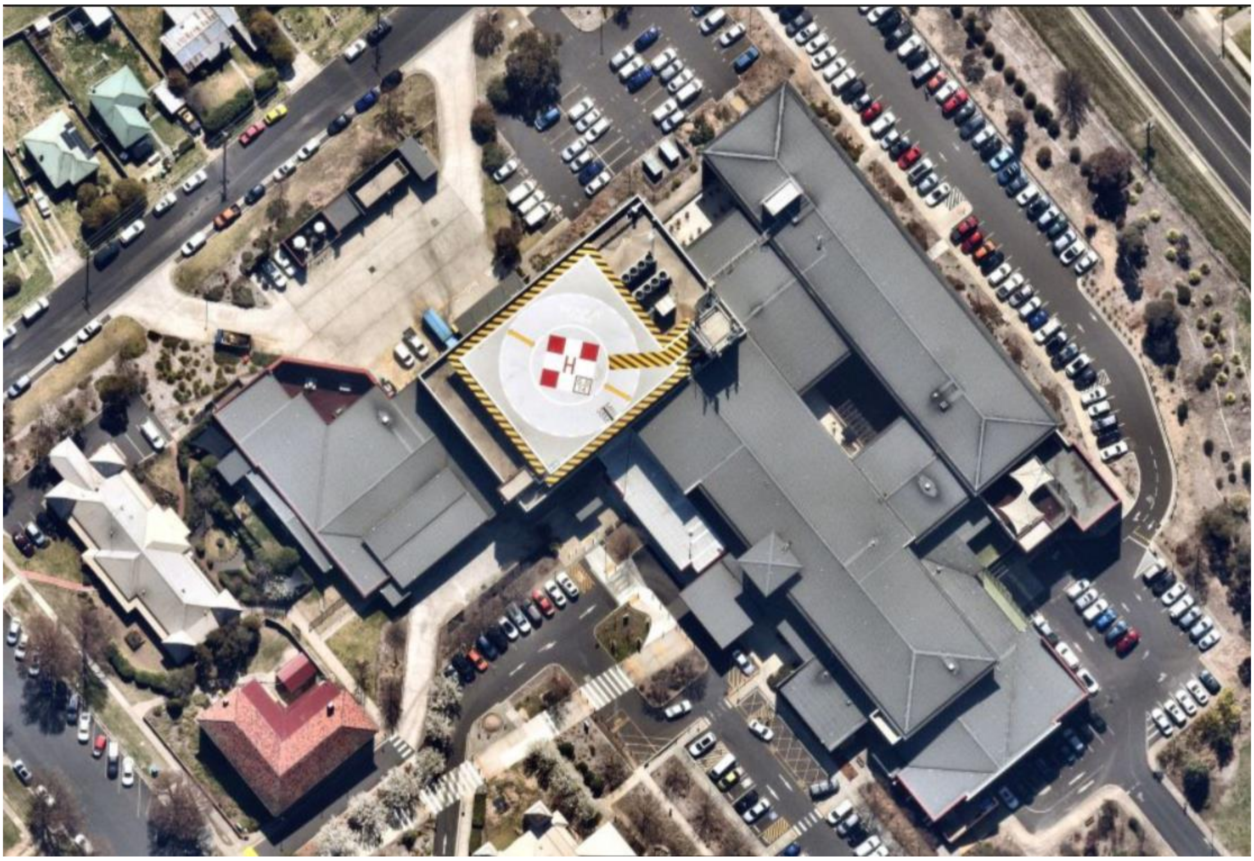
AVIATION IMPACT ASSESSMENT REPORT



AVIATION AND AIRSPACE IMPLICATIONS DUE TO THE BATHURST HOSPITAL REDEVELOPMENT

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Revision 1.0

AviPro
Document Verification
Page 1 of 1

Job title:	Aviation Impact Assessment Report: Bathurst Hospital
Document title:	AIA – BHR
Document ref:	BHR 1.0

Revision	Date	File name			
V1.0	7 Dec 23	Description	Initial issue AIA		
			Prepared by	**Checked by**	**Approved by**
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Revision	Date	File name			
		Description			
			Prepared by	**Checked by**	**Approved by**
		Name			
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Revision	Date	File name			
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			Prepared by	**Checked by**	**Approved by**
		Name			
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		Description			
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This Report on the aviation and airspace implications, both during and following construction of the development is prepared for TSA Management on behalf of the Health Infrastructure by Resolution Response Pty. Ltd. ABN: 94 154 052 883, trading as 'AviPro'.

The Report relates to the coordination aspects associated with the Helicopter Landing Site (HLS) at Bathurst Hospital due to the establishment and site design of the Bathurst Hospital Redevelopment. It also addresses the impact of extant helicopter operations on the new development. The Report is intended to inform design and planning.

