SHELLHARBOUR AIRPORT

MASTER PLAN

Shellharbour City Council

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L+R
AIRPORT CONSULTING

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1. Introduction

L+R Airport Consulting was engaged by Shellharbour City Council to prepare the Shellharbour Airport Master Plan 2023. This Master Plan is an update of the previous Illawarra Regional Airport Master Plan 2013 (2013 Master Plan), taking into account developments which have occurred as well as changes to the aviation standards that have taken place since the release of the 2013 Master Plan. Where applicable, content from the 2013 Master Plan which remains relevant has been incorporated into this document.

1.1 Regional Setting

Shellharbour Airport is located in the Shellharbour suburb of Albion Park Rail which forms part of the Illawarra region. The major city of Wollongong is located about 18 km to the north. The airport's catchment is bordered by Helensburgh to the north, Ulladulla to the south and Moss Vale to the west. A catchment study market assessment (*Shellharbour Airport – Market Assessment – June 2023* prepared by Three Consulting) estimates the resident population of the catchment to be around 483,000 people, as such Australia's ninth largest population centre.

The airport is the only significant aviation facility in the immediate area. Sydney (Kingsford Smith) Airport, the Nancy Bird-Walton Western Sydney International Airport (WSIA) due to open in 2026, and the major general aviation (GA) airports of Bankstown and Camden are located to the north. HMAS Albatross Naval Air Station at Nowra is located to the south.

1.2 Economic Significance

The NSW Government has identified Shellharbour Airport as having economic significance and potential, with the *Shellharbour Regional Economic Development Strategy – 2023 Update* (REDS)[1] noting the delivery of the $20 million Shellharbour Airport Upgrade project as improving physical connectivity to the region.

The REDS also identifies opportunities for investment in complementary industrial or commercial uses at Shellharbour Airport as a key enabler of the strategy to improve services and infrastructure to support the population and business growth and enhance the overall amenity of the region.

The *Illawarra Regional Airport Strategic and Business Plan*[2] sets out a plan to develop the Illawarra Regional Airport into a vibrant business hub that contributes to regional economic development, tourism and employment.

1.3 Aerodrome Standards + Planning

Australia has adopted the International Civil Aviation Organization (ICAO) methodology of using a code system, known as the Aerodrome Reference Code (ARC), to specify the standards for individual aerodrome facilities which are suitable for use by aeroplanes within a range of performances and sizes.

In Australia, the Civil Aviation Safety Authority (CASA) prescribes the detailed technical material for aerodromes (safety standards) that is determined to be necessary for the safety of air navigation. Many

[1] https://www.nsw.gov.au/sites/default/files/2020-05/Shellharbour%20REDS.PDF

[2] https://cdn.shellharbour.nsw.gov.au/sites/default/files/Things_to_do_documents/Illawarra-Regional-Airport-strategic-and-business-plan.pdf

of the aerodrome standards make use of the ARC to prescribe the physical and geometric requirements for the aircraft movement area, and the provision of infrastructure. The standards are supported by several guidelines and advisory publications covering a range of additional planning and operational matters. Collectively, these provide the basis for the geometric planning of all airside elements at Australian airports.

The standards to be adopted for a given ARC in Australia have changed over time, as CASA and its predecessors have gradually aligned the historical Australian airport standards and practices with the Standards and Recommended Practices (SARPs) set out by ICAO. In turn, these ICAO SARPs continually evolve as changes to these are periodically proposed and adopted.

The standards in place in Australia over the time since the airport was originally developed are listed in **Table 1**. Historically, as changes to the standards are introduced, mechanisms for accepting facilities which no longer comply with the new standard (until certain trigger actions occur) are incorporated (known collectively as 'grandfathering').

Table 1: Aerodrome Planning + Design Standards

Period	Applicable Aerodrome Planning + Design Standards	
1960s – 1987	Department of Transport / Department of Civil Aviation *Airport Engineering Instructions*	APEIs
1987 – 2003	Civil Aviation Safety Authority *Rules and Practices for Aerodromes (RPA)*	RPA
2003 – 2020	Civil Aviation Safety Authority *Manual of Standards Part 139 – Aerodromes*	MOS Part 139
2020 – date	Civil Aviation Safety Authority *Part 139 (Aerodromes) Manual of Standards 2019*	Part 139 MOS 2019

Importantly for many Australian regional airports, including Shellharbour, the introduction of the Part 139 MOS 2019 included two important changes to relevant standards:

- The standards for runway strip width were fully aligned with the ICAO SARPs (Australia had previously allowed narrower runway strips and associated Obstacle Limitation Surfaces (OLS) for certain ARCs); and
- The ARC separated the Outer Main Gear Wheel Span (OMGWS), used to determine certain standards such as runway and taxiway width, as a third element in addition to the previous two ARC elements of a code number and a code letter.

Further detail on the ARC system and the critical airport facility planning parameters appropriate to the Shellharbour Airport Master Plan 2023 is given in **Section 4**.

1.4 Aircraft + Airport Compatibility

As a result of the progression in aerodrome planning and design standards it is important to note that the runway facilities at Shellharbour do not meet the required standards for operations by aircraft such as the Boeing 737 and Airbus A320 families, which are much larger than those currently operating regular airline services, even when 'grandfathering' provisions are applied. The runway facilities also do not meet the current Part 139 MOS 2019 standards for smaller jet aircraft such as the Boeing 717 and Embraer E190 currently operated on regional services by airlines such as QantasLink and Alliance.

CASA Advisory Circular AC 139.A-02 v1.0 (August 2020) *Aerodrome and Aircraft Compatibility* notes that, where an aerodrome does not meet the design characteristics for a particular aircraft type, the aircraft

operator may still be able to operate at the aerodrome subject to confirmation that they can do so safely. This will require the completion of a compatibility assessment by the aerodrome operator. Further discussion on the compatibility of the Shellharbour Airport facilities with various aircraft types is provided in **Section 4**.

2. Existing Airport Characteristics

2.1 Historical Development

The airport was originally constructed for military flying training in World War II and then subsequently transferred to the then Department of Civil Aviation after the war. In 1960, the then Shellharbour Municipal Council took over the airport under a permissive occupancy and in 1962 fully transferred to Council under the Commonwealth Aerodrome Local Ownership Plan.

In the 1960s and 1970s the airport was used by small charter operators and in the early 1980s two pilot training schools and an aircraft maintenance operation were the airport's main tenants. Also in the 1980s, the National Safety Council used the airport as a base for helicopter rescue operations, with this being ultimately taken over by the NSW Health Department.

Since assuming ownership and control, Council has been committed to developing the airport to provide regional benefits. In 1990, an airport management study was prepared and a master plan adopted. Further studies have since been carried out to support infrastructure development to encourage business development and employment as well as airline operators to the airport.

Between 1979 and 1999 two airlines operated Regular Public Transport (RPT) services to Canberra and to Melbourne. In 2005, following a major upgrade of the runway and navigational aids, QantasLink commenced services to Melbourne using Code 2C Bombardier Dash 8-100/200 turbo-prop aircraft with 36 seats. This service ceased in July 2008. Between late 2017 and mid-2018 regional airline JetGo operated services to Melbourne and Sydney using 40-seat Embraer ERJ-135 aircraft.

2.2 Current Operations

Currently, Link Airways operates flights to Melbourne (Essendon Fields) and Brisbane using 34-seat Saab 340B Plus aircraft. As at April 2023, the schedule included 28 weekly passenger flights.

Shellharbour Airport is also home to the Historical Aircraft Restoration Society (HARS) Aviation Museum, which have a number of flying aircraft including the Lockheed C-121C Super Constellation and AP-3C Orion types which operate intermittently. The airport also hosts the bi-annual Wings Over Illawarra air show which attracts significant flying displays.

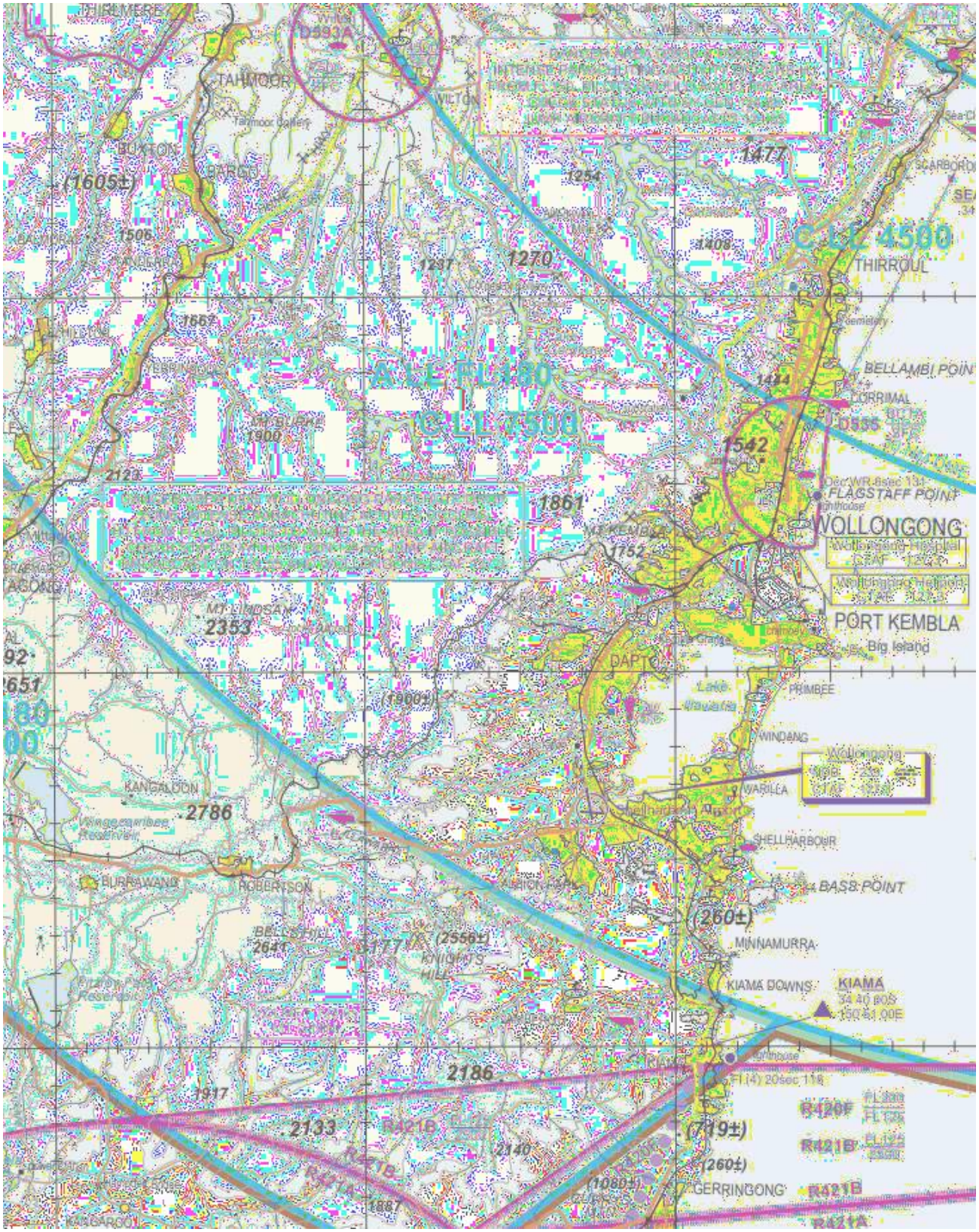
Other operations include the Toll NSW Air Ambulance base, skydiving operations and private recreational flyers. Data recorded for the airport indicate approximately 36,500 aircraft movements in the 2022-23 financial year.

The airport functions as a non-towered aerodrome within Class G airspace from ground level to an altitude of 7,500 feet where it abuts the lower limit of the Sydney Control Area. Non-towered operational procedures apply at the airport and as the airport is certified, mandatory carriage of radio is required.

To the south of the airport, Restricted Areas associated with military flying training at the Royal Australian Navy's Fleet Air Arm Station at Nowra are promulgated. Aircraft transiting this airspace when the areas are active, are therefore required to obtain the required clearances. A Danger Area (D535) has been established near Flagstaff Point associated with parachuting. It operates from the surface to the base of the underlying Sydney Control Area during daylight hours. Hang gliding (including motorised) takes place

to north-east, south and west of the airport. **Figure 1** below illustrates the current airspace arrangements in the vicinity of Shellharbour Airport. There are also a number of local traffic and noise abatement procedures in force as set out in the Aeronautical Information Package – En-Route Supplement Australia.

Figure 1: Shellharbour/Wollongong Airspace Arrangements



Source: Airservices Australia

2.3 Existing Airport Infrastructure + Facilities

The airport is a Civil Aviation Safety Authority (CASA) certified aerodrome under Part 139 of the Civil Aviation Safety Regulations 1998 and the Part 139 MOS (2019). **Figure 2** depicts the major features of the current movement area (airside) layout, landside facilities and surrounding features.

Figure 2: Existing Airport Layout

2.3.1 Runways

The airport has two sealed runways aligned in the 16/34 and 08/26 directions. Both runways are 30 m wide and are contained within 90 m wide graded runway strips and designated as Code number 2 instrument non-precision approach runways.

The main runway (16/34) is 1,819 m long and has a displaced threshold of 176 m at the southern (34) end to account for surrounding terrain and obstacles. The secondary (cross) runway (08/26) is 1,331 m long and has a displaced threshold of 90 m at the eastern (26) end. **Table 2** details the declared distances for each runway.

Table 2: Declared Distances

Runway	Code Number	Take-Off Run Available (**TORA**) (m)	Take-Off Distance Available (**TODA**) (m)	Accelerate Stop Distance Available (**ASDA**) (m)	Landing Distance Available (**LDA**) (m)
16	2	1819	1879	1819	1819
34	2	1819	1879	1819	1643
08	2	1331	1391	1331	1331
26	2	1331	1391	1331	1241

Source: Airservices Australia

Due to obstacles (terrain) the Runway 16 take-off and Runway 34 approach are offset 5 degrees to the west relative to the extended runway centreline.

Following upgrade works in 2018, Runway 16/34 has a pavement strength rating of PCN 40 /F /C /1410 (205PSI) /T. Runway 08/26 is rated as PCN 19 /F /D /1205 (175 PSA) /T.

2.3.2 Taxiways

The airport is served by a sealed partial parallel taxiway system serving the eastern side of Runway 16/34 and the northern side of Runway 08/26 as shown in **Figure 2**. Taxiway D which is located at the intersection of the runways is the main taxiway and is Code C capable and suitable for aircraft OMGWS of 6 m up to but not including 9 m. Taxiways G and H, which lead to the southern end of Runway 34 are also Code C capable. Other taxiways are generally suitable only for Code A aircraft.

2.3.3 Aprons

The main apron is located off Taxiway D and fronts the terminal area. The original apron consisted of one free-moving aircraft parking position to the south of the terminal building. The apron was expanded significantly in 2021 to accommodate a further two free-moving parking positions. Bays 1 and 2 are currently marked for aircraft up to Boeing 717-200 size. Bay 3 is designated for a maximum Fokker F70. Each bay has secondary parking positions for a reversed Saab 340B.

There are a number of other apron areas both sealed and grassed, serving individual hangars throughout the building area. The most significant of these is the large apron associated with the HARS operations on the eastern side of Taxiway D.

2.3.4 Visual Navigation Aids

Runway 16/34 is equipped with low intensity runway edge lighting and a precision approach path indicator (PAPI) system at each end. These are pilot activated as required. The vertical slope guidance for both PAPI directions are aligned slightly above the normal practice of 3 degrees. The 34 PAPI is also offset aligned by 5 degrees to the west. Runway 08/26 is equipped with low intensity runway edge lighting and has recently had PAPI installed (awaiting commissioning).

An illuminated wind direction indicator (IWDI) area is situated near the intersection of the runways in the north-west sector. A signal area is not currently provided. The airport is equipped with an AWIS facility with information available by phone or VHF radio.

2.3.5 Non-Visual Navigation Aids

The airport is equipped with a non-directional beacon (NDB) located in the building area in the north-east sector. The NDB is owned and operated by Airservices Australia and provides for instrument approaches to the airport and en-route navigation guidance.

Australia has now transitioned to new approach and navigation technologies using satellite-based systems. Many ground-based aids such as NDBs have been decommissioned but a back-up network is being retained. This includes Shellharbour, which is on the main air route between Sydney and Melbourne and represents an important navigational waypoint.

