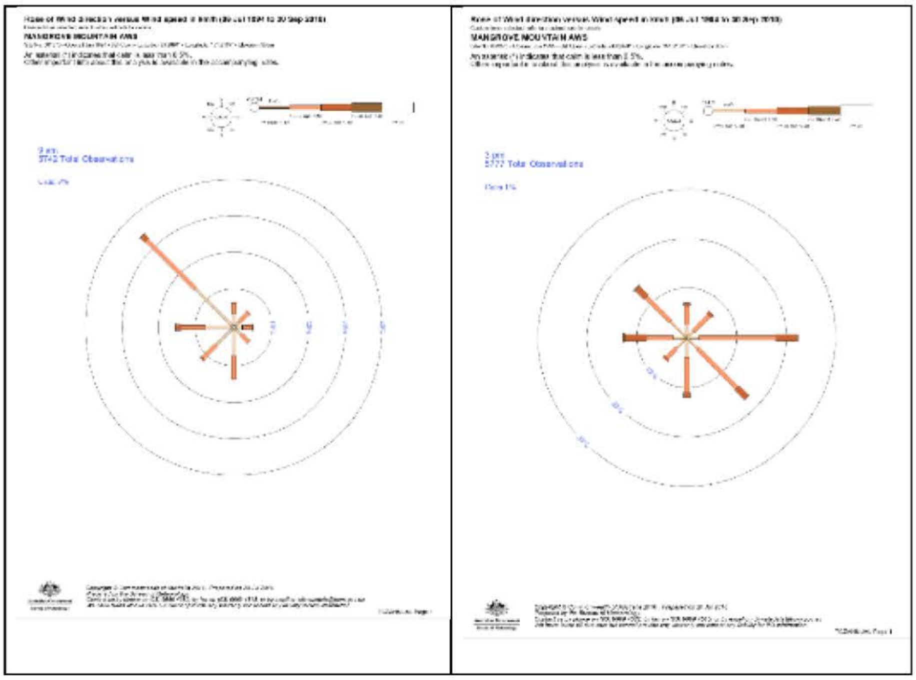


Figure 17 – Mangrove Mountain wind rose (9am and 3pm)

6.3 Aircraft performance

This section contains details of the aircraft performance specifications listed according to their airfield capability:

Aircraft capable of operating with minimal constraint to 1200m x 30m runway

Table 23 – Q300 Specifications

	**Performance Specifications Q300** Operators in Australia: **QantasLink** Image courtesy Bombardier
Passenger Typical	50
Runway requirement	
Max Take-off field length (MTOW, SL, ISA) (m)	1,180
Max Landing field length (MLW, SL) (m)	1,040
High speed cruise (km/h)	532
Ceiling (ft)	25,000
Range (km)	1,711
Weight	
Max Takeoff (kg)	19,500
Max landing (kg)	19,050
Max zero fuel (kg)	17,920

Source: (19)

Table 24 – FK50 Specifications

	**Performance Specifications FK50** Operators in Australia: **Alliance Airlines** Image courtesy Fokker
Passenger Typical	50
Runway requirement	
Max Take-off field length (MTOW, SL, ISA) (m)	1,000
High speed cruise (km/h)	500
Ceiling (ft)	25,000
Range (km)	13,00
Weight	
Max Takeoff (kg)	20,820
Max landing (kg)	20,030
Max zero fuel (kg)	12,250

Source: (20)

Table 25 – FK70 Specifications

	**Performance Specifications FK70** Operators in Australia: **Alliance Airlines** Image courtesy Fokker
Passenger Typical	79
Runway requirement	
Max Take-off field length (MTOW, SL, ISA) (m)	1,150
High speed cruise (km/h)	800
Ceiling (ft)	35,000
Range (km)	2,400
Weight	
Max Takeoff (kg)	38,100
Max landing (kg)	36,760
Max zero fuel (kg)	33,565

Source: (21)

Table 26 – SF340

	**Performance Specifications SF340** Operators in Australia: **Regional Express** Image courtesy ATR Aircraft
Passenger Typical	33
Runway requirement	
Max Take-off field length (MTOW, SL, ISA) (m)	1200
High speed cruise (km/h)	524
Ceiling (ft)	25,000
Range (km)	1,851
Weight	
Max Takeoff (kg)	13,154
Max landing (kg)	12,927
Max zero fuel (kg)	12,020

Source: (22)

Aircraft capable of operating with minimal constraint to 1600m x 30m runway

Table 27 – ATR 72 Specifications

	**Performance Specifications ATR72** Operators in Australia: **Virgin Australia Regional** Image courtesy ATR Aircraft
Passenger Typical	66
Runway requirement	
Max Take-off field length (MTOW, SL, ISA) (m)	1,211
High speed cruise (km/h)	517
Ceiling (ft)	17,000
Range (km)	805
Weight	
Max Takeoff (kg)	21,500
Max landing (kg)	21,350
Max zero fuel (kg)	20,000

Source: (23)

Table 28 –JS32

	**Performance Specifications JS32** Operators in Australia: **FlyPelican** Image Creative Commons
Passenger Typical	19
Runway requirement	
Max Take-off field length (MTOW, SL, ISA) (m)	1,400
High speed cruise (km/h)	460
Ceiling (ft)	25,000
Range (km)	2200
Weight	
Max Takeoff (kg)	7,350
Max landing (kg)	7,080
Max zero fuel (kg)	6,760

Source (24)

Table 29 – Q400

	**Performance Specifications Q400** Operators in Australia: **QantasLink** Image courtesy Bombardier
Passenger Typical	82
Runway requirement	
Max Take-off field length (MTOW, SL, ISA) (m)	1,425
High speed cruise (km/h)	630
Ceiling (ft)	27,000
Range (km)	1,295- 2,000
Weight	
Max Takeoff (kg)	27,987
Max landing (kg)	28,123- exceeds MTOW
Max zero fuel (kg)	25,174

Source: (25)

Table 30 – FK100 Specifications

	**Performance Specifications FK100** Operators in Australia: **Alliance Airlines** Image courtesy Fokker
Passenger Typical	107
Runway requirement	
Max Take-off field length (MTOW, SL, ISA) (m)	1,350
High speed cruise (km/h)	850
Ceiling (ft)	35,000
Range (km)	2,000
Weight	
Max Takeoff (kg)	45,810
Max landing (kg)	39,915
Max zero fuel (kg)	36,740

Source (26)

Aircraft capable of operating unconstrained to 1799m x 30m runway

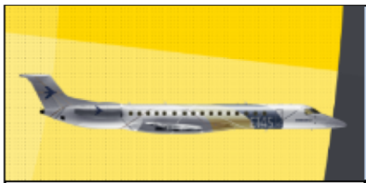
Table 31 – ERJ135

	**Performance Specifications** ERJ 135 Operators in Australia: **Jetgo** Image courtesy Embraer
Passenger Typical	30-37
Runway requirement	
Max Take-off field length (MTOW, SL, ISA) (m)	1,640
High speed cruise (km/h)	M.78-960
Ceiling (ft)	37,000
Range (km)	3,243
Weight	
Max Takeoff (kg)	19,000
Max landing (kg)	18,500
Max zero fuel (kg)	15,600

Source (27)

Aircraft capable of operating unconstrained to 2000m x 30m runway

Table 32 – ERJ145

	**Performance Specifications** ERJ 145 Operators in Australia: **Jetgo** Image courtesy Embraer
Passenger Typical	50
Runway requirement	
Max Take-off field length (MTOW, SL, ISA) (m)	2,270
High speed cruise (km/h)	M.78-960
Ceiling (ft)	37,000
Range (km)	2,870
Weight	
Max Takeoff (kg)	22,000
Max landing (kg)	19,300
Max zero fuel (kg)	17,100

Source (28)

Table 33 –B737-700

	**Performance Specifications** B737-700 Operators in Australia: **Virgin Australia** Image courtesy Boeing
Passenger Typical	126
Runway requirement	
Max Take-off field length (MTOW, SL, ISA) (m)	3,000
High speed cruise (km/h)	M.78-830
Ceiling (ft)	41,000
Range (km)	2,870
Weight	
Max Takeoff (kg)	60,328
Max landing (kg)	58,060
Max zero fuel (kg)	54,658

Source (29)

Table 34 –B737-800

	**Performance Specifications** B737-800 Operators in Australia: **Virgin Australia, Qantas Airways** Image courtesy Boeing
Passenger Typical	160
Runway requirement	
Max Take-off field length (MTOW, SL, ISA) (m)	2,500
High speed cruise (km/h)	M.789- 842
Ceiling (ft)	41,000
Range (km)	2,870
Weight	
Max Takeoff (kg)	70,534
Max landing (kg)	65,317
Max zero fuel (kg)	61,689

Source (28)

7 Consulted parties

NSW Rural Fire Service Charmhaven

Queensland Rescue and Firefighting Services Acacia Ridge

CASA -ARFFS section

CASA - OAR Plume Rises

Airservices ATC- Sydney and Brisbane Centre

Airservices ARFFS –Chief Fire Officer

Defence ATC- Williamtown

Ballina Airport CA/GRS

Central Coast Aero Club

8 Terms and abbreviations

Abbreviation	Name	Description
AIC	Aeronautical Information Circular	An AIC contains explanatory or advisory information concerning technical, legislative or administrative matters, as well as information on the long-term forecast of major changes in legislation, regulations, procedures or facilities liable to affect flight safety
AIM	Aeronautical Information Management	ICAO defines AIM as encompasses the origination, management and distribution of time-sensitive, digital aeronautical information in a safe secure and efficient manner.
AIP	Aeronautical Information Publication	The AIP is defined by the International Civil Aviation Organization as a publication issued by or with the authority of a state and containing aeronautical information of a lasting character essential to air navigation.
AIRAC	Aeronautical Information Regulation and Control	Aeronautical Information Services (AIS) document and defines a series of common dates and an associated standard aeronautical information publication procedure for States.
Airservices	Airservices Australia	Airservices is a corporate Commonwealth entity providing safe, secure, efficient and environmentally responsible air traffic control services to the aviation industry in Australian controlled airspace.
Airspace	Airspace	That portion of the earth's atmosphere over which a nation exercises jurisdiction over aircraft in flight. The continental division of airspace usually coincides with the national boundaries and the oceanic division is determined by mutual agreement of the nations concerned.
AIS	Aeronautical Information Service	The AIS is a service established in support of international civil aviation, whose objective is to ensure the flow of information necessary for the safety, regularity, and efficiency of international air navigation.
ANSP	Air Navigation Service Provider	A company that delivers Air Traffic Services (ATS)
APV	Approach with Vertical Guidance	Instrument approach procedure that involves lateral and vertical guidance to aircraft, but does not meet the requirements established for Precision Approach classification.
ASMGCS	Advanced Surface Movement Guidance and Control System	This tool provides ATC with a plan view of aerodromes deriving data from surveillance and ADSB data. In Australia, it also provides data to the Aerobahn product.
ATC	Air Traffic Control	Tower (TWR) ATC Terminal Manoeuvring Area (TMA) ATC Enroute (ENR) ATC
ATM	Air Traffic Management	ATM consists of three basic elements; Air Traffic Control, Air Traffic Flow Management and Aeronautical Information Services
CASA	Civil Aviation Safety Authority	CASA has the primary responsibility for the maintenance, enhancement and promotion of the safety of civil aviation in Australia.
DAH	Designated Airspace Handbook	The DAH is a publication issued on an alternating approximate 24/28-week cycle. The DAH lists, in tabular form, the lateral and vertical limits and other pertinent details of the airspace types as listed
DIRD	Department of Infrastructure and Regional Development	Federal Government agency
DOE	Department of Environment	Federal Government agency

Abbreviation	Name	Description
GA	General Aviation	General aviation commonly refers to that part of the aviation industry that engages in activity other than commercial air transport activity
HLS	Helicopter Lift off and Landing Site	A location used by helicopters to land and lift off
IAP/IAL	Instrument Approach Procedure	The approved procedure to be allowed by aircraft in descending from cruising level and landing at an aerodrome. It involves a series of predetermined manoeuvres for the orderly transfer of an aircraft by reference to night instruments, from the beginning of the initial approach to a landing or to a point from which a landing may be made visually.
ICAO	International Civil Aviation Authority	ICAO is a United Nations specialized agency formed by the signing of the Chicago Convention (1944) responsible for working with the Convention's 191 Member States and global aviation organizations to develop international Standards and Recommended Practices (SARPs) which States reference when developing their legally-enforceable national civil aviation regulations.
ILS	Instrument Landing System	A system of radio navigation intended to assist aircraft in landing which provides lateral and vertical guidance, which may include indications of distance from the optimum point of landing
IMC	Instrument Meteorological Condition	A flight classification
Maneuvering Area	Manoeuvring Area	A manoeuvring area is that part of an aerodrome to be used by aircraft for take-off, landing, and taxiing, excluding aprons and areas designed for maintenance of an aircraft.
MDP	Major Development Plan	All leased federal airports (except for Tennant Creek and Mount Isa Airports) are required to develop a Major Development Plan for major airport developments on the airport site. A draft version of the Major Development Plan must undergo public consultation before being submitted to the Minister for Infrastructure and Regional Development for a decision
Movement	Movement	Either a take-off or a landing by an aircraft.
Movement Area	Movement Area	A movement area, as defined by ICAO, is "That part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, consisting of the manoeuvring area and the apron(s)."
NAP	Noise Abatement Procedures	Includes the ICAO Noise Abatement Departure Procedures (NADP)
NOTAM	Notice to Airmen	A NOTAM is a notice filed with an aviation authority to alert aircraft pilots of potential hazards along a flight path or at a location that could affect the safety of the flight.
NPA	Non-Precision Approach	An instrument approach procedure involving the use of instruments that provide lateral guidance.
OLS	Obstacle Limitation Surface	A series of surfaces that set the height limits of objects, around an aerodrome.
PANS-OPS	Procedures for Air Navigation Services – Operations	Similar to an OLS, with the purpose of protecting aircraft operating in Instrument Meteorological Condition (IMC) conditions.
RAPAC	Regional Airspace and Procedures Advisory Committee	Regional airspace and procedures advisory committees (RAPACs) are primarily state-based forums for discussion of all matters relating to airspace and related procedures in Australia, and specifically in their areas of responsibility.
SME	Subject Matter Expert	An experienced specialist with subject matter expertise in one or more fields.

Abbreviation	Name	Description
TCU	Terminal Control Unit	A unit responsible for delivering an ATC Approach service
TMA	Terminal Manoeuvring Area	TMA is used to describe a designated area of controlled airspace surrounding a major airport where there is a high volume of traffic.
VFR	Visual Flight Rules	A category of flight
VMC	Visual Meteorological Condition	The conditions required for VFR
VSA	Visual Approach	An approach by an aircraft to a runway executed by a visual reference to terrain.

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Annex A: Obstacle Limitation Surfaces

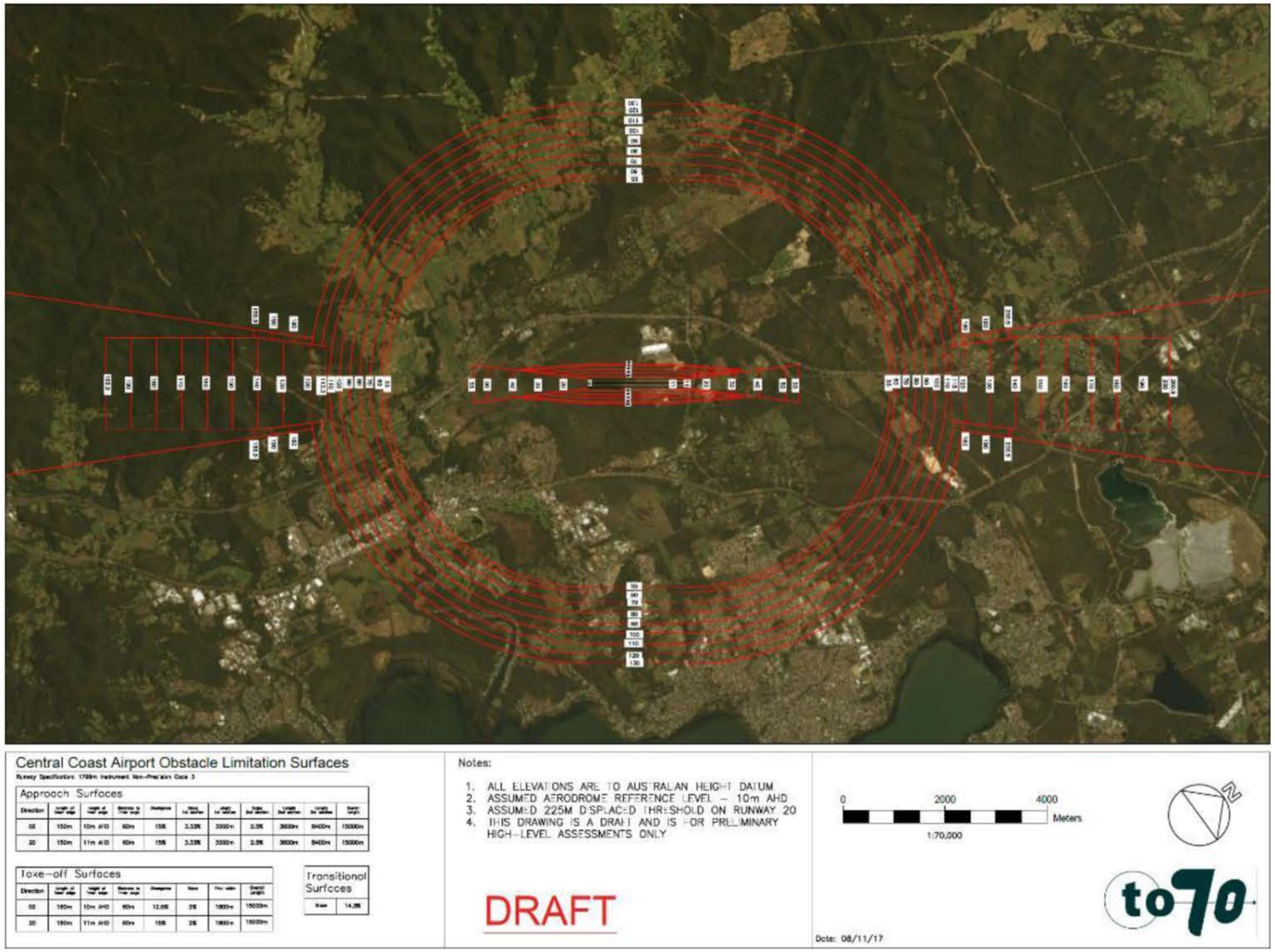
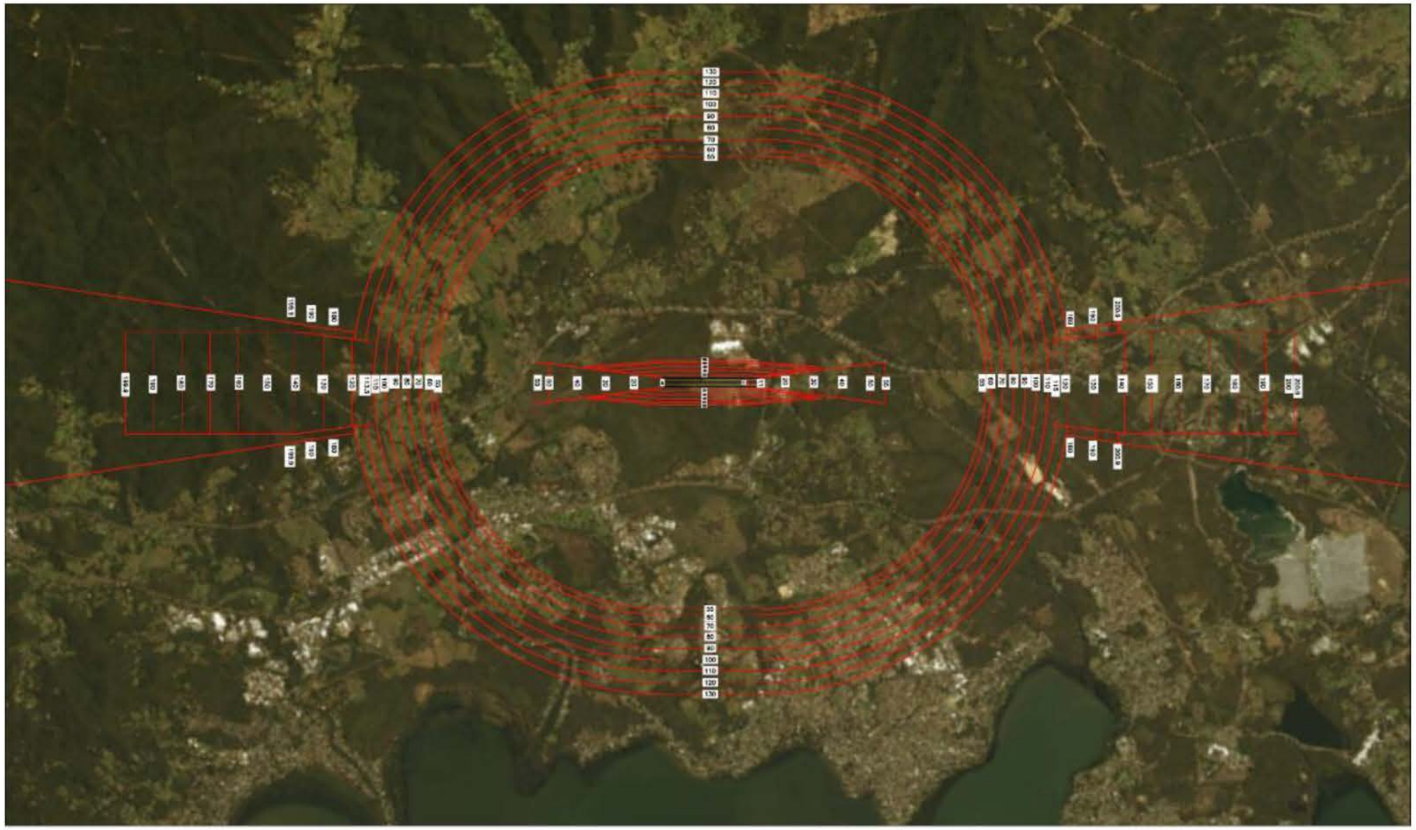


Figure 18 - 1799m Runway OLS



Central Coast Airport Obstacle Limitation Surfaces

Runway Specification: 1600m Instrument Non-Precision Code 3C

Approach Surfaces

Direction	Length of inner edge	Height of inner edge	Distance to inner edge	Divergence	Slope 1st section	Length 1st section	Slope 2nd section	Length 2nd section	Length 3rd section	Overall length
02	150m	10m AHD	60m	15%	3.33%	3000m	2.5%	3600m	8400m	15000m
20	150m	11m AHD	60m	15%	3.33%	3000m	2.5%	3600m	8400m	15000m

Take-off Surfaces

Direction	Length of inner edge	Height of inner edge	Distance to inner edge	Divergence	Slope	Final width	Overall length
02	180m	10m AHD	60m	12.5%	2%	1800m	15000m
20	180m	11m AHD	60m	12.5%	2%	1800m	15000m

Transitional Surfaces

Slope	14.3%

Notes:

1. ALL ELEVATIONS ARE TO AUSTRALIAN HEIGHT DATUM
2. ASSUMED AERODROME REFERENCE LEVEL – 10m AHD
3. ASSUMED 225M DISPLACED THRESHOLD ON RUNWAY 20
4. THIS DRAWING IS A DRAFT AND IS FOR PRELIMINARY HIGH-LEVEL ASSESSMENTS ONLY

DRAFT

0 2000 4000 Meters

1:70,000

Date: 30/10/17

Figure 19 - 1600m Runway OLS

Central Coast Airport Obstacle Limitation Surfaces

Runway Specification: 1200m Instrument Non-Precision Code 3C

Approach Surfaces

Direction	Length of inner edge	Height of inner edge	Distance to inner edge	Divergence	Slope 1st section	Length 1st section	Slope 2nd section	Length 2nd section	Length 3rd section	Overall length
02	150m	10m AHD	60m	15%	3.33%	3000m	2.5%	3600m	8400m	15000m
20	150m	11m AHD	60m	15%	3.33%	3000m	2.5%	3600m	8400m	15000m

Take-off Surfaces

Direction	Length of inner edge	Height of inner edge	Distance to inner edge	Divergence	Slope	Final width	Overall length
02	180m	10m AHD	60m	12.5%	2%	1800m	15000m
20	180m	11m AHD	60m	12.5%	2%	1800m	15000m

Transitional Surfaces

Slope	14.3%

Notes:

1. ALL ELEVATIONS ARE TO AUSTRALIAN HEIGHT DATUM
2. ASSUMED AERODROME REFERENCE LEVEL – 10m AHD
3. ASSUMED 225M DISPLACED THRESHOLD ON RUNWAY 20
4. THIS DRAWING IS A DRAFT AND IS FOR PRELIMINARY HIGH-LEVEL ASSESSMENTS ONLY