Contents

1. BACKGROUND

1.1. Project Establishment and Context

This Aviation Impact Assessment Report has been prepared by AviPro on behalf of Health Infrastructure for the redevelopment of the Bathurst Hospital at 361-365 Howick Street, Bathurst.

The site is located at 361-365 Howick Street, Bathurst, in the Bathurst Local Government Area. It is occupied by Bathurst Health Service, a Level C referral facility in the Western NSW Local Health District.

This report accompanies a State Significant Development Application that seeks approval for the construction and operation of a new-build expansion, refurbishment and repurposing works to the existing Bathurst Health Service main hospital building. Proposed works will include:

- A new-build, three-storey health services building expansion (including one plant level) to include overnight inpatient accommodation and non-admitted care services and a new hospital front-of house and entrance;
- A new-build, two-storey expansion to the Emergency Department and Operating Theatres (plus one plant level);
- A new-build, single-storey expansion to the existing Cancer Service Building – Daffodil Cottage;
- Refurbishment and repurposing to areas of the existing hospital;
- Site establishment, demolition of some existing structure, cut and fill and remediation works;
- Vehicular circulation and car parking improvements;
- Tree removal;
- Landscape works; and
- Alteration and amplification of existing hospital plant and services infrastructure.

For a detailed project description, refer to the Environmental Impact Statement prepared by Ethos Urban.

1.2. SEARs Reporting

In preparing this report, the following SEARs General Requirements and Key Issues have been addressed. Table 1 below sets out the reference or location of these matters within this report.

Item	SEARS Requirement	Relevant Section of Report
24.1	If the development proposes a helicopter landing site (HLS), assess its potential impacts on the flight paths of any nearby airport, airfield, or HLS.	*N/A*
24.2	If the site contains or is adjacent to an HLS, assess the impacts of the development on that HLS.	*See Sections 2, 4.2, 4.7-4.11, 4.16, 4.17 and 4.18*

Table 1: Secretary's Environmental Assessment Requirements (Aviation)

1.3. Explanation of Terms

Aircraft. Refers to both aeroplanes (fixed wing) and helicopters (rotorcraft).

Approach and Departure Path (IFR). The flight track helicopters follow when landing at or departing from the FATO of an HLS under the Instrument Flight Rules. The IFR approach and departure path extends upwards and outwards from the edge of the FATO safety area with an obstacle free gradient of 2.6^0/4.5%/ 1:22.2 (22.2 units horizontal in 1 unit vertical), to a height of 152m above the FATO at a distance of ~3,386 m. The approach and departure path commences at the forward edge of the FATO safety area at a width of 34m, and increases in width uniformly to 152m m above the elevation of FATO surface at a distance of ~3,386 m.

Approach and Departure Path (VFR). The flight track helicopters follow when landing at or departing from the FATO of an HLS under the Visual Flight Rules. Updated standards to align with ICAO requirements now has the VFR (day and) night approach and departure path extending upwards and outwards from the forward edge of the FATO safety area with an obstacle free gradient of 2.6^0/4.5%/ 1:22.2 (22.2 units horizontal in 1 unit vertical), to a height of 152m above the FATO at a distance of ~3,386 m. The approach and departure path commences at the forward edge of the FATO safety area at a width of 34m, and expands uniformly, laterally at an angle of 8.7^0/15%/1:12.8 to a total width of 140 m, then remains parallel to a distance of ~3,386m, where the height is 152 m above the elevation of FATO surface. The path may be curved left or right to avoid obstacles or to take advantage of a better approach or departure path. Changes in direction by day below 300 feet should be avoided and there should be no changes in direction below 500 feet at night.

Design Helicopter. The Agusta AW139 contracted to the NSW Ambulance. The type reflects the new generation Performance Class 1 capable helicopters used in HEMS and reflects the maximum weight and maximum contact load/minimum contact area. The design helicopter has a maximum all up mass of 7 tonnes, however for HLS design purposes it is assumed the helicopter will never exceed 6.8 tonnes on the HLS.

D Value (Overall Length). The distance from the tip of the main rotor tip plane path to the tip of the tail rotor tip plane path or the fin if further aft, of the Design Helicopter.

Elevated Helicopter Landing Site. An HLS located on a roof top or some other elevated structure where the Ground Effect Area/Touchdown and Lift-off Area (TLOF) is at least 2.5m above ground level.

Final Approach. The reduction of height and airspeed to arrive over a predetermined point above the FATO of an HLS.

Final Approach and Takeoff Area (FATO). A defined area over which the final phase of the approach to a hover, or a landing is completed and from which the takeoff is initiated. For the purposes of these guidelines, the specification of 1.5 x D Value or Overall Length of the Design Helicopter is used and equates to 25m. diameter. Area to be load bearing.

Ground Taxi. The surface movement of a wheeled helicopter under its own power with wheels touching the ground.