There are four published instrument approaches as follows:

- GNSS Arrival Procedures;
- RNP Runway 16;
- RNP Runway 34; and
- NDB-A.

These procedures permit appropriately equipped aircraft and instrument rated pilots to conduct instrument approaches under the Instrument Flight Rules (IFR).

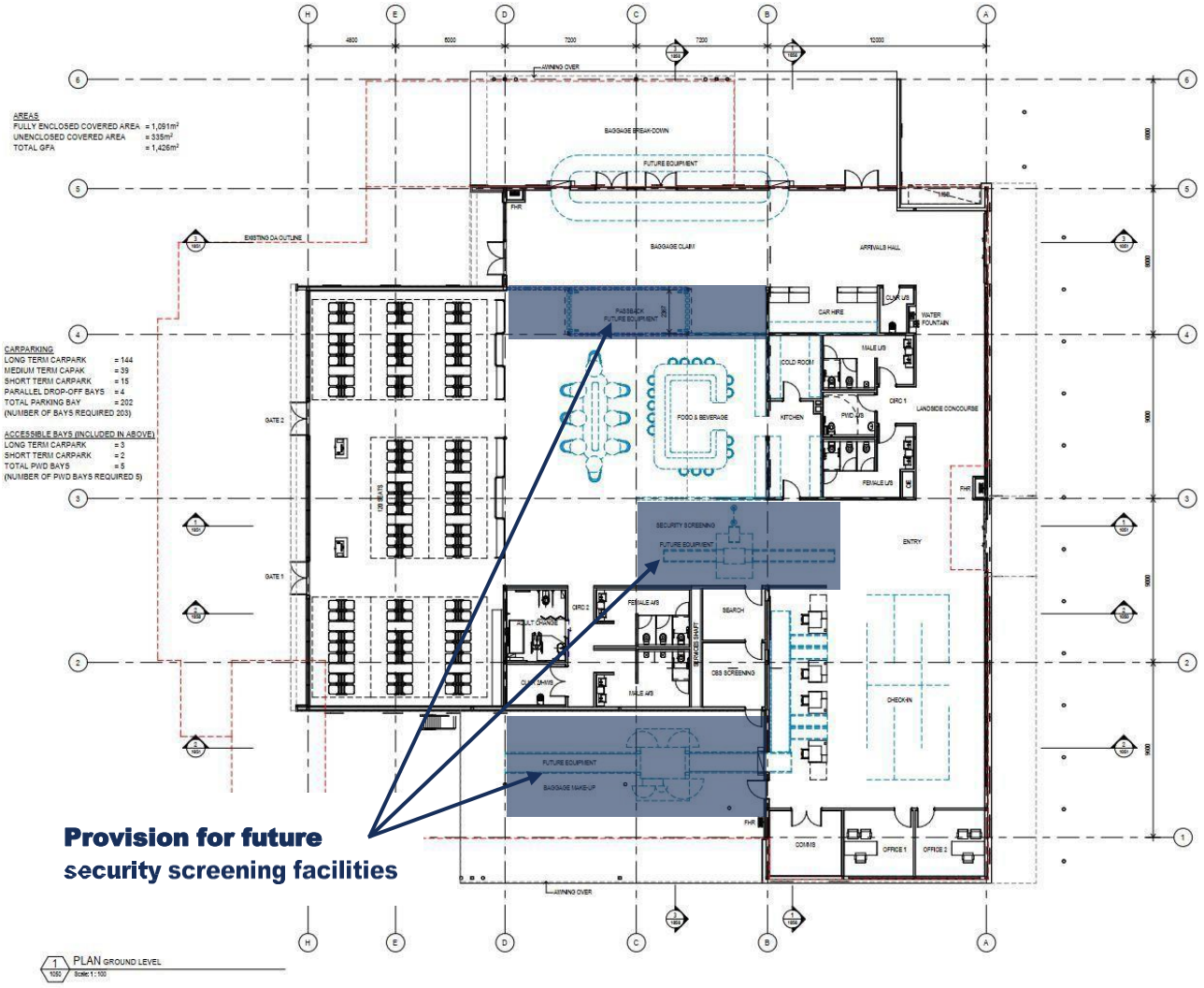
2.3.6 Terminal Precinct

The terminal building was redeveloped in 2021 with an upgrade to accommodate future installation of passenger and checked baggage screening, as shown in **Figure 3**. The terminal includes approximately 150 seats within a gate lounge area, central café and small arrivals area. The area is not currently able to be made sterile, but provision was made in the design to modify the internal layout such that the café and departures areas can be screened when the regulatory authorities determine this to be required.

The terminal precinct includes short term car parking for 13 vehicles in front of the drop off area and 39 medium term parking spaces in a fenced area immediately to the north. Long term parking (approximately 140 spaces) is available on the eastern side of Airport Road 100 m to the north of the terminal precinct.

The existing airport terminal has been retained as a leasable space to a suitable business.

Figure 3: Terminal Building Internal Layout



2.3.7 Building Area

The main features of the building area and current operators are shown in **Figure 4**. These include:

- HARS restoration/workshop/museum and hangar;
- TOLL helicopter rescue/ambulance service;
- NSW Fire Brigade Emergency Training Facility;
- Aerial Patrol Base;
- Aircraft Maintenance Services company;
- Total Aerospace Solutions - aircraft modification e.g. fit outs for the Royal Flying Doctor
- Service;
- AIRag - aircraft repairers; who do work for insurance companies;
- AeroV who build and sell kits for one and two seat hobby planes;
- Capital Aircraft Services - specialised aircraft fit outs/modification;
- Cleary Bros/Go Jet - private hangar for jet charter;
- Sydney Microlights - microlight training and joy flights;
- Community Bus parking and Viva Energy depot for aviation refuelling;
- NSW Air - pilot training and joy flights;
- Skydive the Beach –tandem skydiving;
- Touchdown Helicopters – joy flights and charter services; and

- Southern Biplane Adventures – adventure and scenic flights.

Figure 4: Building Area

2.4 Operational Airspace

Currently, Runway 16/34 thresholds are located relative to meeting legacy Code 2 Instrument Non-precision obstacle limitation requirements, including a slope of 3.33%, an inner edge length of 90 m and length of approach surface of 2,500 m.

The 2023 annual aerodrome obstacle survey identified no additional permanent obstacles in the Obstacle Limitation Surfaces (OLS), however several increased penetrations of the OLS due to vegetation growth were recorded. As a general business-as-usual activity, Council as the aerodrome operator needs to address obstacle infringements of the OLS, and it is assumed that management of these is ongoing in accordance with the obligations of certified aerodrome operators under the Civil Aviation Safety Regulations 1998 and the Part 139 MOS 2019.

There are differences in the OLS specifications that apply to Code 2 Instrument non-precision runways under the Part 139 MOS 2019, compared with those that previously applied under the previous MOS Part 139. There are also differences that would apply to Code 3 or 4 runways. These matters are discussed further at **Section 4.7** and **Section 6.6.2**.

It should be further noted that ICAO is proposing changes to the OLS specifications and the aircraft characteristics that determine the applicable OLS. These changes are not yet finalised and will need to be accounted for in a future update of this Master Plan in due course.

3. Airport Vision + Objectives

The vision and objectives for the Shellharbour Airport Master Plan 2023 are drawn from the NSW Government's *Shellharbour Regional Economic Development Strategy – 2023 Update,* Shellharbour City Council's *Illawarra Regional Airport Strategic and Business Plan* and the *Shellharbour Airport – Market Assessment – June 2023.*

3.1 Vision

To develop the Illawarra Regional Airport into a vibrant business hub that contributes to regional economic development, tourism and employment, while facilitating the viable development of a greater range of affordable air travel options for the region.

3.2 Objectives

The above vision is supported by the following key objectives:

- Deliver sustainable whole-of-life asset management for the community;
- Create, promote and maintain local business, job, investment and lifestyle opportunities;
- Plan, builds and manage infrastructure for the community; and
- Supports and increases employment and business opportunities within a strong local economy.

4. Planning Parameters + Aerodrome Requirements

The *Shellharbour Airport – Market Assessment – June 2023* sets out three infrastructure scenarios together with associated potential high level aviation strategies. Each infrastructure scenario envisages different sizes and operational categories of aircraft for airline services. These scenarios drive the required airport planning parameters, based on the ARC of the largest aircraft envisaged.

The scenarios and the standards required to accommodate each scenario in accordance with the current Part 139 MOS 2019 are discussed in the following sub-sections, which compare these requirements with current and potential airport operational capability and describe possible strategies to address the relevant capability gaps.

Table 3 sets out the representative aircraft types associated with the three scenarios, along with the applicable ARC elements.

Table 3: Aircraft Types and ARC

Scenario	Aircraft types	ARC Code Number	ARC Code Letter	ARC OMGWS
Scenario 1: Business As Usual	Saab 340B	3	B	6 m ≤ 9 m
Scenario 2: Introduction of Airport Security	Dash8-Q400	3	C	9 m ≤ 15m
	Fokker F100	3	C	6 m ≤ 9 m
	Boeing 717	3	C	4.5 m ≤ 6m
	Embraer E190	3 / 4 (1)	C	6 m ≤ 9 m
Scenario 3: Introduction of Affordable Travel Options	Airbus A320 / 321	4	C	6 m ≤ 9 m
	Boeing 737	4	C	6 m ≤ 9 m
	Airbus A220	3 / 4 (2)	C	6 m ≤ 9 m

Notes: (1) Original E190 is code 4, however the next generation E190-E2 is code 3
(2) A220-300 is code 4, however the smaller A220-100 is code 3

Source: Three Consulting / aircraft manufacturer data

4.1 Runway Width

Under the Part 139 MOS 2019, the minimum width of runway is determined by the ARC code number and the OMGWS. The current 30 m runway width meets the minimum standard for all Code 3 aircraft types except for the Dash8-Q400. However, CASA has previously accepted advice from Canada that the Dash8-Q400 is certified to operate from a standard ICAO 3C category aerodrome, which consists of a 30 m wide runway and 15 m wide taxiway. The aircraft has routinely operated from such aerodromes in Australia since its introduction to the fleet.

In terms of Code 4 aircraft, the minimum width of runway for these aircraft under the Part 139 MOS 2019 is 45 m. In Australia, there is ample precedent of Boeing 737-800, Airbus A320 and similar Code 4C size aircraft operating to regional aerodromes with runway widths of 30 m. Widening of the runway pavement to accommodate Code 4C operations is therefore not anticipated to be required, but would come down to an aircraft operator assessment that the aircraft can safely utilise the runway in accordance with the aircraft flight manual or supplement, as noted in the Part 139 MOS 2019.

4.2 Runway Strip

A more critical consideration than the runway pavement width is the width of the associated runway strip and obstacle restriction area. Under the Part 139 MOS 2019 and ICAO SARPs, a runway is required to be centrally located within a runway strip.

YSHL Runway 16/34 has a 'grandfathered' Runway 16/34 strip width of 90 m. The current Part 139 MOS 2019 standard for a Code 2 instrument non-precision runway is 140 m. 140 m is also the minimum width for a Code 3 or 4 non-instrument runway. The minimum runway strip width requirement for a Code 3 or Code 4 instrument non-precision runway under the current standards is 280 m.

It should also be noted that a 150 m wide runway strip is a historical Australian standard previously applied to Code 3C instrument non-precision runways of 30 m width and which varied from the ICAO standard of 300 m for Code 3 instrument non-precision runways.

Figure 5 below shows a 150 m wide strip applied to Runway 16/34. Parts of the strip along the western boundary would be outside the airport fenceline. In addition to no obstacles being permitted within the runway strip width, the runway strip forms the lower boundary of the transitional surface, an Obstacle Limitation Surface (OLS) (see **Section 4.7.1**). The OLS transitional surface should ideally be kept free of obstacles to protect aircraft operating in visual conditions and in the final phase of an instrument approach. The transitional surface slope associated with Code 3 and Code 4 runways is currently 1:7 (14.3%). The transitional surface limits for 5 m and 10 m high (above the runway centreline) obstacles are also shown in **Figure 5**.

There is precedent of Boeing 737-800 and Airbus A320 and similar Code 4C size aircraft operating to regional aerodromes with runway strip widths of 150 m. There is also ample precedent of Code 3C aircraft operating to 90 m wide runway strips. Both of these scenarios were allowable under previous Australian aerodrome standards, subject to landing minima adjustment. Therefore, it would be expected that preparing a safety case for either of these scenarios (i.e. operating Code 3C aircraft such as those envisaged under aviation scenario 2 to the existing 90 m wide runway strip, or Code 4C aircraft envisaged under scenario 3 to a 150 m wide runway strip) would be relatively straightforward and have a reasonable chance of obtaining approval from CASA.

There is, however, no precedent for regular Code 4C aircraft operations to runways with a runway strip width of only 90 m. In order to assess the ability of Code 4C aircraft to operate at Shellharbour within normal aircraft operator operating procedures an aircraft compatibility study and an airline safety case will be required. Developing and obtaining approval for Code 4C operations to the existing runway strip at Shellharbour Airport is not impossible, but it will likely not be straightforward and it may require mitigating measures to be adopted which affect the commercial viability or attractiveness of the operations to airlines. Examples of such measures are discussed in **Section 4.7**.

In order to achieve a 150 m wide Runway 16/34 strip, some land acquisition would be required, at least along the western side of the runway north of Runway 08/26. If the centreline of Runway 16/34 were to be moved such that the 1:7 transitional surface were able to clear a standard 2.5 m high security fence, the centreline would need to move around 15-20 m to the east. Notwithstanding the engineering impacts on infrastructure including runway lighting, strip grading, and drainage infrastructure, which would need a full and detailed evaluation, there would be other aspects to consider, including (but not necessarily limited to):

- Impact on the obstacle height clearances on the main apron and in front of the Illawarra Flyers hangars, and likely loss of additional hardstand parking opportunity in the existing GA precinct. On the main apron it is anticipated this may severely limit airline use of Bay 1 and Bay 2 due to tail height limits;

Figure 5: 150m Wide Runway 16/34 Strip

- Impact on the runway to taxiway separation clearances on the main apron which could mean a reduction in parking area available;
- The newly upgraded Taxiway G would likely need relocation, and the consequential impact on the Aviation Business Park layout would be significant;
- Clearing of trees to the south-east of the Runway 16 threshold, currently predominantly in the transitional surfaces, would then infringe the Runway 16 approach surface, requiring threshold displacement, and the Runway 34 take-off climb surface, affecting aircraft performance; and
- Trees along the western boundary would still require removal or reduction in height to remain clear of the transitional surface, and some buildings may also continue to infringe the transitional surface.

Therefore, relocation of the Runway 16/34 centreline is not likely to be a feasible means by which to achieve a 150 m wide runway strip.

4.3 Runway Length

Although designated as a Code 2 runway, the length of Runway 16/34 at 1,819 m exceeds the lower threshold of aeroplane reference field length for ARC number 4 which is 1,800 m. Shellharbour Airport is also effectively at sea level. Therefore, it is likely that the current runway length is adequate for all Code 3 aeroplane operations, except perhaps for operations at MTOW on very hot days for the most demanding types. The situation is similar for Runway 08/26, in regard to Code 2 operations.

Conversely, the runway length of Runway 16/34 is marginal with respect to Code 4C types associated with Scenario 3 in **Table 3** above.

A potential Code 4C aircraft operator has provided the following indicative lengths required for operations at full passenger capacity (a key consideration for affordable airline services):

- Gold Coast 1,980 m
- Sunshine Coast 2,130 m
- Adelaide 2,270 m
- Cairns 2,620 m

Other potential carriers may have different requirements.

The Part 139 MOS 2019 includes the concept of runway starter extensions. This allows additional runway length to be provided for use on take-off in one direction only. This has the advantage of not requiring the OLS to be changed, which would be impossible at Shellharbour due to surrounding terrain (see **Section 6.7.1** for details of challenges relating to the OLS), and was not a configuration provided for under previous standards. The disadvantage of starter extensions is that twice the physical pavement length is required to achieve the same operational benefit. However, it is the only practical option available at Shellharbour.

Figures **B3086/SK-01** and **B23086/SK-02** at **Appendix A** show how starter extensions might achieve additional take-off length of up to 200 m for Runway 16 and 150 m for Runway 34, based on the constraints imposed by existing road infrastructure to the north and south of the airport.

Implementation of these starter extensions would be subject to a safety case and approval by CASA, and it should be confirmed with operators that the investment would be operationally beneficial. However, if implemented the possible declared distances with the starter extensions are given in **Table 4** (changed values from existing are in **bold**).