DRAFT

0 2000 4000 Meters

1:70,000

Date: 30/10/17

Figure 20 - 1200m Runway OLS

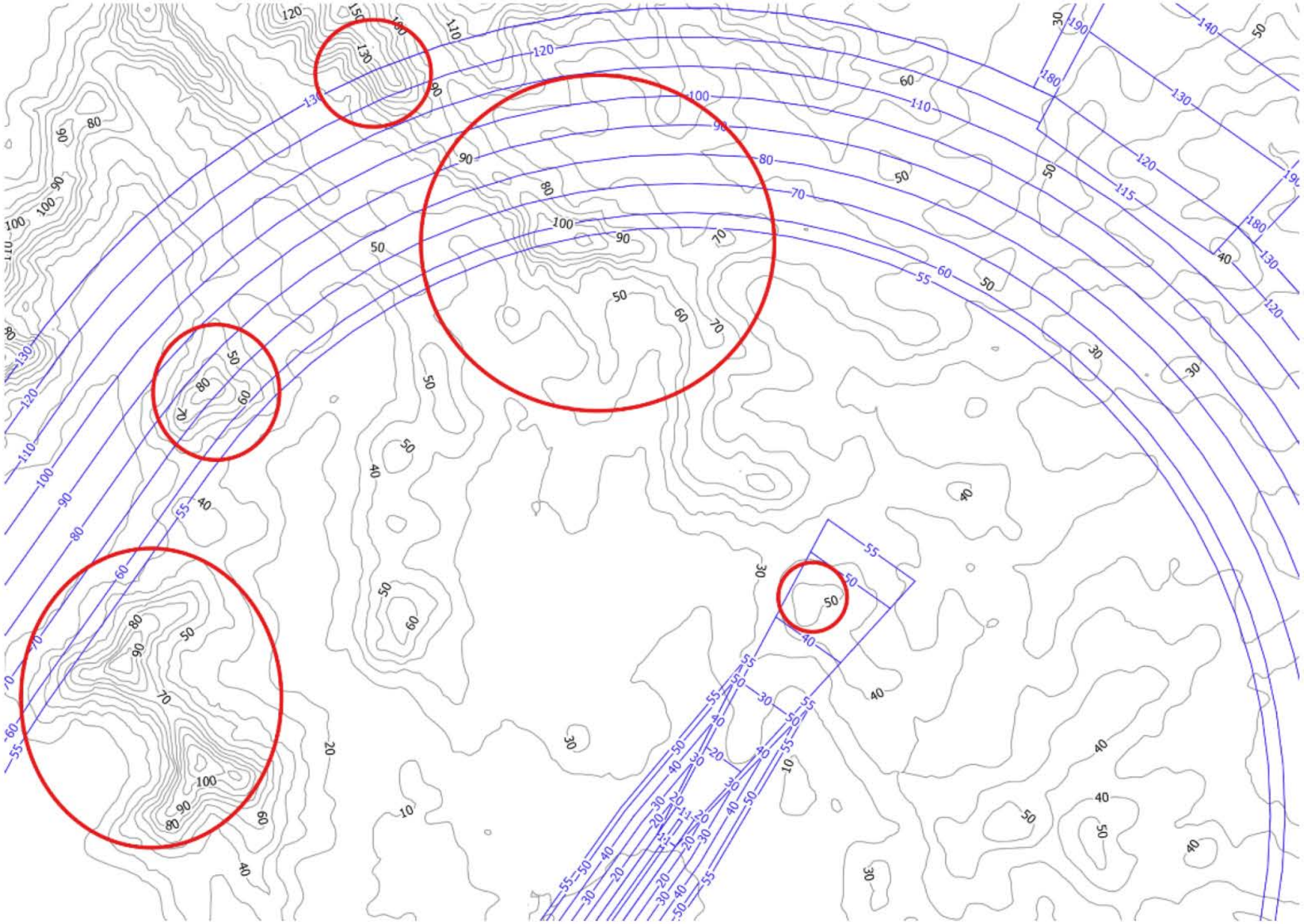


Figure 21 - 1799m RWY OLS northern terrain intrusions

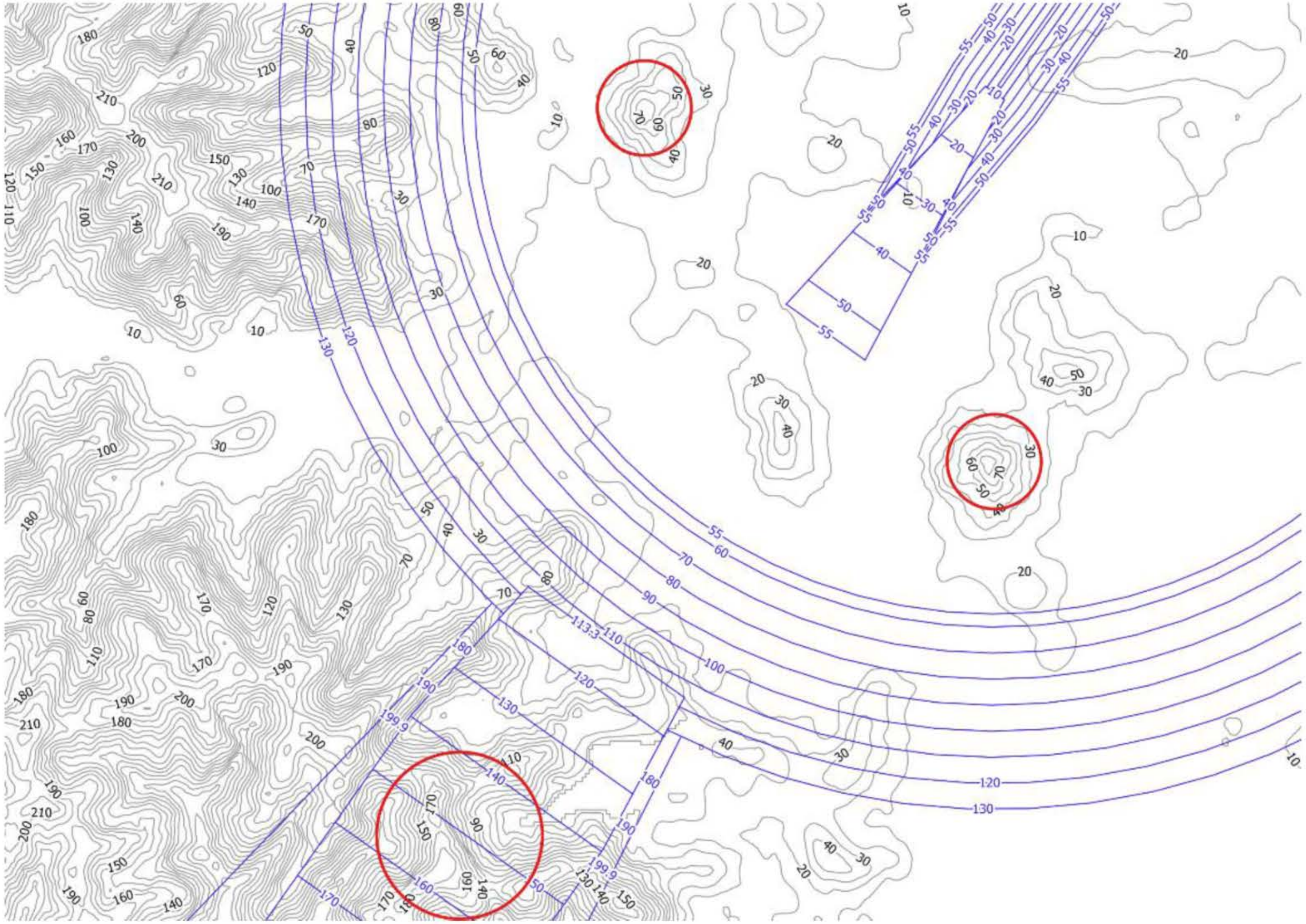


Figure 22 - 1799m RWY OLS southern terrain intrusions

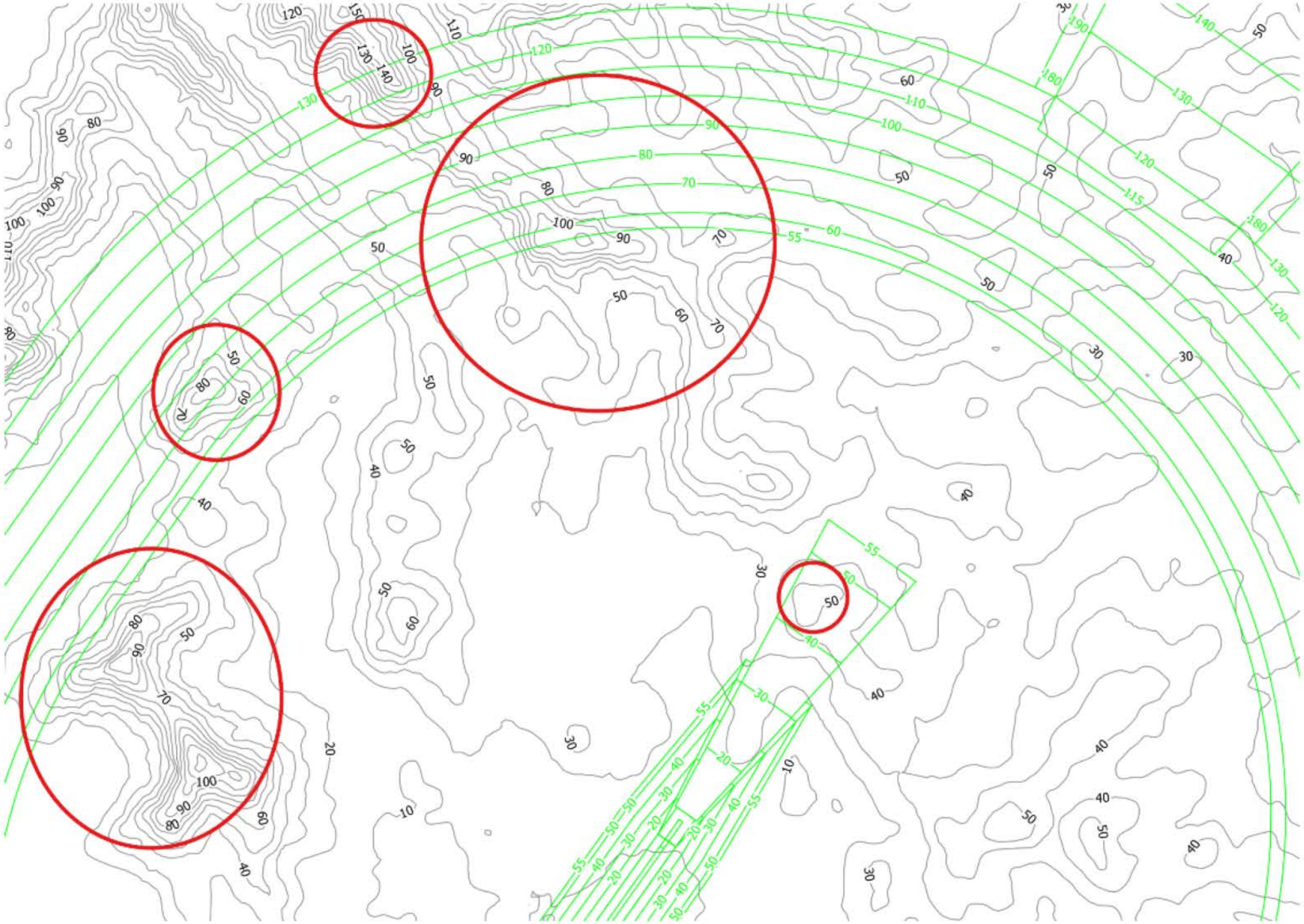


Figure 23 - 1200m RWY OLS terrain intrusions (1)

Figure 24 - 1200m RWY OLS terrain intrusions (2)

Annex B: Airport survey

An airport survey was conducted at Central Coast Aviation Hub. The survey process involved producing a baseline survey on Code 2 parameters as well as a survey of the airport based on Code 3C parameters.
The results are produced below:

WARNERVALE AERODROME

RUNWAY : 02/20
(CODE 3 RUNWAY)

Surveyor : Bryan Fitzgerald
Date of Survey : 25/10/2017

AIRPORT SURVEYS

Runway Length : 1194 metres
Runway Strip Width : 150 metres

RWY 02
TODA : 1254 metres
Take Off SFC Origin RL : 11.41 AHD
20 Threshold RL : 10.68 AHD
20 Threshold Displaced : 210m

RWY 20
TODA : 1254 metres
Take Off SFC Origin RL : 5.26 AHD
02 Threshold RL : 5.26 AHD
02 Threshold Displaced : 0m

APPROACH / TAKE OFF SPECIFICATIONS USED FOR SURVEY

TAKE OFF SURFACES:	
180m	INNER EDGE
12.5%	DIVERGENCE
15000m	LENGTH
2%	GRADIENT

APPROACH SURFACES:	RWY 02 (Non-Precision Inst Apch)	RWY 20 (Non- Precision Inst Apch)
INNER EDGE	150m	150m
DIVERGENCE	15%	15%
LENGTH	15000m	15000m
GRADIENT	3.33%	3.33%
TRANSITIONAL SLOPE	1 in 7	1 in 7

TAKE-OFF RUNWAY No.	Surveyed Point No.	DESCRIPTION	DIST. FROM END OF CLEARWAY	HEIGHT OF OBSTACLE ABOVE CWY END	TAKE-OFF GRADIENT TO OBST.	OBST. R.L.	DIST. FROM START OF TAKE OFF	OFFSET FROM RWY C/L	RELATIONSHIP TO OBSTACLE LIMITATION SURFACES (Positive figures - Above / Negative figures - Below.): 2% Take Off grade	3.33% Apch grade	Transitional Surfaces
02	1	EUC. TREE	121.4	26.65	21.96%	38.06	1374.9	59.0 R	*24.2*	*16.3*	*Obstructs the Apch SFC*
02	2	POWER POLE	109.5	10.82	9.89%	22.23	1363.0	50.2 R	*8.6*	*0.9*	*Obstructs the Apch SFC*
02	3	EUC. TREE	165.7	27.65	16.69%	39.06	1419.2	49.8 L	*24.3*	*15.9*	*Obstructs the Apch SFC*
02	4	EUC. TREE	12.1	19.94	N/A	31.35	1265.6	107.3 L	OUTSIDE	*13.3*	*Obstructs the Apch SFC*
02	5	EUC. TREE	-90.0	22.59	N/A	34.00	1163.5	123.7 L	OUTSIDE		*Obstructs Trans SFC by 14.9m*
02	6	FENCE	3.3	1.54	46.67%	12.95	1256.8	80.6 L	*1.5*	-4.8	Obstructs the Take off SFC
02	7	FENCE	57.2	1.91	3.34%	13.32	1310.7	5.0 L	*0.8*	-6.3	Obstructs the Take off SFC
02	8	FENCE	40.2	2.19	5.45%	13.60	1293.7	83.2 R	*1.4*	-5.4	Obstructs the Take off SFC
02	9	EUC. TREE	1610.5	69.37	4.31%	80.78	2864.0	160.0 L	*37.2*	*9.5*	*Obstructs the Apch SFC*
02	10	EUC. TREE	1440.8	61.31	4.26%	72.72	2694.3	355.2 R	OUTSIDE		*Obstructs Trans SFC by 2.4m*
02	11	LEVEE BANK	25.7	1.37	5.34%	12.78	1279.2	58.5 R	*0.9*	-5.7	Obstructs the Take off SFC
02	12	ROAD - 4.5m HIGH	93.9	5.81	6.19%	17.22	1347.4	1.0 L	*3.9*	-3.6	Obstructs the Take off SFC
02	13	ROAD - 4.5m HIGH	81.1	5.71	7.05%	17.12	1334.6	47.1 R	*4.1*	-3.3	Obstructs the Take off SFC
02	14	ROAD - 4.5m HIGH	70.9	5.60	7.90%	17.01	1324.4	94.0 R	*4.2*	-3.0	Obstructs the Take off SFC
02	15	BUILDING	324.6	11.76	3.63%	23.17	1578.1	56.0 R	*5.3*	-5.3	Obstructs the Take off SFC
02	16	BUILDING	348.5	15.24	4.38%	26.65	1602.0	43.6 R	*8.3*	-2.6	Obstructs the Take off SFC
02	17	AERIAL ON SHED	394.4	27.88	7.07%	39.29	1647.9	133.5 R	*20.0*	*8.5*	*Obstructs the Apch SFC*

TAKE-OFF RUNWAY No.	Surveyed Point No.	DESCRIPTION	DIST. FROM END OF CLEARWAY	HEIGHT OF OBSTACLE ABOVE CWY END	TAKE-OFF GRADIENT TO OBST.	OBST. R.L.	DIST. FROM START OF TAKE OFF	OFFSET FROM RWY C/L	RELATIONSHIP TO OBSTACLE LIMITATION SURFACES (Positive figures - Above / Negative figures - Below.): 2% Take Off grade	3.33% Apch grade	Transitional Surfaces
20	1	EUC. TREE	120.9	14.64	12.11%	19.90	1374.4	4.8 R	*12.2*	*10.6*	*Obstructs the Apch SFC*
20	2	EUC. TREE	134.0	16.72	12.48%	21.98	1387.5	16.6 L	*14.0*	*12.3*	*Obstructs the Apch SFC*
20	3	EUC. TREE	97.4	13.98	14.36%	19.24	1350.9	30.4 L	*12.0*	*10.7*	*Obstructs the Apch SFC*
20	4	EUC. TREE	89.4	20.96	23.45%	26.22	1342.9	73.9 L	*19.2*	*18.0*	*Obstructs the Apch SFC*
20	5	EUC. TREE	123.2	24.36	N/A	29.62	1376.7	112.7 L	OUTSIDE		*Obstructs Trans SFC by 17.5m*
20	6	EUC. TREE	66.4	24.19	N/A	29.45	1319.9	108.3 L	OUTSIDE		*Obstructs Trans SFC by 18.6m*
20	7	EUC. TREE	-85.1	19.36	N/A	24.62	1168.4	109.9 L	OUTSIDE		*Obstructs Trans SFC by 14.4m*
20	8	EUC. TREE	-25.2	12.32	N/A	17.58	1228.3	151.9 R	OUTSIDE		*Obstructs Trans SFC by 1.3m*
20	9	POWER PYLON	7353.9	205.05	2.79%	210.31	8607.4	445.4 R	*58.0*	*46.7*	*Obstructs the 3rd Section of Apch*
20	10	RADIO MAST	7638.4	283.27	3.71%	288.53	8891.9	1164.2 R	OUTSIDE	*124.9*	*Obstructs the 3rd Section of Apch*
20	11	EUC. TREE	3659.8	77.66	2.13%	82.92	4913.3	75.1 L	*4.5*	-44.2	Obstructs the Take off SFC

WARNERVALE AERODROME

RUNWAY : 02/20
(CODE 3 RUNWAY)

Surveyor : Bryan Fitzgerald
Date of Survey : 25/10/2017

AIRPORT SURVEYS

TRANSITIONAL SURFACE

NOTE: Calculations are based on a 1:7 Transitional Surface from the edge of the 150 metres wide Runway Strip.

RUNWAY No.	Surveyed Point No.	DESCRIPTION	PERP. DIST FROM 20 RWS END	OFFSET FROM C/L	HEIGHT ABOVE C/L	HEIGHT OF Trans SFC	HEIGHT DIFF. + Above - Below	NOTES
02 - 20	1	Office Bldg - East Side	512	82.0	4.89	1.00	*3.89*	*Obstructs the Transitional Surface*
02 - 20	2	Palm Tree - East Side	499	96.5	8.43	3.07	*5.36*	*Obstructs the Transitional Surface*
02 - 20	3	Aerial - East Side	513	81.8	6.01	0.97	*5.04*	*Obstructs the Transitional Surface*
02 - 20	4	Shed - East Side	585	115.6	5.18	5.80	-0.62	
02 - 20	5	Hangar - East Side	571	135.6	6.41	8.66	-2.25	
02 - 20	6	Tree - West Side	649	136.3	11.84	8.76	*3.08*	*Obstructs the Transitional Surface*
02 - 20	7	Euc. Tree - West Side	541	158.5	22.13	11.93	*10.20*	*Obstructs the Transitional Surface*
02 - 20	8	Euc. Tree - West Side	311	120.1	14.82	6.44	*8.38*	*Obstructs the Transitional Surface*

Table 35: Code 3 1200m Runway

WARNERVALE AERODROME

RUNWAY : 02/20
(CODE 2 RUNWAY)

Surveyor : Bryan Fitzgerald
Date of Survey : 25/10/2017

AIRPORT SURVEYS

Runway Length : 1194 metres
Runway Strip Width : 80 metres

	RWY 02	RWY 20
TODA	1254 metres	1254 metres
Take Off SFC Origin RL	11.41 AHD	5.26 AHD
20 Threshold RL / 02 Threshold RL	20 Threshold RL : 10.68 AHD	02 Threshold RL : 5.26 AHD
20 Threshold Displaced / 02 Threshold Displaced	20 Threshold Displaced : 210m	02 Threshold Displaced : 0m

APPROACH / TAKE OFF SPECIFICATIONS USED FOR SURVEY

TAKE OFF SURFACES:

80m	INNER EDGE
10%	DIVERGENCE
2500m	LENGTH
4%	GRADIENT

APPROACH SURFACES:	RWY 02 (Non-Precision Inst Apch)	RWY 20 (Non- Precision Inst Apch)
INNER EDGE	90m	90m
DIVERGENCE	15%	15%
LENGTH	2500m	2500m
GRADIENT	3.33%	3.33%
TRANSITIONAL SLOPE	1 in 5	1 in 5

RELATIONSHIP TO OBSTACLE LIMITATION SURFACES (Positive figures - Above / Negative figures - Below.)

TAKE-OFF RUNWAY No.	Surveyed Point No.	DESCRIPTION	DIST. FROM END OF CLEARWAY	HEIGHT OF OBSTACLE ABOVE CWY END	TAKE-OFF GRADIENT TO OBST.	OBST. R.L.	DIST. FROM START OF TAKE OFF	OFFSET FROM RWY C/L	4% Take Off grade	3.33% Apch grade	Transitional Surfaces
02	1	EUC. TREE	121.4	26.65	21.96%	38.06	1374.9	59.0 R	OUTSIDE	16.3	Obstructs the Apch SFC
02	2	POWER POLE	109.5	10.82	9.89%	22.23	1363.0	50.2 R	6.4	0.9	Obstructs the Apch SFC
02	3	EUC. TREE	165.7	27.65	16.69%	39.06	1419.2	49.8 L	21.0	15.9	Obstructs the Apch SFC
02	4	EUC. TREE	12.1	19.94	N/A	31.35	1265.6	107.3 L	OUTSIDE		Obstructs Trans SFC by 7.5m
02	5	EUC. TREE	-90.0	22.59	N/A	34.00	1163.5	123.7 L	OUTSIDE		Obstructs Trans SFC by 7.2m
02	6	FENCE	3.3	1.54	N/A	12.95	1256.8	80.6 L	OUTSIDE		Below Trans SFC by 5.6m
02	7	FENCE	57.2	1.91	3.34%	13.32	1310.7	5.0 L	-0.4	-6.3	
02	8	FENCE	40.2	2.19	5.45%	13.60	1293.7	83.2 R	OUTSIDE		Below Trans SFC by 5.5m
02	9	EUC. TREE	1610.5	69.37	4.31%	80.78	2864.0	160.0 L	5.0	9.5	Obstructs the Apch SFC
02	10	EUC. TREE	1440.8	61.31	4.26%	72.72	2694.3	355.2 R	OUTSIDE		Below Trans SFC by 5.4m
02	11	LEVEE BANK	25.7	1.37	5.34%	12.78	1279.2	58.5 R	OUTSIDE	-5.7	
02	12	ROAD - 4.5m HIGH	93.9	5.81	6.19%	17.22	1347.4	1.0 L	2.1	-3.6	Obstructs the Take off SFC
02	13	ROAD - 4.5m HIGH	81.1	5.71	7.05%	17.12	1334.6	47.1 R	2.5	-3.3	Obstructs the Take off SFC
02	14	ROAD - 4.5m HIGH	70.9	5.60	7.90%	17.01	1324.4	94.0 R	OUTSIDE		Below Trans SFC by 4.4m
02	15	BUILDING	324.6	11.76	3.63%	23.17	1578.1	56.0 R	-1.2	-5.3	
02	16	BUILDING	348.5	15.24	4.38%	26.65	1602.0	43.6 R	1.3	-2.6	Obstructs the Take off SFC
02	17	AERIAL ON SHED	394.4	27.88	7.07%	39.29	1647.9	133.5 R	OUTSIDE	8.5	Obstructs the Apch SFC

RELATIONSHIP TO OBSTACLE LIMITATION SURFACES (Positive figures - Above / Negative figures - Below.)

TAKE-OFF RUNWAY No.	Surveyed Point No.	DESCRIPTION	DIST. FROM END OF CLEARWAY	HEIGHT OF OBSTACLE ABOVE CWY END	TAKE-OFF GRADIENT TO OBST.	OBST. R.L.	DIST. FROM START OF TAKE OFF	OFFSET FROM RWY C/L	4% Take Off grade	3.33% Apch grade	Transitional Surfaces
20	1	EUC. TREE	120.9	14.64	12.11%	19.90	1374.4	4.8 R	9.8	10.6	Obstructs the Apch SFC
20	2	EUC. TREE	134.0	16.72	12.48%	21.98	1387.5	16.6 L	11.4	12.3	Obstructs the Apch SFC
20	3	EUC. TREE	97.4	13.98	14.36%	19.24	1350.9	30.4 L	10.1	10.7	Obstructs the Apch SFC
20	4	EUC. TREE	89.4	20.96	N/A	26.22	1342.9	73.9 L	OUTSIDE		Obstructs Trans SFC by 14.9m
20	5	EUC. TREE	123.2	24.36	N/A	29.62	1376.7	112.7 L	OUTSIDE		Obstructs Trans SFC by 10.4m
20	6	EUC. TREE	66.4	24.19	N/A	29.45	1319.9	108.3 L	OUTSIDE		Obstructs Trans SFC by 11.3m
20	7	EUC. TREE	-85.1	19.36	N/A	24.62	1168.4	109.9 L	OUTSIDE		Obstructs Trans SFC by 5.4m
20	8	EUC. TREE	-25.2	12.32	N/A	17.58	1228.3	151.9 R	OUTSIDE		Below Trans SFC by 10.1m
20	9	POWER PYLON	7353.9	205.05	2.79%	210.31	8607.4	445.4 R	OUTSIDE	OUTSIDE	
20	10	RADIO MAST	7638.4	283.27	3.71%	288.53	8891.9	1164.2 R	OUTSIDE	OUTSIDE	
20	11	EUC. TREE	3659.8	77.66	2.13%	82.92	4913.3	75.1 L	OUTSIDE	OUTSIDE	

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WARNERVALE AERODROME

RUNWAY : 02/20
(CODE 2 RUNWAY)

Surveyor : Bryan Fitzgerald
Date of Survey : 25/10/2017

AIRPORT SURVEYS

TRANSITIONAL SURFACE

NOTE: Calculations are based on a 1:5 Transitional Surface from the edge of the 80 metres wide Runway Strip.

RUNWAY No.	Surveyed Point No.	DESCRIPTION	PERP. DIST FROM 20 RWS END	OFFSET FROM C/L	HEIGHT ABOVE C/L	HEIGHT OF Trans SFC	HEIGHT DIFF. + Above - Below	NOTES
02 - 20	1	Office Bldg - East Side	512	82.0	4.89	8.40	-3.51	
02 - 20	2	Palm Tree - East Side	499	96.5	8.43	11.30	-2.87	
02 - 20	3	Aerial - East Side	513	81.8	6.01	8.36	-2.35	
02 - 20	4	Shed - East Side	585	115.6	5.18	15.12	-9.94	
02 - 20	5	Hangar - East Side	571	135.6	6.41	19.12	-12.71	
02 - 20	6	Tree - West Side	649	136.3	11.84	19.26	-7.42	
02 - 20	7	Euc. Tree - West Side	941	158.5	22.13	23.70	-1.57	
02 - 20	8	Euc. Tree - West Side	311	120.1	14.82	16.02	-1.20	

Table 36- Code 2 1200m Runway

WARNERVALE AERODROME — **RUNWAY : 02/20** (CODE 3 RUNWAY)

Surveyor : Bryan Fitzgerald
Date of Survey : 25/10/2017

AIRPORT SURVEYS

Runway Length : 1800 metres
Runway Strip Width : 150 metres

	RWY 02	RWY 20
TODA	1860 metres	1860 metres
Take Off SFC Origin RL	11.41 AHD	5.26 AHD
Threshold RL	20 Threshold RL : 11.41 AHD	02 Threshold RL : 5.26 AHD
Threshold Displaced	20 Threshold Displaced : 0m	02 Threshold Displaced : 0m

APPROACH / TAKE OFF SPECIFICATIONS USED FOR SURVEY

TAKE OFF SURFACES:	
180m	INNER EDGE
12.5%	DIVERGENCE
15000m	LENGTH
2%	GRADIENT

APPROACH SURFACES:	RWY 02	RWY 20
	(Non-Precision Inst Apch)	(Non- Precision Inst Apch)
INNER EDGE	150m	150m
DIVERGENCE	15%	15%
LENGTH	15000m	15000m
GRADIENT	3.33%	3.33%
TRANSITIONAL SLOPE	1 in 7	1 in 7

TAKE-OFF RUNWAY No.	Surveyed Point No.	DESCRIPTION	DIST. FROM END OF CLEARWAY	HEIGHT OF OBSTACLE ABOVE CWY END	TAKE-OFF GRADIENT TO OBST.	OBST. R.L.	DIST. FROM START OF TAKE OFF	OFFSET FROM RWY C/L	RELATIONSHIP TO OBSTACLE LIMITATION SURFACES (Positive figures - Above / Negative figures - Below.): 2% Take Off grade	3.33% Apch grade	Transitional Surfaces
02	1	EUC. TREE	121.4	26.65	21.96%	38.06	1981.4	59.0 R	24.2	22.6	Obstructs the Apch SFC
02	2	POWER POLE	109.5	10.82	9.89%	22.23	1969.5	50.2 R	8.6	7.2	Obstructs the Apch SFC
02	3	EUC. TREE	165.7	27.65	16.69%	39.06	2025.7	49.8 L	24.3	22.1	Obstructs the Apch SFC
02	4	EUC. TREE	12.1	19.94	N/A	31.35	1872.1	107.3 L	OUTSIDE		Obstructs Trans SFC by 15.2m
02	5	EUC. TREE	-90.0	22.59	N/A	34.00	1770.0	123.7 L	OUTSIDE		Obstructs Trans SFC by 15.6m
02	6	FENCE	3.3	1.54	46.67%	12.95	1863.3	80.6 L	1.5		Obstructs Trans SFC by 0.7m
02	7	FENCE	57.2	1.91	3.34%	13.32	1917.2	5.0 L	0.8	0.0	Obstructs the Apch SFC
02	8	FENCE	40.2	2.19	5.45%	13.60	1900.2	83.2 R	1.4		Obstructs Trans SFC by 0.5m
02	9	EUC. TREE	1610.5	69.37	4.31%	80.78	3470.5	160.0 L	37.2	15.7	Obstructs the Apch SFC
02	10	EUC. TREE	1440.8	61.31	4.26%	72.72	3300.8	355.2 R	OUTSIDE		Obstructs Trans SFC by 4.2m
02	11	LEVEE BANK	25.7	1.37	5.34%	12.78	1885.7	58.5 R	0.9	0.5	Obstructs the Apch SFC
02	12	ROAD - 4.5m HIGH	93.9	5.81	6.19%	17.22	1953.9	1.0 L	3.9	2.7	Obstructs the Apch SFC
02	13	ROAD - 4.5m HIGH	81.1	5.71	7.05%	17.12	1941.1	47.1 R	4.1	3.0	Obstructs the Apch SFC
02	14	ROAD - 4.5m HIGH	70.9	5.60	7.90%	17.01	1930.9	94.0 R	4.2		Obstructs Trans SFC by 2.0m
02	15	BUILDING	324.6	11.76	3.63%	23.17	2184.6	56.0 R	5.3	1.0	Obstructs the Apch SFC
02	16	BUILDING	348.5	15.24	4.38%	26.65	2208.5	43.6 R	8.3	3.6	Obstructs the Apch SFC
02	17	AERIAL ON SHED	394.4	27.88	7.07%	39.29	2254.4	133.5 R	20.0	14.7	Obstructs the Apch SFC

TAKE-OFF RUNWAY No.	Surveyed Point No.	DESCRIPTION	DIST. FROM END OF CLEARWAY	HEIGHT OF OBSTACLE ABOVE CWY END	TAKE-OFF GRADIENT TO OBST.	OBST. R.L.	DIST. FROM START OF TAKE OFF	OFFSET FROM RWY C/L	RELATIONSHIP TO OBSTACLE LIMITATION SURFACES (Positive figures - Above / Negative figures - Below.): 2% Take Off grade	3.33% Apch grade	Transitional Surfaces
20	9	POWER PYLON	6747.9	205.05	3.04%	210.31	8607.9	445.4 R	70.1	46.7	Obstructs the 3rd Section of Apch
20	10	RADIO MAST	7032.4	283.27	4.03%	288.53	8892.4	1164.2 R	OUTSIDE	124.9	Obstructs the 3rd Section of Apch
20	11	EUC. TREE	3053.8	77.66	2.55%	82.92	4913.8	75.1 L	16.6	-24.0	Obstructs the Take off SFC

WARNERVALE AERODROME — **RUNWAY : 02/20** (CODE 3 RUNWAY)

Surveyor : Bryan Fitzgerald
Date of Survey : 25/10/2017

AIRPORT SURVEYS

TRANSITIONAL SURFACE

NOTE: Calculations are based on a 1:7 Transitional Surface from the edge of the 150 metres wide Runway Strip.

RUNWAY No.	Surveyed Point No.	DESCRIPTION	PERP. DIST FROM 20 RWS END	OFFSET FROM C/L	HEIGHT ABOVE C/L	HEIGHT OF Trans SFC	HEIGHT DIFF. + Above - Below	NOTES
02 - 20	1	Office Bldg - East Side	512	82.0	4.89	1.00	3.89	Obstructs the Transitional Surface
02 - 20	2	Palm Tree - East Side	499	96.5	8.43	3.07	5.36	Obstructs the Transitional Surface
02 - 20	3	Aerial - East Side	513	81.8	6.01	0.97	5.04	Obstructs the Transitional Surface
02 - 20	4	Shed - East Side	585	115.6	5.18	5.80	-0.62	
02 - 20	5	Hangar - East Side	571	135.6	6.41	8.66	-2.25	
02 - 20	6	Tree - West Side	649	136.3	11.84	8.76	3.08	Obstructs the Transitional Surface
02 - 20	7	Euc. Tree - West Side	941	158.5	22.13	11.93	10.20	Obstructs the Transitional Surface
02 - 20	8	Euc. Tree - West Side	311	120.1	14.82	6.44	8.38	Obstructs the Transitional Surface

Table 37- Code 3 1799m Runway

17.074.02 • November 2017

Central Coast Aviation Hub Noise Assessment

Report – 1200m length runway

Aviation Consultants

to70

Central Coast Aviation Hub Noise Assessment

Final report

Report

Jamie Barclay,
Economic Development and Project Delivery
Central Coast Council
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North Melbourne, November 2017

Table of Contents

1 Introduction

To70 Aviation Australia (To70) has been appointed by Central Coast Council (CCC) to carry out an airport noise assessment for Central Coast Aviation Hub (CCAH). This required preparation of ANEF, ANEC, N65, N70 and LAmax contours.