Hazard to Air Navigation. Any object having a substantial adverse effect upon the safe and efficient use of the navigable airspace by aircraft, upon the operation of air navigation facilities, or upon existing or planned airport/heliport capacity.

Helicopter Landing Site (HLS). One or more may also be known as a **Heliport**. The area of land, water or a structure used or intended to be used for the landing and takeoff of helicopters, together with appurtenant buildings and facilities.

Helicopter Landing Site Elevation. At an HLS without a precision approach, the HLS elevation is the highest point of the FATO expressed as the distance above mean sea level.

Helicopter Landing Site PC1 Survey Reference Point. A position at the forward edge of the FATO safety area in the centre of the approach and departure path, from which the PC1 survey at 2.6º (4.5%) is initiated.

Helicopter Landing Site Reference Point (HRP). The geographic position of the HLS expressed as the latitude and longitude at the centre of the FATO.

Hospital Helicopter Landing Site. HLS limited to serving helicopters engaged in air ambulance, or other hospital related functions.

Note:

*A designated HLS located at a hospital or medical facility is an emergency services HLS and **not** a medical emergency site.*

Heliport. Two or more co-existing helicopter landing sites (HLS). There are no implications for operating a heliport as opposed to an HLS, other than having a "Heliport Operations Manual" rather than an "HLS Operations Manual" which would address the various interactions and interoperability (aviation, clinical etc) at the dual sites.

Hover Taxi. The movement of a helicopter above the surface, generally at a wheel/skid height of approximately one metre. For facility design purposes, a skid-equipped helicopter is assumed to hover-taxi.

Landing and Lift Off Area (LLA). A load-bearing, nominally paved area, normally located in the centre of the TLOF, on which helicopters land and lift off. Minimum dimensions are based upon a 1 x metre clearance around the undercarriage contact points of the Design Helicopter.

Lift Off. To raise the helicopter into the air.

Movement. A landing or a lift off of a helicopter.

Object Identification Surface. The OIS are a set of imaginary surfaces associated with a heliport. They define the volume of airspace that should ideally be kept free from obstacles in order to minimise the danger to a helicopter during an entirely visual approach.

Obstacle Limitation Surface. The OLS are a set of imaginary surfaces associated with an aerodrome. They define the volume of airspace that should ideally be kept free from obstacles in order to minimise the danger to aircraft during an entirely visual approach.

Obstruction to Air Navigation. Any fixed or mobile object, including a parked helicopter, which impinges the approach/departure surface or the transitional surfaces.

Parking Pad. The paved centre portion of a parking position, normally adjacent to an HLS.

Performance Class 1 (PC1). Similar to Category A requirements. For a rotorcraft, means the class of rotorcraft operations where, in the event of failure of the critical power unit, performance is available to enable the rotorcraft to land within the rejected take-off distance available, or safely continue the flight to an appropriate landing area, depending on when the failure occurs. For an elevated HLS, the reject area is that area within the FATO (25 m. diameter) and therefore this area is to be load bearing. PC1 also requires CASA approved flight path surveys to/from the HLS.

Performance Class 2 (PC2). For a rotorcraft, means the class of rotorcraft operations where, in the event of failure of the critical power unit, performance is available to enable the rotorcraft to safety continue the flight, except when the failure occurs early during the take-off manoeuvres, in which case a forced landing may be required. PC2 also requires CASA approved flight path surveys to/from the HLS.

Performance Class 2 With Exposure (PC2WE). PC2WE is very similar to PC2 as mentioned above. The primary difference is that there need not be any provision for a suitable forced landing area during the take-off and landing phases of flight, within the designated exposure period for the rotorcraft. PC2WE offers operators alternative mitigation strategies based on: a defined exposure time limit, demonstrated engine reliability, engine maintenance standards, pilot procedures and training, and operator risk assessments. Specific approval to operate with exposure is required from CASA and will require a number of mitigation strategies from the operator to gain that approval.

Performance Class 3 (PC3). For a rotorcraft, means the class of rotorcraft operations where, in the event of failure of the critical power unit at any time during the flight, a forced landing:

- in the case of multi-engine rotorcraft – may be required; or
- in the case of single-engine rotorcraft – will be required.

Pilot Activated Lighting (PAL). A PAL system utilises a hospital-based VHF radio and timed switching device, activated by the pilot via a radio transmission on a pre-set frequency, to turn on the associated HLS lighting.

Prior Permission Required (PPR) HLS. An HLS developed for exclusive use of the owner and persons authorized by the owner, i.e. a hospital-based emergency services HLS.

Note:

The HLS owner and the HEMS operator are to ensure that all pilots are thoroughly knowledgeable with the HLS (including such features as approach/departure path characteristics, preferred heading, facility limitations, lighting, obstacles in the area, size of the facility, etc.). This is addressed as part of the HLS commissioning process.