Table 4: Possible Runway 16/34 Declared Distances with Starter Extensions

Runway	Take-Off Run Available (**TORA**) (m)	Take-Off Distance Available (**TODA**) (m)	Accelerate Stop Distance Available (**ASDA**) (m)	Landing Distance Available (**LDA**) (m)
16	**2019**	1879	1819	1819
34	**1969**	1879	1819	1643

A full and detailed business case, incorporating technical engagement with potential operators, is strongly recommended given the physical limitations on the provision of additional runway strip width within the existing airport site, as discussed in **Section 4.2** above and the additional challenges presented by the available operational airspace discussed in **Section 4.7** below. Without surmounting those, the operational and possible commercial benefit provided by the additional ground infrastructure may be significantly eroded.

4.4 Runway End Safety Areas

Under the Part 139 MOS 2019, Runway End Safety Areas (RESAs) must be provided beyond the end of the runway strip. The implementation of starter extensions can be expected to trigger the requirement for RESAs as part of the safety case, even if Runway 16/34 remains published as a Code 2 runway. RESAs of appropriate length should be incorporated into the detailed design of the starter extensions and agreed with CASA. The minimum length of RESA for Code 3 and 4 runways of 90 m is shown on B22086/SK-01 and SK-02, noting that the CASA preferred length of a RESA is 240m.

4.5 Pavement Strength

Table 5 shows the maximum operating weight and Aircraft Classification Number (ACN) at maximum weight for each of the main aircraft types identified in **Table 3** above. The ACN is number that expresses the relative effect of an aircraft at a given configuration on a pavement structure for a specified standard subgrade strength. The ACN is used in conjunction with the Pavement Classification Number (PCN), which identifies the strength of a runway, taxiway or apron, in terms of the equivalent ACN of the most damaging aircraft that can use to pavement on a regular basis ('regular' being defined by the aerodrome operator). [3]

Table 5: Aircraft Pavement Data

Aircraft	Max Weight	ACN at Max Weight	Max Op. Weight (PCN 40)
Airbus A321	89.4 t	57	66.0 t
Boeing 737 MAX 8	82.9 t	53	66.4 t
Airbus A320 neo	78.4 t	47	68.5 t
Boeing 717-200	55.3 t	37	55.3 t
Airbus A220-300	64.2 t	36	64.2 t
Fokker F100	46.0 t	30	46.0 t
Embraer E190	50.5 t	27	50.5 t
Dash8-Q400	29.4 t	19	29.4 t

Source: Aircraft Manufacturer Data

[3] www.skybrary.com

The current main runway pavement strength of PCN 40 /F /C /1410 (205PSI) /T is adequate for those aircraft envisaged in Scenario 2, as well as the Airbus A220-300 to operate unrestricted. However, operational weight limits would be required for Airbus A320/321 and Boeing 737 aircraft to avoid damaging the pavement. While it is likely that the Boeing 737 and Airbus A320 aircraft could operate adequately on the existing pavement, a full technical assessment considering aircraft loads at the proposed actual operating weights should be undertaken to determine the adequacy of the existing runway, taxiway and apron areas. This should include an assessment of the likely impact of proposed operations on the expected timing of a maintenance overlay, which can then be planned to incorporate and additional strengthening the assessment deems appropriate. An upgrade of the Bay 3 and 4 pavement area is likely to be required before the larger aircraft can operate to these areas at all (see **Section 4.8**).

4.6 Jet Blast

Regardless of whether starter extensions are introduced, management of jet blast impacts on public areas would be required. In accordance with Part 139 MOS 2019, jet blast and propeller wash impacts on public areas must be limited to 60 km/h or less (or 50 km/h on public roads where the vehicle speed is likely to be 80 km/h or more). Code 3 and 4 jet aircraft typically produce air velocities in excess of 50-60 km/h for distances of around 335 m in the case of a new generation aircraft such as the Boeing 737 8 MAX or A320 NEO, and further in cases of aircraft with older engine types.

Figure **B23086/SK-03** at **Appendix A** shows the extent of these take-off jet blast impacts based on the starter extension take-off zones. Substantial and suitably engineered deflector barriers (capable of withstanding impact velocities of 320+ km/h) would be required to mitigate the impact on public areas. Jet blast mitigation would also be required for aircraft turning at the start of take-off when using starter extensions due to the proximity to the fence.

If the runway is not extended, jet blast mitigation of some form would also be required along the airport fence line behind aircraft taking off. The nature of the mitigation treatment would depend on the aircraft types in use, but the velocities it would be required to withstand would be less than for the starter extensions, on a like-for-like aircraft basis.

4.7 Operational Airspace

4.7.1 Obstacle Limitation Surfaces (OLS)

Even though the provision of a 150 m wide runway strip free of obstacles on the ground may not be practicable (as it would require the acquisition of land and removal of trees and structures outside the airport boundary) it is still appropriate to consider what can be done to limit additional obstacles intruding into the airspace that would be associated with a 150 m wide runway strip. There are two reasons for this:

- The current Part 139 MOS 2019 requirement for Code 3 or Code 4 non-precision instrument approach runways is for a 280 m wide runway strip and approach surface inner edge and the current Part 139 MOS 2019 requirement for Code 1 or 2 instrument non-precision approach runways is for a 140 m wide runway strip and approach surface inner edge, both of which exceed the current width of 90 m; and
- Any aircraft operators wishing to operate aircraft with maximum take-off weight of 22,700 kg or greater will be required to take into account obstacles outside of the current published Code 2 take-off climb surfaces (which have an inner edge of 90 m) in accordance with Civil Aviation Order (CAO) 20.7.1B and Part 91 of the Civil Aviation Safety Regulations 1998.

Limiting the obstacles present within the approach and take-off climb surfaces previously permitted for Code 3C instrument non-precision runways will assist any prospective aircraft operators develop compliant take-off and approach procedures which will be necessary as part of any safety case for operating to narrower than prescribed runway strip widths.

An OLS based on the previous Code 3 instrument non-precision requirements, applied to Runway 16/34, has been prepared for illustrative purposes (refer to **Section 6.7.1** for details). There is reasonable precedent for Code 3 and Code 4 aircraft operations of the types listed in **Table 3** to runways which have airspace protected to such requirements. It is understood that the airport operator, Shellharbour City Council undertakes annual obstacle survey to Code 3 requirements, and it is recommended that this practice continue as discussed at **Section 6.6.2**. It is also recommended that, for planning purposes, additional intrusions into the Code 3 transitional surfaces for Runway 16/34 be avoided as far as possible. This may affect the position and height of some on-airport development proposals.

Mitigations to assist in the safe operation of larger Code 3C and Code 4C aircraft, such as Required Navigation Performance – Authorisation Required (RNP-AR) approach procedures, introduction of standard instrument departures, limitations on payload due to obstacles, or adoption of lower crosswind operating limits may be possible. However, they may not be practical in terms of the viability of particular commercial operations, due to specialised training or non-standard operational procedures. Nor do these mitigations absolve the accepted safety principle of minimising risk as far as practicable.

4.7.2 Possible Future OLS Changes

ICAO is currently considered potential changes to the OLS specifications as part of a modernisation project. These proposals are not yet final and it is important to note that they have not yet occurred and may not occur for many years. However, once they occur, currently anticipated to be around 2028-2030, they may reduce some of the barriers to compliance that Shellharbour currently faces in relation to runway strip width and obstacles required for Boeing 737/A320 operations. These OLS modernisation proposals, once finalised by ICAO, may assist in forming the basis for safety case discussions between Council, airlines and CASA prior to being implemented into Australian aerodrome standards. It is recommended the status of the ICAO proposals be kept under close review.

4.7.3 Instrument Approach Procedures

Shellharbour currently has published Required Navigation Performance (RNP) satellite-based instrument approach procedures to Runway 16 and Runway 34, as well as non-runway aligned GNSS (satellite-based) and Non-Directional Beacon (NDB) (ground-based) circling approaches.

Most Instrument Flight Rules (IFR) traffic, including airline operations, would utilise the RNP approaches. These approaches are both set somewhat steeper than the standard and ICAO recommended 3 degrees – at 3.5˚ for Runway 16 and 3.4˚ for Runway 34, in order to provide the required minimum clearance to terrain. The Runway 34 approach also has a relatively high minima of 1,340 feet, which could limit the ability of aircraft to land from this direction in poor weather.

The current RNP procedures are applicable for Approach Category C operations. The approach category determines the range of speeds the procedure designer has considered when calculating airspace and obstacle clearance requirements for each segment of the approach procedure. Medium airliner jets, such as the Boeing 737 and Airbus A320 families, typically fall into approach category C, although not always. Skybrary lists the Boeing 737 Max 8 as an approach category (APC) C aircraft[4] along with medium jet

[4] https://skybrary.aero/aircraft/b38m

types as well as the Dash8 Q400 turboprop[5]. However, other sources indicate the 737 Max 8 is approach category D[6], along with the Boeing 737-800. Suitability of the current approach procedures requires confirmation by particular aircraft operators, as part of a comprehensive safety case specific to Shellharbour. Nonetheless it is noted that Albury, Ballina and Bundaberg (as examples of airports where Boeing 737, including the MAX 8, operate to a 150 m wide runway strip) have RNP approaches suitable for maximum approach category C aircraft.

4.8 Apron + Taxiway

In terms of Code 3C aircraft operations, the main apron bays 1, 2 and 3 already provide for aircraft including the Dash 8-Q400 and the Boeing 717.

A review of the parking positions suggests that there is adequate space to accommodate a Code 4C aircraft such as the Boeing 737 MAX 8 or similar without the need to provide more pavement. The tail would be below the current published OLS, as required by the Part 139 MOS 2019, however on the existing Bay 1 and Bay 2 the tail would infringe a hypothetical OLS based on a 150 m wide runway strip and a 1:7 (14.3%) transitional surface. This may be acceptable temporarily, subject to detailed Code 3C/4C operational safety assessment. Use of Bay 2 for jet aircraft operations would be preferable, to minimise jet blast impacts on the movement area to the north.

If safety assessments for Code 3C or 4C operations require the aircraft tails to remain clear of the hypothetical OLS, then use of Bay 3 would provide the necessary clearance. Some adjustment to the fence line and Bay 4 parking clearance may be required to accommodate apron wingtip clearances in accordance with Part 139 MOS 2019, as well as strengthening of the pavement area. A further secondary position on Bay 2 (nominally Bay 2B) could also be provided to align the aircraft parallel to the runway with the tail below the hypothetical OLS. This would provide for independent power-in/power-out Code 4C operations on Bay 2B and Bay 3, although the use of Bay 2B would restrict Bay 1 to Saab 340 aircraft and smaller only.

These arrangements could provide a minimum of two (2) Code 4C parking positions, with reconfiguration of Bay 4 providing a third, and Bay 1 providing a possible fourth contingency overflow depending on the acceptability of tail infringement of the OLS in such circumstances.

As simultaneous Code 4C parking is likely to be required at the passenger traffic levels associated with Aviation Development Scenario 3, and noting the restrictions on Bay 1 usage this may introduce, re-introduction of Bay 4 for airline operations would be beneficial in providing options to manage aircraft.

Figure 8 at **Section 5.4** illustrates the apron concept arrangement along with areas to reserve for passenger terminal and ground transport expansion which are discussed in **Section 4.9** and **Section 4.10** below.

4.9 Passenger Terminal

The current passenger terminal footprint, once a sterile area has been established, could accommodate a full (186-seat) Code 4C aircraft such as the Boeing 737 MAX 8. However, comfort levels would likely be low, with all seats occupied and some standing passengers. The arrivals area would also be very congested and the baggage reclaim may not be sufficiently long. Although workable for infrequent and

5 https://skybrary.aero/aircraft-types?facets_query=&f%5B0%5D=approach_category_apc%3A840

6 https://contentzone.eurocontrol.int/aircraftperformance/details.aspx?ICAO=B38M&ICAOFilter=B38M

isolated Code 4C aircraft operations, some minor expansion would increase passenger comfort levels.In order to meet the assessed passenger potential of 880,000 to 1.5 million passengers per annum would require between approximately 6 and 14 passenger aircraft turnarounds (150-180 passengers each flight) per day. At this frequency, at least two airlines and a range of destinations can be anticipated. As such, the likelihood of two or more flights overlapping should be considered high, if not inevitable, and planning for a significant expansion of the terminal facilities should allowed for. This is likely to result in the loss of some of the medium-term car parking spaces immediately to the north of the terminal forecourt.

For aircraft envisaged in aviation development Scenario 2, of 70 to 110 seats approximately, with the installation of passenger and baggage screening facilities envisaged and allowed for in the recent terminal upgrade, the sterile area is likely to be comfortable for departing passengers. The arrivals baggage claim area may become congested for short periods with full flights on larger aircraft, as the introduction of a hard wall to the secure departure lounge would limit space available for passenger waiting and circulation at the reclaim belt. Nonetheless, the current infrastructure is likely to be workable for the traffic levels envisaged in Scenario 2.

4.10 Ground Access

As passenger traffic grows, it is likely that additional car parking will be required. There is limited opportunity to expand the existing long stay car parking without encroaching into the NDB Building Restricted Area (BRA) (see **Section 6.8**) so any further development in this area would need assessment by Airservices. Subject to Airservices evaluation, another 150 on-grade spaces may be achievable with a possible further 50-100 spaces to the north of Airport Road. Whether a total of 350-400 parking spaces is adequate for the assessed passenger traffic potential will depend on the travel mode proportions realised in practice as well as any demand moderators such as pricing.

A car parking demand assessment in the 2013 master plan indicated a possible total car parking requirement (short- and long-term public, plus car rental) of 1,200 spaces. This was predicated on annual passenger throughput of around 976,000 annual passengers.

It is recommended that car parking provision be reviewed regularly as traffic increases. If additional spaces are required, options in the longer term include an additional level on the existing and/or expanded long term car park area (subject to NDB BRA assessment by Airservices) or re-purposing of some of the currently leased areas further south.

The terminal forecourt would likely also require re-configuration and expansion to cope with increased passenger flows, if Code 3C or 4C jet operations eventuate. For this reason it is recommended to preserve the areas immediately north, east and south (when vacated by HARS) of the existing terminal for terminal and forecourt expansion.

Provision for electric vehicle (EV) charging stations in suitable locations in the long- and short-term parking areas should be made. Charging facilities could also be accommodated with the Future Commercial Precinct (see **Section 5.8**) subject to provision of necessary electrical infrastructure.

4.11 Aerodrome Rescue and Fire Fighting

CASA's *Manual of Standards Part 139H – Standards Applicable to the Provision of Aerodrome Rescue and Fire Fighting Services* (MOS 139H) provides the criteria for establishment of Aerodrome Rescue and Fire Fighting Services (ARFFS) and the technical basis for ARFFS siting considerations.

MOS 139H requires ARFFS to be established where an aerodrome serves international passenger air services (not envisaged for Shellharbour) or any domestic aerodrome through which more than 350,000 passengers passed in the previous financial year. Therefore, in order to fulfil the vision and potential of

the *Shellharbour Airport – Market Assessment – June 2023* Scenarios 2 or 3, provision for establishing ARFFS is required.

The aerodrome category for ARFFS provision is calculated on the overall length of the longest aircraft normally using the aerodrome and the maximum width of the fuselage. Based on the traffic scenarios, Shellharbour would fall into Category 6 or Category 7 (it is unlikely to exceed Category 7 as that would require regular operations by wide-body aircraft). Both categories have a requirement for a minimum of 2 ARFFS vehicles.

The associated Fire Control Centre (FCC) cabin must provide clear vision of the runways and short final approaches. FCC installations typically incorporate an elevated cabin to assist in meeting this requirement.

The FCC site needs to be located having regard to MOS 139H requirements although consideration of a visual surveillance system (i.e. CCTV) may be required should FCC line of sight become an issue. In order to achieve the required response times to each runway end, as well as maximising line-of-sight, a central location is desirable. The 2013 Master Plan suggested a site northwest of the intersection of the runways, co-located with the air traffic control tower, on land which would require acquisition by Council. In the absence of any appetite to acquire (and develop) such land, it is recommended that a suitable site be identified as part of the detailed Aviation Business Park layout design. The north-west corner of Aviation Business Park is likely to be the preferable location due to its central location on the aerodrome. However, Airservices Australia may require a fire training ground to be provided and a suitable location for this would need to be found. It may require modest land acquisition if it cannot be incorporated within the current airport land boundary. A specialist study involving consultation with Airservices is recommended as part of the development of a wider business case around the feasibility of larger Code 3C and 4C aircraft operations.