The airport noise contours were produced using Integrated Noise Model (INM) version 7.0d which is the current version. INM is a computer noise prediction model developed by the U.S. Federal Aviation Administration used for airport noise assessments worldwide and Australia.

This document presents results of the noise model calculations, including inputs and parameters used to build the INM model. In addition to this report, all models will be forwarded to CCC as shape files and CAD formats.

To70 has also undertaken a count of property lots within N65 and N70 contours in order to determine CCAH's development impact on population.

2 Inputs and Assumptions

2.1 General settings

Weather

Average weather parameters in the model have been created from Bureau of Meteorology (BoM) data for the period from 1995 to 2017. The annual average temperature and pressure at Central Coast Aviation Hub was sourced from the nearest weather station at Norah Head (station no. 61366). The average pressure data was collected for the period of August 2016 – August 2017, as the data was only available for past year.

Weather settings are as follows:

Table 1: Weather settings

Parameter	Value
Temperature	19.18 °C
Pressure	761.68 mm-Hg
Relative humidity	64%
Headwind	14.8 km/h

Aerodrome Reference Point (ARP)

Details of the CCAH ARP is shown below:

Description	Latitude	Longitude	Elevation (m)
ARP	-33.240278	151.430278	10

Runway and Helipad Coordinates

To70 has modelled "stage 1"development configuration detailed in the Master Plan 2017 draft. Stage 1 includes an extended runway with a length of 1200m, which is one of the options CCC has considered.

Stage	Description	Latitude	Longitude	Length × Width (m)	Elevation (m)
Stage 1	Runway 02	-33.245334	151.425361	1200 x 30	10
	Runway 20	-33.236666	151.432944		11

Helipad

The proposed helicopter landing site (HLS) location was modelled at coordinates received from CCC.

Description	Latitude	Longitude	Elevation (m)
HLS	-33.242236	151.426799	10

2.2 Traffic

Forecast traffic movements were provided by CCC; detailing the predicted number of movements for the years 2018, 2024, 2025 and 2029. Forecast movements in 2025 and 2029 present medium and high movement estimates. To70 modelling assumes that the worst-case scenario, in terms of noise pollution (i.e. high movement estimates), is the most representative for this study. Therefore, To70 has modelled 2025 and 2030 scenarios based on 2025 and 2029 high estimation data, where 2030 movements are considered equal as in 2029. Table 2 shows the forecast annual and daily movements for the airport.

Forecasts

Table 2 - Forecast annual and daily movements for 2025 and 2030

Aircraft type (fixed and rotary wings)	2025 Movements		2030 Movements	
	Annual	Daily	Annual	Daily
C150/PA28/C172/C182/M020T/BE36	46,000	126	50,000	136.98
PA44/B76PA30/PA31/AC50	1,960	5.36	2,200	6.02
M500/TBM750/PC12/BE20/C441/C208/LJ	5,000	13.69	5,600	15.34
LJ35/LJ45/CITATION 500 or 600	600	1.64	800	2.19
DHC8-30/METRO/ATR72/FK50/SF34	17,400	47.67	26,280	72
R22/R44/B206/BH47/AS50/A109/AS135	1,100	3.01	1,320	3.61

Aircraft mix and INM representative

To70 has modelled the forecast aircraft data using INM equivalents detailed in Table 3 below.

Table 3 - INM Aircraft representatives

Aircraft type (fixed and rotary wings)	INM ID
C150/PA28/C172/C182/M020T/BE36	CNA182
PA44/B76PA30/PA31/AC50	BEC58P
M500/TBM750/PC12/BE20/C441/C208/LJ	CNA208
LJ35/LJ45/CITATION 500 or 600	CNA525C
DHC8-30/METRO/ATR72/FK50/SF34	DHC830
R22/R44/B206/BH47/AS50/A109/AS135	R44

Where substitute aircraft are required for INM modelling, To70 have utilised the aircraft types suggested within the INM tool.

Usage splits

CCC have indicated the following runway utilisation proportions based on observation of predominant wind direction, shown in Table 4.

Table 4 - Runway usage split

Runway	Usage proportion
02	20%
20	80%

Day and Night operations

INM calculations weigh night time flights more heavily than day-time flights. Daytime operations are defined as 0700-1900 and night-time is defined as 1900-0700 in the ANEF system. To accurately model noise impacts, a day / night split of operations needs to be defined. The day / night split is assumed to be identical to the previous ANEF/OLS study report of 2006 provided by CCC, outlined in Table 5.

Table 5 - Daytime and night-time operation split

Description	Proportion
Day	98.5%
Night	1.5%

Tracks and usage

This section shows the expected flight paths at CCAH in 2025 and 2030, according to inputs received from CCC. To70 modelled the circuits based on the previous ANEF/OLS study report 2006 provided by CCC, as well as the CCAH airspace and OLS assessment. Figure 1- Figure 3 below illustrate the approach, departure, and circuit Visual Flight Rules (VFR) tracks used at CCAH. The report assumes circuit traffic operates in a RWY02 LH / RWY20 RH direction.

Instrument Flight Rules (IFR) tracks, including RPT traffic, are assumed to be straight in and out as illustrated in Figure 4. Helicopter training circuits and arrival and departure flight paths are displayed in Figure 5.

Figure 1 - VFR arrival tracks

Figure 2 - VFR departure tracks

Figure 3 - Circuit tracks (02 LH and 20 RH)

Figure 4 - IFR approach and departure tracks

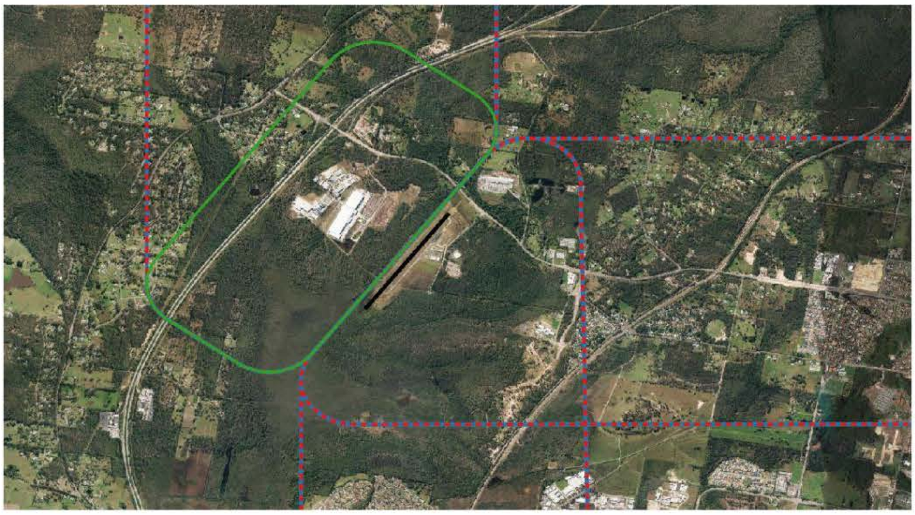

Figure 5: Helicopter flight paths

Track utilisation is assumed to be identical to the previous ANEF/OLS study report 2006 provided by CCC. RPT movements will be assumed to be only utilising the IFR straight in and out tracks.

Operations type split

In order to complete the aircraft noise model, the proportion of private/Business/Training traffic conducting circuit operations was included in the model. All RPT, charter and corporate movements will be assumed to be arrival/departure operations, as detailed in Table 6. VFR Arrival and departure movements were split equally and then divided by flight paths as outlined in Table 7, following consultation with CCC.

Table 6: Operations split

Aircraft Group	ARR/DEP operation split	Circuit operation split
C150/PA28/C172/C182/MO20T/BE36	10%	90%
PA44/B76PA30/PA31/AC50	50%	50%
M500/TBM750/PC12/BE20/C441/C208/LJ	80%	20%
LJ35/LJ45/CITATION 500 or 600	100%	-
DHC8-30/METRO/ATR72/FK50/SF34	100%	-
R22/R44/B206/BH47/AS50/A109/AS135	50% (directions N, S and E)	50%

Table 7: IFR flight track split

Aircraft (INM id)	SE/E (Victor 1)	NW (Cessnock)	NW (Maitland)	NE (Nobby's Head)	SW (Brooklyn Bridge)	W (Mt. McQuoid)
CNA182	60%	8%	8%	8%	8%	8%
BEC58P	16.67%	16.67%	16.67%	16.67%	16.67%	16.67%
CNA208	20%	13.33%	13.33%	13.33%	20%	20%

2.3 Count of Property Lots - assumptions

To70 used public available data from the New South Wales Department of Finance and Services. Lots information was gathered using "SIX Maps", an online mapping tool for NSW. To70 collected cadastral data for the regions of Central Coast and Lake Macquarie.

Due to the limitation of data availability, the lots count involved the total number of lots that would be within N65 and N70 contours without specifically identifying:

a) Number of buildings in the lot
b) Type of building in the lot
c) Type of lot (state/private owned)

Results of this analysis are presented in Section 3.4.

3 Results

In this section, we present the results of the noise modelling, describe the metrics used to generate the contours and provide the number of property lots within N70 and N65 contours. To70 has generated the following contours:

- ANEC for 2025 and 2030
- ANEF for 2025 and 2030
- N65 and N70 contours for 2025 and 2030
- LAmax for all the aircraft used in the model for 2025 and 2030

3.1 ANEC results

Australian Noise Exposure Concept (ANEC) charts are used to show forecasted contours of aircraft noise exposure. The ANEC contours represent the average noise impact from an average day's aircraft movements. The average exposure is calculated over a twelve-month period. Figure 6 - Figure 7 show the ANEC results obtained for runway configuration 02LH-20RH in 2025 and 2030.

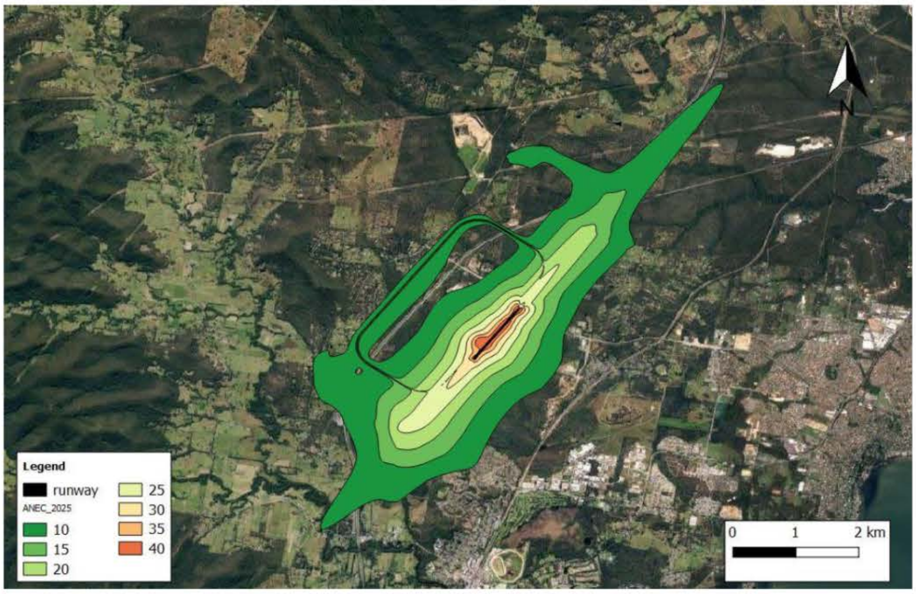

Figure 6: ANEC 2025 (02LH-20RH)

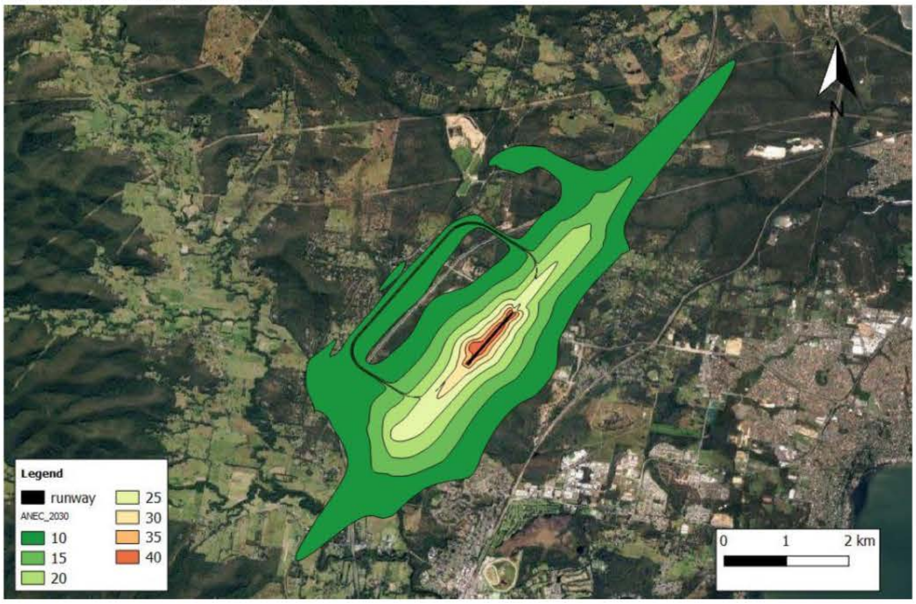

Figure 7: ANEC 2030 (02LH-20RH)

ANEF results

ANEF contours are used to quantify the noise impact of airport development scenarios. The maps in Figure 8 - Figure 9 are based on assumptions about the shape, size and demand of aircraft and airport operations. The ANEF uses the Effective Perceived Noise Level (EPNL) which applies a weighting to account for the fact that the human ear is less sensitive to low audio frequencies.

Figure 8: ANEF 2025 (02LH-20RH)

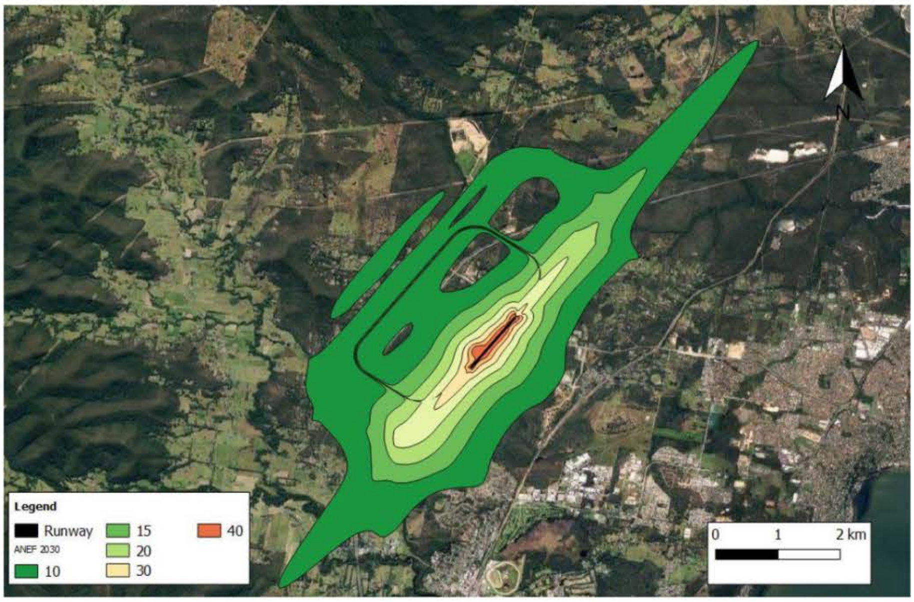

Figure 9: ANEF 2030 (02LH-20RH)

3.2 N65 and N70 Contours

N contours show the number of times a noise level is reached in a 24-hour day. N contours are used to supplement the ANEF and provide a clear understanding of aircraft noise levels. To70 has modelled N contours in order to measure the number of aircraft noise events per day that exceed 65 and 70 decibels. Results are presented in Figure 10 - Figure 13

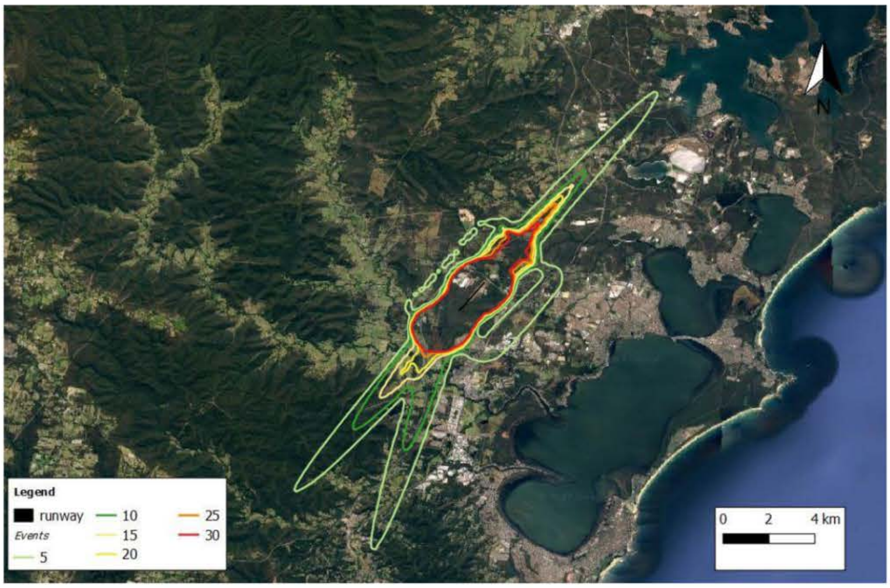

Figure 10: N65 – 2025 (02LH-20RH)

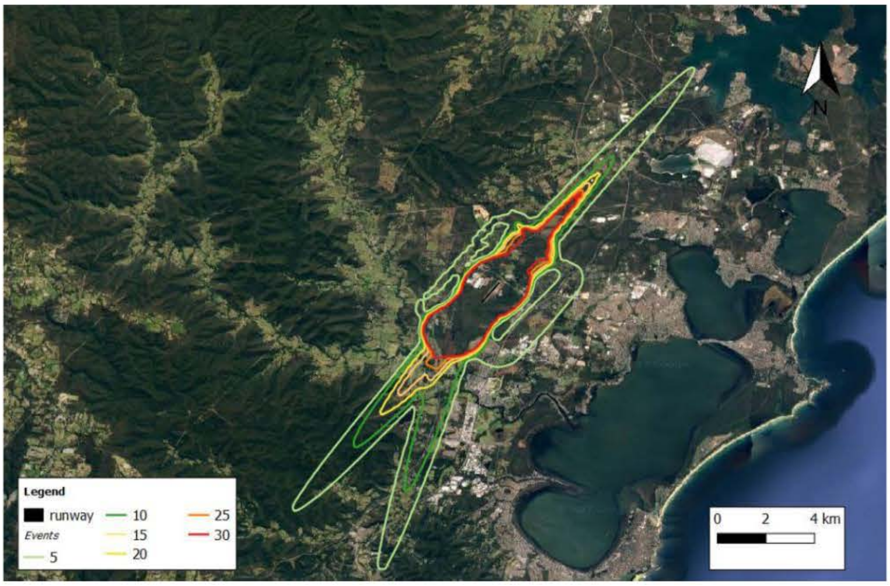

Figure 11: N65 – 2030 (02LH-20RH)

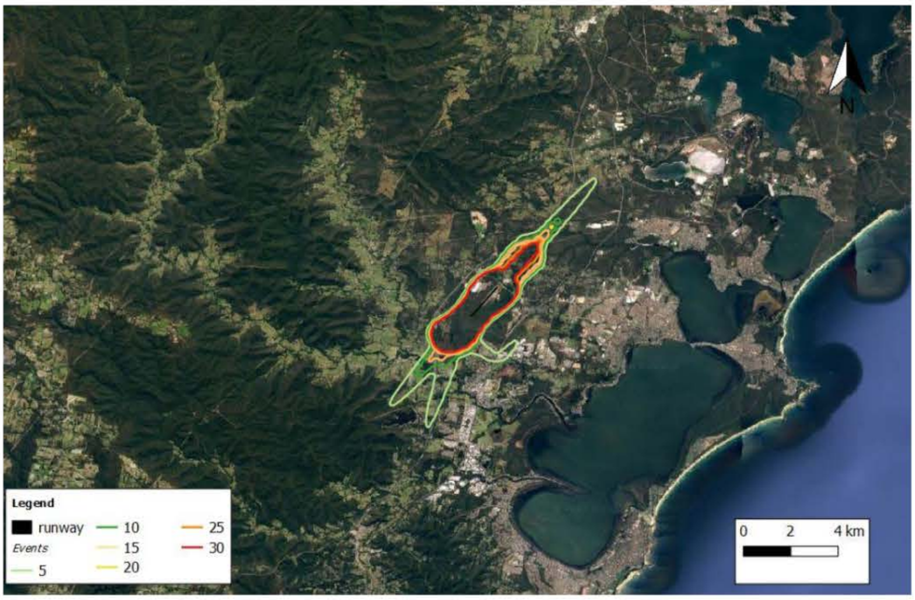

Figure 12: N70 – 2025 (02LH-20RH)

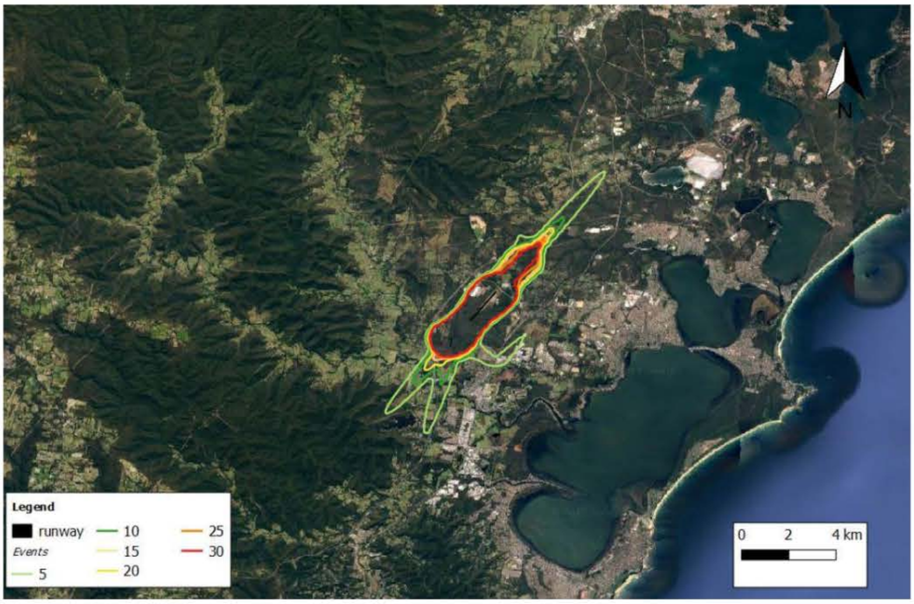

Figure 13: N70 – 2030 (02LH-20RH)

3.3 LAmax

LAmax measures the maximum sound level of a single event and it indicates the highest noise level that a person on the ground would hear from a single aircraft. To70 has modelled LAmax for the proposed aircraft that would take off and land at CCC. Potential noise impacts for the DHC-8 300 series (DHC-830), which is the loudest frequently used aircraft in the model, are presented in Figure 14 and Figure 15.

Figure 14: DHC- 830 on RWY 02

Figure 15: DHC- 830 on RWY 20

3.4 Lots count

Based on the assumptions stated in section 2.3, results for the lots count within N65 and N70 contours for years 2025 and 2030 are presented in the following tables:

- Table 8 and Table 9 show the total lots in Central Coast and Lake Macquarie regions that fall within the N65 and N70 contours.
- Table 10 and Table 11 present the number of lots that would experience 5,10, 15, 20, 25 and 30 events per day within the N65 and N70 contours.
- Figure 16 - Figure 19 show N contours results and the lots distribution in Central Coast and Lake Macquarie districts.

Table 8: Lots count within N65 contours at Central Coast and Lake Macquarie

N65	Lots within Central Coast	Lots within Lake Macquarie	Total number of Lots
2025	5,039	548	5,587
2030	5,417	889	6,306

Table 9: Lots count within N70 contours at Central Coast and Lake Macquarie

N70	Lots within Central Coast	Lots within Lake Macquarie	Total number of Lots
2025	1,337	1	1,338
2030	1,484	1	1,489

Table 10: Lots count within N65 contours

N65	5 events	10 events	15 events	20 events	25 events	30 events
2025	3,231	781	508	418	350	299
2030	3,698	896	554	456	374	328

Table 11: Lots count within N70 contours

N70	5 events	10 events	15 events	20 events	25 events	30 events
2025	880	198	104	63	49	44
2030	944	242	120	75	57	47

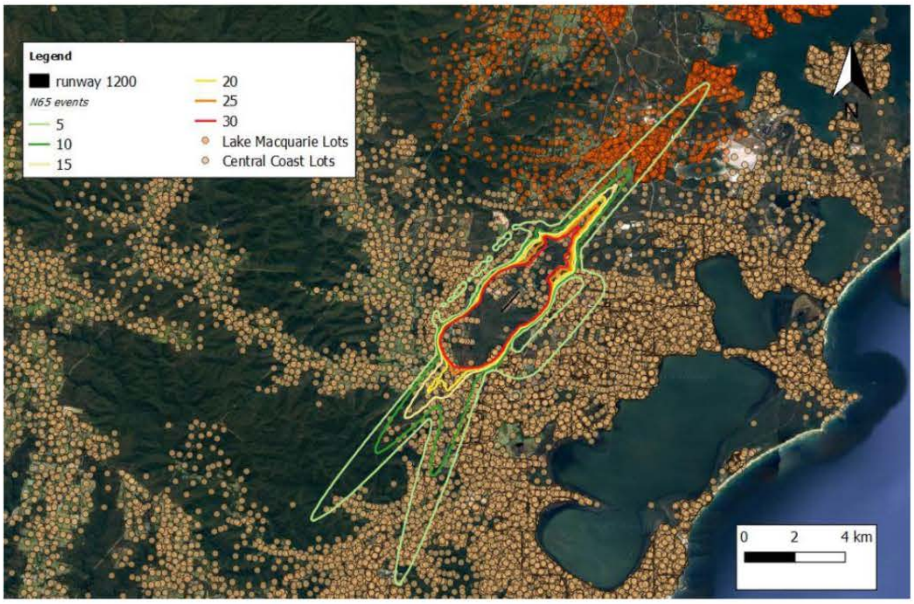

Figure 16: Lots within N65 contours (2025)

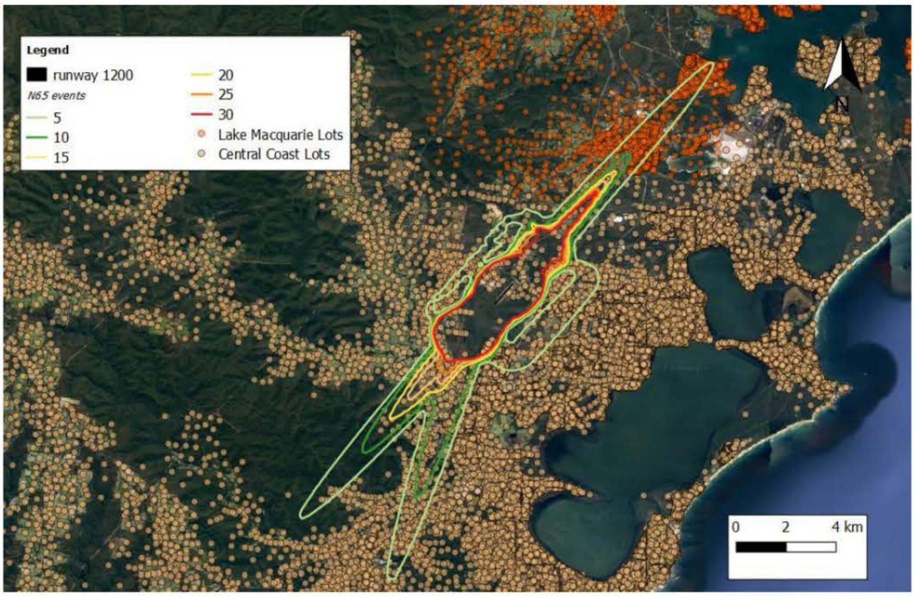

Figure 17: Lots within N65 contours (2030)

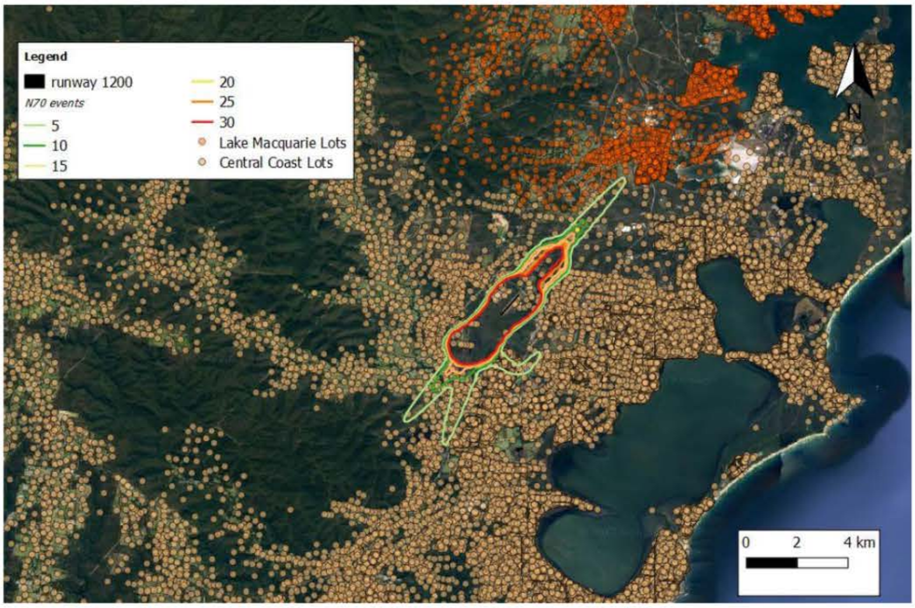

Figure 18: Lots within N70 contours (2025)

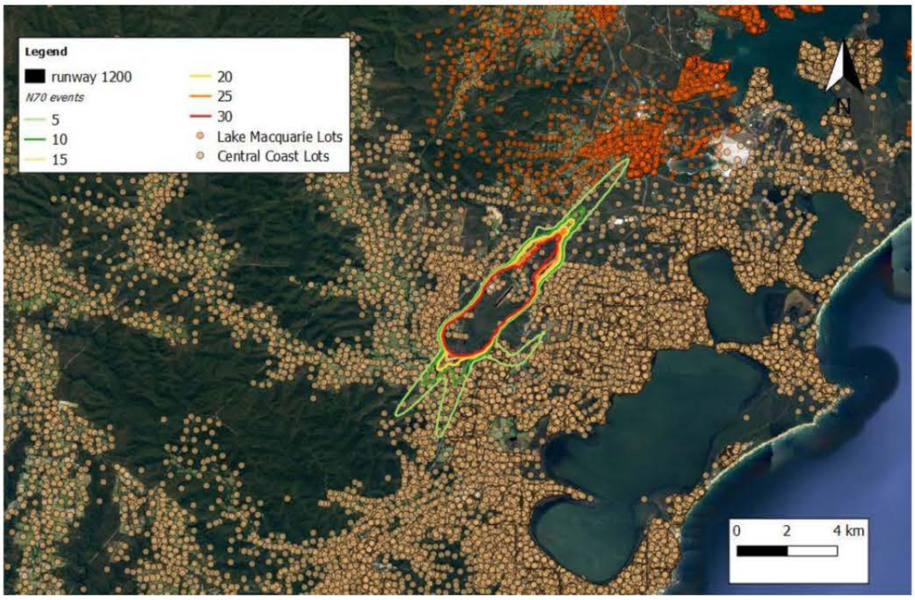

Figure 19: Lots within N70 contours (2030)

3.5 Commentary on skydiving operations

Council has previously accommodated the operations of a skydiving company at CCAH but ended the arrangement following community concerns.