Rotor Downwash. The volume of air moved downward by the action of the rotating main rotor blades. When this air strikes the ground or some other surface, it causes a turbulent outflow of air from beneath the helicopter.

Safety Area. A defined area on an HLS surrounding the FATO intended to reduce the risk of damage to helicopters accidentally diverging from the FATO. This area should be free of objects, other than those frangible mounted objects required for air navigation purposes. The Safety Area for the Design Helicopter extends 4.5 m. beyond the FATO perimeter forming a 34 m. X 34 m. square or a 34m. diameter circle.

Safety Net. Surrounds the outer edge of a rooftop HLS. It is to be a minimum of 1.5 m. wide and have a load carrying capacity of not less than 122 kg/m^2. The outer edge is not to project above the HLS deck, and slope back and down to the deck edge at approximately 10 degrees, and not more than 20 degrees. Both the inside and outside edges of the safety net are to be secured to a solid structure.

Shielded Obstruction. A proposed or existing obstruction that does **not** need to be marked or lit due to its close proximity to another obstruction whose highest point is at the same or higher elevation.

Standard HLS. A place that may be used as an aerodrome for helicopter operations by day and night.

Take off. To accelerate and commence climb at the relevant climb speed.

Take off Position. A load bearing, generally paved area, normally located on the centreline and at the edge of the TLOF, from which the helicopter takes off. Typically, there are two such positions at the edge of the TLOF, one for each of two takeoff or arrival directions.

Touchdown and Lift-off Area (TLOF). A load bearing, generally paved area, normally centred in the FATO, on which the helicopter lands or takes off, and that provides ground effect for a helicopter rotor system. Size is based on 1 x main rotor diameter of Design Helicopter, and is 14m diameter.

Transitional Surfaces. Starts from the side edges of the FATO safety area parallel to the approach and departure path centre line, and extends upwards and outwards (to the sides) at a slope of 2:1 (two-units horizontal in one-unit vertical or 26.6°) to a height of 45m above the elevation of the FATO surface. Further, from the forward edge of the side transitional surfaces, the transitional surface joins the outer edges of the approach and departure surface, and proceeds upwards and outwards until the outer edges are 152m wide at ~3386m which corresponds with the end of the approach and departure surface.

Unshielded Obstruction. A proposed or existing obstruction that may need to be marked or lit since it is **not** in close proximity to another marked and lit obstruction whose highest point is at the same or higher elevation.

1.4. Applicable Abbreviations

Acronym	Meaning
AC	Advisory Circular (US FAA)
ACC	Aeromedical Control Centre (HQ Eveleigh). Responsible for control and tasking of HEMS
ACMA	Australian Communication and Media Authority
ADS-B	Automated Dependent Surveillance - Broadcast
AsA	Airservices Australia
A-SMGCS	Advanced Surface Movement Guidance & Control System
ATC	Air Traffic Control
CAAP	Civil Aviation Advisory Publication (Australia)
CASA	Civil Aviation Safety Authority (Australia)
CASRs	Civil Aviation Safety Regulations (1998) Australia
CTAF	Common Traffic Advisory Frequency
D	Helicopter D value - (also referred to as Overall Length) - the total distance between the main rotor and tail rotor tip path planes when rotating
DA	Development Application
DDO	Design and Development Overlay
DIFFS	Deck Integrated Fire Fighting System
DPIE	Department of Planning, Industry and Environment (NSW)
FAA	Federal Aviation Administration, USA
FATO	Final Approach and Take-Off Area (1.5 x helicopter length)
FARA	Final Approach Reference Area
FMS	Fixed Monitor System (foam fire-fighting system)
GPS	Global Positioning System
HEMS	Helicopter Emergency Medical Service
HF	High Frequency
HI	Health Infrastructure
HLS	Helicopter Landing Site
HLSRO	HLS Reporting Officer (Airservices Australia requirement)
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions – requiring IFR flight
L	Helicopter fuselage length
LDP	Landing Decision Point (Category A/Performance Class 1 operations)

Acronym	Meaning
LGA	Local Government Area
LHD	Local Health District
LLA	Landing and Lift Off Area. Solid surface meeting dynamic loading requirements, with undercarriage contact points + I metre in all directions
MoH	Ministry of Health NSW
MOS	Manual of Standards (CASA)
MRI	Magnetic Resonance Imagers
MTOM	Maximum Take Off Mass
MTOW	Maximum Take Off Weight
NOTAM	Notice to Airmen. Issued by Airservices Australia in relation to airspace and navigation warnings
NVG	Night Vision Goggle(s)
OIS	Object Identification Surface(s) (Heliport/HLS)
OLS	Obstacle Limitation Surface(s) (Aerodrome)
PC1	Performance Class 1
PC2	Performance Class 2
PC2WE	Performance Class 2 With Exposure
PC3	Performance Class 3
PRM	Precision Runway Monitoring
RD	Main Rotor Diameter
RTCC	Radar Terrain Clearance Chart
SARPS	Standards and Recommended Practices developed by ICAO and promulgated in the Annexes to the Convention of International Civil Aviation
SEARs	Secretary’s Environmental Assessment Requirements
SSD	State Significant Development
SSDA	State Significant Development Application
TDP	Takeoff Decision Point (Category A/Performance Class 1 operations)
TLOF	Touch Down and Lift Off Area. Load bearing min. 1 x main rotor diameter.
UHF	Ultra High Frequency
VFR	Visual Flight Rules
VHF	Very High Frequency radio
VMC	Visual Meteorological Conditions - allowing flight under VFR
V_{TOSS}	Take off Safety Speed
WAM	Wide Area Multilateration