4.12 Air Traffic Control

Subject to CASA review of the airspace complexity, over time as traffic grows CASA may impose requirements to mitigate risks associated with a higher frequency of larger IFR aircraft mixing with general aviation and other commercial operations. These risks may be addressed through the provision of a certified air/ground radio service (CA/GRS) (at least initially) but may over the longer term require provision of controlled airspace and air traffic control (ATC) services.

The CASA *Manual of Standards Part 172 – Air Traffic Services* sets out the requirements for air traffic control facilities and equipment, including visibility and detecting movement of departing aircraft. Since 2023, the Part 172 MOS has allowed the use of visual surveillance systems (i.e. CCTV and suitable controller displays) to be used to meet the visibility and detection requirements. Airservices is developing and implementing Digital Aerodrome Services (DAS) which allows aerodromes to be controlled from a remote location rather than the on-site tower. It is assumed that any future ATC tower requirement for Shellharbour would be satisfied through the implementation of DAS and that, if necessary to achieve detection times and lines-of-sight, this would be achievable through multiple camera locations rather than a single physical tower.

4.13 Sustainability

Shellharbour Airport, like all aerodrome operators, will need to adapt to rapidly changing technologies over the next 20 years in line with global moves towards a de-carbonised economy. These adaptations will doubtless include a range of challenges and opportunities, many of which remain unclear at the time of this Master Plan. Two areas of relative clarity, however, include:

- Maximisation of renewable energy sources, in particular the use of rooftop solar installations on existing buildings and future developments; and
- Provision of electric vehicle (EV) charging facilities, including a range of fast- and slow- charging stations for the amenity of airport users but also to support the wider strategic network attracting passers-by to the airport as a charging destination strategically located between Sydney and the NSW South Coast holiday destinations.

These aspects should be incorporated as appropriate into each of the development concept precincts and other sustainability imperatives can be expected to emerge and become clearer over the coming few years.

5. Development Concept

5.1 Land Use Plan

Figure 6 shows the proposed Shellharbour Airport Land Use Plan, incorporating seven (7) distinct precincts, which are discussed and described in more detail in the following sub-sections.

Figure 6: Proposed Land Use Plan

5.2 Illawarra Flyers

The main constraints to expanding the use of this area is the curved nature of the adjacent lots and the requirement to maintain landside vehicle access to these. Options were prepared in 2017 to identify how best to accommodate additional hangars similar in size to the adjacent Illawarra Flyers hangars, suitable for the storage of private light aircraft.

That exercise confirmed that the maximum potential of the site lies in accommodating three 15m x 15m hangars facing east on the area currently used for light aircraft tie-down. Realignment of the vehicle access road further to the east would be required, to accommodate aircraft taxilane clearances for access by Code A aircraft.

Additional hangar lots are also possible to the south of Taxiway J. These could be of a consistent depth front-to-back and varying in width to suit the demand. Pedestrian access only would be possible along the south face adjacent Albion Creek and to gain the full extent of hangar space, realignment of Taxiway J access is required. Taxilane clearances only can be provided within this area, with no aircraft parking available in front of the hangars. Therefore, suitable operational requirements are recommended to manage the possible congestion. Consultation with CASA on specific proposals is recommended prior to implementation of additional hangars.

5.3 Existing GA Precinct

Within the existing GA Precinct there are three (3) key principal opportunities:

- Opportunities to implement hangar development previously conceptualised, subject to the successful attraction of a suitable commercial operator;
- Opportunities to realise additional hangar areas; and
- Opportunities to provide additional all-weather hardstand parking areas (in lieu of current grass)

Each of these shown in **Figure 7** and discussed in the following subsections.

5.3.1 Previous Hangar Concept

A draft concept was previously developed in 2017 to accommodate a possible commercial operator in an area at the eastern end of Taxiway K. This site is constrained by the available area, so concept options investigated the feasibility of accommodating various commercial operations on the site.

There are several options for accommodating commercial operators on this site and the optimum layout will to a large extent depend on the exact requirements of the lessee. The site could be leased as a whole, for the tenant to allocate as they see fit, or could be subdivided by Council.

The preferred concept layout splits the site into four sub-lots. These lots could be combined as necessary. Two of the sub-lots would have airside access and the other two would have only landside access. These might be suitable for supporting uses such as administration or non-aeronautical commercial activities which may either be associated with the adjacent airside lots or not.

Figure 7: Existing GA Precinct Development Concept

5.3.2 Additional Hangar Opportunities

As existing lease agreements expire opportunities Council should continue to explore opportunities to ensure it maximises the use of the airport property assets to generate revenue. Two areas where potential has been identified are:

- To the north of the existing fuel depot. This would be subject to Council vacating or relocating it's current site to another location. The extent of possible hangar space would also be subject to ongoing arrangements for road tanker access to the fuel facility.
- On the Illawarra Hangars Pty Ltd site (site 6 on Figure 4 at Section 2.3.7) the possibility of rebuilding and expanding the existing hangar space.

5.3.3 Hardstand Parking

Current grass aircraft parking areas located east and west of Taxiway B could be converted to all-weather hardstand for greater amenity. It is recommended that Code B taxiway clearances per Part 139 MOS 2019 be preserved on Taxiway C and Taxiway B south of Taxiway C, to maximise the ability for larger aircraft, including Link Airways, to use this access to Runway 16/34 and minimise the need to backtrack on the runway.

Aircraft on the runway side should be parked with tails to the east to minimise the risk of intrusions into the side-slopes associated with a hypothetical 150 m wide runway strip.

5.4 Passenger Terminal Precinct

The development concept for the passenger terminal precinct, incorporating the terminal facilities and the main apron is shown in **Figure 8** below. These areas are described in the following subsections.

5.4.1 Terminal Facilities

As discussed in **Section 4.9** the passenger terminal precinct needs to reserve enough space to accommodate substantial expansion of the terminal facilities and forecourt, in the event that the assessed passenger traffic potential is realised through the implementation of Scenario 3: Introduction of Affordable Travel Options per the Three Consulting *Shellharbour Airport – Market Assessment – June 2023*. The recommended areas for this include the area potentially vacated by HARS (see **Section 5.5**) and the area to the north of the existing terminal.

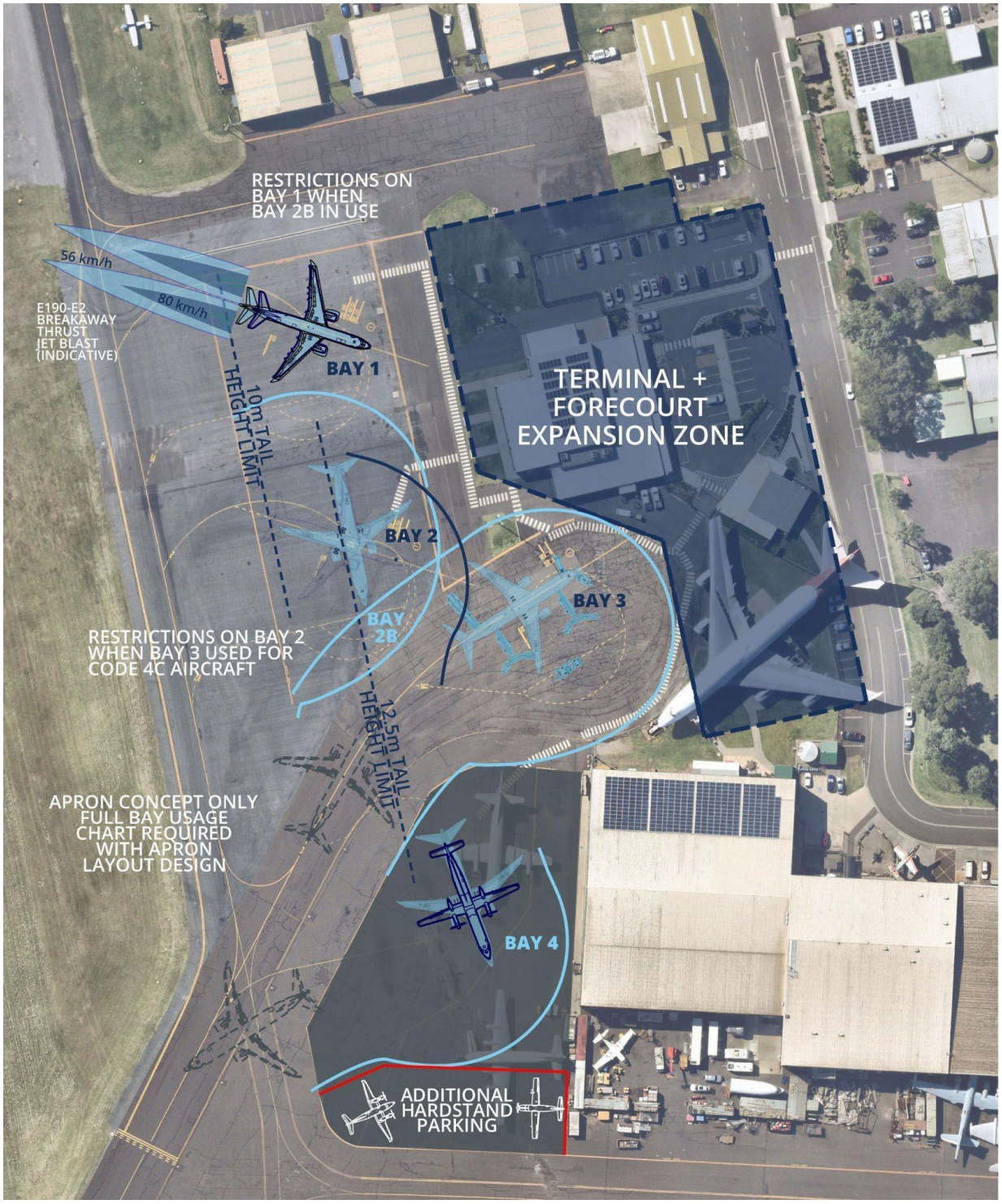
5.4.2 Main Apron

With simultaneous Code 4C aircraft operations, the following is noted:

- Operations on Bay 3 are preferred, as this places the tail of the aircraft as far from the runway strip as practical. It also provides the greatest room for servicing and adjacent storage and staging of Ground Support Equipment (GSE). However, when Bay 3 is occupied by a Code 4C aircraft, the wingtips, rear stairs and horizontal stabiliser infringe the Bay 2 wingtip clearance limits in accordance with CASA Part 139 MOS 2019, preventing the Bay 2 aircraft from exiting (this restriction likely affects most aircraft types using Bay 2).
- A possible Bay 2B parking arrangement parallel to the runway allows independent Bay 2B/Bay 3 operations and also keeps larger aircraft tails clear of the hypothetical transitional OLS associated with a 150 m wide runway strip (pending airline safety case to the contrary, it is assumed for this Master Plan that this will be required). When Bay 2B is in use the accessibility to exit Bay 1 or enter Bay 1A is limited to the Saab 340B aircraft.
- The reconfiguration of Bay 4 could provide a third Code 4C capable position, with the aircraft re-oriented to minimise passenger exposure to operations into and out of Bay 3.
- There is opportunity for additional hardstand parking for smaller charter aircraft to the south of Bay 4.

The optimal apron parking position layout and usage restrictions will depend on exact demand profiles and aircraft mix and can only be determined with certainty once an operational profile is known (and, in this case details of the airline safety case with respect to obstacles in relation to aircraft tail positioning). However, strengthening of Bay 3 and an expanded Bay 4 to accommodate Code 4 aircraft would provide the greatest flexibility to develop a detailed apron marking layout design which provides for the widest range of operational scenarios.

Figure 8: Passenger Terminal Precinct Concept Layout



5.5 HARS Precinct

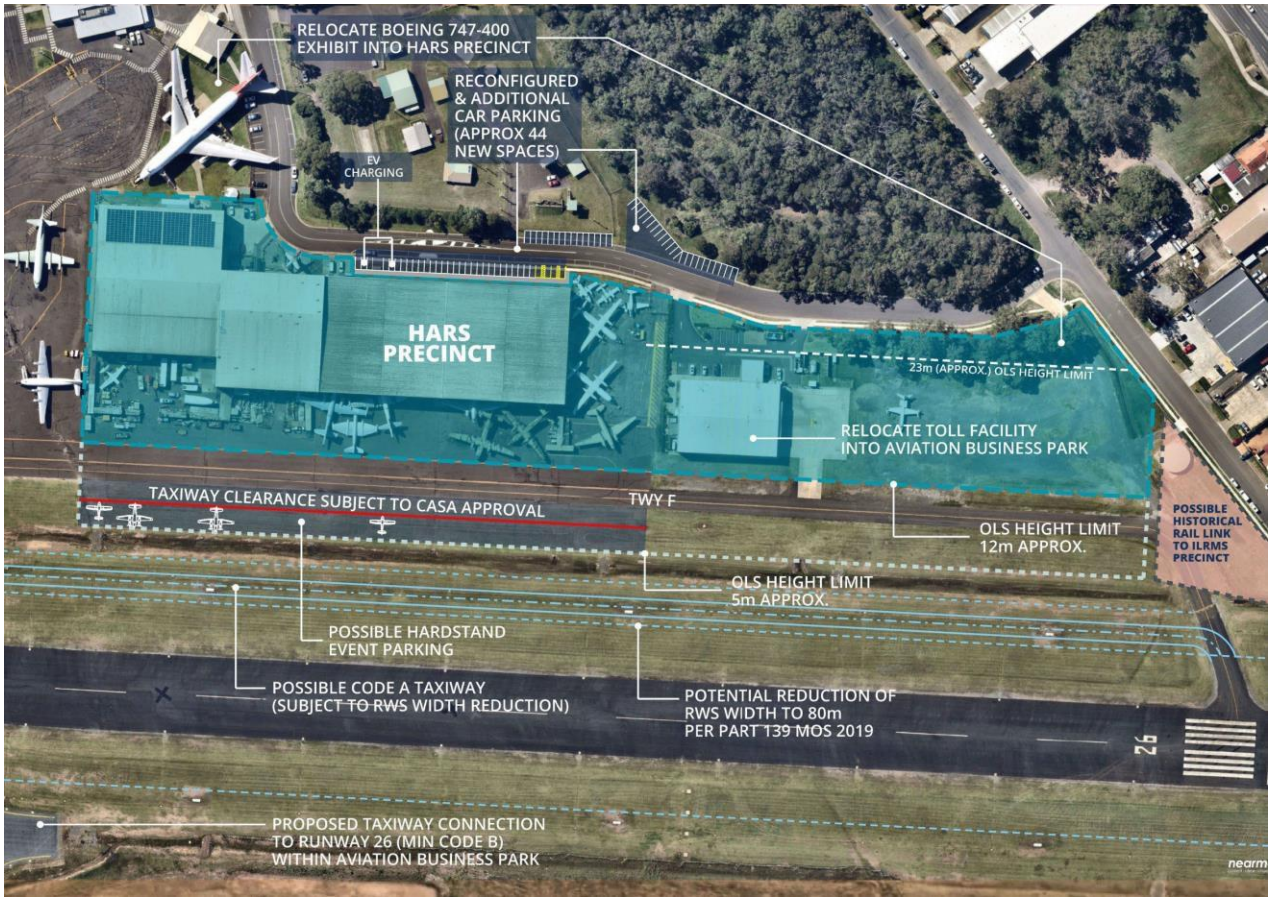
The HARS Precinct is intended to provide a defined footprint with which HARS can plan and implement it expansion plans (subject to all applicable aviation safeguarding and security requirements), including the establishment of a museum, education and conference centre.

The future expansion of the passenger terminal and forecourt will require the use of the area to the south of the existing making relocation of the HARS Boeing 747-400 exhibit necessary to free up space.

Initially, the HARS Precinct is constrained by Boomerang Avenue to the north, Taxiway E to the south and the adjacent Toll rescue helicopter facility to the east. The relocation of the rescue helicopter facility into a suitable site within the Aviation Business Park would be a requirement for this precinct concept to eventuate.

There is an opportunity for possible event hardstand parking to be introduced on the southern side of Taxiway E. However, even without the introduction of this parking, the width of the Taxiway E strip does not meet full Code A taxiway standards and is constrained by the HARS apron to the north. Once the Aviation Business Park is developed, there will be a taxiway connection on the southern side of Runway 08/26, which will be accessible for Code B aircraft through to Runway 26 end, and which will help minimise backtracking on the runway. At this point, Taxiway E/F will largely become redundant and there could be an opportunity to expand the HARS apron (subsuming the event parking hardstand). This would allow HARS more independence in managing its activities and may provide the ability to allocate land for airside/landside flexibly as different events and opportunities allow, such as air shows and potential light rail connection to the Illawarra Light Railway Museum Society (ILRMS) precinct (see **Section 0** for further discussion on this).