Skydiving operations are looking to make optimal use of aircraft assets; and attempt to minimise flight times as an objective (in order to reduce the turnaround time between drops). This can often manifest itself as aircraft operating under full power for a 10-minute climb, using a spiral pattern, which localises the noise impacts.

To mitigate the impacts and operate as a good neighbour, many reputable skydiving operations will modify their operations to reduce noise, albeit at a slight cost to efficiency. Such mitigations can include:

- Climbing on a heading until reaching a nominal altitude (i.e. A070, A080) and then turning toward the drop site for the remaining climb. Then for each subsequent departure from the airport, varying the initial heading.
- Reducing power after take-off until passing through A040 to reduce engine noise.
- Using the quietest aircraft available.

17.074.02 • November 2017

Central Coast Aviation Hub Noise Assessment

Report – 1799m length runway

Aviation Consultants

Central Coast Aviation Hub Noise Assessment

Final report

Report

Jamie Barclay,
Economic Development and Project Delivery
Central Coast Council
PO Box 20
Wyong
NSW 2259

To70 Aviation Australia

Suite 19, 70 Racecourse Road,
North Melbourne
VIC 3051
Email: info@to70.com.au

North Melbourne, November 2017

Table of Contents

1 Introduction

To70 Aviation Australia (To70) has been appointed by Central Coast Council (CCC) to carry out an airport noise assessment for Central Coast Aviation Hub (CCAH). This required preparation of ANEF, ANEC, N65, N70 and LAmax contours.

The airport noise contours were produced using Integrated Noise Model (INM) version 7.0d which is the current version. INM is a computer noise prediction model developed by the U.S. Federal Aviation Administration used for airport noise assessments worldwide and Australia.

This document presents results of the noise model calculations, including inputs and parameters used to build the INM model. In addition to this report, all models will be forwarded to CCC as shape files and CAD formats.

To70 has also undertaken a count of property lots within N65 and N70 contours in order to determine CCAH's development impact on population.

2 Inputs and Assumptions

2.1 General settings

Weather

Average weather parameters in the model have been created from Bureau of Meteorology (BoM) data for the period from 1995 to 2017. The annual average temperature and pressure at Central Coast Aviation Hub was sourced from the nearest weather station at Norah Head (station no. 61366). The average pressure data was collected for the period of August 2016 – August 2017, as the data was only available for past year.

Weather settings are as follows:

Table 1: Weather settings

Parameter	Value
Temperature	19.18 °C
Pressure	761.68 mm-Hg
Relative humidity	64%
Headwind	14.8 km/h

Aerodrome Reference Point (ARP)

Details of the CCAH ARP is shown below:

Description	Latitude	Longitude	Elevation (m)
ARP	-33.240278	151.430278	10

Runway and Helipad Coordinates

To70 has modelled "stage 3"development configuration detailed in the Master Plan 2017 draft. Stage 1 includes an extended runway with a length of 1800m, which is one of the options CCC has considered.

Stage	Description	Latitude	Longitude	Length × Width (m)	Elevation (m)
Stage 1	Runway 02	-33.249790	151.421516	1800 x 30	10
	Runway 20	-33.236666	151.432944		11
	Runway 20 displaced threshold	-33.23787716	151.4318884		11

Helipad

The proposed helicopter landing site (HLS) location was modelled at coordinates received from CCC.

Description	Latitude	Longitude	Elevation (m)
HLS	-33.242236	151.426799	10

2.2 Traffic

Forecast traffic movements were provided by CCC; detailing the predicted number of movements for the years 2018, 2024, 2025 and 2029. Forecast movements in 2025 and 2029 present medium and high movement estimates. To70 modelling assumes that the worst-case scenario, in terms of noise pollution (i.e. high movement estimates), is the most representative for this study. Therefore, To70 has modelled 2025 and 2030 scenarios based on 2025 and 2029 high estimation data, where 2030 movements are considered equal as in 2029. Table 2 shows the forecast annual and daily movements for the airport.

Forecasts

Table 2 - Forecast annual and daily movements for 2025 and 2030

Aircraft type (fixed and rotary wings)	2025 Movements		2030 Movements	
	Annual	Daily	Annual	Daily
C150/PA28/C172/C182/M020T/BE36	46,000	126	50,000	136.98
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LJ35/LJ45/CITATION 500 or 600	600	1.64	800	2.19
DHC8-30/METRO/ATR72/FK50/SF34	17,400	47.67	5,840	16
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Aircraft mix and INM representative

To70 has modelled the forecast aircraft data using INM equivalents detailed in Table 3 below.

Table 3 - INM Aircraft representatives

Aircraft type (fixed and rotary wings)	INM ID
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LJ35/LJ45/CITATION 500 or 600	CNA525C
DHC8-30/METRO/ATR72/FK50/SF34	DHC830
B737-800/A320/FK70	737800
R22/R44/B206/BH47/AS50/A109/AS135	R44

Where substitute aircraft are required for INM modelling, To70 have utilised the aircraft types suggested within the INM tool.

Usage splits

CCC have indicated the following runway utilisation proportions based on observation of predominant wind direction, shown in Table 4.

Table 4 - Runway usage split

Runway	Usage proportion
02	20%
20	80%

Day and Night operations

INM calculations weigh night time flights more heavily than day-time flights. Daytime operations are defined as 0700-1900 and night-time is defined as 1900-0700 in the ANEF system. To accurately model noise impacts, a day / night split of operations needs to be defined. The day / night split is assumed to be identical to the previous ANEF/OLS study report of 2006 provided by CCC, outlined in Table 5.

Table 5 - Daytime and night-time operation split

Description	Proportion
Day	98.5%
Night	1.5%

Tracks and usage

This section shows the expected flight paths at CCAH in 2025 and 2030, according to inputs received from CCC. To70 modelled the circuits based on the previous ANEF/OLS study report 2006 provided by CCC, as well as the CCAH airspace and OLS assessment. Figure 1- Figure 3 below illustrate the approach, departure, and circuit Visual Flight Rules (VFR) tracks used at CCAH. The report assumes circuit traffic operating in RWY02 LH / RWY20 RH direction:

Instrument Flight Rules (IFR) tracks, including RPT traffic, are assumed to be straight in and out tracks illustrated in Figure 4. Helicopter training circuits and arrival and departure flight paths are displayed in Figure 5.

Figure 1 - VFR arrival tracks

Figure 2 - VFR departure tracks

Figure 3 - Circuit tracks (02 LH and 20 RH)

Figure 4 - IFR approach and departure tracks

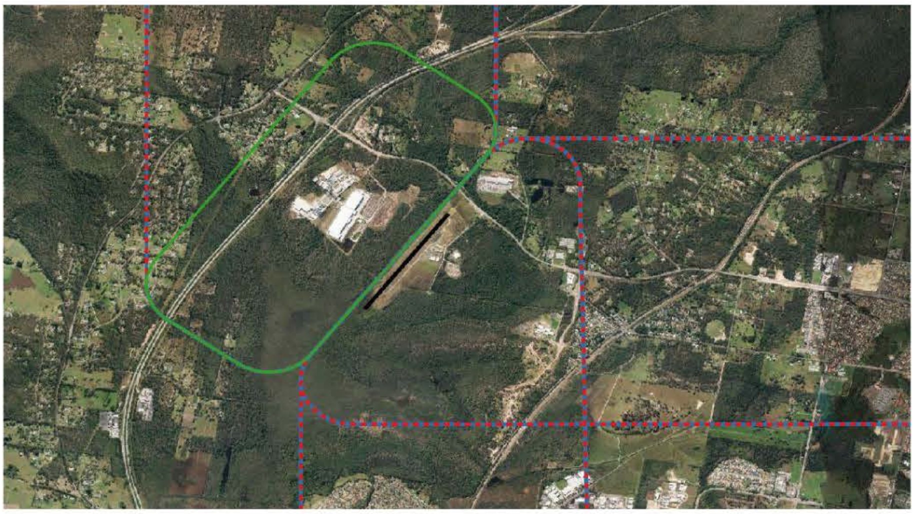

Figure 5: Helicopter flight paths

Track utilisation is assumed to be identical to the previous ANEF/OLS study report 2006 provided by CCC. RPT movements will be assumed to be only utilising the IFR straight in and out tracks.

Operations type split

In order to complete the aircraft noise model, the proportion of private/Business/Training traffic conducting circuit operations was included in the model. All RPT, charter and corporate movements will be assumed to be arrival/departure operations, as detailed in Table 6. VFR Arrival and departure movements were split equally and then divided by flight paths as outlined in Table 7, following consultation with CCC.

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LJ35/LJ45/CITATION 500 or 600	100%	-
DHC8-30/METRO/ATR72/FK50/SF34	100%	-
B737-800/A320/FK70	100%	-
R22/R44/B206/BH47/AS50/A109/AS135	50% (directions N, S and E)	50%

Table 7: IFR flight track split

Aircraft (INM id)	SE/E (Victor 1)	NW (Cessnock)	NW (Maitland)	NE (Nobby's Head)	SW (Brooklyn Bridge)	W (Mt. McQuoid)
CNA182	60%	8%	8%	8%	8%	8%
BEC58P	16.67%	16.67%	16.67%	16.67%	16.67%	16.67%
CNA208	20%	13.33%	13.33%	13.33%	20%	20%

2.3 Count of Property Lots - assumptions

To70 used public available data from the New South Wales Department of Finance and Services. Lots information was gathered using "SIX Maps", an online mapping tool for NSW. To70 collected cadastral data for the regions of Central Coast and Lake Macquarie.

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Results of this analysis are presented in Section 0.

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In this section, we present the results of the noise modelling, describe the metrics used to generate the contours and provide the number of property lots within N70 and N65 contours. To70 has generated the following contours:

- ANEC for 2025 and 2030
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3.1 ANEC results

Australian Noise Exposure Concept (ANEC) charts are used to show forecasted contours of aircraft noise exposure. The ANEC contours represent the average noise impact from an average day's aircraft movements. The average exposure is calculated over a twelve-month period. Figure 6 - Figure 7**Error! Reference source not found.** show the ANEC results obtained for circuits 02LH-20RH in 2025 and 2030.

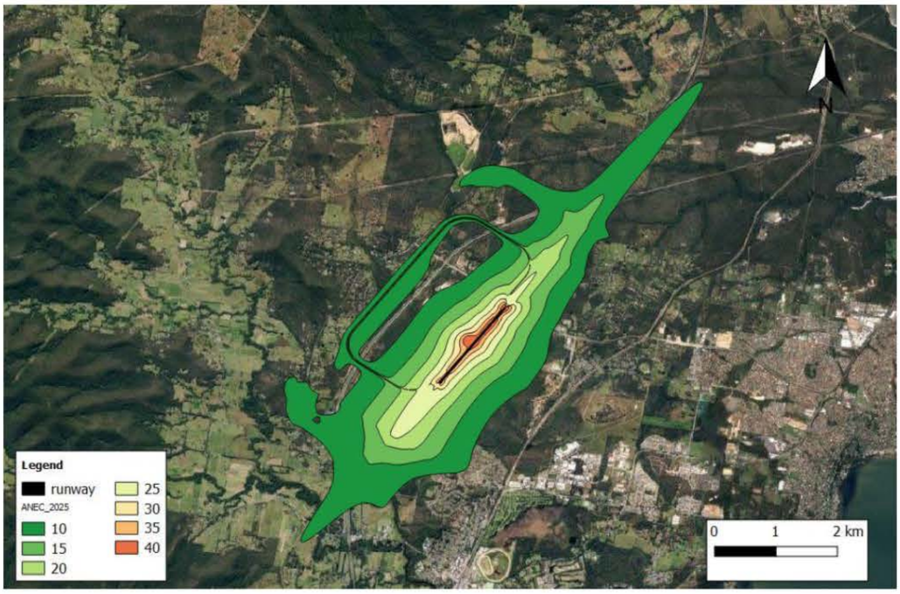
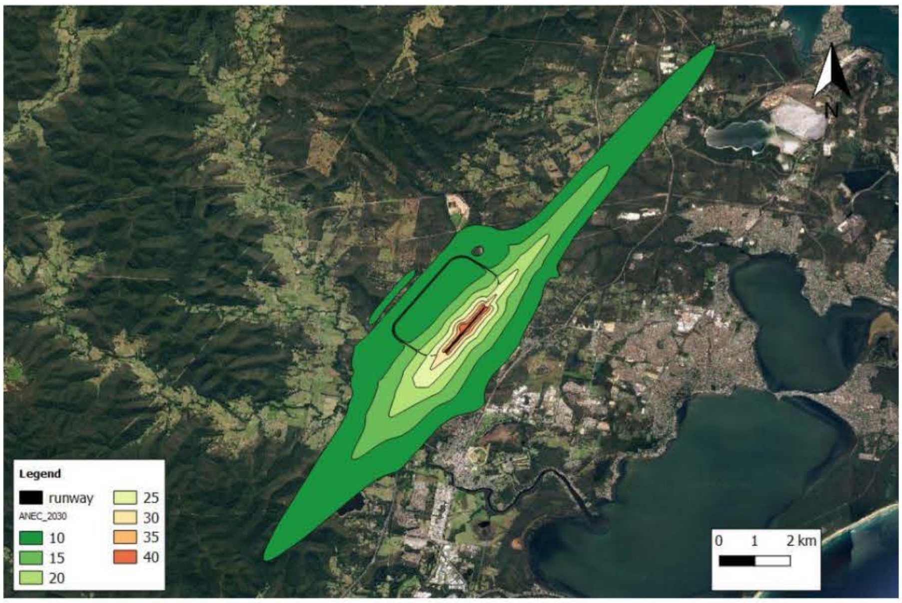


Figure 6: ANEC 2025 (02LH-20RH)



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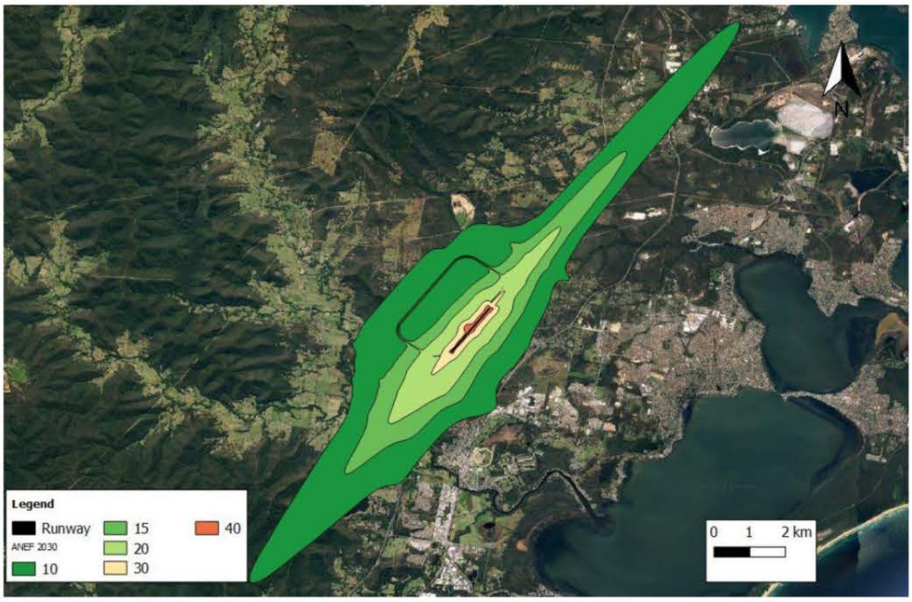

Figure 9: ANEF 2030 (02LH-20RH)

17.074.02 • November 2017

Central Coast Aviation Hub Noise Assessment

Report – 1799m length runway

Aviation Consultants

Central Coast Aviation Hub Noise Assessment

Final report

Report

Jamie Barclay,

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HLS	-33.242236	151.426799	10

2.2 Traffic

Forecast traffic movements were provided by CCC; detailing the predicted number of movements for the years 2018, 2024, 2025 and 2029. Forecast movements in 2025 and 2029 present medium and high movement estimates. To70 modelling assumes that the worst-case scenario, in terms of noise pollution (i.e. high movement estimates), is the most representative for this study. Therefore, To70 has modelled 2025 and 2030 scenarios based on 2025 and 2029 high estimation data, where 2030 movements are considered equal as in 2029. Table 2 shows the forecast annual and daily movements for the airport.

Forecasts

Table 2 - Forecast annual and daily movements for 2025 and 2030

Aircraft type (fixed and rotary wings)	2025 Movements		2030 Movements	
	Annual	Daily	Annual	Daily
C150/PA28/C172/C182/MO20T/BE36	46,000	126	50,000	136.98
PA44/B76PA30/PA31/AC50	1,960	5.36	2,200	6.02
M500/TBM750/PC12/BE20/C441/C208/LJ	5,000	13.69	5,600	15.34
LJ35/LJ45/CITATION 500 or 600	600	1.64	800	2.19
DHC8-30/METRO/ATR72/FK50/SF34	17,400	47.67	5,840	16
B737-800/A320/FK70	-	-	14,600	40
R22/R44/B206/BH47/AS50/A109/AS135	1,110	3.01	1,320	3.61

Aircraft mix and INM representative

To70 has modelled the forecast aircraft data using INM equivalents detailed in Table 3 below.

Table 3 - INM Aircraft representatives

Aircraft type (fixed and rotary wings)	INM ID
C150/PA28/C172/C182/MO20T/BE36	CNA182
PA44/B76PA30/PA31/AC50	BEC58P
M500/TBM750/PC12/BE20/C441/C208/LJ	CNA208
LJ35/LJ45/CITATION 500 or 600	CNA525C
DHC8-30/METRO/ATR72/FK50/SF34	DHC830
B737-800/A320/FK70	737800
R22/R44/B206/BH47/AS50/A109/AS135	R44

Where substitute aircraft are required for INM modelling, To70 have utilised the aircraft types suggested within the INM tool.

Usage splits

CCC have indicated the following runway utilisation proportions based on observation of predominant wind direction, shown in Table 4.

Table 4 - Runway usage split

Runway	Usage proportion
02	20%
20	80%

Day and Night operations

INM calculations weigh night time flights more heavily than day-time flights. Daytime operations are defined as 0700-1900 and night-time is defined as 1900-0700 in the ANEF system. To accurately model noise impacts, a day / night split of operations needs to be defined. The day / night split is assumed to be identical to the previous ANEF/OLS study report of 2006 provided by CCC, outlined in Table 5.

Table 5 - Daytime and night-time operation split

Description	Proportion
Day	98.5%
Night	1.5%

Tracks and usage

This section shows the expected flight paths at CCAH in 2025 and 2030, according to inputs received from CCC. To70 modelled the circuits based on the previous ANEF/OLS study report 2006 provided by CCC, as well as the CCAH airspace and OLS assessment. Figure 1- Figure 3 below illustrate the approach, departure, and circuit Visual Flight Rules (VFR) tracks used at CCAH. The report assumes circuit traffic operating in RWY02 LH / RWY20 RH direction:

Instrument Flight Rules (IFR) tracks, including RPT traffic, are assumed to be straight in and out tracks illustrated in Figure 4. Helicopter training circuits and arrival and departure flight paths are displayed in Figure 5.

Figure 1 - VFR arrival tracks


Figure 2 - VFR departure tracks


Figure 3 - Circuit tracks (02 LH and 20 RH)

Figure 4 - IFR approach and departure tracks

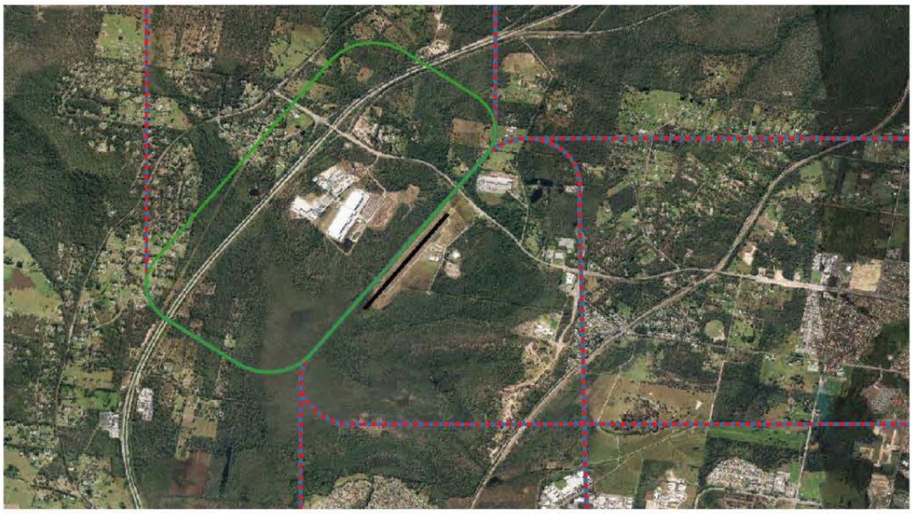

Figure 5: Helicopter flight paths

Track utilisation is assumed to be identical to the previous ANEF/OLS study report 2006 provided by CCC. RPT movements will be assumed to be only utilising the IFR straight in and out tracks.

Operations type split

In order to complete the aircraft noise model, the proportion of private/Business/Training traffic conducting circuit operations was included in the model. All RPT, charter and corporate movements will be assumed to be arrival/departure operations, as detailed in Table 6. VFR Arrival and departure movements were split equally and then divided by flight paths as outlined in Table 7, following consultation with CCC.

Table 6: Operations split

Aircraft Group	ARR/DEP operation split	Circuit operation split
C150/PA28/C172/C182/M020T/BE36	10%	90%
PA44/B76PA30/PA31/AC50	50%	50%
M500/TBM750/PC12/BE20/C441/C208/LJ	80%	20%
LJ35/LJ45/CITATION 500 or 600	100%	-
DHC8-30/METRO/ATR72/FK50/SF34	100%	-
B737-800/A320/FK70	100%	-
R22/R44/B206/BH47/AS50/A109/AS135	50% (directions N, S and E)	50%

Table 7: IFR flight track split

Aircraft (INM id)	SE/E (Victor 1)	NW (Cessnock)	NW (Maitland)	NE (Nobby's Head)	SW (Brooklyn Bridge)	W (Mt. McQuoid)
CNA182	60%	8%	8%	8%	8%	8%
BEC58P	16.67%	16.67%	16.67%	16.67%	16.67%	16.67%
CNA208	20%	13.33%	13.33%	13.33%	20%	20%

2.3 Count of Property Lots - assumptions

To70 used public available data from the New South Wales Department of Finance and Services. Lots information was gathered using "SIX Maps", an online mapping tool for NSW. To70 collected cadastral data for the regions of Central Coast and Lake Macquarie.

Due to the limitation of data availability, the lots count involved the total number of lots that would be within N65 and N70 contours without specifically identifying:

a) Number of buildings in the lot
b) Type of building in the lot
c) Type of lot (state/private owned)

Results of this analysis are presented in Section 0.

3 Results

In this section, we present the results of the noise modelling, describe the metrics used to generate the contours and provide the number of property lots within N70 and N65 contours. To70 has generated the following contours:

- ANEC for 2025 and 2030
- ANEF for 2025 and 2030
- N65 and N70 contours for 2025 and 2030
- LAmax for all the aircraft used in the model for 2025 and 2030

3.1 ANEC results

Australian Noise Exposure Concept (ANEC) charts are used to show forecasted contours of aircraft noise exposure. The ANEC contours represent the average noise impact from an average day's aircraft movements. The average exposure is calculated over a twelve-month period. Figure 6 - Figure 7**Error! Reference source not found.** show the ANEC results obtained for circuits 02LH-20RH in 2025 and 2030.

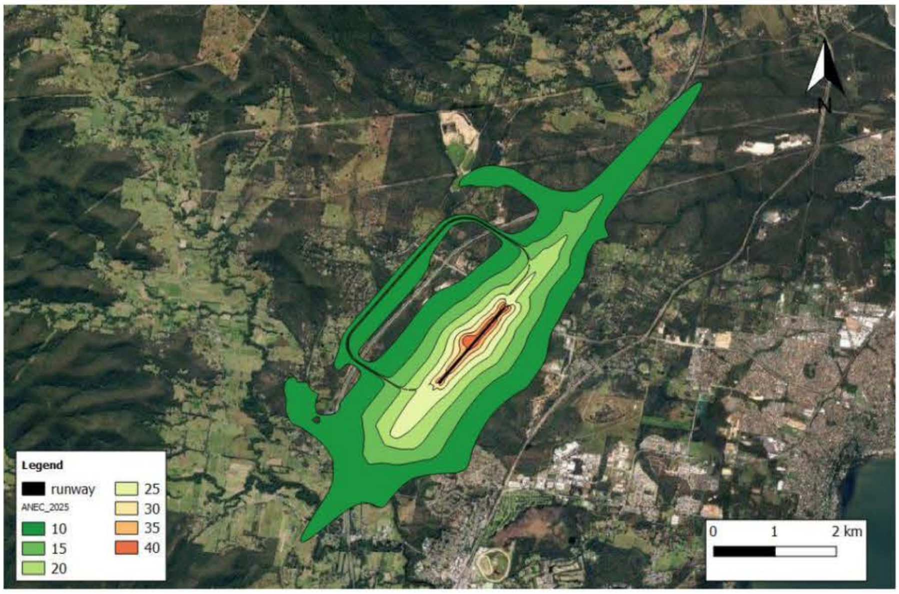

Figure 6: ANEC 2025 (02LH-20RH)

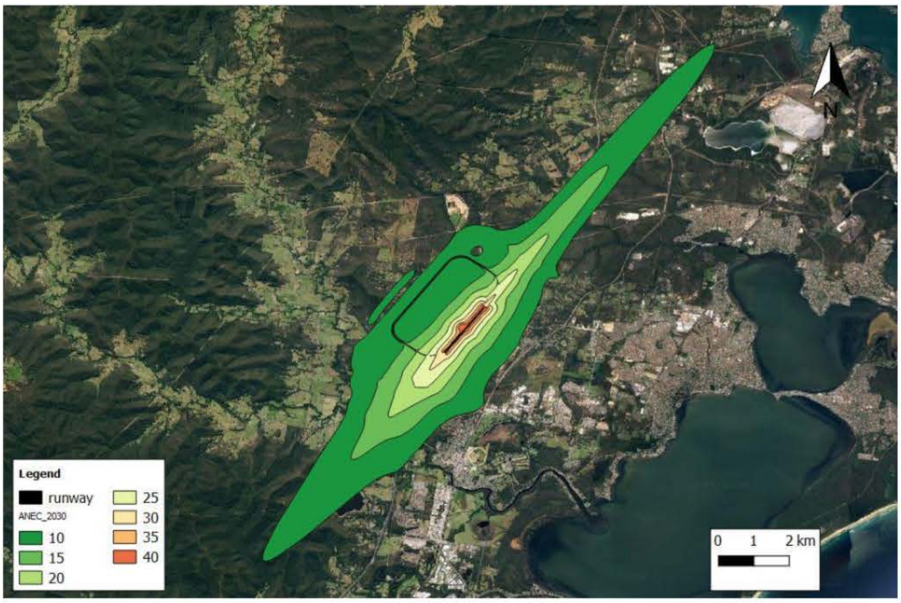

Figure 7: ANEC 2030 (02LH-20RH)

3.2 ANEF results

ANEF contours are used to quantify the noise impact of airport development scenarios. The maps in Figure 8 - Figure 9 are based on assumptions about the shape, size and demand of aircraft and airport operations. The ANEF uses the Effective Perceived Noise Level (EPNL) which applies a weighting to account for the fact that the human ear is less sensitive to low audio frequencies.