1.5. List of Figures

2. EXECUTIVE SUMMARY

The aim of this report is to provide insights into the impacts of the Bathurst Hospital Redevelopment on the aviation operations into and out of the Bathurst Hospital HLS. The report analyses likely impact of the construction cranes, and how these impacts might be managed; as well as the impacts of the completed building on those same aviation activities. An assessment is also made on the impacts that helicopter operations in the vicinity of the HLS will have on the new buildings, both during construction and once complete.

The following key outcomes arose from the analysis:

- Helicopter operations to and from the Bathurst Hospital HLS will not adversely impact the new BHR buildings following their construction.
- The BHR buildings will not intrude into any protected airspace for the Bathurst Aerodrome.
- The BHR buildings, once constructed, will not impact the Bathurst Hospital HLS approach and departure paths provided services with plume rises greater than 4.3 m/sec are not erected inside those approach and departure paths.
- Any construction crane(s) for the Cancer Services Building and the health services building expansion which are significantly higher than HLS elevation will force closure of the HLS.
- Construction of the Cancer Services Building will require closure of the HLS due to the unacceptable risks posed to personnel on and around that site by helicopter operations.
- All cranes erected in the vicinity of the Bathurst Hospital HLS when it is operational will require to be fitted aviation-standard lighting obstacle lighting.
- Helicopter operations will not restrict the positioning of solar (photovoltaic) panels on rooftops within the Bathurst Hospital campus provided some cautionary principles are observed.
- Fresh air intakes should be placed as far as possible from the HLS and not in line of sight.

There is insufficient detail known about the crane(s) to be used to construct the BHR buildings to provide definitive advice in some areas. To that end, it is useful that a good understanding of the types, positions, elevations, jib lengths and operational dates of the construction cranes intended to be used in the development are assessed early in the planning process. At this early stage it is assessed that it will not be possible to keep the Bathurst Hospital HLS operating during the whole of the construction phase. The primary area of concern that will close the HLS for a period is the construction of the new-build, single-storey expansion to the existing Cancer Service Building – Daffodil Cottage.

Some additional risk management notification activities (HLS Notification and additional Ozrunways information) will be required to ensure HEMS operators are fully apprised of the crane hazards in the vicinity of Bathurst Hospital’s HLS.

3. GENERAL AIRSPACE REQUIREMENTS AND CONSIDERATIONS

3.1. Purpose of this Section

It is important that the reader has a good understanding of the fundamentals of airspace protection for aerodromes and heliports/HLS in order to be able to understand parts of the analysis later in this report. Section 3 provides this general overview.

3.2. Airspace Regulation in Australia - Aerodromes

Approvals will be required if primary prescribed airspace could be impinged. The normal contact for this process is the local airport owner/operator.

Primary prescribed airspace includes an airport's Obstacle Limitation Surfaces (OLS) involving a set of imaginary surfaces associated with an aerodrome that should be kept free of obstacles. Additionally, the Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) surfaces that takes account of the airspace associated with aircraft instrument procedures, must be considered.

3.3. Airspace Management in Australia – Heliports and Helicopter Landing Sites

Currently within Australia, there are no set rules or regulations applicable to the design, placement, construction or protection of HLSs. There may however be local council planning, location and movement approvals required. The appropriate national regulatory guidance at present for the use of HLSs is Civil Aviation Safety Regulation (CASR) 91.410 which places the onus on the helicopter pilot to determine the suitability of a landing site.

CASA, the regulator of aviation in Australia divested itself of responsibility for regulating HLSs in the early 1990s and currently provide only basic operating guidelines via Advisory Circular (AC) 91-29 Guidelines for helicopters – suitable places to takeoff and land which replaced Civil Aviation Advisory Publication (CAAP) 92-2 (2) Guidelines for the Establishment and Operation of Onshore Helicopter Landing Sites on 2 Dec 2021. The new AC continues to reinforce that CASA does not provide design, structural information or advice to HLS designers. CASA, as a component of a Regulatory Reform Program, does propose to prepare rules for HLS' and currently has a panel established for this purpose. The new rules will form Civil Aviation Safety Regulation (CASR) Sub-part 139R. When they are introduced, there will be an implementation phase and "grandfather" clauses. Standards set by NSW Health Infrastructure and NSW Ambulance were established to meet or exceed anticipated CASA requirements.