Figure 9: HARS Precinct Concept Layout



If required, there appears to be room for a Code A taxiway to the north of Runway 08/26 (in addition to the taxiway to the south), at the prescribed minimum offset of 47.5 m from runway centreline to taxiway centreline, with the graded strip width of 10.25 m remaining south of the existing open drain. This would require the 08/26 runway strip (RWS) to be reduced from the current 90 m width to 80 m, which is the minimum required for a Code 2 runway under the Part 139 MOS 2019.

5.6 Possible Historical Rail Link

There has been a suggestion that the HARS precinct could incorporate a possible link to the Illawarra Light Rail Museum which is located adjacent to the airport and accessed off Tongarra Road. A historical or model rail link within the airport land would require suitable security provisions including fencing, as well as consideration of the OLS for Runway 08/26. A zone in which the rail link is likely to be most feasible is illustrated on **Figure 6**, however the feasibility of such a link with respect to the safety and security of aviation operations, including possible impacts on the length of Runway 08/26, needs further detailed investigation.

5.7 Aviation Business Park

Land to the south of Runway 08/26 and east of Runway 16/34 has been set aside for Aviation Business Park development. The area is shown in **Figure 10**.

Figure 10: Aviation Business Park Precinct

Council has previously developed draft concept layouts for the area incorporating a combination of Code C hangar sites (in the western portion) and Code B hangar sites (in the eastern portion closer to the Runway 26 threshold).

Council has commenced development of Stage 1 of the Aviation Business Park, by upgrading Taxiway G to Code C standard. This has been done along the pre-existing Taxiway G centreline alignment, which is 93 m offset from the Runway 16/34 centreline. This offset is based on the legacy Code 3 runway strip standard width of 150 m. Bearing in mind aspirations for larger Code 3C and potentially even 4C aircraft operations borne out of the *Shellharbour Airport – Market Review – June 2023*, it is recommended that hangar heights in this area respect the legacy Code 3/4 OLS transitional surface, consisting of a 1:7

(14.3%) slope originating 75 m from the Runway 16/34 centreline in accordance with the previous MOS Part 139 v1.15 July 2020.

Bearing in mind these OLS considerations, as well as other developments including revisions to the aerodrome standards effective 2020, it is recommended that a full and detailed review of the Aviation Business Park internal layout be undertaken prior to formalising any subdivision or further construction proceeding. This will enable commercial opportunities to be maximise, whilst accommodating changes such as the incorporation of a suitable replacement rescue helicopter facility to enable the HARS Precinct concept and the recent installation of a Precision Approach Path Indicator (PAPI) on Runway 26, neither of which were envisaged in the 2017 draft concept layout. The latter especially will affect the parallel taxiway alignment in order to avoid the PAPI units and avoid aircraft infringing the Obstacle Assessment Surface as required by the Part 139 MOS 2019. Such re-alignment will have flow-on effects on the internal hangar site layout.

Council could consider a review of the Aviation Business Park zoning, currently SP1 Aviation, to ensure that the desired employment-related and/or commercial outcomes are maximised, by adjusting the zoning of selected portions of the business park to allow a more diverse range of uses compatible with the on-airport location. However, caution should be exercised to avoid businesses that do not require airside access from denying opportunities to businesses that do require direct access to the aerodrome airside infrastructure and facilities. Any zoning review should be undertaken in conjunction with development of the detailed internal business park layout and a corresponding business case review.

Relocation of the Bureau of Meteorology instrumentation located in the centre of this area would be necessary for the next stage of the business park.

It is also noted that the Aviation Business Park access road off Tongarra Road is not ideally positioned, directly at the end of the Runway End Safety Area (see **Section 4.4**) and requiring mitigation against jet blast (see **Section 4.6**). It is understood the location of the access road intersection with Tongarra Road is a result of Transport for NSW (TfNSW) requirements. Bearing in mind the impact and interaction with aircraft operations, especially if jet aircraft operations are introduced, as well as potential for pilot distraction due to heavy vehicle movements directly under the final approach, Council should consider further engagement with TfNSW regarding options available to mitigate these issues, including the potential to relocate the intersection further to the west, avoiding or reducing the amount of traffic passing directly below aircraft as they approach

5.8 Future Commercial Precinct

At present, this area in and around the NDB, is largely constrained by the NDB Building Restricted Area (BRA) as described in **Section 6.8**. **Figure 11** below shows how the NDB BRA restricts potential building heights in the Future Commercial Precinct and therefore limits the development of this precinct while the NDB remains operational.

The larger area, to the north of the existing long-term car park is largely restricted to ground level by the inner 60 m radius of the NDB. Any development in this darker shaded area must be referred to Airservices for assessment in accordance with NASF Guideline G. Development above 5.25 m high outside the shaded area may be possible, however if it breaches the Zone B boundary (see **Section 6.8** for details) details must be submitted to Airservices for assessment. **Figure 11** shows the approximate height above ground level of the Zone B limit. It is recommended that any developments in this area are submitted to Airservices for information, even if they do not breach the BRA limits.

In addition to car parking, potential hotel accommodation has been mentioned in this precinct. Given the NDB restrictions this may not be possible until the NDB is decommissioned, for which there are currently no plans by Airservices. Minor development of things like EV charging facilities may be possible in the meantime.

Figure 11: NDB Building Restrictions

6. Airport Safeguarding Plan

Adequate protection of the basic capability to undertake aircraft operations in accordance with accepted safety standards and regulatory requirements, and in efficient and economic manner, is imperative to the future realisation of aeronautical opportunities at Shellharbour Airport. Safeguarding is particularly important where the capability for future upgrades is to be preserved, for example to accommodate larger aircraft. Development on and around Shellharbour Airport will require adequate respect for safeguarding in order to develop the vision and objectives of the Master Plan and preserve possible future opportunities.

Airport safeguarding includes a number of elements that will be required throughout the planning and development processes. The various safeguarding elements will be triggered by different activities and aircraft operations.

6.1 National Airports Safeguarding Framework

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

- Improve community amenity by minimising aircraft noise-sensitive developments near airports including through the use of additional noise metrics and improved noise-disclosure mechanisms; and
- Improve safety outcomes by ensuring aviation safety requirements are recognised in land use planning decisions through guidelines being adopted by jurisdictions on various safety-related issues.

The NASF was developed by the National Airports Safeguarding Advisory Group (NASAG), comprising of Commonwealth, State and Territory Government planning and transport officials, the Australian Government Department of Defence, the Civil Aviation Safety Authority (CASA), Airservices Australia and the Australian Local Government Association (ALGA).

NASF currently consists of a set of seven principles and nine guidelines. The full NASF principles and guidelines can be found on the Department of Infrastructure and Regional Development's website at: *www.infrastructure.gov.au/aviation/environmental/airport_safeguarding/nasf* .

The NASF principles are as follows, and each Guideline is described in the following subsections.

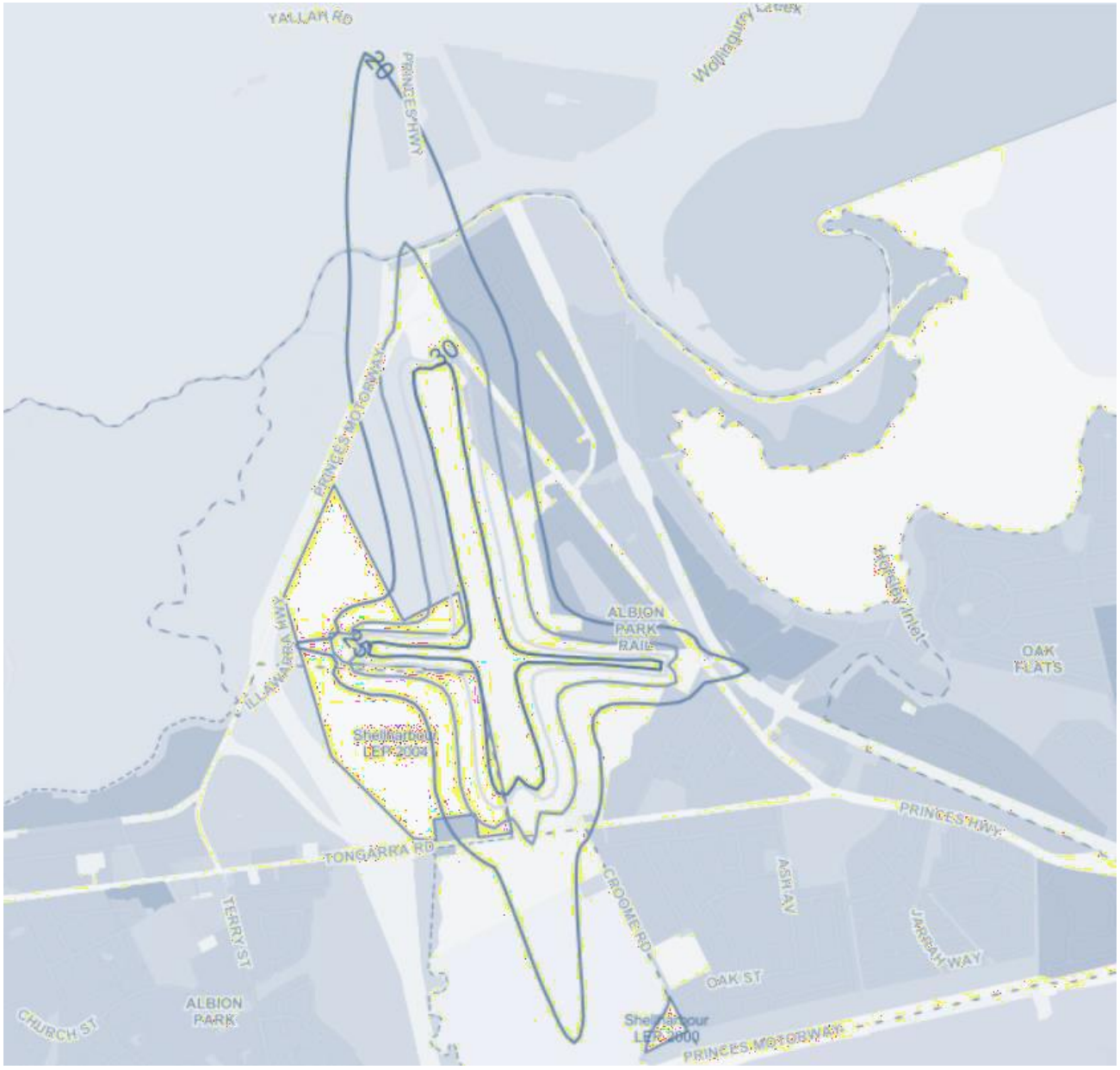
- **Principle 1:** The safety, efficiency and operational integrity of airports should be protected by all governments, recognising their economic, defence and social significance
- **Principle 2:** Airports, governments and local communities should share responsibility to ensure that airport planning is integrated with local and regional planning
- **Principle 3:** Governments at all levels should align land use planning and building requirements in the vicinity of airports
- **Principle 4**: Land use planning processes should balance and protect both airport/aviation operations and community safety and amenity expectations
- **Principle 5**: Governments will protect operational airspace around airports in the interests of both aviation and community safety
- **Principle 6:** Strategic and statutory planning frameworks should address aircraft noise by applying a comprehensive suite of noise measures
- **Principle 7:** Airports should work with governments to provide comprehensive and understandable information to local communities on their operations concerning noise impacts and airspace requirements.

The NASF Guidelines are presented here in their alphabetical order, however the guideline considered most relevant to this Master Plan and its vision, as stated as **Section 3**, is that relating to protection of operational airspace and associated matters discussed in **Section 6.6.2**.

6.2 Aircraft Noise

The Shellharbour Local Environmental Plan 2013 (LEP) includes an Australian Noise exposure Forecast (ANEF), understood to have been developed around 2008 and shown in **Figure 12**.

Figure 12: Current Shellharbour Airport ANEF



Source: Shellharbour Local Environmental Plan 2013

The basis of this ANEF, in terms of aircraft types and frequencies modelled, is not clear. It is, however, likely that due to the passage of time the aircraft types included do not represent all of the types which may commence operations as a result of the aviation strategies set out in the *Shellharbour Airport – Market Assessment – June 2023*.

Noting the technical challenges to the establishment of regular services by larger Code 3 or Code 4 aircraft, it is recommended that if these services prove possible, an updated aircraft noise assessment and ANEF be developed to account for the expected aircraft fleet and frequency of operations.

6.3 Building Generated Windshear + Turbulence

The purpose of NASF Guideline B: *Managing the Risk of Building Generated Windshear and Turbulence at Airports* is to assist land use planners and airport operators in their planning and development processes to reduce the risk of building generated windshear and turbulence at airports near runways.

Applicability of this Guideline is initially determined by the location of the building within an 'assessment trigger area' around the runway ends, that is:

- 1200 metres or closer perpendicular from the runway centreline (or extended runway centreline);
- 900 metres or closer in front of runway threshold (towards the landside of the airport); and
- 500 metres or closer from the runway threshold along the runway.

The guideline recommends that all developments within the assessment trigger areas which will infringe a 1:35 sloping surface from the runway centreline should be subject to further assessment.

Positioning of all developments on airport will need to be evaluated on a case-by-case basis. Subject to confirmation through such evaluation that no adverse impact on aircraft operations is predicted, then buildings may be located closer to the runways and within the 1:35 surface. **Figure 13** illustrates the assessment trigger areas.

Proposed developments in these areas should initially be assessed against the relevant 1:35 surface as described in Guideline B. Buildings that are proposed to infringe this surface may require further assessment in accordance with Guideline B to confirm that no adverse impact on aircraft operations is predicted. With reference to **Figure 6** at **Section 5.1**, it can be seen that developments in the Landside and Commercial precincts would be within the assessment trigger area for Runway 08-26 and developments with the HARS Precinct and the Aviation Business Park would be within the assessment trigger areas for both Runway 08-26 and Runway 16-34.

Figure 13: BGWT Assessment Trigger Areas

Building Generated Windshear + Turbulence Assessment Trigger Areas

Runway 16/34

Runway 08/26

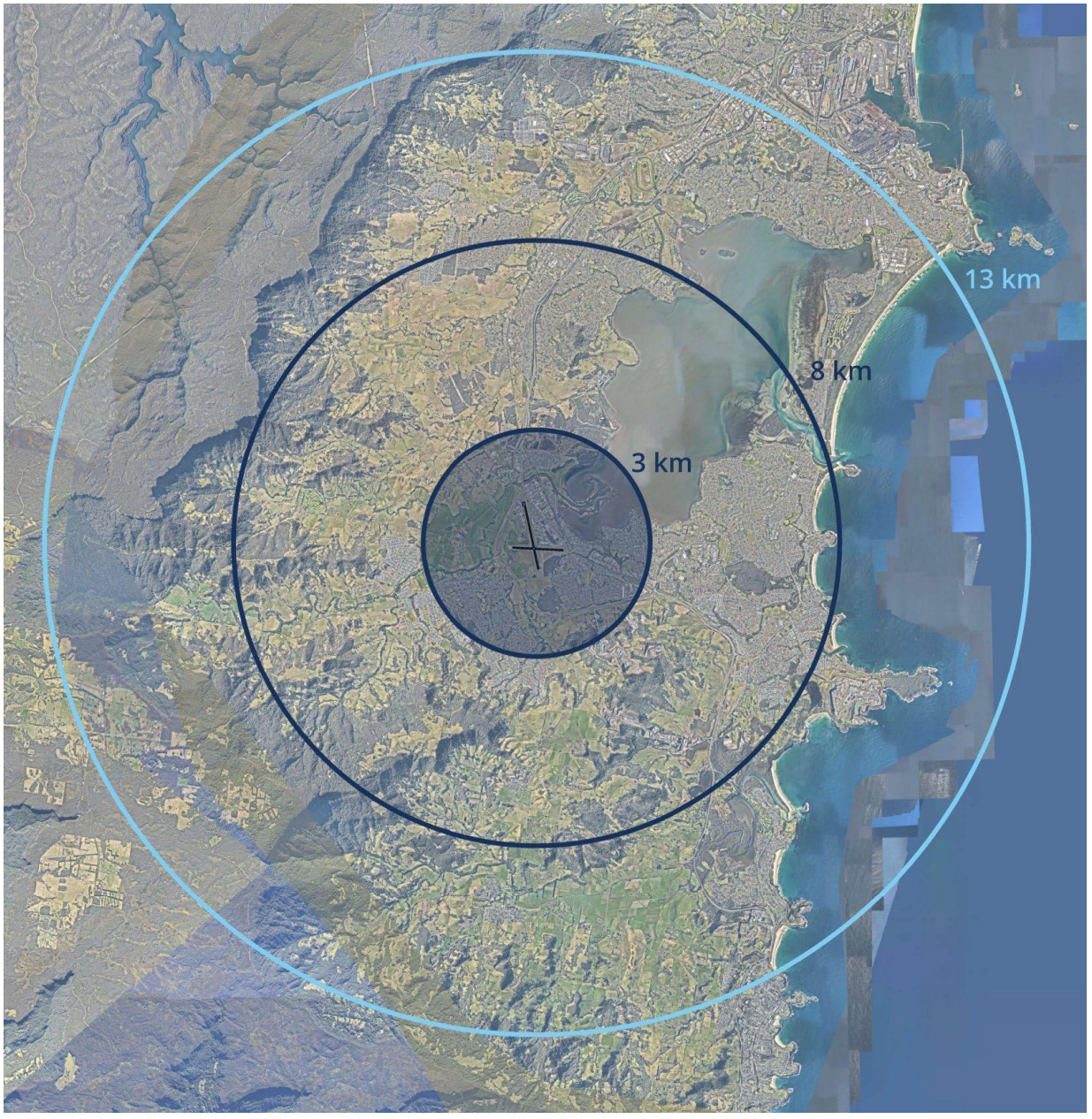
Airport Precincts:

1 Illawarra Flyers
2 Existing GA Precinct
3 Passenger Terminal Precinct
4 HARS Precinct
5 Aviation Business Park
6 Landside Precinct
7 Future Commercial Precinct

6.4 Wildlife Hazards

The purpose of NASF Guideline C: *Managing the Risk of Wildlife Strikes in the Vicinity of Airports*, is to inform the land use planning decisions and the way in which existing land use is managed in the vicinity of airports with respect to the attraction of wildlife, particularly birds. A table is included in Attachment 1 to Guideline C which indicates wildlife attraction risk and associated actions for developments within buffer zones around airports of three (3), eight (8) and 13 kilometres radius. These buffer zones are shown on **Figure 14** for Shellharbour Airport. Council should consider Guideline C in its planning decisions with respect to land uses and developments within 13 kilometres of the Airport.