Figure 8: ANEF 2025 (02LH-20RH)

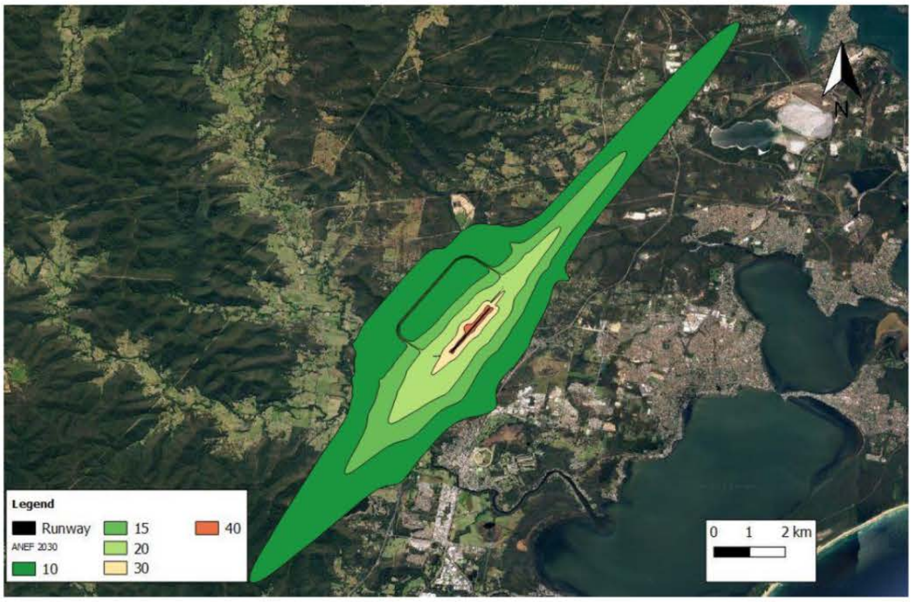

Figure 9: ANEF 2030 (02LH-20RH)

3.3 N65 and N70 Contours

N contours show the number of times a noise level is reached in a 24-hour day. N contours are used to supplement the ANEF and provide a clear understanding of aircraft noise levels. To70 has modelled N contours in order to measure the number of aircraft noise events per day that exceed 65 and 70 decibels. Results are presented in Figure 10 -Figure 13.

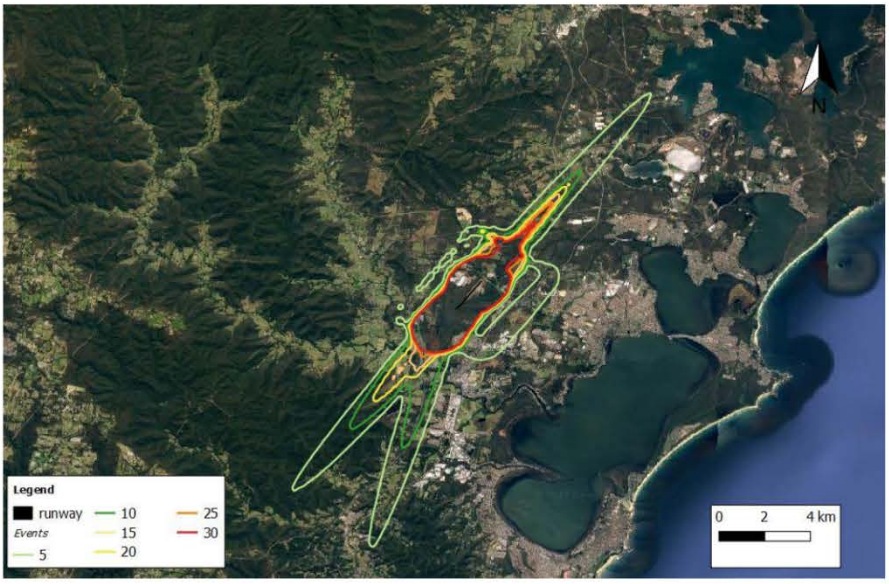

Figure 10: N65 – 2025 (02LH-20RH)

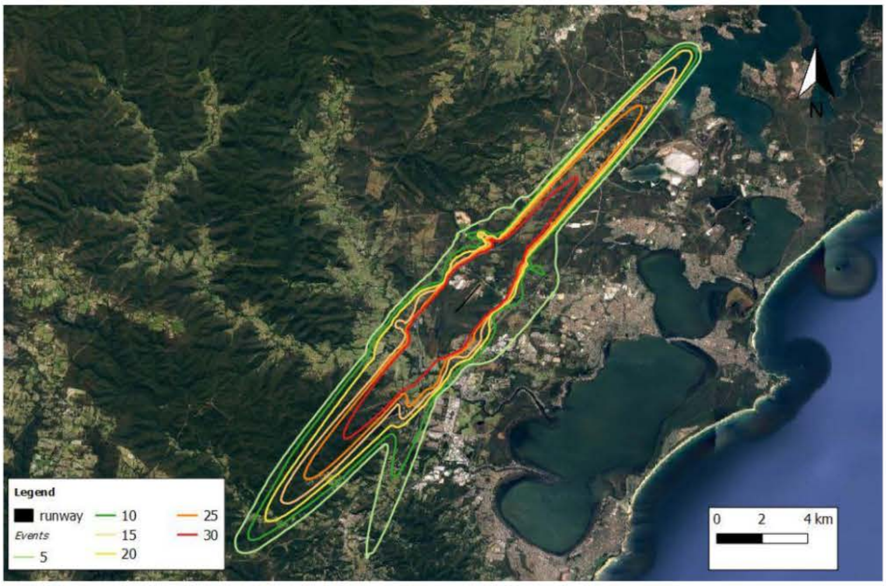

Figure 11: N65 – 2030 (02LH-20RH)

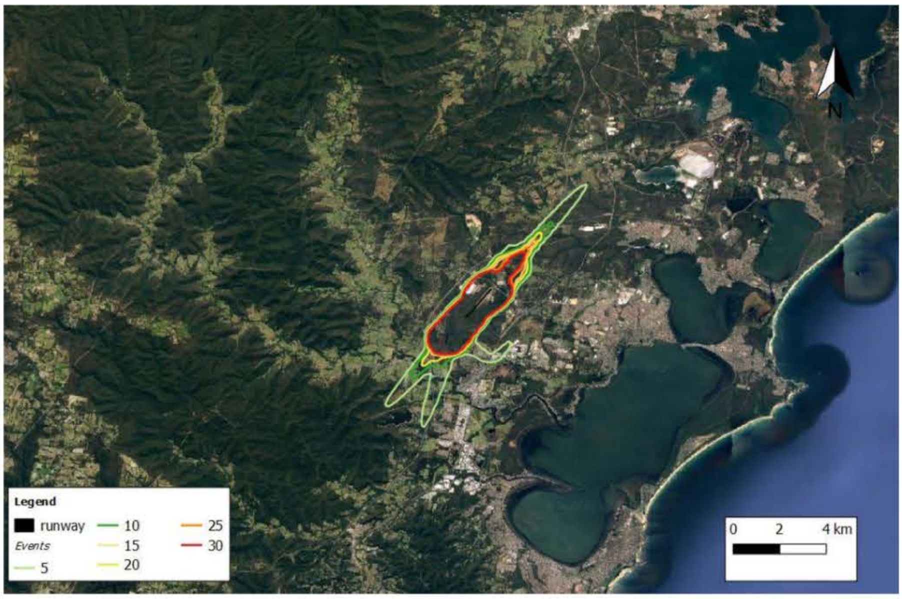

Figure 12: N70 – 2025 (02LH-20RH)

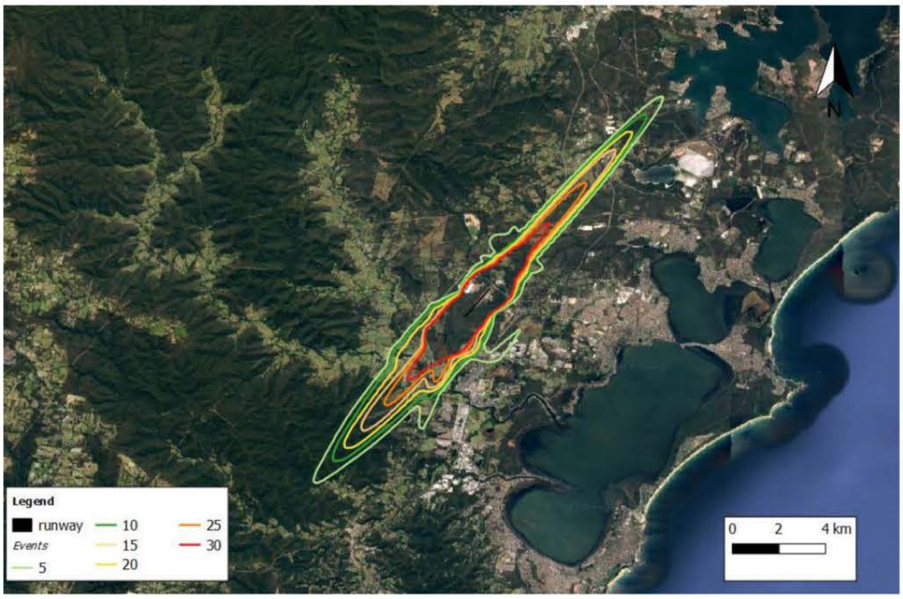

Figure 13: N70 – 2030 (02LH-20RH)

3.4 LAmax

LAmax measures the maximum sound level of a single event and it indicates the highest noise level that a person on the ground would hear from a single aircraft. To70 has modelled LAmax for the proposed aircraft that would take off and land at CCC. Potential noise impacts for the DHC-8 300 series (DHC-830) and the B737-800 (737800), which are the loudest frequently used aircraft in the model, are presented in Figure 14 through Figure 17.

Figure 14: DHC- 830 on RWY 02

Figure 15: DHC- 830 on RWY 20

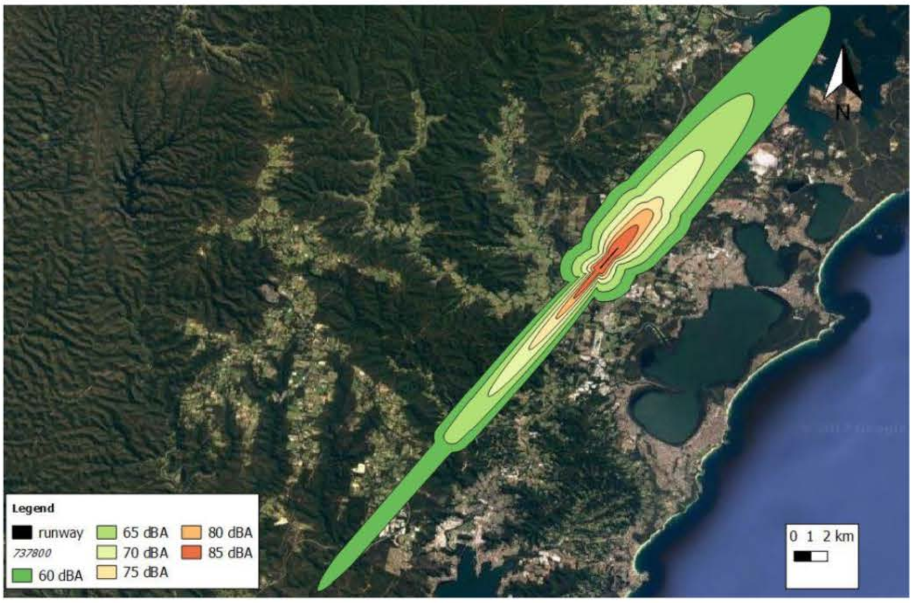

Figure 16: 737-800 RWY 02

Figure 17: 737-800 RWY 20

3.5 Lots count

Based on the assumptions stated in section 2.3, results for the lots count within N65 and N70 contours for years 2025 and 2030 are presented in the following tables:

- Table 8 and Table 9 show the total lots in Central Coast and Lake Macquarie regions that fall within the N65 and N70 contours.
- Table 10 and Table 11 present the number of lots that would experience 5,10, 15, 20, 25 and 30 events per day within the N65 and N70 contours.
- Figure 18 - Figure 21 show N contours results and the lots distribution in Central Coast and Lake Macquarie districts.

Table 8: Lots count within N65 contours at Central Coast and Lake Macquarie

N65	Lots within Central Coast	Lots within Lake Macquarie	Total number of Lots
2025	5,149	522	5,671
2030	10,870	7,496	18,366

Table 9: Lots count within N70 contours at Central Coast and Lake Macquarie

N70	Lots within Central Coast	Lots within Lake Macquarie	Total number of Lots
2025	1,357	0	1,357
2030	4,010	1,439	5,449

Table 10: Lots count within N65 contours

N65	5 events	10 events	15 events	20 events	25 events	30 events
2025	3,230	788	529	433	364	327
2030	5,657	4,215	3,574	2,796	1,471	653

Table 11: Lots count within N70 contours

N70	5 events	10 events	15 events	20 events	25 events	30 events
2025	875	202	108	72	55	45
2030	2,017	1,373	1,003	614	289	153

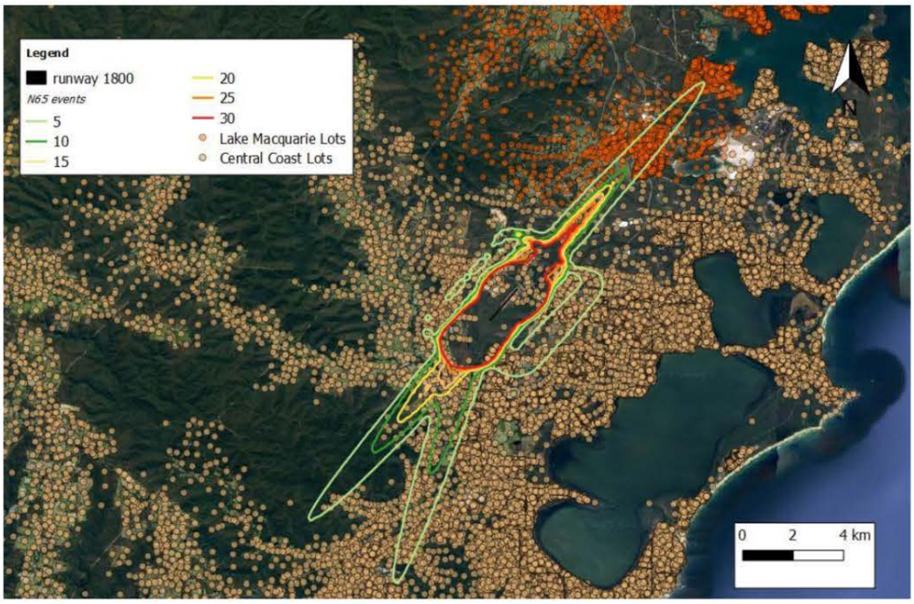

Figure 18: Lots within N65 contours (2025)

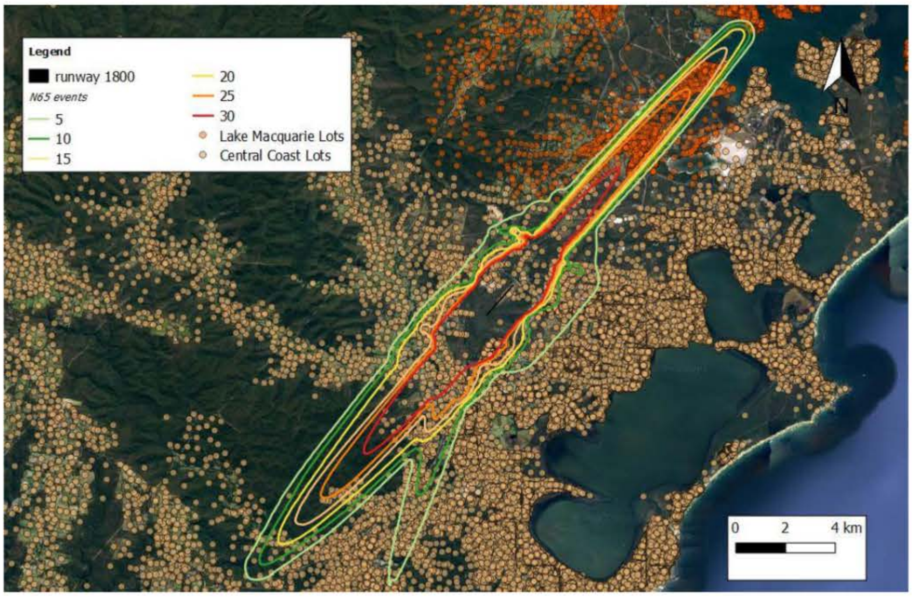

Figure 19: Lots within N65 contours (2030)

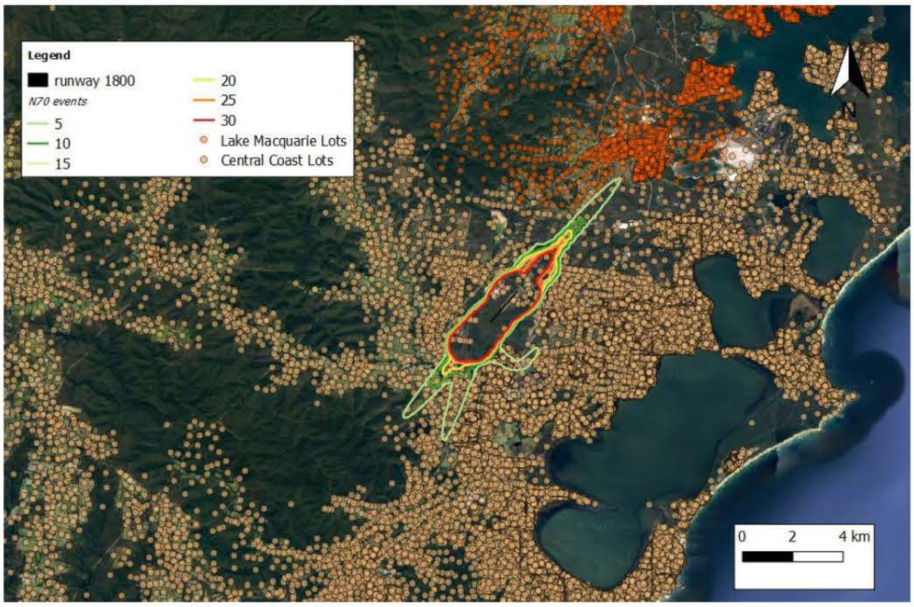

Figure 20: Lots within N70 contours (2025)

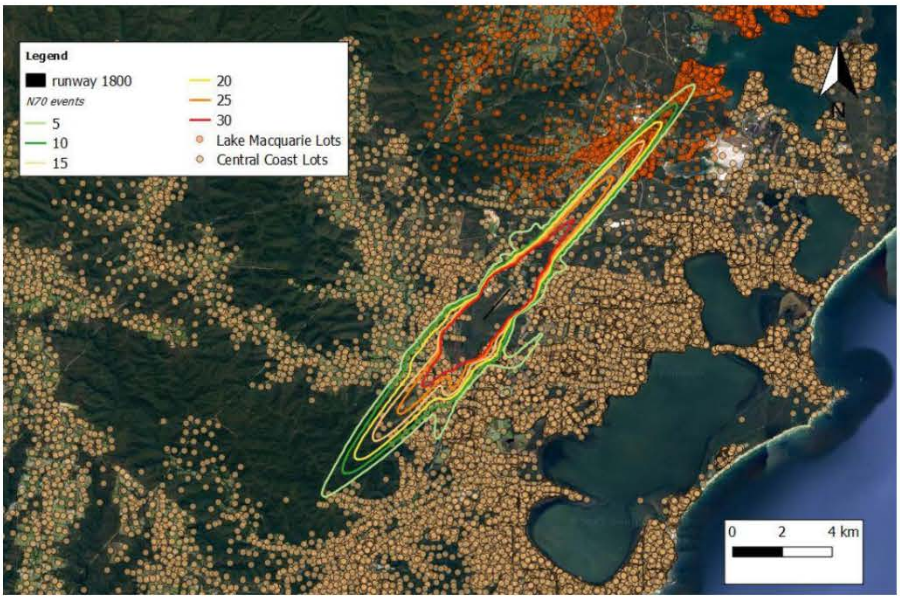

Figure 21: Lots within N70 contours (2030)

3.6 Commentary on skydiving operation

Council has previously accommodated the operations of a skydiving company at CCAH but ended the arrangement following community concerns.

Skydiving operations are looking to make optimal use of aircraft assets; and attempt to minimise flight times as an objective (in order to reduce the turnaround time between drops). This can often manifest itself as aircraft operating under full power for a 10-minute climb, using a spiral pattern, which localises the noise impacts.

To mitigate the impacts and operate as a good neighbour, many reputable skydiving operations will modify their operations to reduce noise, albeit at a slight cost to efficiency. Such mitigations can include:

- Climbing on a heading until reaching a nominal altitude (i.e. A070, A080) and then turning toward the drop site for the remaining climb. Then for each subsequent departure from the airport, varying the initial heading.
- Reducing power after take-off until passing through A040 to reduce engine noise.
- Using the quietest aircraft available.

WOOD & GRIEVE ENGINEERS

ENQUIRIES: HOCK CHUA
PROJECT NO: 33493

13 November 2017

Central Coast Council
PO Box 20
WYONG NSW 2259

Attention: Jamie Barclay

Dear Jamie

RE: TRAFFIC & TRANSPORT - SERVICES PROVIDES - AIR TRANSPORT - CENTRAL COAST AVIATION HUB SERVICES MASTER PLAN AT WARNERVALE

1. INTRODUCTION

Wood and Grieve Engineers (WGE) was commissioned by Central Coast Council in October 2017 to undertake an Airport Services Masterplan for Central Coast Aviation Hub for the delivery and layout of services to facilitate the development and operation of the airport as a general aviation industry hub.
The report will form part of the Detailed Airport Master Plan currently undertaken by others.

The Central Coast Council is currently investigating the impacts of an upgrade of the existing Warnervale Airport to cater for general aviation industry.

The Central Coast Aviation Hub is programmed to be progressively upgraded to cater for general aviation and potentially regional RPT traffic in the future.

This Services Master plan report (SMP) will provide a high level Strategic approach required to service the long term development program outlines in the Airport Master Plan 2017, in stages as indicated in the report.

The SMP will provide a planning framework for:

- Electrical power, HV and LV
- Communication
- Water supply and reticulation
- Gas
- Sewerage reticulation
- Fire water
- Fire protection Services and system

To us, it's more than just work

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Albany • Brisbane • Busselton • Melbourne • Perth • Sydney

2. CURRENT SERVICES UTILITIES

The airport has basic water, power and telecom connections.

A 100mm diameter watermain runs from a trunk main in Sparks Road, along Jack Grant Ave to a sewer pump station at the southern end of the access road.

A gravity sewer main servicing the Warren Close and Burnet Ave industrial subdivision crosses the airport and connects with the sewer pump station at the southern end of Jack Grant Ave. The sewer rising main then continues east to Albert Warner Drive. No sewer infrastructure is available in Jack Grant Ave.

Aerial electrical power and telecom lines runs from Sparks Rad along Jack Grant Ave to the CCAC.

3. STRATEGIC SERVICES MASTERPLAN

Proposed individual services masterplan are as follows:

3.1 Electrical

From an electrical perspective the site will be segregated into a northern and southern reticulation zone divided by the airport runway. The intention is that the site will be a high voltage customer and that separate Authority high voltage feeds will be provided to each of the reticulation zones. The northern reticulation zone will be supplied by Authority cabling entering the site via the Burnet Rd entrance and the southern reticulation zone will be supplied by Authority cabling entering the site via the Jack Grant Ave entrance. Authority high voltage cabling will then terminate at the nominated high voltage switchrooms nominated within each zone. Private high voltage reticulation will eminate from these switchrooms and be reticulated to various private substations nominated throughout the site for further low voltage reticulation to each allotment. Power supplies to each site will be assessed on an individual basis once the power requirements are known, with large power consumers required to have their own substation.

Design Basis

- The development will be a single title with allotments leased
- The site will be a high voltage customer with two Authority feeds segregated into a northern and southern reticulation zone
- The reticulation of high voltage and low voltage cabling throughout the site will be a private network
- Each allotment will be provided with a 100A 3ph supply.
- Large power consumers will require their own substation to be provided.

3.2 Communications

Communications will be similar to electrical and be segregated into a northern and southern reticulation zone divided by the airport runway. NBN pit and pipe infrastructure will be provided throughout each of the reticulation zones for NBN fibre to be reticulated throughout the site and to each allotment. The intention is that the NBN pit and pipe infrastructure will be reticulated adjacent to electrical infrastructure. Further details on the NBN installation will be confirmed during the detailed design phase.

Design Basis
- The development will be a single title with allotments leased
- The site will be segregated into a northern and southern reticulation zone
- NBN pit and pipe infrastructure will be reticulated adjacent to the electrical infrastructure within the street and to each allotment

3.3 Water

The potable water system site reticulation will be independent and utilised for the supply of domestic type water usage requirements such as ablution areas, kitchens, cleaners rooms etc. The sites potable water reticulation will be provided from two (2) off new connections to the local authority water main in Sparks Road incorporating authority billing meters and backflow prevention devices. The intention of the two (2) x connections is to provide the airport and associated buildings additional redundancy. It is not envisaged at this stage that site pumpsets will be required. The proposed potable water service is to be installed throughout the site in a combined trenching arrangement to create two (2) x site ring mains with the inclusion of interconnection branches for added efficiency and maintenance purposes. Independent lots will be provided with their own potable connection and sub-meter for water usage recording and billing purposes. Isolation valves shall be located at all branch lines, piping interconnections and at a distance of no more than 90m along the service to assist in mitigating disruptions to the operational day to day activities in the event of system failure and damage.

Design Basis
- The existing authority water supply performance characteristics are suitable for the proposed development without upgrade
- The development is to be single title with allotments leased
- Services installed within combined services trench
- Performance design to the NCC-BCA 2016 deemed to satisfy criteria
- System demand to Table A1 WSA02-2002: (Industrial Future use 150EP per Ha)
- Site area = 565 Ha (From Pg 11 Dev strategy review CAPA Consulting)

3.4 Gas

The gas service site reticulation system shall be utilised for the supply of Natural gas throughout the development. It shall be supplied from the authority gas main in Sparks Road. An authority boundary regulator set will be installed to reduce the incoming site pressure from an anticipated 1050kPa to 210kPa. The gas service will then reticulate within a combined trenching arrangement throughout the site where Independent lots will be provided with their own natural gas connection and regulator set to reduce the site reticulation pressure down to independent lot requirement and an authority meter and for gas usage recording and billing purposes.

Design Basis

- The existing authority gas supply performance characteristics are suitable for the proposed development without upgrade
- The development is to be single title with allotments leased
- Services installed within combined services trench
- Performance design to the NCC-BCA 2016 deemed to satisfy criteria
- System reticulation of maximum 210kPa

3.5 Sewer

The site sewer system shall be a network of gravitational drainage pipework in various sizes from DN222 to DN450. The site will be separated into two (2) areas being Zone 1 and Zone 2. The site sewer system shall be installed to utilise the natural ground plane and provide independent lots with a point of connection for their own discharge. Proposed locations for the sewer connections within each lot are to be within 1m of the allotment boundary terminating with a boundary trap and induct mica flap for surcharge protection. The entire site shall be installed to drain via gravity to the existing Warnervale sewer pumpstation (C15) located to the southern end adjacent Jack Grant Avenue.

Design Basis

- The existing authority sewer infrastructure performance characteristics and capacities are suitable for the proposed development without upgrade
- The development is to be single title with allotments leased
- Performance design to the NCC-BCA 2016 deemed to satisfy criteria
- System demand to Table A1 WSA02-2002: (Industrial Future use 150EP per Ha, Excl Proposed passenger terminal with 75EP per Ha)
- Site area = 87 Ha
- Approximate depth of Invert 6.50m from surface

3.6 Fire Water

The fire water system site reticulation will be independent and utilised for the supply of fire services only, incorporating street fire hydrants and allotment supply. The sites fire water reticulation will be provided from one (1) off new connections to the local authority water main in Sparks Road incorporating authority backflow prevention devices. The fire water system design intent is that the site reticulation will be in a combined trenching arrangement is a communal water supply infrastructure where independent lots will draw water from to provide their own fire-fighting systems. The proposed fire water service is to be installed throughout the site to create ring mains with the inclusion of interconnection branches for added efficiency and maintenance purposes. Independent lots will be provided with their own connection for fire fighting water supply to accommodate their individual requirements. Isolation valves shall be located at all branch lines, piping interconnections and at a distance of no more than 90m along the service to assist in mitigating disruptions to the operational day to day activities in the event of system failure and damage.

Design Basis

- The existing authority water supply performance characteristics are suitable for the proposed development without upgrade
- The development is to be single title with allotments leased
- Services installed within combined services trench
- Performance design to the NCC-BCA 2016 deemed to satisfy criteria
- No onsite water storage tanks

3.7 Fire Protection Services

3.7.1 Design Approach

Consistent with the manner in which the site will be developed and let the fire systems will be designed to accommodate ongoing expansion and flexibility.

Fire protection will be provided in the form of a dedicated fire services ring main that will supply a system of external hydrants and allow extension for fire hose reels to buildings requiring this service. Should the size and/or use of a building require the installation of a sprinkler system the water supply for this services will be extended from the fire services ring main.

Hydrant coverage shall be provided throughout the site.

Fire Hose Reel coverage shall be provided to all buildings with fire compartments exceeding 500m2 in area or where internal hydrants are required for BCA compliance.

Fire alarm systems shall be provided where the BCA dictates the size and/or use of a building require the service. Each installation will be served by a dedicated Fire Indicator Panel that will interconnect directly with the Fire Brigade to call for their turn-out.

Emergency Warning systems shall be provided where the BCA and/or an Australian Standard dictates the size and/or use of a building require the service.

Fire Extinguishers will be provided as required by the BCA.