Figure 14: Wildlife Buffer Zones



6.5 Wind Turbines

NASF Guideline D: *Managing the Risk to Aviation Safety of Wind Turbine Installations* provides general information and advice in relation to wind farms and turbines and their hazards to aviation. Proponents of such installations should take account of Guideline D in undertaking assessments of the impacts of the proposals, including on aviation.

Council should be aware of Guideline D and it may assist in evaluating and commenting on any wind farm proposals within 30 km of Shellharbour Airport.

6.6 Lighting and Glare

6.6.1 Lighting

NASF Guideline E *Managing the Risk of Distraction to Pilots from Lighting in the Vicinity of Airports* provides guidance on the risk of distractions to pilots of aircraft from lighting and light fixtures near airports. The CASA Manual of Standards part 139 Aerodromes Section 9.21: Lighting in the Vicinity of Aerodromes sets out the restrictions and provides advice to lighting suppliers on the general requirements, information and correspondence avenues.

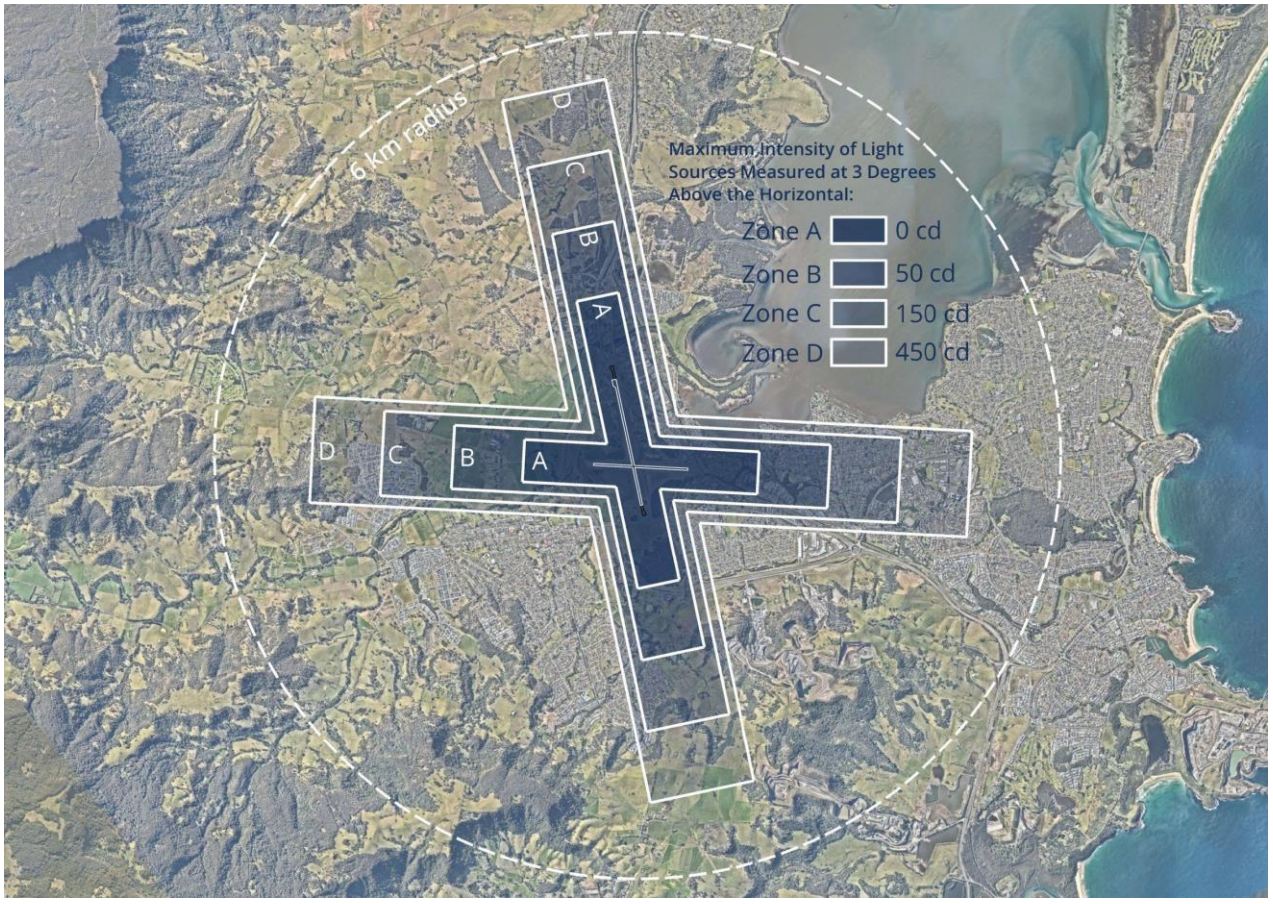
Advice for the guidance of designers and installation contractors is provided for situations where lights are to be installed within a six (6) kilometre radius of the airport. Lights within this area fall into a category most likely to be subject to the provisions of regulation 94 of the Civil Aviation Regulations 1988, under which CASA has the power to require lights which may cause confusion, distraction or glare to pilots in the air, be extinguished or modified.

The primary area is divided into four light control zones; A, B, C and D, as shown in **Figure 15**. These zones reflect the degree of interference ground lights are permitted to cause pilots as they approach. Lighting associated with any developments should therefore meet the maximum intensity of light sources measured at three (3) degrees above the horizontal associated with each Zone as follows:

- Zone A – 0 cd;
- Zone B – 50 cd;
- Zone C – 150 cd; and
- Zone D – 450 cd.

Council should consider Guideline E in relation to any proposed lighting installations on airport, as well as off-airport (for example, associated with sports fields, industrial facilities and similar) within six (6) kilometres of Shellharbour Airport.

Figure 15: Lighting Restriction Zones



6.6.2 Solar Glare

Potential for glare from solar panel installations and other reflective surfaces has, traditionally, been a concern for aviation safety around airports. Currently, there are no specific Australian standards the apply to solar farms near aerodromes, or the installation of rooftop solar panels on buildings on airport. CASA has generally followed the US Federal Aviation Administration (FAA) which is relatively advanced in terms of solar farm glare evaluation. The FAA revised its guidance in May 2021 as follows:

> *"In most cases glint and glare from solar energy systems to pilots on final approach is similar to glint and glare pilots routinely experience from water bodies, glass-façade buildings, parking lots, and similar features. However, FAA has continued to receive reports of potential glint and glare from on-airport solar energy systems on personnel working in ATCT cabs. Therefore, FAA has determined the scope of agency policy should be focused on the impact of on-airport solar energy systems to federally-obligated towered airports, specifically the airport's ATCT cab."*

CASA has adopted this updated FAA policy in its response to Council's request to review the Bass Point Quarry Solar Farm, where CASA has recommended a technical glare assessment is not required, " … mainly due to the lack of a near ATC tower."

Therefore, on the basis of the CASA advice, rooftop solar installation on individual buildings are not expected to pose a significant risk to aircraft operations as a result of glint and glare to pilots.

Noting the possibility of an ATC tower (albeit likely a digital solution as discussed in **Section 4.12**) ultimately being required to fulfil aviation development scenarios, it is recommended that any installation go ahead on the proviso, in the future it may need to be adjusted or removed if it causes safety risks as a result of glint and glare on ATC.

6.7 Protected Operational Airspace

NASF Guideline F: *Managing the Risk of Intrusions into the Protected Operational Airspace of Airports*, provides guidance to State/Territory and local government decision makers as well as airport operators to jointly address the issue of intrusions into the operational airspace of airports by tall structures, as well as trees in the vicinity of airports.

If these activities are not regulated, CASA may have to mitigate risk by imposing restrictions on the runway distance that can be used. Alternatively, the minimum descent altitude for aircraft approaching in inclement weather may have to be lifted, with the result that fewer aircraft may be able to land under such conditions. Either way, an increase in the prevalence of obstacles in Shellharbour Airport operational airspace poses a threat to the ongoing operational efficiency of the airport, whether in regard to existing operations or a desired introduction of larger aircraft services.

Two separate groups of criteria determine the dimensions and volumes of the required operational airspace. The first group, Obstacle Limitation Surfaces (OLS), protect visual operations (which typically include most general aviation operations, as well as air transport operations in good weather). The OLS are described in **Section 6.7.1**. The second group of criteria protect aircraft operations that are solely reliant on navigational instruments. These criteria, known as PANS-OPS, are discussed in **Section 6.7.2**.

Finally, NASF Guideline F also addresses activities that could cause air turbulence or the emission of steam, gas, smoke, dust and other particulate matter where this could affect the operation of aircraft in accordance with the Visual Flight Rules (VFR). These matters are discussed in **Section 6.7.3**, in particular with reference to the Tallawarra B power station.

6.7.1 Obstacle Limitation Surfaces

The current Obstacle Limitation Surfaces (OLS) for Shellharbour Airport were established for Code 2 instrument non-precision approach and take-off operations on Runway 16/34 and non-instrument operations on Runway 08/26. Since these OLS were established, the standards for OLS applicable to Code 2 and Code 3 instrument runways have changed.

Table 6 shows how the existing OLS compares with the current *Part 139 (Aerodromes) Manual of Standards 2019* (Part 139 MOS 2019) specifications for Code 2 and Code 3/4 instrument non-precision approach operations. It can be seen that, with an inner edge width of only 90 m, the Runway 16/34 approach surfaces do not meet the current standards for Code 2 instrument non-precision operations. Also shown in

Table 6 are the historical standards which applied to Code 3 instrument non-precision Runways prior to the introduction of the Part 139 MOS 2019. These are taken from the legacy *Manual of Standards Part 139 – Aerodromes* v1.15 July 2020 (MOS Part 139 v1.15).

Table 6: Comparison of OLS Specifications

Element	Existing OLS	Part 139 MOS 2019 Code 2	Part 139 MOS 2019 Code 3 / 4	Legacy MOS Part 139 v1.15 Code 3 / 4
CONICAL				
Slope	5%	5%	5%	5%
Height	60 m	60 m	75 m / 100 m	75 m
INNER HORIZONTAL				
Height	45 m	45 m	45 m	45 m
Radius	3,500 m	3,500 m	4,000 m	4,000 m
APPROACH				
Length of inner edge	90 m	140 m	280 m	150 m / 150 m
Divergence each side	15%	15%	15%	15%

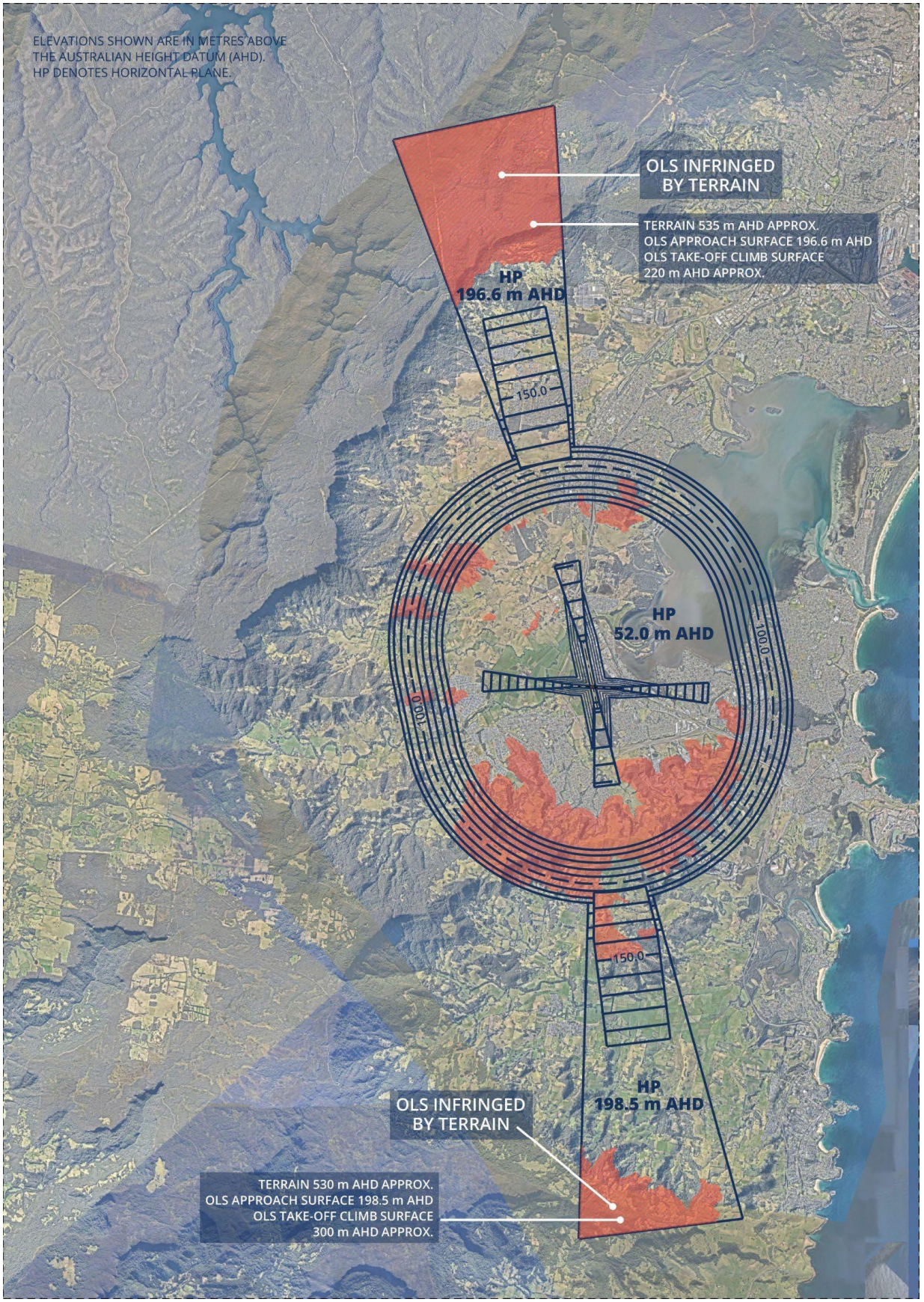
Element	Existing OLS	Part 139 MOS 2019 Code 2	Part 139 MOS 2019 Code 3 / 4	Legacy MOS Part 139 v1.15 Code 3 / 4
First section length	2,500 m	2,500 m	3,000 m	3,000 m
Slope	3.33%	3.33%	2.0%	3.33% / 2.0%
Second section length	-	-	3,600 m	3,600 m
Slope	-	-	2.5%	2.5%
Horizontal section length	-	-	8,400 m	8,400 m
Total length	2,500 m	2,500 m	15,000 m	15,000 m
TRANSITIONAL				
Slope	20%	20%	14.3%	14.3%
TAKE-OFF CLIMB				
Length of inner edge	90 m	80 m	180 m	180 m
Rate of divergence	10%	10%	12.5%	12.5%
Final width	580 m	580 m	1,800 m	1,800 m
Overall length	2,500 m	2,500 m	15,000 m	15,000 m
Slope	4%	5%	2%	2%
* 150 m approach surface inner edge and runway strip width was permissible for Code 4 aeroplanes only requiring a 30 m wide runway				

The 2013 Master Plan recommended protecting the long-term potential to be able to conduct Code 3C or 4C operations and included a set of OLS applicable to Code 4 instrument non-precision approaches and Code 4 take-offs for Runway 16/34. Those 2013 OLS were based on a 2.0% approach surface slope. The OLS in **Figure 16** below are based on a 3.33% approach surface and are what would be applicable if Runway 16/34 had been 'grandfathered' to the previous Code 3 standards. It is provided to illustrate the historical challenges in safeguarding for Code 3 or 4 OLS compliance at Shellharbour as a result of the extensive infringement of the OLS by surrounding hilly terrain. These permanent and irremovable infringements may explain why Runway 16/34 has instead been grandfathered to historical Code 2 standards, given the inability to have complied with even the historical Code 3 requirements.