Special Hazard fire protection systems will be designed where the compliance with the BCA leads to the requirement for such a system or, if specifically requested as an enhancement over the minimum BCA deemed to Satisfy fire protection solution.

3.7.2 Authorities

Fire Protection services design to comply with all current statutory requirements and guidelines including: -

- Central Coast Council
- Waters and Rivers Commission
- Airport Building Controller (ABC)
- FRNSW
- Health Department
- Department of Environmental Protection.

3.7.3 Codes and Standards

The project will be designed to satisfy the following Australian Standards and the National Construction Code (NCC) BCA 2016.

Fire Protection services design will comply with current Australian Standards where applicable and particularly the following:

System	National Construction Code (NCC) Clause Reference	Applicable Australian Standards
Hydrants	Spec E1.3	AS2419.1:2005
Fire Hose Reels	Spec E1.5	AS2441:2005
Fire Sprinklers	Spec E1.5	AS 2118.1-2017 & NFPA 409 (if applicable)
Portable Fire Extinguishers	Spec E1.6	AS 2444-2001
Smoke Hazard Management	Spec E2.2a	AS1670.1:2015

3.8 Fire Protection Systems

3.8.1 Fire Systems Water Supply Infrastructure

The fire services ring main shall take connection from the Local Authority town main water supply at the Stage 1 site entry point. The town main will be extended through a Fire Brigade suction and booster facility (FBB) complete with a double detector check valve (DCV) arrangement to eliminate feedback to the potable water supply. A pump bypass will be provided around the FBB. The pump system will comprise a single pump designed to elevate the site wide ring main to the maximum pressure possible at the limit of the town main flow capability. This arrangement will allow the combined operation of hydrants and sprinklers to all but the most demanding sprinkler installations.

The site wide ring main shall be equipped with a pressure maintenance pump to ensure fluctuations in town main pressure or minor leaks within the system does not cause the large system pump to operate in false alarm circumstances.

Where a particular building development requires a sprinkler system flow demand higher than the capability of the pumped town main ring main service, it will be necessary for the development to allocate space for a dedicated sprinkler system tank and fire pump. The site wide ring main will provide the hydrant demand for the building and the surplus will be utilised to infill the dedicated water storage tank thereby reducing the total storage capacity required.

3.8.2 Hydrants

Hydrants will generally provide coverage from positions external to buildings and will be located to maximise their effective coverage to all sites. Where the size of a building dictates the installation of internal hydrants these will be provided as an extension from the site wide ring main.

Where located externally double head hydrant outlets will be located adjacent roadways and protected with bollards.

When located internally single hydrant outlets will be located in fire protected egress paths.

3.8.3 Automatic Fire Sprinkler Systems

Sprinkler protection will be provided where required for deemed to satisfy BCA compliance. System design will be in accordance with the Hazards of Classification defined in AS 2118.1:2017. These requirements have been interpreted to require:

• Workshop areas	Ordinary Hazard 3 – 18 sprinklers discharging 60 lpm as a minimum
• Car Park areas (covered >40 cars)	Ordinary Hazard 2 – 12 sprinklers discharging 60 lpm as a minimum
• Showroom areas	Ordinary Hazard 2 – 12 sprinklers discharging 60 lpm as a minimum
• Administration areas	Light Hazard – 6 sprinklers discharging 60 lpm as a minimum

Where the building occupancy includes processes such as:

- Aircraft Engine Testing
- Aircraft Hangars
- Flammable Liquid Spraying
- Paint works (solvent based)
- Vehicle Repair Paint workshops

and storage facilities that exceed the limits for Ordinary Hazard Occupancies as defined in AS2118.1 the building will require provision of a High Hazard sprinkler system. In these instances, the sprinkler system will require additional water supply infrastructure in the form of a water storage tanks and fire pump. The sizes of this equipment are the subject of a specific design in each case.

The BCA specifically identifies Aircraft Hangars as an occupancy of excessive hazard. As part of the building approval process protection of these occupancies is generally considered to be beyond the capability of the Australian Standard and the Authority turns to American Standards for solutions. The National Fire Protection Association (NFPA) is an American Authority that has produced NFPA 409 - Standard on Aircraft Hangars. This document typically forms part of any Australian fire protection design involving the storage of Aircraft. NFPA 409 stipulates the level of fire protection required dependant on the size of the enclosing construction, the shadow created by aircraft wings and whether or not the aircraft will be fuelled or unfuelled. Larger buildings often require the installation of foam protection systems that in themselves can create environmental issues if not considered and addressed in the design process. In addition, NFPA 409 includes requirements for self-draining of floors, specific fire separation between spaces within the building, passive fire protection of the building structural elements and requires the protected building maintain a separation distance of 10m from any other structure.

3.8.4 Fire Hose Reels

Fire Hose reels will be extended from the domestic water supply provided to each building. This arrangement will overcome the issue of fire hose reels being used for general wash-down and inadvertently causing the fire Brigade to be called out.

Fire Hose Reels will be the Australian Standard 30m type. Where installed in external location they will be equipped with covers to protect the hoses from UV rays.

3.8.5 Fire Extinguishers

Portable Fire Extinguishers will be installed in accordance with the distribution requirements of BCA 2016. Accessibility and signage shall be in accordance with AS 2444:2001

3.9 Fire Alarm Systems

Fire alarm system will be installed in accordance with the requirements of BCA 2016. Systems will comprise an interconnected system of addressable smoke detectors controlled a Fire Indicator Panel.

The Fire Indicator Panel will be installed at the main entry point to each building and serve to monitor and control the buildings fire system installations i.e. smoke detectors and sprinkler systems. The system will also interface with the buildings mechanical system to effect any smoke hazard management requirements of the BCA. In addition the system will initiate the Fire Brigade direct alarm system to automatically call the Brigade in the event of system activation.

3.10 Emergency Warning Systems

Emergency Warning (Building Occupant Warning) systems will be installed in accordance with the requirements of BCA 2016.

The system will sound tones to advise occupants of the activation of the fire detection and/or fire sprinkler systems.

Occupant warning to be designed in accordance with AS 1670.1 to achieve the following:

- Minimum 65 dB(A), at least 10 dB(A) above ambient
- Maximum 105 dB(A)

3.11 Further Investigation

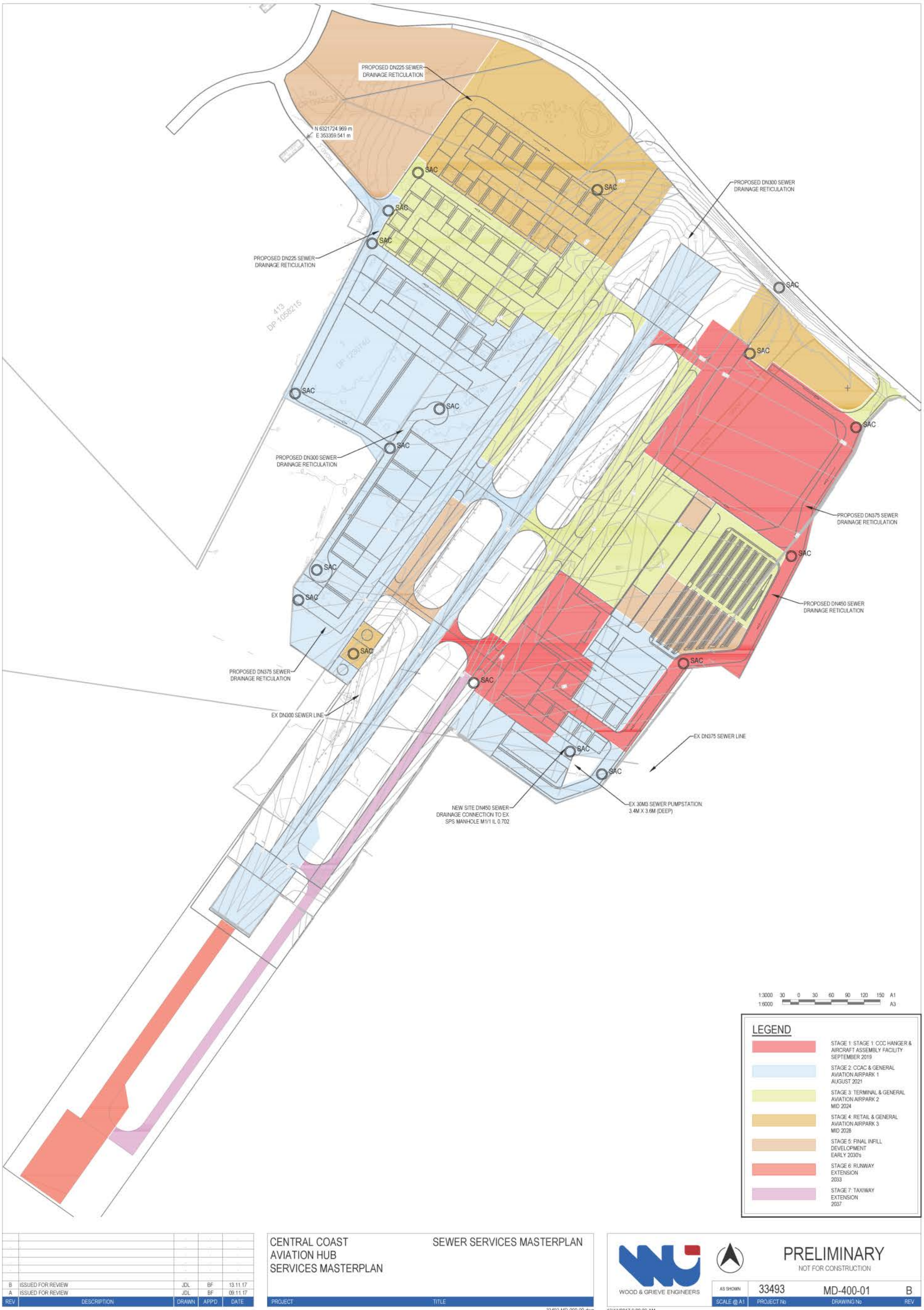
Further investigation will be required to mitigate the risk as indicated below:

- Accuracy of the existing documentation;
- Existing SPS capacities and performance for proposed loads inadequate;
- Authority Water supply pressures and flows inadequate for proposed demand;
- Authority Sewer network capacities inadequate for proposed discharge;
- Site water table (Charged ground);
- Change in development, staging and/or proposed lots and usage;

Yours faithfully

Hock Chua
for **Wood & Grieve Engineers**

Attach Sewer Services Master Plan
Domestic Water, Fire Water and Gas Services Master Plan
Electrical Services Master Plan


PROPOSED DN225 SEWER DRAINAGE RETICULATION
N 6321724.969 m
E 353359.541 m
PROPOSED DN300 SEWER DRAINAGE RETICULATION
PROPOSED DN225 SEWER DRAINAGE RETICULATION
SAC
PROPOSED DN300 SEWER DRAINAGE RETICULATION
PROPOSED DN375 SEWER DRAINAGE RETICULATION
PROPOSED DN450 SEWER DRAINAGE RETICULATION
PROPOSED DN375 SEWER DRAINAGE RETICULATION
EX DN300 SEWER LINE
EX DN375 SEWER LINE
NEW SITE DN450 SEWER DRAINAGE CONNECTION TO EX. SPS MANHOLE M1/1 IL 0.702
EX 30M3 SEWER PUMPSTATION 3.4M X 3.6M (DEEP)
1:3000 30 0 30 60 90 120 150 A1
1:6000 A3
LEGEND
STAGE 1: STAGE 1: CCC HANGER & AIRCRAFT ASSEMBLY FACILITY SEPTEMBER 2019
STAGE 2: CCAC & GENERAL AVIATION AIRPARK 1 AUGUST 2021
STAGE 3: TERMINAL & GENERAL AVIATION AIRPARK 2 MID 2024
STAGE 4: RETAIL & GENERAL AVIATION AIRPARK 3 MID 2028
STAGE 5: FINAL INFILL DEVELOPMENT EARLY 2030's
STAGE 6: RUNWAY EXTENSION 2033
STAGE 7: TAXIWAY EXTENSION 2037
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A ISSUED FOR REVIEW JDL BF 09.11.17
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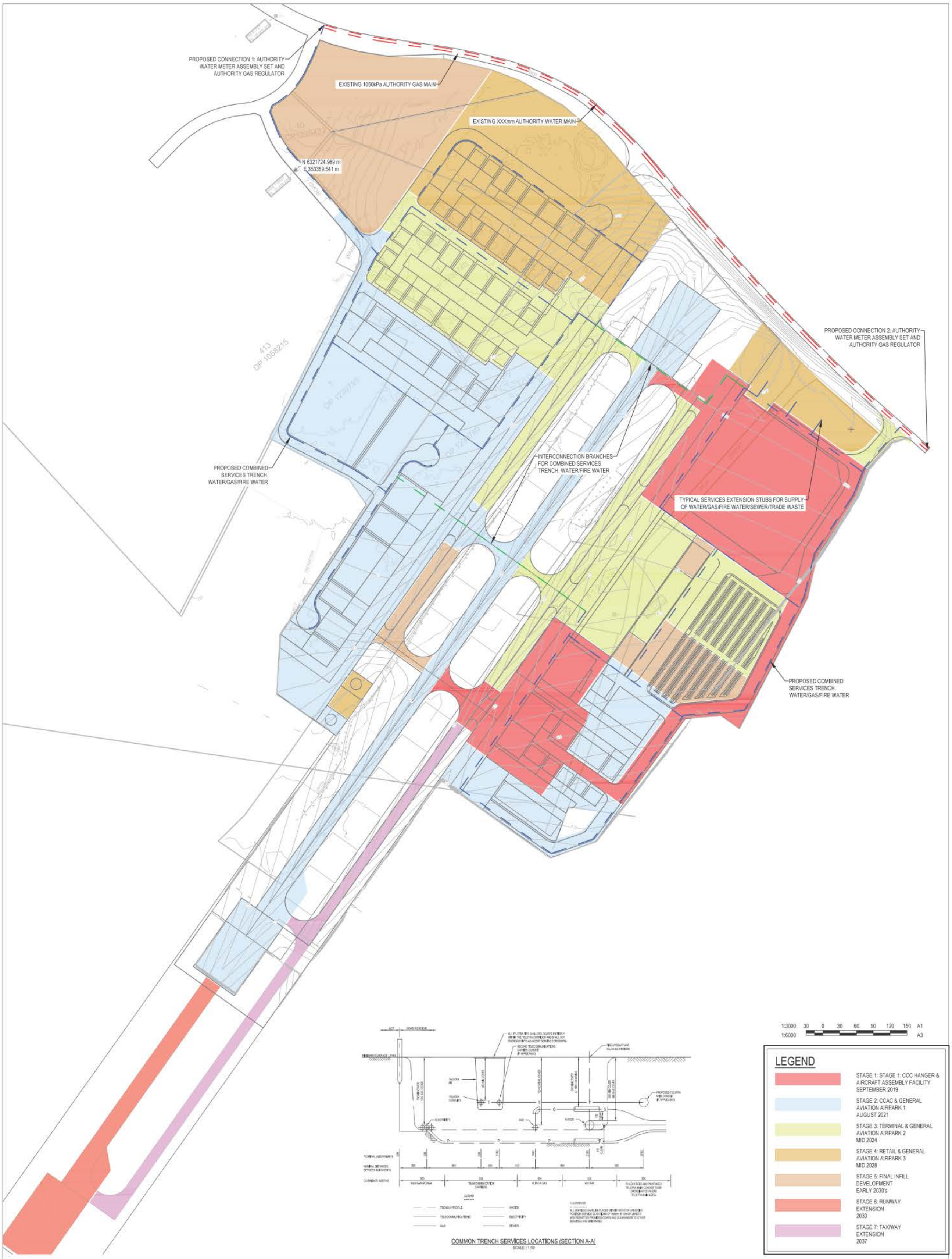

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A	ISSUED FOR REVIEW	JDL	BF	09.11.17

PROJECT: CENTRAL COAST AVIATION HUB SERVICES MASTERPLAN

TITLE: DOMESTIC WATER, FIRE WATER, AND GAS SERVICES MASTERPLAN

33493-MD-000-00.dwg

WOOD & GRIEVE ENGINEERS

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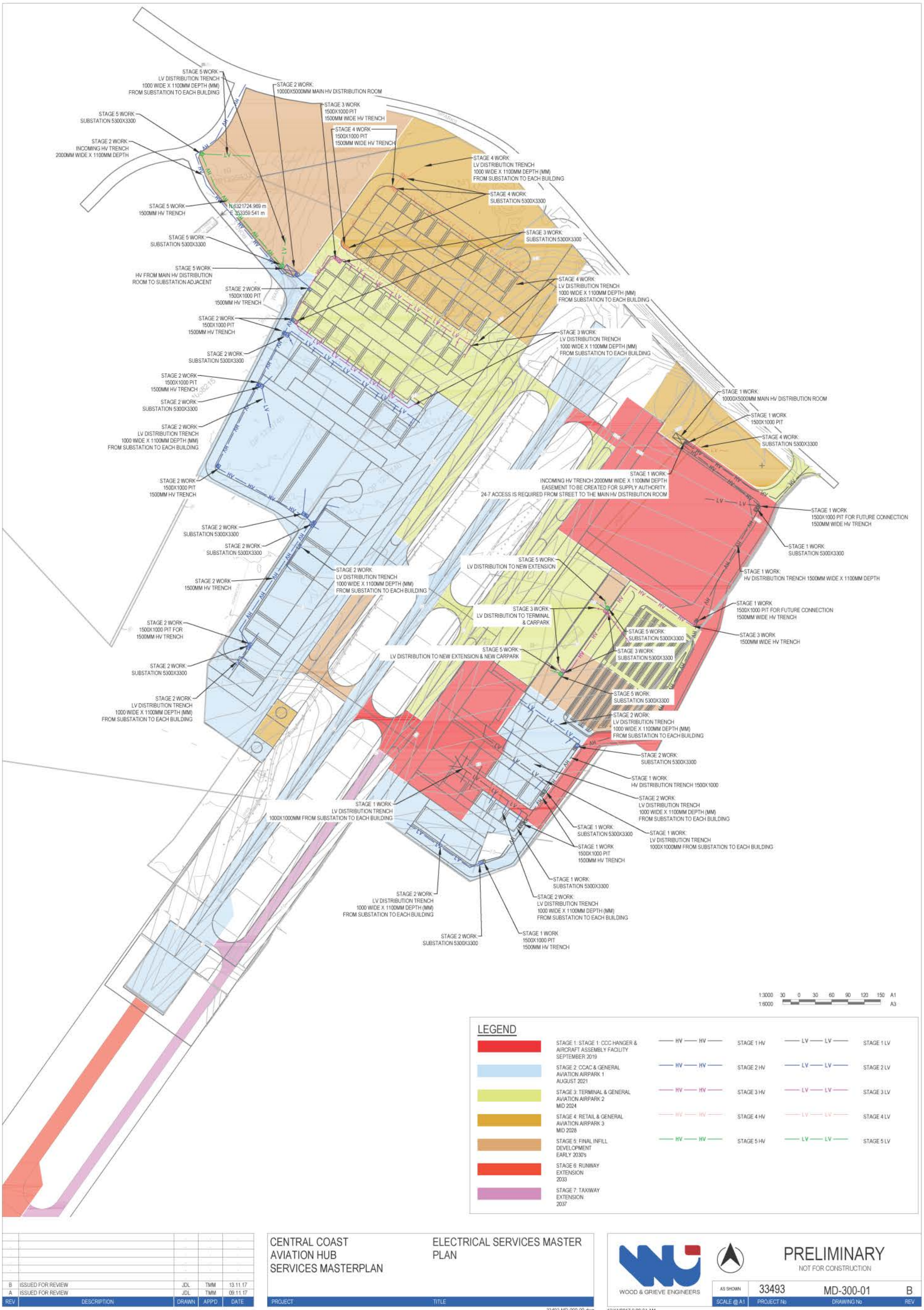
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FROM SUBSTATION TO EACH BUILDING
STAGE 2 WORK
10000X5000MM MAIN HV DISTRIBUTION ROOM
STAGE 3 WORK
1500X1000 PIT
1500MM WIDE HV TRENCH
STAGE 4 WORK
1500X1000 PIT
1500MM WIDE HV TRENCH
STAGE 5 WORK
SUBSTATION 5300X3300
STAGE 2 WORK
INCOMING HV TRENCH
2000MM WIDE X 1100MM DEPTH
STAGE 4 WORK
LV DISTRIBUTION TRENCH
1000 WIDE X 1100MM DEPTH (MM)
FROM SUBSTATION TO EACH BUILDING
STAGE 4 WORK
SUBSTATION 5300X3300
STAGE 5 WORK
1500MM HV TRENCH
STAGE 3 WORK
SUBSTATION 5300X3300
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STAGE 3 WORK
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1000 WIDE X 1100MM DEPTH (MM)
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10000X5000MM MAIN HV DISTRIBUTION ROOM
STAGE 1 WORK
1500X1000 PIT
STAGE 1 WORK
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1500X1000 PIT FOR FUTURE CONNECTION
1500MM WIDE HV TRENCH
STAGE 1 WORK
SUBSTATION 5300X3300
STAGE 1 WORK
HV DISTRIBUTION TRENCH 1500MM WIDE X 1100MM DEPTH
STAGE 5 WORK
LV DISTRIBUTION TO NEW EXTENSION
STAGE 3 WORK
LV DISTRIBUTION TO TERMINAL
& CARPARK
STAGE 5 WORK
LV DISTRIBUTION TO NEW EXTENSION & NEW CARPARK
STAGE 3 WORK
1500MM WIDE HV TRENCH
STAGE 2 WORK
HV DISTRIBUTION TRENCH 1500X1000
STAGE 1 WORK
LV DISTRIBUTION TRENCH
1000X1000MM FROM SUBSTATION TO EACH BUILDING
LEGEND
STAGE 1: STAGE 1: CCC HANGER & AIRCRAFT ASSEMBLY FACILITY SEPTEMBER 2019
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STAGE 7: TAXIWAY EXTENSION 2037
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STAGE 2 LV
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STAGE 5 LV
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Deloitte.
Access Economics

The economic impact of developing the Central Coast Aviation Hub

Central Coast Council

November 2017

Contents

Executive summary

Deloitte Access Economics was commissioned by the Central Coast Council (the Council) to model the economic impact of the proposed Central Coast Aviation Hub (the aviation hub). The aviation hub contains over 30 hectares of terminal, industrial hangar and other development site space, and would act as a local gateway for commercial passenger transport, as well as a general use facility for manufacturing operations, aviation training, air tourism services and more upon commencement.

To service these activities, particularly the commercial flight operations, the Council is proposing a redevelopment and possible extension of the existing on-site runway, currently only used for small scale general aviation.

Deloitte Access Economics used computable general equilibrium (CGE) modelling and data supplied by the Council[1] to estimate the economic impact of the proposed aviation hub. The modelling was based on estimates of the capital expenditure, operational expenditure, and induced tourism expenditure associated with the aviation hub.

Deloitte Access Economics CGE modelling suggests that the aviation hub would have a material impact on the living standards and employment possibilities of people residing in the Central Coast, which includes Gosford, Wyong, The Entrance and Budgewoi. Two scenarios were considered based on runways of 1200 metres (scenario one) and 1800 metres (scenario two).

- The 1200m runway aviation hub is projected to increase the size of the region's economy by $286 million and lift consumption by around $231 million in net present value terms[2] over the period from 2017-18 to 2039-40;
- The 1800m runway aviation hub is projected to increase the size of the region's economy by $312 million and increase consumption by $243 million in net present value terms[2] over the period from 2017-18 to 2039-40 (see Chart i);
- The aviation hub is projected to increase regional employment by an average of 109 full time equivalent (FTE) **jobs per year** in the 1200m runway scenario and by 116 FTE jobs per year in the 1800m scenario over the period from 2017-18 to 2039-40 (see Chart ii);[3]
- At its peak, the construction phase is expected to create around 70 additional jobs per annum across the region;
- The aviation hub is also projected to have flow on benefits for the rest of the state, as Central Coast businesses import goods from the surrounding regions. The aviation hub is projected to increase New South Wales' economy by $364 million in scenario one and by $391 million in scenario two in net present value terms over the period from 2017-18 to 2039-40; and
- Data provided by firms who have made pre-commitments to rent hanger space at the site suggests that between 700 and 950 full time equivalent jobs may be created at the aviation hub at the peak of its operational phase. Deloitte Access Economics modelling indicates a material portion of this employment will come from other local businesses in the same industries and from other industries. Critically, this means that the *net* employment creation – that is, the number of additional jobs – will be considerably less than the total onsite employment. In fact, the economic modelling indicates that net employment creation will be closer to 150 FTE.

[1] The Council in turn sourced this data from a range of qualified independent consultants
[2] $2016-17 and 7% discount rate
[3] It is important to note that the employment figures provide a net measure of the economic impact, meaning it only captures job creation that hasn't come at the expense of jobs in other areas. For example, if changes in economic conditions led to the creation of 30 new construction jobs and the loss of 10 jobs in services, then the results reflect the net gain of 20 jobs.

Inputs to the modelling

CGE modelling for the two aviation hub scenarios were based on three main inputs provided by the Council[4]:

1. Capital expenditure (CAPEX) estimates of the main construction costs for the hangar and aircraft assembly facility, terminal, runway and broader aviation hub, and the lessee construction costs associated with onsite operations such as car parking and landscaping. Construction is assumed to commence in 2017-18, and to be completed in 2029-30 for scenario one and 2036-37 for scenario two.

    - Scenario one CAPEX was estimated at $516 million, consisting of $274 million in main construction costs and $242 million in lessee construction costs; and
    - Scenario two CAPEX was estimated at $638 million, consisting of $396 million[5] in main construction costs and $242 million in lessee construction costs.

2. Operational expenditure (OPEX) estimates of the revenue generated by the new aviation hub. Revenue estimates of the main aviation hub were based on projected income from passenger and landing fees. Revenue estimates for businesses that plan to lease the facilities or airside land were based on rental expenses, and then scaled up to reflect total expenses. Expenditure estimates were further disaggregated into one of three industry types using airside rental submissions received by the Council. The aviation hub is assumed to start receiving landing fees in 2018-19, rental income in 2019-20, and passenger fees in 2024-25.

    - Scenario one OPEX was estimated at $2.26 billion, consisting of $97 million in passenger and landing fees, $1.5 billion in expenses for aircraft manufacturing and repair firms, $663 million in expenses for non-scheduled air transport firms and $4 million in expenses for private lessees; and
    - Scenario two OPEX was estimated at $2.28 billion, consisting of $113 million in passenger and landing fees, $1.5 billion in expenses for aircraft manufacturing and repair firms, $663 million in expenses for non-scheduled air transport firms and $4 million in expenses for private lessees.

3. Induced tourism expenditure estimates of the additional tourism (and associated spending) that will result from the aviation hub. Central Coast Aviation Hub passenger forecasts were provided by the Council, and based on previous modelling by the Centre for Asia Pacific Aviation. Passenger forecasts were first disaggregated into local residents (which do not contribute to tourism), and interstate domestic and international tourists. Tourist spending data from Tourism Research Australia (TRA) was then used to estimate induced tourism expenditure in the Central Coast region. Expenditure estimates were then further disaggregated by industry type using Deloitte Access Economics modelling. The aviation hub is assumed to start receiving passenger planes in 2024-25.

    - Scenario one tourism expenditure was estimated at $242 million, consisting of $127 million in trade expenditure, $98 million in transport expenditure, and $18 million in recreation expenditure; and
    - Scenario two tourism expenditure was estimated at $253 million, consisting of $133 million in trade expenditure, $102 million in transport expenditure, and $18 million in recreation expenditure.

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[4] The Council in turn sourced this data from a range of qualified independent consultants.

[5] The Quality Surveyor has since made small variations to these estimates. Main construction costs for the 1800m runway scenario are now expected to cost $385 million. These changes are not expected to have a material impact on the CGE results.

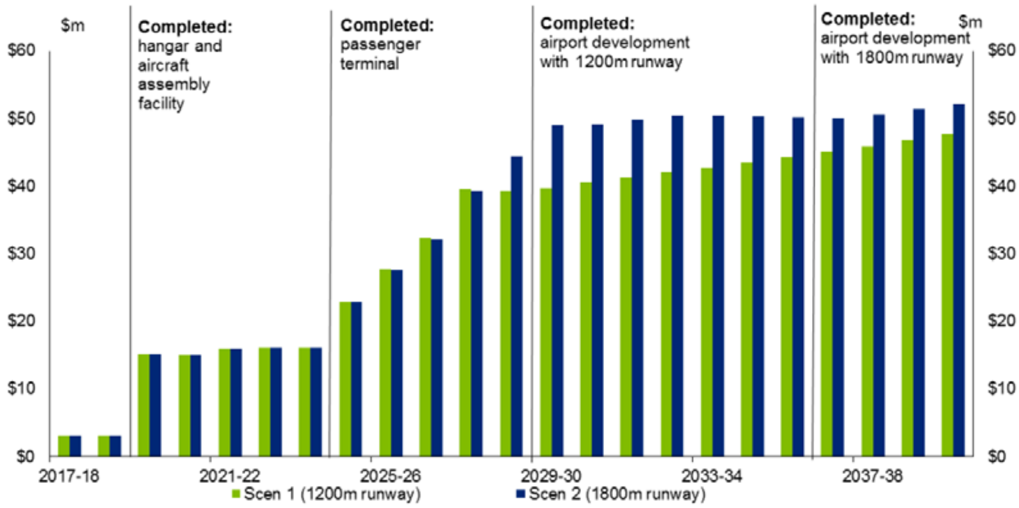
Detailed results

The Deloitte Access Economics regional general equilibrium model (DAE-RGEM) was used to estimate the economic impact of building and operating the aviation hub, relative to a counterfactual scenario in which the aviation hub does not occur. The modelling focused on the Central Coast region, which includes Gosford, Wyong, The Entrance and Budgewoi. CGE modelling is the preferred framework for projects of this kind as it takes into account the opportunity cost of resources, including labour, and explicitly reflects changes in prices, supply and demand across the economy.