To operate larger Code 3C aircraft or Code 4C aircraft, the infringements shown in **Figure 16** would need to be safely avoided through operational procedures, such as curved VFR take-off and approach paths, existing or upgraded instrument approach procedures, possible standard instrument departures, and airline one-engine inoperative (OEI) take-off procedures to keep aircraft safely clear of obstacles. Demonstrating to CASA's satisfaction how the challenges presented by terrain and other obstacles would be an essential part of an airport compatibility study and airline safety case.

As discussed in Section 4.7.2, possible future OLS changes currently under consideration by ICAO may lead to greater flexibility in safely accommodating operations by larger aircraft, which more commonly operate under instrument procedures, in line with improvements in aircraft navigation technologies. Such developments should be kept under review, however pending finalisation and publication of any updated OLS specifications by ICAO and subsequently by CASA, the legacy MOS Part 139 v.1.15 Code 3 OLS should be protected from further intrusion.

Figure 16: Illustrative Legacy Code 3 OLS Showing Terrain Infringements



6.7.2 PANS-OPS

In addition to the OLS, Council is also required to monitor and report obstacles to the Procedures for Air Navigation Surfaces – Aircraft Operations (PANS-OPS) surfaces which may affect the published instrument approach procedures.

The PANS-OPS surfaces protect the airspace in the vicinity of the airport for instrument operations. The PANS-OPS surfaces differ to the OLS in that they protect aircraft conducting operations under IFR and as such cannot be infringed under any circumstances, as aircraft are relying on them for the avoidance of obstacles. However, like the OLS, they comprise a series of airspace reference surfaces. PANS-OPS surfaces are generally (though not always) higher than the OLS, but they extend further from the airport than the OLS.

Currently, the airport monitors the Visual Segment Surfaces (VSS) for Runway 16 and 34 approaches as part of its annual obstacle survey. The current VSS has an inner edge width of 90 m, in line with the published runway strip width. Consistent with the principle of minimising obstacles within the OLS associated with a 150 m wide runway strip, Council should consider monitoring the VSS that would apply to a 150 m wide runway strip.

Council should work with Airservices Australia to ensure the information needed for monitoring obstacles within the associated instrument approach procedure protection areas is available, to allow it to fulfil its obligations under the relevant regulations.

6.7.3 Plume Rise

Exhaust plumes from industrial and other facilities can be considered obstacles if they present a significant risk of turbulence of sufficient severity to cause a loss of safe control of aircraft by pilots.

CASA has established a process, set out in Advisory Circular AC 139.E-02 v1.0 *Plume rise assessments* March 2023 for assessing proposed plume rises for risk to aviation operations.

The proposed Tallawarra B Power Station is the source of a significant exhaust plume which has the potential to cause a turbulence hazard to aircraft operations above and near to the power station. The gas turbine exhaust is located approximately 3.6 km northeast of the airport and is below the existing OLS conical surface. The proponent, Energy Australia, has proposed a plume dispersion device (PDD), to discharge the exhaust horizontally. However due to the high exhaust temperature, the potential for turbulence remains. To assess the potential safety impacts, assessment has been carried out by others, in consultation with CASA, in accordance with the process set out in AC 139.E-02.

CASA has provided advice to the NSW Department of Planning and Environment (NSW DPE), the Land Use Planning Authority (LUPA) responsible for the Tallawarra B approval, as follows:

- A plume rise velocity lower than 6.1 m/s by 700 ft AMSL would achieve an acceptable level of safety for aviation; and
- NSW DPE should satisfy itself that the modelling of the final design is valid and that the average plume rise velocity will not exceed 6.1 m/s at 700 ft AMSL.

CFD modelling has been carried out for Energy Australia[7] and independently reviewed by GHD[8]. The modelling concludes the resulting plume rise velocity will be below 6.1 m/s at 700 ft AMSL. It is beyond

[7] Tallawarra B Power Station CFD Plume Modelling – GE Modified PDD Design Version 3B, Summary Report, 7th March 2023

[8] Tallawarra B Power Station Review of CFD Plume Rise Assessment, ref:12606819, 04 April 2023

the scope of this Master Plan to further validate this specialist assessment. However, from an airport safeguarding perspective it is important to note that CASA also advised NSW DPE that (emphasis added)[9]:

> *CASA advises that theoretical modelling must be validated using the final design* ***and actual plume data during power plant operation. Any real time outcomes that create a plume velocity greater than 6.1 m/s above 700 ft AMSL will require further mitigation to achieve an acceptable level of safety for aviation.***

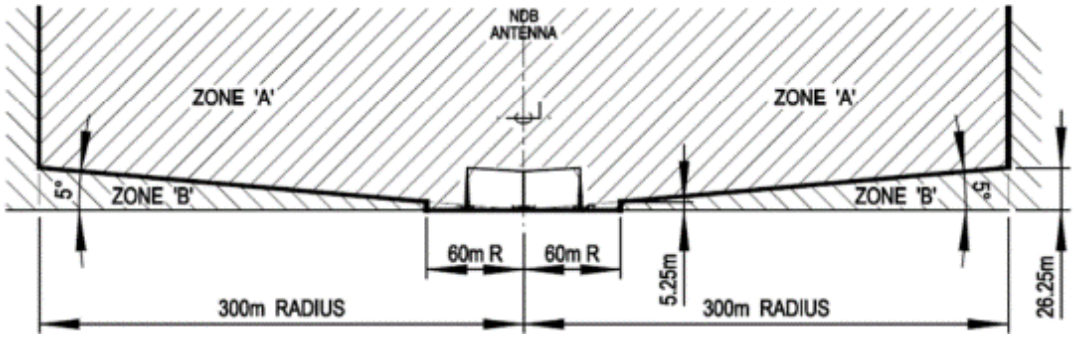
It is understood that this requirement has been imposed as a condition of the approval of Tallawarra B under a Plume Validation Monitoring Program. It is recommended Council liaise closely with NSW DPE to ensure that the monitoring program is implemented diligently.

6.8 Communication, Navigation and Surveillance (CNS) Facilities

Shellharbour Airport has a non-directional beacon (NDB) owned and operated by Airservices Australia (Airservices). Whereas most NDBs in Australia have now been decommissioned, as a result of the reduced reliance on ground-based navigation aids (navaids) and increased usage of Global Navigation Satellite System (GNSS) as the primary means of instrument flight rules navigation in Australia, the NDB at Shellharbour remains as one of the navaids forming the Backup Navigation Network (BNN). The BNN is maintained and monitored by Airservices to support a GNSS contingency mode of operation, in the unexpected case where a pilot is unable to access the GNSS service. Airservices is currently undertaking a post implementation review of the BNN[10], however there are at present no indications that the Shellharbour NDB is likely to be decommissioned in the foreseeable future. It is nevertheless possible that at some point the NDB will become unnecessary and could ultimately be decommissioned. In the meantime development will need to accommodate the NDB Building Restricted Area (BRA) as defined in NASF Guideline G: *Protecting Aviation Facilities – Communication, Navigation and Surveillance (CNS).*

The purpose of Guideline G is to provide a consistent approach to land use planning protection of CNS facilities. Guideline G assists land use planning decision makers with guidance for assessing development proposals in Building Restricted Areas (BRA). Attachment 3 to the Guideline provides the BRAs for aviation facilities, including the NDB, as shown in **Figure 17**.

Figure 17: NDB Building Restricted Area Requirements



(Cont.)

[9] Proposed Tallawarra Power Plant, CASA Ref:F17/8039-27, 27 August 2021, CASA letter to NSW Department of Planning, Industry and Environment

[10] https://www.avsef.gov.au/consultations/post-implementation-review-australian-backup-navigation-network

Building Restricted Area	Location of development	Action required
Zone A	If development is located: a. within 60 metres of the Non-Directional Beacon antenna; or b. between 60-300 metres from the Non-Directional Beacon antenna and the development will cross the zone boundary (defined as an elevation angle of 5° from ground level at the centre of the Non-Directional Beacon antenna).	All applications must be referred to Airservices Australia for assessment.
Zone B	If development is located between 60-300 metres from the centre of the Non-Directional Beacon antenna and the development will not cross the zone boundary.	No requirements.
General guidance: • within a 60 metres radius from the centre of the Non-Directional Beacon antenna vegetation should be kept to less than 60cm high. Naturally occurring native flora may be allowed to exceed 60cm subject to a site environment plan. • high voltage overhead powerlines 33kv or greater should be at least 300 metres from the centre of the Non-Directional Beacon antenna.		

Source: NASF Guideline G

6.9 Public Safety Areas

NASF Guideline I: *Managing the Risk in Public Safety Areas at the Ends of Runways* provides guidance on approaches for the application of a Public Safety Area (PSA) planning framework in Australian jurisdictions. The Guideline is intended to ensure there is no increase in risk from new development and to assist land-use planners to better consider public safety when assessing development proposals, rezoning requests and when developing strategic land use plans.

Guideline I provides two examples of most relevance to Australia (the UK and Queensland approaches) to developing PSA extents, however it is notable that since publication of Guideline I the UK has updated its policy regarding the establishment, size and shape of PSAs.

Council has previously established PSAs at all four runway ends in line with the Queensland template dimensions. Under the Queensland model, an airport's main runway requires a PSA if the runway meets the following criteria:

- RPT (i.e. airline) jet aircraft services are provided, or
- Greater than 10 000 aircraft movements occur per year (excluding light aircraft movements).

Under NASF Guideline I, an alternative approach is to establish a PSA based on an estimated individual risk level of 1 in 100,000 per year. To do this requires detailed forecasts of future aviation activity, which are not available as part of this Master Plan. However, some analysis has been undertaken to estimate the levels of risk associated with possible aviation activity scenarios.

6.9.1 Runway 08/26

Runway 08/26 is not capable of accommodating jet airline services. Nor is it anticipated to handle more than 10,000 aircraft movements per year, of any size. Therefore, under the Queensland criteria, it would not trigger a requirement for PSAs.

An assessment of risk levels was carried out separate to this Master Plan. It concluded:

- Even with unrealistic 'worst-case' assumptions around future Runway 08/26 use, calculation of individual risk levels estimates a maximum individual risk level of around 0.7-0.8 in 100,000 per year, which is below the level of 1.0 in 100,000 at which NASF Guideline I recommends the establishment of a PSA.
- Modelling of actual risk levels based on 2022-23 financial year aircraft movements estimates a maximum individual risk level of 0.1-0.2 in 100,000 (1 in a million to 2 in a million), with levels exceeding 1 in a million remaining west of the Albion Park station and the rail line.

While this assessment represents a best endeavours order of magnitude estimation of public safety risk levels in accordance with the stated methodology, the acceptability or otherwise of the estimated risk levels for particular land uses or developments in the vicinity of the runway is a matter for Council, in line with NASF Guideline I and/or NSW HIPAP4 as may be appropriate.

6.9.2 Runway 16/34

Under either of the scenarios envisaged in this Master Plan (other than Scenario 1 Business as Usual), Runway 16/34 is envisaged to accommodate jet airline services. Therefore, under the Queensland criteria a PSA would be triggered.

Preliminary assessment of risk levels undertaken for this Master Plan indicate that, under Scenario 3 passenger levels, and including an allowance for growth of general aviation activity commensurate with Aviation Business Park and air show event growth (i.e. an approximate doubling on non-airline operations), levels of risk approximating the NASF Guideline I suggested criteria for a PSA of 1 in 100,000 per year would be generated.

Therefore, to safeguard for the nature of operations envisaged by this Master Plan, retention of the Runway 16/34 PSAs is recommended.

7. Summary & Recommendations

7.1 Summary

This Shellharbour Airport Master Plan has been developed in response to Council's vision to develop the Illawarra Regional Airport into a **vibrant business hub that contributes to regional economic development, tourism and employment**, while **facilitating the viable development of a greater range of affordable air travel options** for the region.

To achieve the first element of this vision requires development of additional infill and new build hangar sites within the Existing GA Precinct as well as the realisation of the Aviation Business Park. To complement this, the consolidation of HARS activities into a dedicated precinct, within which development of a high-quality aviation museum can occur, is a key element of the strategy.

Despite some limitations, on-ground infrastructure is largely fit-for-purpose to accommodate regular operations by a wider range of aircraft types than has been the case in the past, as a result of careful application of funding over recent years to runway, apron and terminal upgrades. These facilities, with appropriate staged upgrades, should not be a barrier to realisation of the vision. Opportunities appear to exist to provide additional runway take-off distance, to further strengthen the capacity for larger aircraft and more airlines operating to a wider range of destinations, albeit subject to satisfying CASA around certain safety matters, including the management of jet blast impacts off airport.

It is important to recognise though, that some aspects of the Shellharbour Airport context present challenges and uncertainty around what is genuinely feasible. These challenges relate primarily to runway strip width, and obstacles and terrain intruding into the airspace required for operations by larger aircraft. The airport is not able to meet the current standards for airspace and obstacle restriction applicable to Code 3 or 4 aircraft (nor even the most recent historical ones) and so will be unable to ever declare itself a Code 3 or 4 Aerodrome Reference Code facility.

Operations by larger aircraft are, nonetheless, not precluded. They are however subject to considerable uncertainty around what the limits of possibility are, especially in relation to the types of aircraft that offer the lowest cost base and bring the most affordable travel outcomes. To resolve these uncertainties will require further detailed technical safety-related work, involving potentially lengthy discussions and collaboration between Council, potential airlines, CASA and other stakeholders. Ultimately, the requirements to mitigate safety necessary to enable some operations may add to the cost base and erode the commercial viability of potential opportunities. Therefore, it is essential for Council to understand the true technical and financial reality before making an informed investment decision in expansion and upgrade of runway infrastructure.

Table 7 below provides a summary of the key Master Plan requirements relating to each of the development scenarios in the *Shellharbour Airport – Market Assessment – June 2023* as indicated in **Table 3** at **Section 4**.

Table 7: Master Plan Key Requirements Summary by Scenario

Master Plan Requirements	Scenario 1 "Business as Usual"	Scenario 2 "Introduction of Airport Security"	Scenario 3 "Introduction of Affordable Travel Options"
Aircraft Types (typical)	Saab 340B	Dash8-Q400, Fokker F100, Boeing B717, Embraer E190, Airbus A220-100	Airbus A320 / 321, Boeing 737, Airbus A220-300
Runway strip & airspace	Maintain existing obstacles below OLS	Safety case required but likely to be achievable	Additional runway strip required (min 150m currently) and 1:7 obstacle free transitional surfaces Safety case required but likely to be straightforward if the above is achieved, but challenging otherwise
Runway length	Existing is adequate	Existing is likely adequate Additional take-off length may be beneficial – consult with operators	Additional take-off length required
Pavement strength	Existing is adequate	Existing is adequate	Runway is adequate for start-up, plan for additional strengthening in next scheduled maintenance overlay Taxiway/apron strengthening likely required earlier
Terminal Expansion	Existing is adequate	Passenger and baggage security screening required Minor terminal expansion may improve baggage claim and give greater comfort levels if overlapping flights	Passenger and baggage security screening required Minor terminal expansion may accommodate single flights Significant expansion required for overlapping flights.
Car Parking	Existing is adequate	Existing potentially adequate, minor additional long stay may be required	Minor expansion for infrequent flights. Substantial expansion required for higher traffic levels, likely requiring use of existing landside precinct lease areas.
Aerodrome Rescue & Fire Fighting Service	Not required	Potentially required (trigger 350,000 pax per FY)	Required once 350,000 pax per FY achieved

7.2 Recommended Actions

It is therefore recommended that, in pursuit of Aviation Development Scenario 2 or 3, as set out in the *Shellharbour Airport – Market Assessment – June 2023*, being those which embody more affordable and varied travel options, the Council undertake the following steps:

- Council engage with potential airline operators, CASA and other possible stakeholders (e.g. Airservices Australia) to develop a clear understanding of what a comprehensive safety case for the regular operation of a given aircraft type will require, in terms of mitigating actions.
- With that knowledge in hand, then develop an informed business case in conjunction with potential airline operators, as to what scale of airline operation is viable for each carrier and what this means for the provision of airport infrastructure (including aspects such as runway length and considerations such as ARFFS in future).
- Apply this information to a detailed business case including cost-benefit analysis for any investment proposals, especially in relation to runway extensions, before committing to infrastructure development.

These steps are likely to be incremental, inter-related and potentially iterative. However, the implementation of this process of due diligence should not need to delay other unrelated elements of this Shellharbour Airport Master Plan.

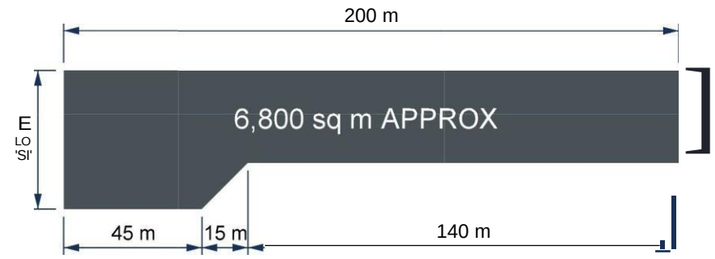
Based on current infrastructure and operational airspace, Aviation Development Scenario 2 is likely to be more realistically achievable in the short- to medium-term, subject to the above steps. Accommodating Scenario 3 is likely to require the acquisition of some surrounding land to meet runway strip width and transitional obstacle limitation surface requirements. However, this should be re-evaluated once proposals for changes to airspace protection requirements, currently under consideration by ICAO, become more certain.

Appendix A: Runway Starter Extension Concepts

NOTES:

1. STARTER EXTENSION LAYOUT CONCEPT ONLY. FINAL LENGTH & LAYOUT SUBJECT TO DETAILED ENGINEERING DESIGN AND CASA APPROVAL.
2. LENGTH SHOWN (200m) EXCEEDS THAT ALLOWABLE UNDER PART 139 MOS 2019 6.04 (1) (a) (MAX. 150m). A SAFETY CASE AND APPROVAL FROM CASA WILL BE REQUIRED.
3. JET BLAST IMPACT SURFACES ARE INIDICATIVE AND BASED ON MANUFACTURER DATA FOR SELECTED AIRCRAFT TYPES UNDER STANDARD CONDITIONS. ADDITIONAL JET BLAST MITIGATION MAY BE REQUIREDDEPENDING ON ACTUAL OPERATING AIRCRAFT TYPES AND REAL-WORLD CONDITIONS.

FULL-STRENGTH PAVEMENT DIMENSIONS (NTS):



OLS HEIGHT LIMIT 3.2m APPROX.
(CODE 3 OR 4 INSTRU T
TKOF OR APCH SFC@2%)

CODE C WINGTIP CLEARANCE

19m D NG x60m WD E RESA

JET BLAST DEFLECTOR

JET BLAST DEFLECTOR

3 m WIDE SHOULDERS

STARTER EXTENSION LIGHTING LAYOUT TO BE AS PART 139 MOS 2019

OLS HEIGHT LIMIT 2.3m APPROX.
(CODE 3 OR 4 INSTRUMENT
TKOF OR APCH SFC @ 2%)

JET BLAST KEY

56 km/h IMPACT SURFACES - BREAKAWAY THRUST:

- a BOEING 737 MAX 8 / [LEAP 1-B]
- b AIRBUS A320-200 / [V2500]
- c AIRBUS A320 NEO / [LEAP 1- B]
- d AIRBUS A220-300 / [PW1521G]
- e AIRBUS A320-200 / [CFM56]
- f AIRBUS A320 NEO / [PW1100G]
- g BOEING B737-800W / [CFM56-7]

80 km/h IMPACT SURFACE - BREAKAWAY THRUST:

- h EMBRAER E190 STD/ [CF34-1OE]

FOR TAKE-OFF JET BLAST SEE B23086/SK/03

L+R AIRPORT CONSULTING

SHELLHARBOUR CITY COUNCIL

SHELLHARBOUR AIRPORT MASTER PLAN

RWY 16 STARTER EXTENSION CONCEPT LAYOUT

0 10 30 50m

1:1,000 @A3

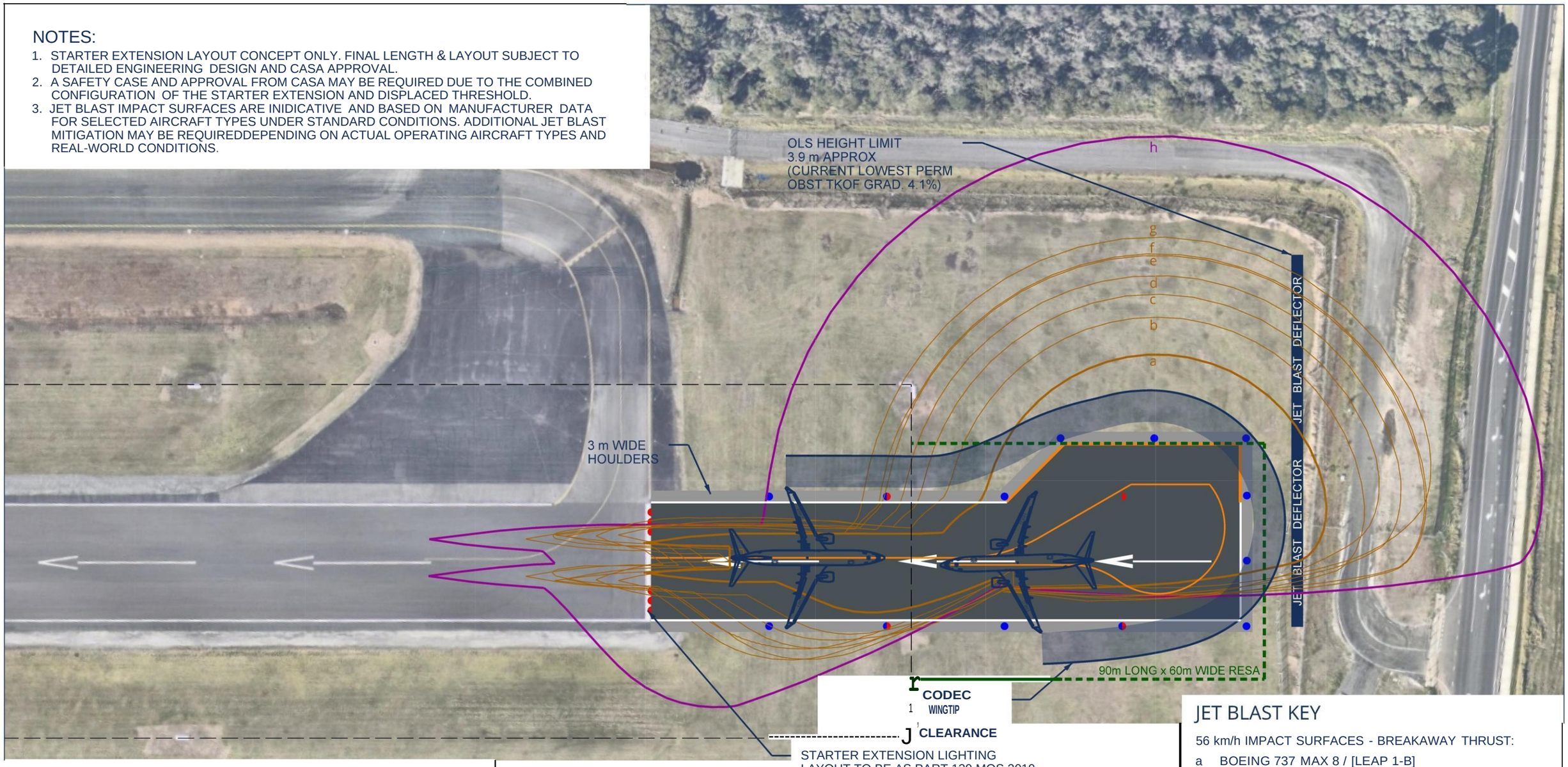
FIGURE

823O86/Sl(-O1

Drawn: BJH 20.12.23 Rev 2

NOTES:

1. STARTER EXTENSION LAYOUT CONCEPT ONLY. FINAL LENGTH & LAYOUT SUBJECT TO DETAILED ENGINEERING DESIGN AND CASA APPROVAL.
2. A SAFETY CASE AND APPROVAL FROM CASA MAY BE REQUIRED DUE TO THE COMBINED CONFIGURATION OF THE STARTER EXTENSION AND DISPLACED THRESHOLD.
3. JET BLAST IMPACT SURFACES ARE INIDICATIVE AND BASED ON MANUFACTURER DATA FOR SELECTED AIRCRAFT TYPES UNDER STANDARD CONDITIONS. ADDITIONAL JET BLAST MITIGATION MAY BE REQUIREDDEPENDING ON ACTUAL OPERATING AIRCRAFT TYPES AND REAL-WORLD CONDITIONS.



JET BLAST KEY

56 km/h IMPACT SURFACES - BREAKAWAY THRUST:

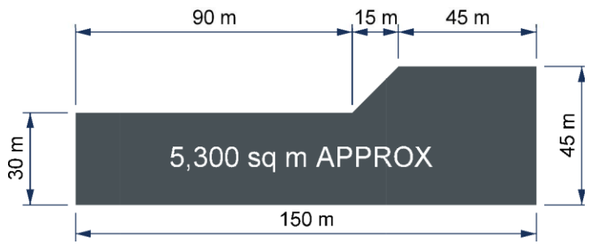
- a BOEING 737 MAX 8 / [LEAP 1-B]
- b AIRBUS A320-200 / [V2500]
- c AIRBUS A320 NEO / [LEAP 1- B]
- d AIRBUS A220-300 / [PW1521G]
- e AIRBUS A320-200 / [CFM56]
- f AIRBUS A320 NEO / [PW1100G]
- g BOEING B737-800W / [CFM56-7]

80 km/h IMPACT SURFACE - BREAKAWAY THRUST:

- h EMBRAER E190 STD/ [CF34-1OE]

FOR TAKE-OFF JET BLAST SEE B23086/SK-03

FULL-STRENGTH PAVEMENT DIMENSIONS (NTS):



L+R AIRPORT CONSULTING

SHELLHARBOUR CITY COUNCIL

SHELLHARBOUR AIRPORT MASTER PLAN

RWY 34 STARTER EXTENSION CONCEPT LAYOUT

NORTH

0 10 30 50m

1:1,000 @A3

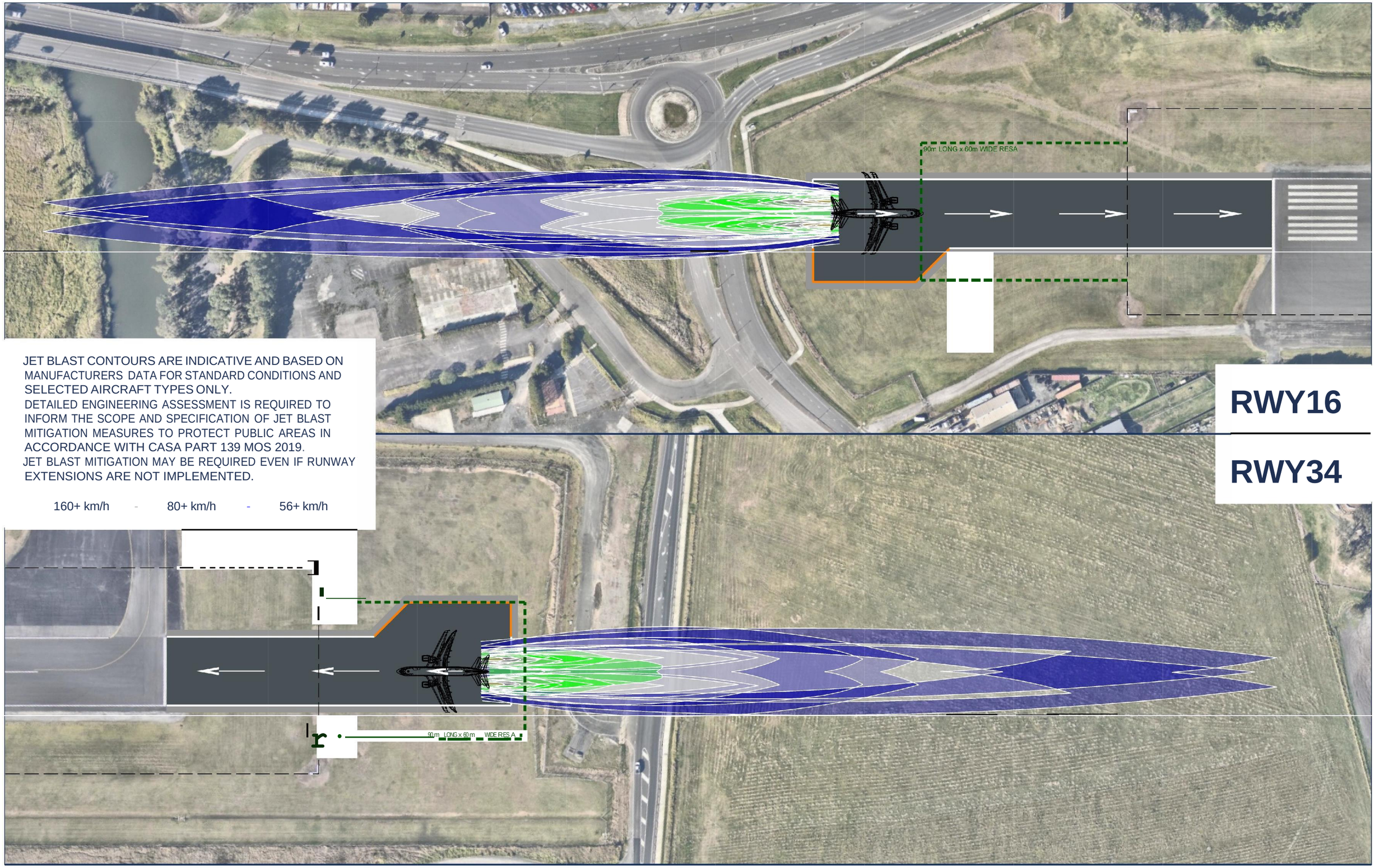
FIGURE

823086/SI(-02

Drawn: BJH 20.12.23 Rev 2

JET BLAST CONTOURS ARE INDICATIVE AND BASED ON MANUFACTURERS DATA FOR STANDARD CONDITIONS AND SELECTED AIRCRAFT TYPES ONLY.
DETAILED ENGINEERING ASSESSMENT IS REQUIRED TO INFORM THE SCOPE AND SPECIFICATION OF JET BLAST MITIGATION MEASURES TO PROTECT PUBLIC AREAS IN ACCORDANCE WITH CASA PART 139 MOS 2019.
JET BLAST MITIGATION MAY BE REQUIRED EVEN IF RUNWAY EXTENSIONS ARE NOT IMPLEMENTED.

160+ km/h - 80+ km/h - 56+ km/h



RWY16

RWY34

L+R AIRPORT CONSULTING

SHELLHARBOUR CITY COUNCIL

SHELLHARBOUR AIRPORT MASTER PLAN

TAI(E-OFF JET BLAST CONTOURS

NORTH

20 60 rnom

1:1,500 @A3

FIGURE

823O86/SI(-O3

Drawn: BJH

20.12.23

Rev 1