The modelling suggests that the aviation hub has the potential to increase Central Coast's gross regional product by $286 million in scenario one and by $312 million in scenario two in net present value terms over the period from 2017-18 to 2039-40.

As shown in Chart i and Chart ii, the economic and employment impact of the proposed development is expected to increase over time. Economic activity and the number of jobs created each year first picks up in 2019-20 following the completion of the hangar and aircraft assembly facility, and the subsequent lease of the premises for commercial activities. Economic and employment activity also increases in 2024-25 following the completion of the main airport and terminal, and the subsequent arrival of passenger planes. Construction activity associated with the aircraft development is also expected to contribute to economic growth in the region, particularly over the first decade.

Chart i: Annual change in real Gross Regional Product, 2017-18 to 2039-40 ($2016-17 – Deviation relative to business as usual)

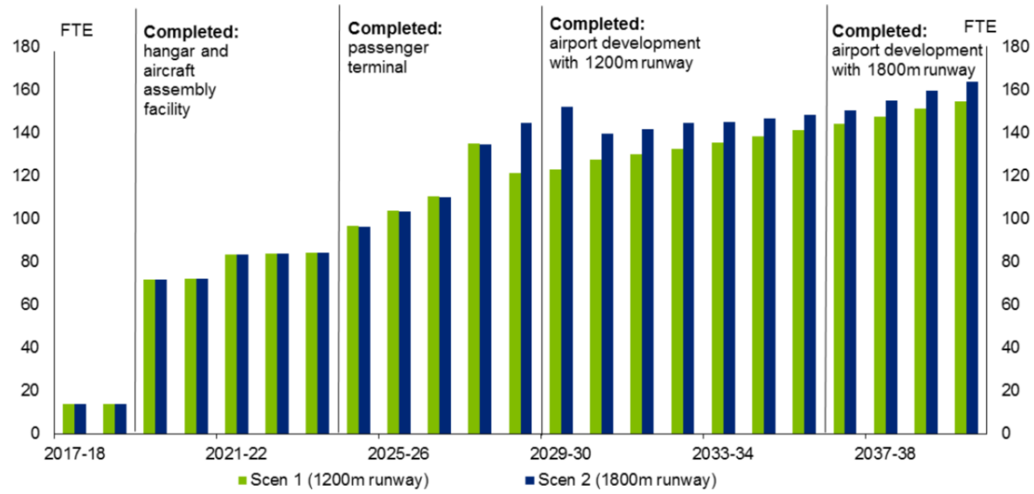


Source: Deloitte Access Economics - Regional General Equilibrium Model.

While additional economic activity begins to taper around 2030 for both scenarios, economic activity is expected to remain permanently higher over the longer term suggesting that the aviation hub will increase the number of economic opportunities available to people residing in the Central Coast.

The economic and employment impact of the proposed development is larger in the second scenario, particularly over the longer term. The reason for this is twofold, firstly the longer runway involves more capital expenditure, particularly during the construction phase of the runway extension in 2028-29 to 2022-23, which is expected to have flow on benefits to construction and related industries. Secondly, the longer runway is likely to make the Central Coast a more viable and popular destination for investment in transport infrastructure and services, which will in turn lift output and employment in the sector and the region more broadly (as detailed in Chart iii and Chart iv).

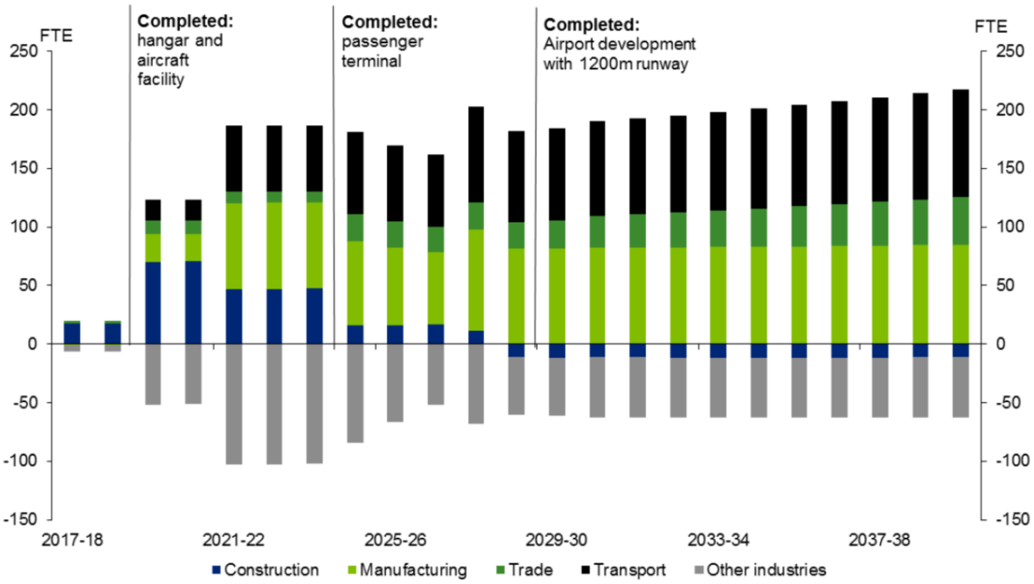
Chart ii: Annual change in employment, 2017-18 to 2039-40 ($2016-17 – Deviation relative to business as usual)



Source: Deloitte Access Economics - Regional General Equilibrium Model.

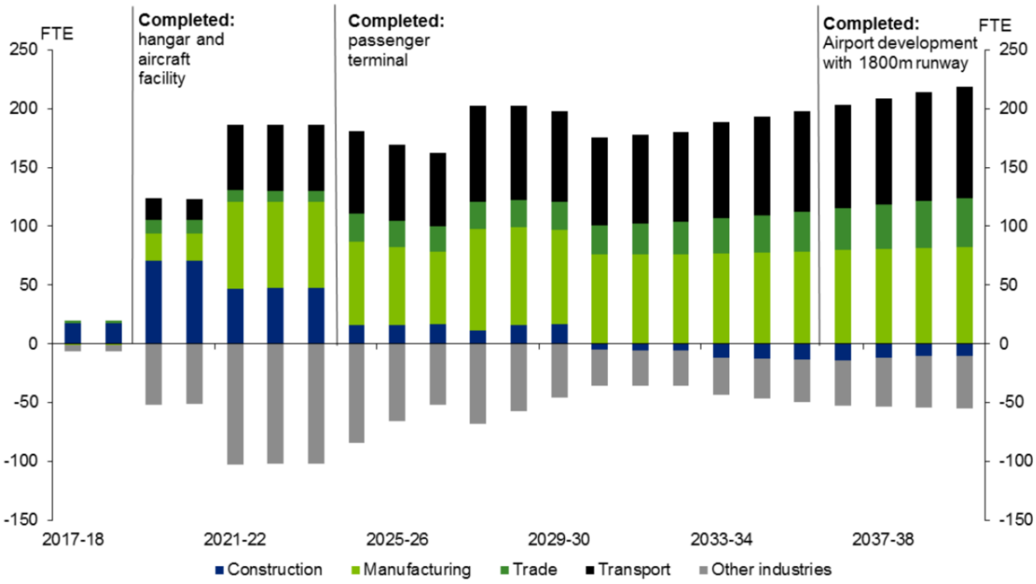
The aviation hub is expected to have flow on benefits to a range of industries within the Central Coast economy. As shown in Chart iii and Chart iv employment impacts of the aviation hub are expected to become more diversified over time. Initially, construction activity in the Central Coast increases, benefiting local construction workers and business owners. In 2025, once the hangar facilities and main passenger airport terminal become fully operational, increases in aircraft manufacturing and air transport activity is expected to benefit workers and business owners in these industries, as well as a number of tourism related industries including retail and wholesale trade.

Chart iii: Industry composition of the annual average change in employment in scenario one, 2017-18 to 2039-40



Source: Deloitte Access Economics - Regional General Equilibrium Model.
Note: Other industries includes agriculture, mining, manufacturing, electricity, communications, financial services, insurance, recreation and government services.

Chart iv: Industry composition of the annual average change in employment in scenario two, 2017-18 to 2039-40



Source: Deloitte Access Economics - Regional General Equilibrium Model.
Note: Other industries includes agriculture, mining, manufacturing, electricity, communications, financial services, insurance, recreation and government services.

7

1 Background

1.1 Purpose of this report

This report presents the findings of an economic impact analysis of a proposed aviation hub on the Central Coast; conducted by Deloitte Access Economics using our in-house computable general equilibrium (CGE) model. The study is based on information provided by Central Coast Council. All data sources, assumptions and other relevant information are documented in this report for completeness and transparency.

This report is structured as follows: section 1 provides background on the proposed aviation hub and tourism to the Central Coast; section 2 outlines the methodology including the modelling, input data and assumptions used; section 3 provides estimates of the economic impact of developing the Central Coast Aviation Hub; and section 4 outlines options for further analysis.

1.2 The Central Coast Aviation Hub

The Council is proposing to develop the Central Coast Aviation Hub as an industrial facility for manufacturing, aviation training, and other aviation activities. The primary focus of the development is to attract new industries to the region, and to facilitate economic growth and employment. The proposed aviation hub contains over 30 hectares of industrial hangar space, and the Council has already received numerous expressions of interest from aircraft manufacturing and repair firms, non-scheduled air transport firms such as sky diving, and other aviation businesses to establish their business at the site.

The development of the airport into a general aviation and industry hub will complement other planned developments in the Council's northern precinct, including the SMART Hub, technology business park, Warnervale Town Centre, a higher education and business park precinct, and Wyong Employment Zone industrial lands, all of which comprise the Wyong SMART City strategic development precinct.

The Council also plans to allow for regional commercial airline services and have budgeted for the construction of an airport terminal and additional runway. The convenience of an airport is likely to attract more tourists to the region, which will in turn benefit a range of businesses such as the accommodation and retail trade industries.

The aviation hub is also likely to change the spending profile of visitors to the Central Coast. Visitors the Central Coast typically spend less per night than the NSW average, particularly when compared to touristic areas of Sydney, the Blue Mountains and the Hunter region. This discrepancy can be explained in part by the large proportion of visitors that come to the Central Coast to visit family and friends, and thus spend less on accommodation and food, as they stay with a friend or relative. The aviation hub is expected to act as a local gateway for commercial passenger transport, and thus is likely to increase the number of visitors that come to the Central Coast for holidays.

1.3 The Central Coast Region

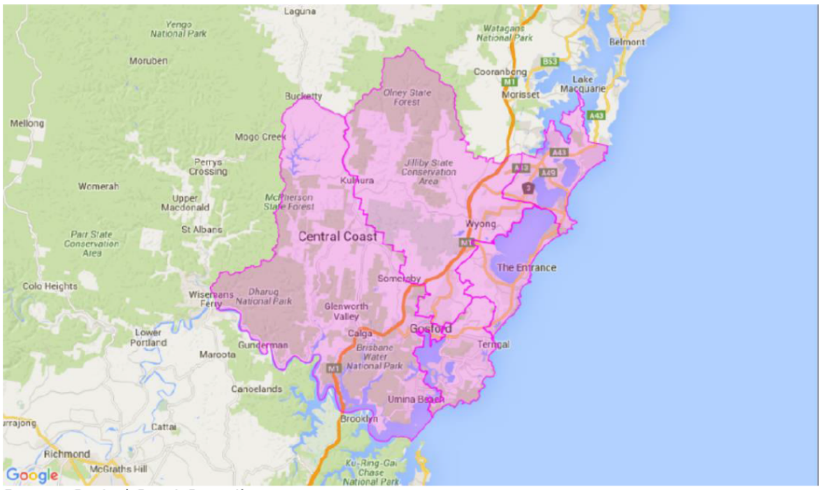
The Central Coast is situated on the East Coast of Australia, in between the Hornsby and Lake Macquarie regions (see Figure 1.1), and includes Gosford, Wyong, The Entrance and Budgewoi[6].

In 2016, the Central Coast had a population of 328,000 people and a median age of 42 years. Employment prospects for Central Coast residents are slightly worse than the rest of New South Wales.

[6] https://www.centralcoast.nsw.gov.au/

The Central Coast had a higher rate of unemployment at 6.7% (compared to 6.3% for NSW) and lower median weekly incomes at $1258 per household (compared to $1438 per household for NSW)[7].

Figure 1.1: The Central Coast region



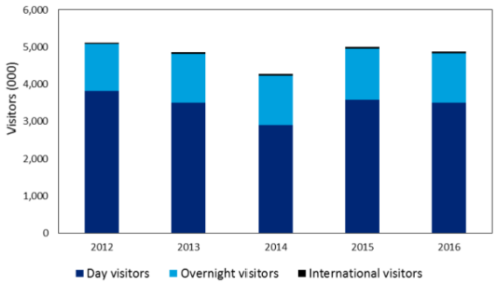
Source: Central Coast Council

1.4 Tourism to the Central Coast

Tourism Research Australia (TRA) survey data shows the number of people visiting the Central Coast has increased in recent years, from 4.3 million visitors in 2014 to 4.9 million visitors in 2016. As shown in Chart 1.1 the majority of tourists are domestic visitors coming to the region for a day, with domestic day trips comprising 72% of total visitors to the Central Coast.

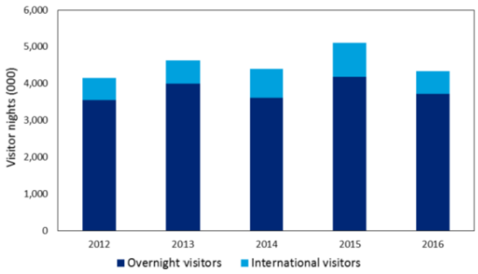
The number of international and domestic overnight visitors traveling to the Central Coast has increased in recent years. At the same time, however, the average length of time spent on the Central Coast fell in 2016 (see Chart 1.2) suggesting that more visitors are coming, but for shorter periods of time. This is in line with broader trends observed within the major domestic and outbound visitor sectors as tourists are seen to combat budget constraints through shorter trip durations, rather than postpone travel plans altogether[8].

Chart 1.1: Visitors to the Central Coast



Source: Tourism Research Australia Visitor Survey, 2016

Chart 1.2: Visitor nights spent on the Central Coast



Source: Tourism Research Australia Visitor Survey, 2016

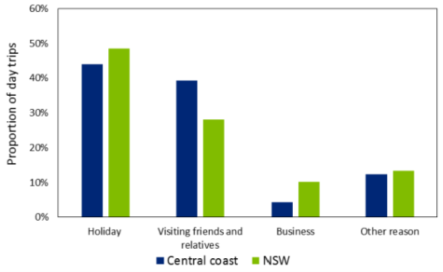
[7] http://www.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/LGA11650?opendocument

[8] Tourism Hotel and Market Outlook, Edition 2 2017, Deloitte Access Economics

Domestic day visitors

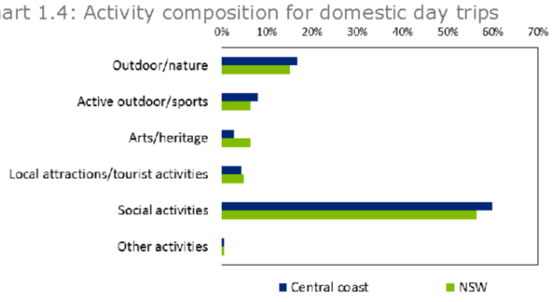
In 2016, the Central Coast recorded 3.5 million domestic day visitors. The majority of domestic day visitors came to the Central Coast to holiday and to visit friends and relatives. Around 60% of day trips involved social activities, such as dining at restaurants, visiting friends and relatives, and sightseeing.

Chart 1.3: Share of day trips by purpose of visit



Source: Tourism Research Australia Visitor Survey, 2016

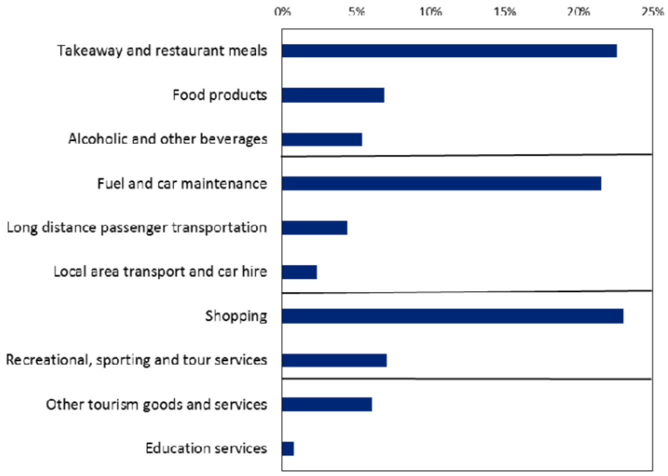
Chart 1.4: Activity composition for domestic day trips



Source: Tourism Research Australia Visitor Survey, 2016

The average domestic day visitor spent $83 per trip to the larger Central Coast region in 2015. According to Deloitte Access Economics' in-house tourism expenditure profiling model, takeaway and restaurant meals, fuel and car maintenance, and shopping were the three biggest expenditure items for day visitors to the Central Coast in 2016. Together, these items make up two thirds of total trip expenditure. This is perhaps unsurprising given that most day trips involve driving to the Central Coast for social activities.

Chart 1.5: The Composition of tourism expenditure for day trip visitors to the Central Coast

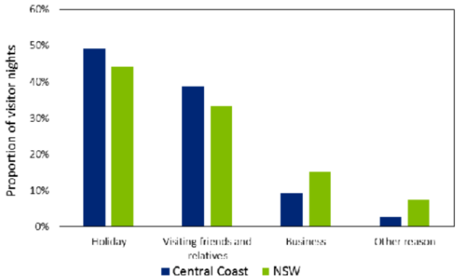


Source: Deloitte Access Economics - Tourism Expenditure Profiling Model

Domestic overnight Visitors

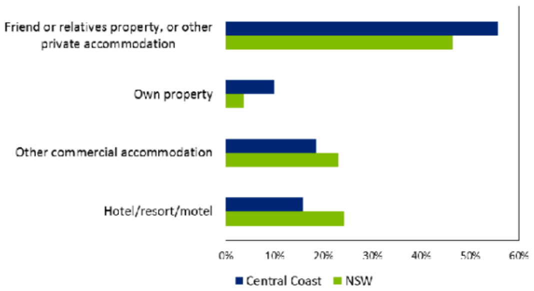
Domestic overnight visitors spent a total of 3.7 million nights on the Central Coast in 2016. Around 40% of overnight domestic visitor nights were spent visiting friends and relatives. Consequently, more than half of total domestic nights were spent in a friend or relative's property or other private accommodation.

Chart 1.6: Share of domestic visitor nights by purpose of visit



Source: Tourism Research Australia Visitor Survey, 2016

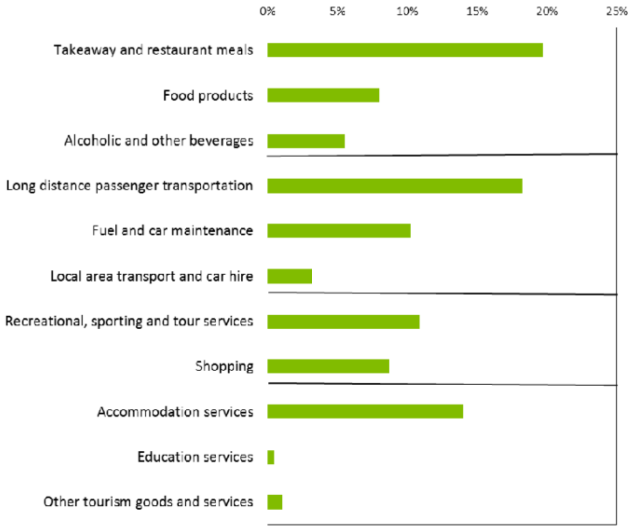
Chart 1.7: Share of domestic visitor nights by accommodation type



Source: Tourism Research Australia Visitor Survey, 2016

Overnight domestic visitors spent an average of $136 per night when travelling to the larger Central Coast region in 2016. Deloitte Access Economics' tourism expenditure profiling model suggests that the biggest expenditure categories for overnight domestic visitors are takeaway and restaurant meals, and long distance passenger transportation. Accommodation services comprises a relatively small share of domestic overnight tourism expenditure because a large proportion of domestic overnight visitors stay on a friend or relative's property.

Chart 1.8: The Composition of tourism expenditure for domestic overnight visitors to the Central Coast



Source: Deloitte Access Economics - Tourism Expenditure Profiling Model.

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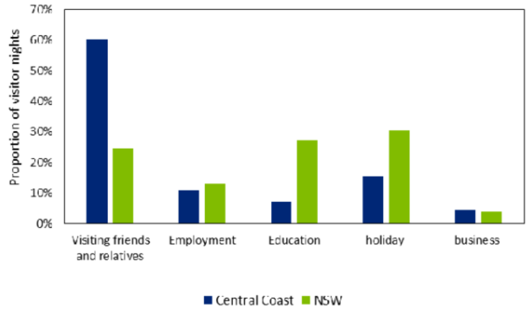
International visitors

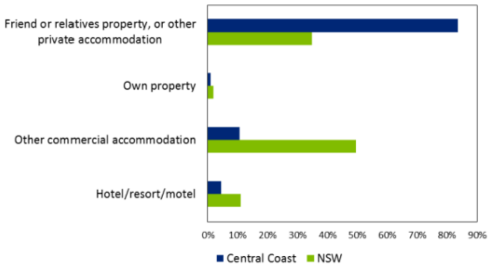
Of the 620,000 nights international visitors spent on the Central Coast, around 60% were spent visiting friends. As a result, the majority of international visitor nights were spent at a friend or relative's property or other private accommodation.

Chart 1.9: Share of international nights by purpose of visit



Source: Tourism Research Australia Visitor Survey, 2016

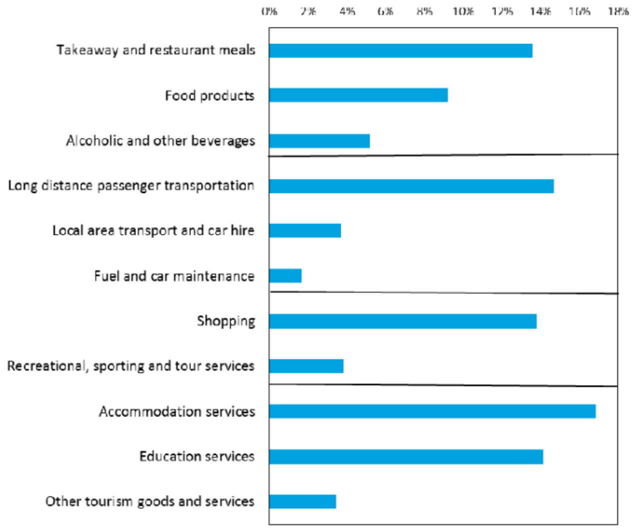
Chart 1.10: Share of international visitor nights by accommodation type



Source: Tourism Research Australia Visitor Survey, 2016

International visitors to the larger Central Coast region spent an average of $56 per night in 2016. The Deloitte Access Economics' in-house tourism expenditure profiling model suggests that accommodation services, long distance transportation, and education services are the biggest expenditure items for international visitors.

Chart 1.12: Composition of tourism expenditure for visitors to the Central Coast



Source: Deloitte Access Economics - Tourism Expenditure Profiling Model.

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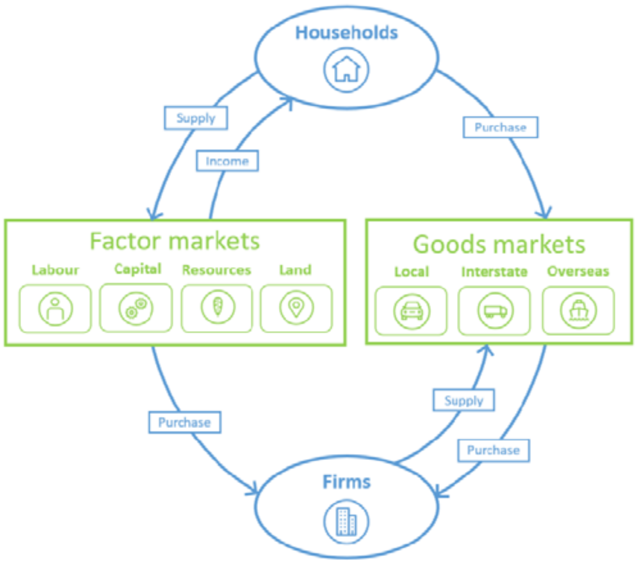
2 Methodology

2.1 Computable general equilibrium modelling

The project utilises the Deloitte Access Economics' – Regional General Equilibrium Model (DAE-RGEM). DAE-RGEM is a large scale, dynamic, multi-region, multi-commodity CGE model of the world economy with bottom-up modelling of Australian regions. DAE-RGEM encompasses all economic activity in an economy – including production, consumption, employment, taxes and trade – and the inter-linkages between them. For this project, the model has been customised to explicitly identify the Central Coast economy where the event will take place, including some of its unique economic characteristics.

Figure 2.1 is a stylised diagram showing the circular flow of income and spending that occurs in DAE-RGEM. To meet demand for products, firms purchase inputs from other producers and hire factors of production (labour and capital). Producers pay wages and rent (factor income) which accrue to households. Households spend their income on goods and services, pay taxes and put some away for savings. The government uses tax revenue to purchase goods and services, while savings are used by investors to buy capital goods to facilitate future consumption. As DAE-RGEM is an open economy model, it also includes trade flows with other regions, interstate and foreign countries.

Figure 2.1: The components of DAE-RGEM and their relationships



Source: Deloitte Access Economics

The model compares a baseline scenario where the proposed aviation hub *does not* occur with a counterfactual scenario where the development *does occur*. A set of inputs that stylise these alternative scenarios, so that the economic impact of the event can be projected have been developed. More detail on the modelling framework used is provided in Appendix A.

2.2 Inputs to the modelling

This study is based on information provided by Central Coast Council, which was in turn sourced from a range of qualified independent consultants. Key inputs are highlighted in Table 2.1 below and include capital expenditure, operational expenditure and induced tourism impacts. Table 2.3 provides a more detailed temporal input summary.

Table 2.1: Summary of main input data

Metric	Scenario one, 1200m runway	Scenario two, 1800m runway
- Main construction costs	$274 million	$396 million
- Lessee construction costs	$242 million	$242 million
Total capital expenditure (CAPEX)	**$516 million**	**$638 million**
- Passenger and landing fees	$97 million	$113 million
- Total expenses for aircraft manufacturing and repair firms that lease airside land	$1500 million	$1500 million
- Total expenses for non-scheduled air transport firms that lease airside land	$663 million	$663 million
- Rental fees for hangars designated for private use	$4 million	$4 million
Total Operational expenditure (OPEX)	**$2264 million**	**$2280 million**
- Tourist expenditure on wholesale and retail trade	$127 million	$133 million
- Tourist expenditure on transport including air transport	$97 million	$102 million
- Tourist expenditure on recreational services	$18 million	$18 million
Induced tourism expenditure	**$242 million**	**$253 million**

Estimates of the capital expenditure required to build the aviation hub were provided by Council. The main construction costs for the hangar and aircraft assembly facility, terminal, runway and broader aviation hub were estimated at $274 million for the 1200m runway, and $396 million for the 1800m runway. Additional lessee construction costs associated with onsite operations such as car parking and landscaping were estimated at $242 million. The construction is assumed to commence in 2017-18, and to be completed in 2029-30 for scenario one and 2036-37 for scenario two.

Operational expenditure estimates of the revenue generated by the main aviation hub were based on projections of passenger and landing fees, and provided by the Council. Landing and passenger fees were provided by the Council, and estimated to be $97 million if a 1200m runway is built and $113 million if an 1800m runway is built. The aviation hub is assumed to start receiving landing fees in 2018-19 and passenger fees in 2024-25.

Due to a lack of data on the operational expenditures of firms that plan to lease airside land, expenditure estimates for these firms were based on hangar rents, and scaled up to reflect total expenses[9]. Hangar rental fees were based on the amount of hangar space and airside land available at the new site, and estimated by assuming that each square metre of constructed hangar space and airside land was rented as soon as it becomes available[10]. Rental fees were further disaggregated into one of three industry types (aircraft manufacturing, or air transport for commercial use or private use) using the industry split of submissions received by the Council to lease airside land or purpose built facilities at Central Coast Aviation Hub.

[9] Expenses were assumed to approximate revenues.
[10] As the Council was negotiating lease contracts for these sites at the time of writing, it has yet to release any publically available information on rental rates per square metre. The closest airport with publically available information is Bankstown airport http://www.bankstownairport.com.au/assets/documents/20170504%20-%20BAL%20Site%20638%20-%20CHC%20Helicopters%20-%20Fact%20Sheet%20-%20Negotiable.pdf

As rents only account for an estimated 2% of non-scheduled air transport expenses[11] and 4% of aircraft manufacturing and repair expenses[12], rental expenses were scaled up to obtain an estimate of total expenses for businesses in these industries. Rental expenses for individuals that plan to lease the facilities for private use were not scaled. Operational expenses were estimated to be $1.5 billion for aircraft manufacturing firms, $663 million for non-scheduled air transport firms and $4 million for private lessees. The aviation hub is assumed to gradually start renting its facilities in 2019-20.

Induced tourism expenditure estimates of the additional tourism (and associated spending) that will result from the aviation hub conducted by the Centre for Asia Pacific Aviation (CAPA). Estimates of annual passenger movements at the Central Coast Aviation Hub from 2024-25 when the aviation hub becomes operational until 2039-40 are summarised in Table 2.2.

Passenger estimates are segregated into the following market segments:

- Local residents; or people who live in the Central Coast and surrounding New South Wales region. It is assumed that people in this segment would have travelled to the Central Coast with or without the aviation hub, and thus don't contribute to tourism.
- Domestic and international tourists; or people that reside outside of New South Wales and outside of Australia respectively. For the purposes of this analysis, all domestic and international passengers are assumed to contribute to induced tourism. That is, all of the interstate and international visitors that travel to the Central Coast by plane are assumed to be tourists that would not have otherwise visited the region if the aviation hub had not been there.

Table 2.2: Estimates of passengers traveling to the Central Coast by aeroplane – 2024-25 to 2039-40

	Local residents		**Domestic tourists**		**International tourists**	
	Scenario one	**Scenario two**	**Scenario one**	**Scenario two**	**Scenario one**	**Scenario two**
Average passenger movements per annum	229,000	238,000	57,000	59,000	4,000	4,000
Average persons per annum	114,000	119,000	28,000	30,000	2,000	2,000

Source: Centre for Asia Pacific Aviation. Average persons are calculated by assuming that each passenger uses air transport to arrive and depart the Central Coast, and hence involves dividing passenger movements by two.

Tourist spending data from TRA was then used to estimate projected tourist expenditure. In 2015, international tourists to the Central Coast had an average spend of $56 per night and stayed for 21 nights, and domestic tourists to the Central Coast had an average spend of $136 per night and stayed for three nights. Average spend per visitor to the Central Coast is lower than the NSW average because the destination is currently weighted towards people visiting friends and relatives.

As the aviation hub is expected to act as a gateway, and boost the region's popularity as a tourism destination, tourism expenditure in the Central Coast region was assumed to begin at current average expenditure levels and increase to the NSW average of $64 per night for international tourists and $151 for domestic tourists over a five year period following the passenger terminal's completion. Tourism expenditure estimates were further disaggregated into spending on trade, transport and recreational goods and services using Deloitte Access Economics' in-house tourism expenditure profiling model.

[11] IBISWorld Industry Report (June 2017) Non-Scheduled Air Transport in Australia
[12] IBISWorld Industry Report (January 2017) Aircraft Manufacturing and Repair Services in Australia

Induced tourism expenditure was estimated at $242 million for scenario one, consisting of $127 million in trade expenditure, $98 million in transport expenditure, and $18 million in recreation expenditure. Scenario two induced tourism expenditure was estimated at $253 million, consisting of $133 million in trade expenditure, $102 million in transport expenditure, and $18 million in recreation expenditure. The aviation hub is assumed to start receiving passenger planes in 2024-25.

Table 2.3: Main input data including capital expenditure, operational expenditure and tourism expenditure

FY ending	**Capital expenditure ($m)**		**Operational expenditure ($m)**		**Tourism expenditure ($m)**	
	Scenario one	**Scenario two**	**Scenario one**	**Scenario two**	**Scenario one**	**Scenario two**
2018	18.1	18.1	-	-	-	-
2019	18.1	18.1	0.1	0.1	-	-
Completed: Hangar and aircraft assembly facility						
2020	73.8	73.8	29.0	29.0	-	-
2021	73.8	73.8	29.0	29.0	-	-
2022	56.8	56.8	79.0	79.0	-	-
2023	56.8	56.8	79.2	79.2	-	-
2024	56.8	56.8	79.2	79.2	-	-
Completed: Hangar and aircraft assembly facility						
2025	36.2	35.8	94.3	94.3	9.3	9.3
2026	36.2	35.8	94.5	94.5	9.8	9.8
2027	36.2	35.8	94.7	94.7	10.3	10.3
2028	36.2	35.8	128.3	128.3	10.8	10.8
2029	8.7	39.7	128.7	128.7	11.5	11.5
2030	8.7	39.7	128.9	128.9	12.1	12.1
Completed: Aviation hub – 1200m scenario						
2031	-	12.6	129.0	129.0	14.2	14.2
2032	-	12.6	129.2	129.2	14.9	14.9
2033	-	12.6	129.4	129.4	15.6	15.6
2034	-	5.9	129.6	131.7	16.4	17.7
2035	-	5.9	129.8	132.0	17.2	18.6
2036	-	5.9	130.0	132.2	18.1	19.5
2037	-	5.9	130.2	132.5	19.0	20.5
Completed: Aviation hub – 1800m scenario						
2038	-	-	130.4	132.8	20.0	21.5
2039	-	-	130.6	133.1	21.0	22.6
2040	-	-	130.8	133.3	22.0	23.7
Total	**516.2**	**638.2**	**157.1**	**173.4**	**242.2**	**252.7**

3 Results

This study estimates the economic impact of building and operating an aviation hub in the Central Coast, using the Deloitte Access Economics regional general equilibrium model (DAE-RGEM). Two scenarios are considered, an aviation hub with a 1200 metre runway (scenario one) and an aviation hub with a longer 1800 metre runway (scenario two), and both scenarios are modelled relative to a counterfactual in which the aviation hub does not occur. The modelling is focused on the Central Coast region, which includes Gosford, Wyong, The Entrance and Budgewoi.

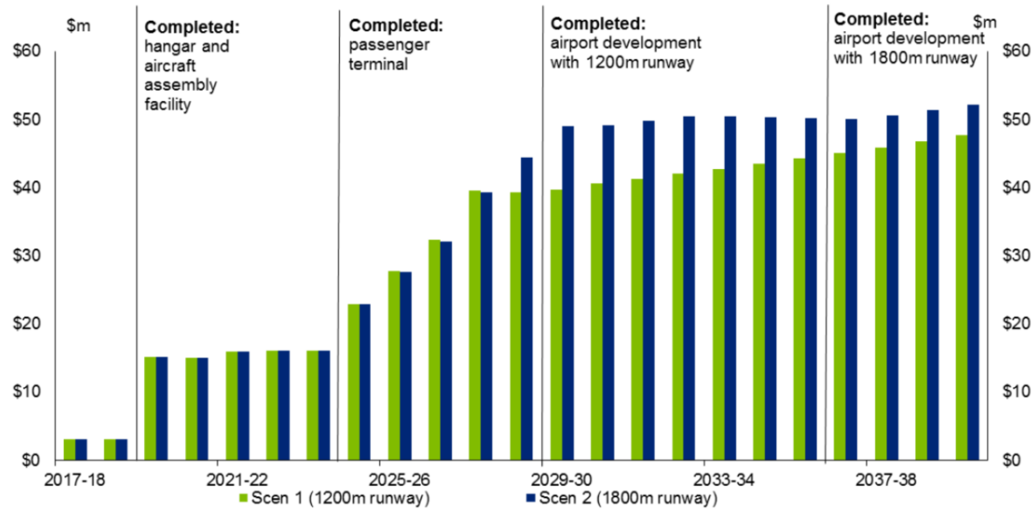
3.1 Impact on Gross Regional Product

The Central Coast aviation hub is estimated to increase the region's real Gross Regional Product (GRP), and by extension lift living standards for the people residing in the Central Coast.

- The 1200m runway aviation hub is projected to increase the size of the region's economy by $286 million net present value terms ($2016-17 and 7% discount rate) over the period from 2017-18 to 2039-40; and
- The 1800m runway aviation hub is projected to increase the size of the region's economy by $312 million in net present value terms ($2016-17 and 7% discount rate) over the period from 2017-18 to 2039-40.

As shown in Chart 3.1 below, the economic impact of the proposed development is expected to increase over time. Economic activity first picks up in 2019-20 following the completion of the hangar and aircraft assembly facility, and the subsequent lease of the premises for commercial activities. Economic activity also increases in 2024-25 following the completion of the main aviation hub and terminal, and the subsequent arrival of passenger planes.

Chart 3.1: Annual change in real Gross Regional Product, 2017-18 to 2039-40 ($2016-17) – Deviation relative to forecast baseline



Source: Deloitte Access Economics - Regional General Equilibrium Model.

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While the modelled economic impact tapers off around 2030 for both scenarios, economic activity is expected to remain permanently higher over the longer term suggesting that the aviation hub will increase economic opportunities of people residing in the Central Coast.

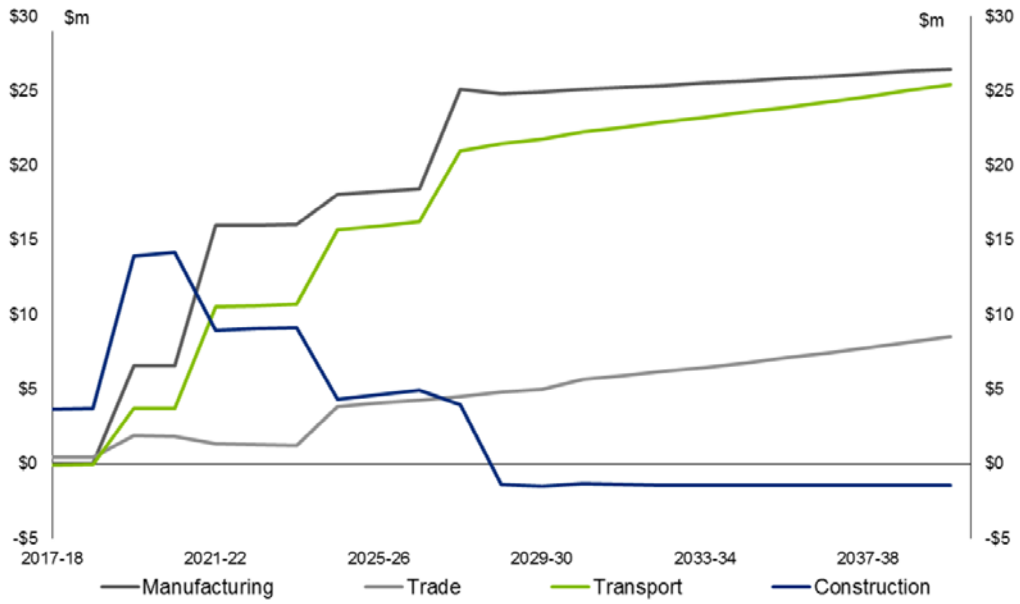
The economic and employment impact of the proposed development is much larger in the second scenario, particularly over the longer term. The reason for this is twofold, firstly the longer runway involves more capital expenditure, particularly during the runway extension phase in 2028-29 to 2022-23, which is expected to have flow on benefits to the construction and related industries. Secondly, the longer runway is likely to make the Central Coast a more viable and popular destination for transport investment, which will in turn lift output and employment in the transport sector and the region more broadly.

3.2 Impact on industry value added

The aviation hub is projected to have a flow on positive impact to a number of industries within the Central Coast economy. Value added, a broad measure of financial performance, increases across a range of industries in both scenarios.

Chart 3.2 and Chart 3.3 show that construction value added is projected to increase substantially during the first decade while the aviation hub is being built, benefiting workers and business owners in the industry. Aircraft manufacturing and air transport value added are projected to dramatically increase following the construction of the hangar facilities in 2019-20, providing jobs and boosting incomes for Central Coast residents. Once the main terminal becomes operational in 2024-25, the value added of tourism related industries is projected to increase, benefiting workers and business owners in retail and wholesale trade industries.

Chart 3.2: Change in value added by industry for selected industries, 2017-18 to 2039-40 ($2016-17), scenario one



Source: Deloitte Access Economics - Regional General Equilibrium Model.

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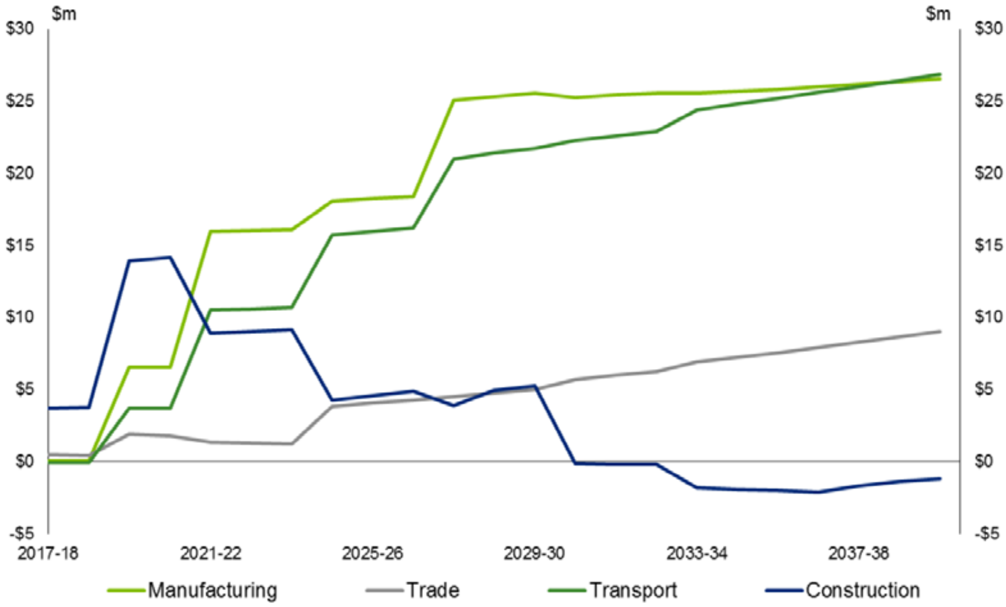
Chart 3.3: Change in value added by industry for selected industries, 2017-18 to 2039-40 ($2016-17), scenario two



Source: Deloitte Access Economics - Regional General Equilibrium Model.

3.3 Impact on Central Coast employment

The Central Coast aviation hub is estimated to increase the region's average annual employment, and increase the range of employment possibilities for the people residing in the Central Coast. It is also worth noting that employment is reported in terms of FTE which is not the same as 'jobs' in that one FTE generally accounts for around 1.5 jobs.

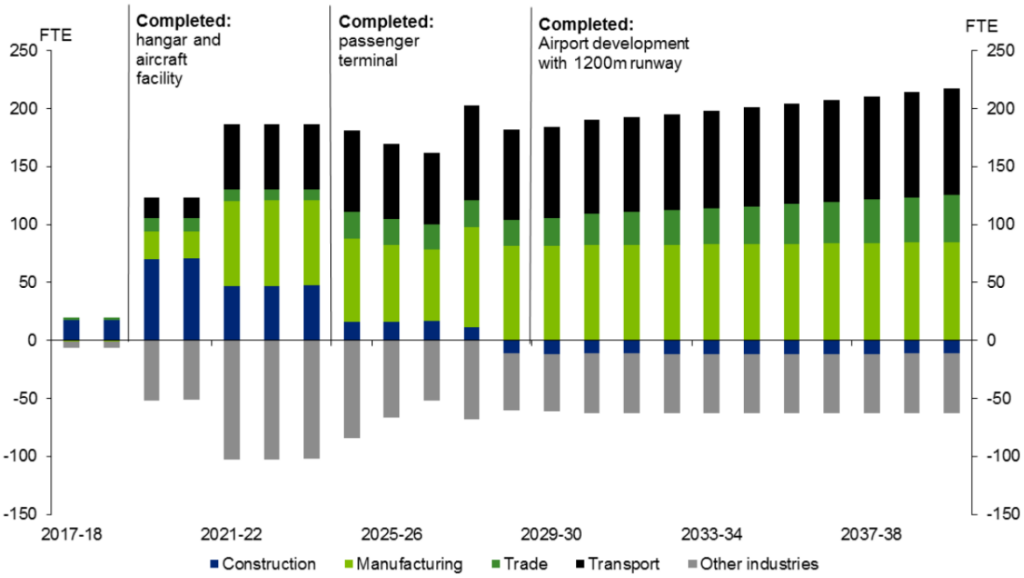
- The 1200m runway aviation hub has the potential to increase employment by around 109 full-time-equivalent (FTE) jobs, in average annual terms over the period from 2017-18 to 2039-40; and
- The 1800m runway aviation hub has the potential to increase employment by around 116 full-time-equivalent (FTE) jobs, in annual average terms over the period from 2017-18 to 2039-40.

The employment impacts of the main aviation hub's operations are however broadly consistent with recent research from the Bureau of Infrastructure, Transport and Regional Economics[13], which suggests that low density aviation hubs generate 350-750 jobs per million passengers per annum. As the Central Coast aviation Hub is expected to receive around 300,000 passengers per annum[14], this would suggest that the Central Coast Aviation Hub should generate around 105-225 jobs.

As shown in Chart 3.5 and Chart 3.6 below, employment impacts of the aviation hub are expected to become more diversified over time. Initially, construction activity in the Central Coast increases, benefiting local construction workers and business owners. In 2025, once the hangar facilities and main passenger airport terminal become fully operational, increases in aircraft manufacturing and air transport activity is expected to benefit workers and business owners in these industries, as well as a number of tourism related industries including retail and wholesale trade.

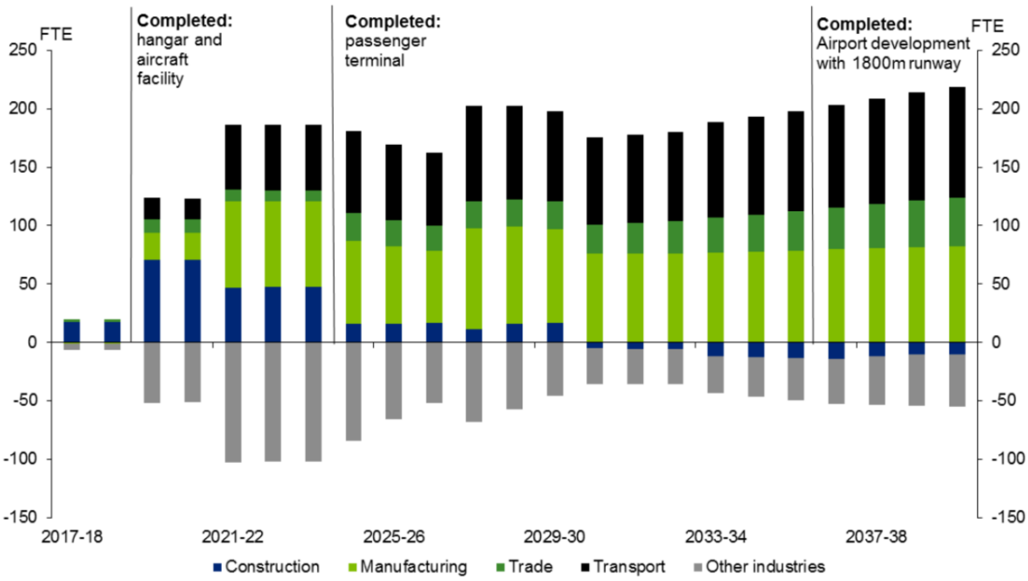
[13] https://bitre.gov.au/publications/2013/files/is_046.pdf
[14] Centre for Asia Pacific Aviation

Chart 3.4: Industry composition of the average annual change in employment in scenario one , 2017-18 to 2039-40 ($2016-17)



Source: Deloitte Access Economics - Regional General Equilibrium Model.
Note: Other Industries includes agriculture, mining, manufacturing, electricity, communications, financial services, insurance, recreation and government services.

Chart 3.5: Industry composition of the average annual change in employment in scenario two , 2017-18 to 2039-40 ($2016-17)



Source: Deloitte Access Economics - Regional General Equilibrium Model.
Note: Other Industries includes agriculture, mining, manufacturing, electricity, communications, financial services, insurance, recreation and government services.

3.4 Impact on Central Coast consumption

The Central Coast aviation hub is estimated to increase the welfare of people residing in the Central Coast region. Consumption is used to measure welfare, as it is considered the best approximation of consumer welfare in our CGE model.

- The 1200m runway aviation hub has the potential to increase the region's real consumption by almost $231 million in net present value terms ($2016-17 and 7% discount rate) over the period from 2017-18 to 2039-40.
- The 1800m runway aviation hub has the potential to increase the region's real consumption by almost $243 million in net present value terms ($2016-17 and 7% discount rate) over the period from 2017-18 to 2039-40.

3.5 Impact on Gross State Product

The aviation hub is also projected to have flow on benefits for the rest of the state, as Central Coast businesses import a large amount of goods from the surrounding regions.

- The 1200m runway aviation hub is projected to increase the size of the New South Wales economy by $364 million in net present value terms ($2016-17 and 7% discount rate) over the period from 2017-18 to 2039-40.
- The 1800m runway aviation hub is projected to increase the size of the New South Wales economy by $391 million in net present value terms ($2016-17 and 7% discount rate) over the period from 2017-18 to 2039-40.

4 Potential for further analysis

The preceding analysis was based on the best available data as at the 25th October 2017, much of which was sourced by the Council from qualified independent consultants and stakeholders, such as CAPA, a Quantity Surveyor, Expressions of Interests and further negotiations for onsite leasing of precinct hangers and commercial sites. The independent nature of the data, assumption and modelling advice sought by the Council provides the sound information base required to undertake broader stakeholder consultations and to make strategic operational decisions.

That said, the information and decision base would continue to benefit from further value-adding analysis and modelling exercises, these include:

- A **follow-up economic impact study** once all quantity estimates are finalised: Essentially, this would act as a 'Phase 2' to the analysis in this report, by rerunning the model with more certain and comprehensive data inputs. This would capture such things as a more detailed profile of on-site business operations, the full range of operating costs for onsite businesses, and the final capital estimates as advised by the Quantity Surveyor.
- A comprehensive **cost benefit analysis** to determine the overall economic benefit of the development to the different stakeholder groups (e.g. local residents, Local and State Governments, private enterprises and businesses). This type of analysis could capture a broader range of welfare and non-market impacts such as social or environmental considerations.
- **Firm level consultations and analysis:** A key question - that was out of scope for this analysis – is what the proposed aviation hub would do to attract specific business operations into the local economy, bringing additional investment and skilled employment into the region. While the CGE model is useful for measuring industry level impacts (and provides a sound basis for commencing negotiations with State Government), to understand the likely impact at a more granular, firm level basis, a series of consultations would need to be undertaken to gauge business demand and capacity to move (before and after the aviation hub). Such an analysis would be of particular interest to community, business and regional development stakeholders.
- **Analysis of the potential 'catalytic' impact of the aviation hub**: incorporating case studies and consultations to illustrate the potential for the aviation hub to drive significant regional infrastructure and service developments. Such developments might include a co-located retail and commercial hub against the aviation hub site, a potential education or cultural precinct development, or detailed scoping of the impact of the changing tourism demand on key tourism sectors such as accommodation, recreation and retail, and the capacity of these sectors to service the additional demand.
- **Induced drive tourism case study analysis**: The emerging lessee profile of onsite businesses is revealing a significant contingent of tourism related operations, including air shows, sky diving, joy flights and flight schools. It is anticipated that these businesses would further boost regional tourism through drive visitation. An understanding of the likely regional impact of induced drive tourism could be developed through a series of case studies or consultations with identified tourism business operators.

Deloitte Access Economics would be happy to discuss the scope and content of any or all of these suggested options for further analysis.

Appendix A: Economic Modelling Framework

The Deloitte Access Economics Regional General Equilibrium Model (DAE-RGEM) is a large scale, dynamic, multi-region, multi-commodity computable general equilibrium model of the world economy with bottom-up modelling of Australian regions. The model allows policy analysis in a single, robust, integrated economic framework. This model projects changes in macroeconomic aggregates such as GDP, employment, export volumes, investment and private consumption. At the sectoral level, detailed results such as output, exports, imports and employment are also produced.

The model is based upon a set of key underlying relationships between the various components of the model, each which represent a different group of agents in the economy. These relationships are solved simultaneously, and so there is no logical start or end point for describing how the model actually works. However, they can be viewed as a system of interconnected markets with appropriate specifications of demand, supply and the market clearing conditions that determine the equilibrium prices and quantity produced, consumed and traded.

DAE-RGEM is based on a substantial body of accepted microeconomic theory. Key assumptions underpinning the model are:

- The model contains a 'regional consumer' that receives all income from factor payments (labour, capital, land and natural resources), taxes and net foreign income from borrowing (lending).
- Income is allocated across household consumption, government consumption and savings so as to maximise a Cobb-Douglas (C-D) utility function.
- Household consumption for composite goods is determined by minimising expenditure via a CDE (Constant Differences of Elasticities) expenditure function. For most regions, households can source consumption goods only from domestic and imported sources. In the Australian regions, households can also source goods from interstate. In all cases, the choice of commodities by source is determined by a CRESH (Constant Ratios of Elasticities Substitution, Homothetic) utility function.
- Government consumption for composite goods, and goods from different sources (domestic, imported and interstate), is determined by maximising utility via a C-D utility function.
- All savings generated in each region are used to purchase bonds whose price movements reflect movements in the price of creating capital.
- Producers supply goods by combining aggregate intermediate inputs and primary factors in fixed proportions (the Leontief assumption). Composite intermediate inputs are also combined in fixed proportions, whereas individual primary factors are combined using a CES production function.
- Producers are cost minimisers, and in doing so, choose between domestic, imported and interstate intermediate inputs via a CRESH production function.
- The supply of labour is positively influenced by movements in the real wage rate governed by an elasticity of supply.
- Investment takes place in a global market and allows for different regions to have different rates of return that reflect different risk profiles and policy impediments to investment. A global investor ranks countries as investment destinations based on two factors: global investment and rates of return in a given region compared with global rates of return. Once the aggregate investment has been determined for Australia, aggregate investment in each Australian sub-

region is determined by an Australian investor based on: Australian investment and rates of return in a given sub-region compared with the national rate of return.

- Once aggregate investment is determined in each region, the regional investor constructs capital goods by combining composite investment goods in fixed proportions, and minimises costs by choosing between domestic, imported and interstate sources for these goods via a CRESH production function.
- Prices are determined via market-clearing conditions that require sectoral output (supply) to equal the amount sold (demand) to final users (households and government), intermediate users (firms and investors), foreigners (international exports), and other Australian regions (interstate exports).
- For internationally-traded goods (imports and exports), the Armington assumption is applied whereby the same goods produced in different countries are treated as imperfect substitutes. But, in relative terms, imported goods from different regions are treated as closer substitutes than domestically-produced goods and imported composites. Goods traded interstate within the Australian regions are assumed to be closer substitutes again.
- The model accounts for greenhouse gas emissions from fossil fuel combustion. Taxes can be applied to emissions, which are converted to good-specific sales taxes that impact on demand. Emission quotas can be set by region and these can be traded, at a value equal to the carbon tax avoided, where a region's emissions fall below or exceed their quota.

Below is a description of each component of the model and key linkages between components.

A.1. Households

Each region in the model has a so-called representative household that receives and spends all income. The representative household allocates income across three different expenditure areas: private household consumption; government consumption; and savings.

The representative household interacts with producers in two ways. First, in allocating expenditure across household and government consumption, this sustains demand for production. Second, the representative household owns and receives all income from factor payments (labour, capital, land and natural resources) as well as net taxes. Factors of production are used by producers as inputs into production along with intermediate inputs. The level of production, as well as supply of factors, determines the amount of income generated in each region.

The representative household's relationship with investors is through the supply of investable funds – savings. The relationship between the representative household and the international sector is twofold. First, importers compete with domestic producers in consumption markets. Second, other regions in the model can lend (borrow) money from each other.

- The representative household allocates income across three different expenditure areas – private household consumption; government consumption; and savings – to maximise a Cobb-Douglas utility function.
- Private household consumption on composite goods is determined by minimising a CDE (Constant Differences of Elasticities) expenditure function. Private household consumption on composite goods from different sources is determined is determined by a CRESH (Constant Ratios of Elasticities Substitution, Homothetic) utility function.
- Government consumption on composite goods, and composite goods from different sources, is determined by maximising a Cobb-Douglas utility function.
- All savings generated in each region is used to purchase bonds whose price movements reflect movements in the price of generating capital.

A.2. Producers

Apart from selling goods and services to households and government, producers sell products to each other (intermediate usage) and to investors. Intermediate usage is where one producer supplies inputs to another's production. For example, coal producers supply inputs to the electricity sector.

Capital is an input into production. Investors react to the conditions facing producers in a region to determine the amount of investment. Generally, increases in production are accompanied by increased investment. In addition, the production of machinery, construction of buildings and the like that forms the basis of a region's capital stock, is undertaken by producers. In other words, investment demand adds to household and government expenditure from the representative household, to determine the demand for goods and services in a region.

Producers interact with international markets in two main ways. First, they compete with producers in overseas regions for export markets, as well as in their own region. Second, they use inputs from overseas in their production.

- Sectoral output equals the amount demanded by consumers (households and government) and intermediate users (firms and investors) as well as exports.
- Intermediate inputs are assumed to be combined in fixed proportions at the composite level. As mentioned above, the exception to this is the electricity sector that is able to substitute different technologies (brown coal, black coal, oil, gas, hydropower and other renewables) using the 'technology bundle' approach developed by ABARE (1996).
- To minimise costs, producers substitute between domestic and imported intermediate inputs is governed by the Armington assumption as well as between primary factors of production (through a CES aggregator). Substitution between skilled and unskilled labour is also allowed (again via a CES function).
- The supply of labour is positively influenced by movements in the wage rate governed by an elasticity of supply is (assumed to be 0.2). This implies that changes influencing the demand for labour, positively or negatively, will impact both the level of employment and the wage rate. This is a typical labour market specification for a dynamic model such as DAE-RGEM. There are other labour market 'settings' that can be used. First, the labour market could take on long-run characteristics with aggregate employment being fixed and any changes to labour demand changes being absorbed through movements in the wage rate. Second, the labour market could take on short-run characteristics with fixed wages and flexible employment levels.

A.3. Investors

Investment takes place in a global market and allows for different regions to have different rates of return that reflect different risk profiles and policy impediments to investment. The global investor ranks countries as investment destination based on two factors: current economic growth and rates of return in a given region compared with global rates of return.

- Once aggregate investment is determined in each region, the regional investor constructs capital goods by combining composite investment goods in fixed proportions, and minimises costs by choosing between domestic, imported and interstate sources for these goods via a CRESH production function.

A.4. International

Each of the components outlined above operate, simultaneously, in each region of the model. That is, for any simulation the model forecasts changes to trade and investment flows within, and between, regions subject to optimising behaviour by producers, consumers and investors. Of course, this implies some global conditions that must be met, such as global exports and global imports, are the same and that global debt repayment equals global debt receipts each year.

Limitation of our work

General use restriction

This report is prepared solely for the internal use of Central Coast Council. This report is not intended to and should not be used or relied upon by anyone else and we accept no duty of care to any other person or entity. The report has been prepared for the purpose of assessing the economic impact on the Central Coast economy of the proposed Central Coast aviation hub. You should not refer to or use our name or the advice for any other purpose.

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