Because no Federal or State (NSW) legislation is in place to protect VFR approach and departure paths and the transitional surfaces associated with hospital HLS', in May 2018, the Commonwealth Department of Infrastructure, Transport, Regional Development and Communications issued Guideline H: Protecting Strategically Important Helicopter Landing Sites under the National Airports Safeguarding Framework (NASF). Whilst this publication has no legal effect in NSW as yet, its content is gradually being aligned within the NSW MoH Guidelines for Hospital Helicopter Landing Sites in NSW.

3.4. State Government Requirements

The various legislative/regulatory requirements relating to HLS' in NSW are complex. Current regulation excludes emergency service landing sites from the definition of "designated development" in the Environmental Planning and Assessment Regulation (which otherwise includes most HLS'). Generally, hospital HLS' are considered "ancillary-uses" to hospital purposes and are thus not separate "development". The same cannot necessarily be said about off-site emergency medical HLS, e.g. local sports fields.

To ensure that all requirements are met, close consultation with a NSW Ambulance approved Aviation Consultant should be maintained throughout the design and construction phases.

3.5. Local Government Requirements

For Federally-leased aerodromes, requirements emanate from the Airports Act 1996 and the Airports (Protection of Airspace) Regulations 1996.

The Airports (Protection of Airspace) Regulations 1996 differentiate between short-term (less than 3 months) and long-term controlled activities. The Regulations provide for the airport operator to approve short-term controlled activities that penetrate the OLS, and for the Commonwealth Department of Infrastructure, Transport, Regional Development and Communications for approval of long-term controlled activities and those short-term controlled activities referred to it by the airport operator. However, the airport operator must refer short-term PANS-OPS intrusions to the Department for approval. Long term intrusions of the PANS-OPS surface are prohibited.

Where an aerodrome is owned or operated by a Local Government Authority (LGA) or other entity, local government requirements for airspace protection are normally included in a Local Environment Plan (LEP), Development Control Plan (DCP) or similar document.

3.6. Obstacle Limitation Surfaces

The objective of the OLS is to define a volume of airspace in proximity to the airport which should be kept free of obstacles that may endanger aircraft in visual operations, or during the visual stages of an instrument approach.

The intention is not to restrict or prohibit all obstacles, but to ensure that either existing or potential obstacles are examined for their impact on aircraft operations and that their presence is properly taken into account. Since they are relevant to visual operations, it may sometimes be sufficient to ensure that the obstacle is conspicuous to pilots, and this may require that the obstacle be marked or lit.

In reality, there is little issue with breaching the OLS as pilots will be visual with the obstruction and can work on "see and avoid" principles. OLS at a multi-runway aerodrome look akin to Figure 1 below:

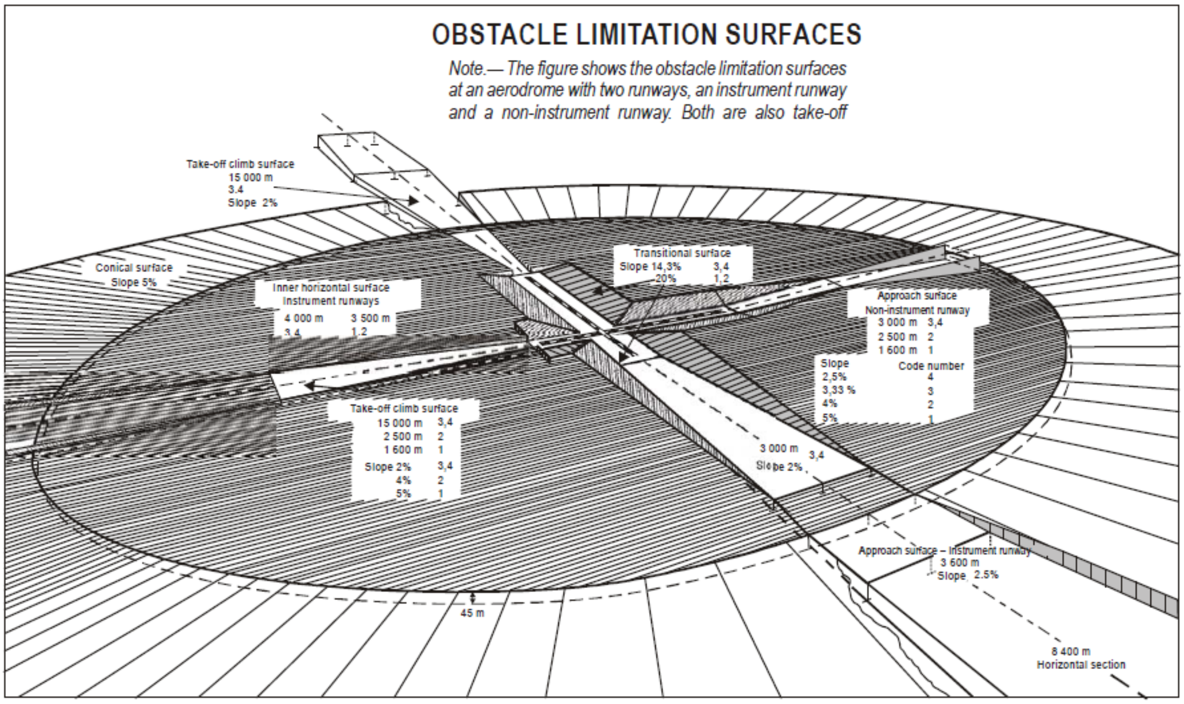

Figure 1: Example of Obstacle Limitation Surfaces

3.7. Procedures for Air Navigation – Aircraft Operations (PANS-OPS) Surfaces

PANS-OPS surfaces detail essential areas and obstacle clearance requirements for the achievement of safe, regular instrument flight operations.

The instrument flight procedures enable pilots to either descend from the high enroute environment of cruise type flight to establish visual contact with the landing runway, or climb from the runway to the enroute environment, with a prescribed safe margin above terrain and obstacles, by use of aircraft instruments and radio navigation aids or GPS in conditions where the pilot cannot maintain visual contact with the terrain and obstacles due to inclement weather conditions.

Pilots must be protected against protrusions into the PANS-OPS surfaces as they have no way of avoiding obstructions if they get off track and they cannot see such obstructions.

PANS-OPS surfaces are constructed differently to OLS however they serve a similar purpose. An example of PANS-OPS surfaces is in Figure 2 below:

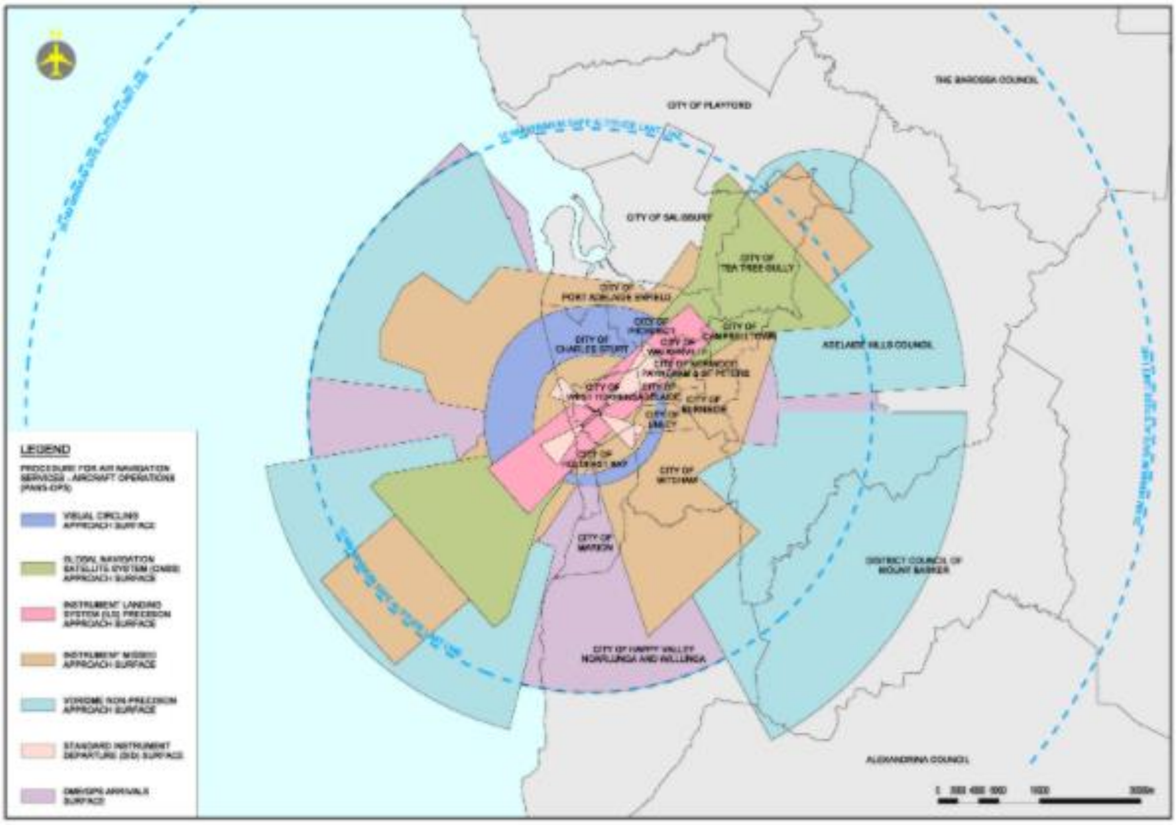

Figure 2: Example of PANS-OPS Surfaces

3.8. Radar Terrain Clearance Charts

The Radar Terrain Clearance Chart defines an area in the vicinity of an aerodrome, in which the minimum safe levels allocated by an Air Traffic Controller (ATC) vectoring Instrument Flight Rules (IFR) flights with Primary and/or Secondary Surveillance RADAR equipment have been predetermined. The figure shown on the chart is the lowest altitude which an ATC may assign to a pilot. An example of an RTCC is in Figure 3 below:

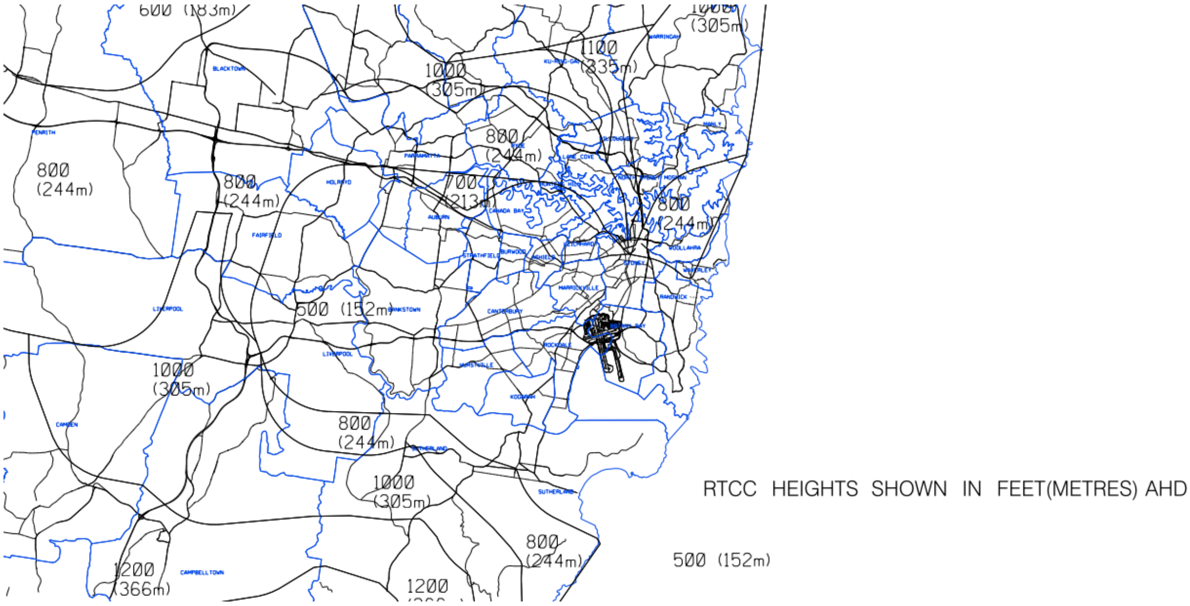

Figure 3: Example of a Radar Terrain Clearance Chart (RTCC)

3.9. HLS Approach and Departure Paths

The purpose of approach and departure path is to provide a portion of airspace sufficiently clear of hazards to allow safe approaches to, and departures from, the HLS. Approach and departure paths can be designed for both visual (VFR) use by day and by night using different criteria; and for instrument (IFR) flight (also by day and night, albeit there are no differences in design requirements).

VFR approach and departure paths should be such that there are no downwind operations and crosswind operations are kept to a minimum. To accomplish this, an HLS must have more than one path which provides an additional safety margin and operational flexibility.

The preferred approach and departure path should, where possible, be aligned with the predominant, prevailing wind when taking account of potential obstacles. Other approach and departure paths should also be based on an assessment of the average, prevailing winds and potential obstacles. The separation between approach and departure paths should not be less than 135^0, and should preferably be 180^0.

3.10. VFR Approach and Departure (Take-off Climb) Surface

VFR approach and departure surfaces can be designed for both day and night operations. Because all NSW hospital HLS' are required to be capable of both day and night use, the night tolerances are always used. A (day and) night approach and departure surface starts at the forward edge of the FATO safety area and slopes upward at 2.6^0/4.5%/1:22.2 (22.2 units horizontal in 1 unit vertical) for a distance of ~3,386 m. The approach and departure path commences at a width of 34 m and expands uniformly, laterally at an angle of 8.7^0/15%/1:12.8 to a width of 140 m, then remains parallel to a distance of 3,386 m, where the height is 152 m above the elevation of FATO surface. The VFR approach and departure paths are to be obstacle free. It is important to achieve the 2.6^0/4.5%/1:22.2 obstacle free slope to account for the performance requirements of one engine inoperative (OEI) flight following an emergency. See Figures 4 and 5 below.

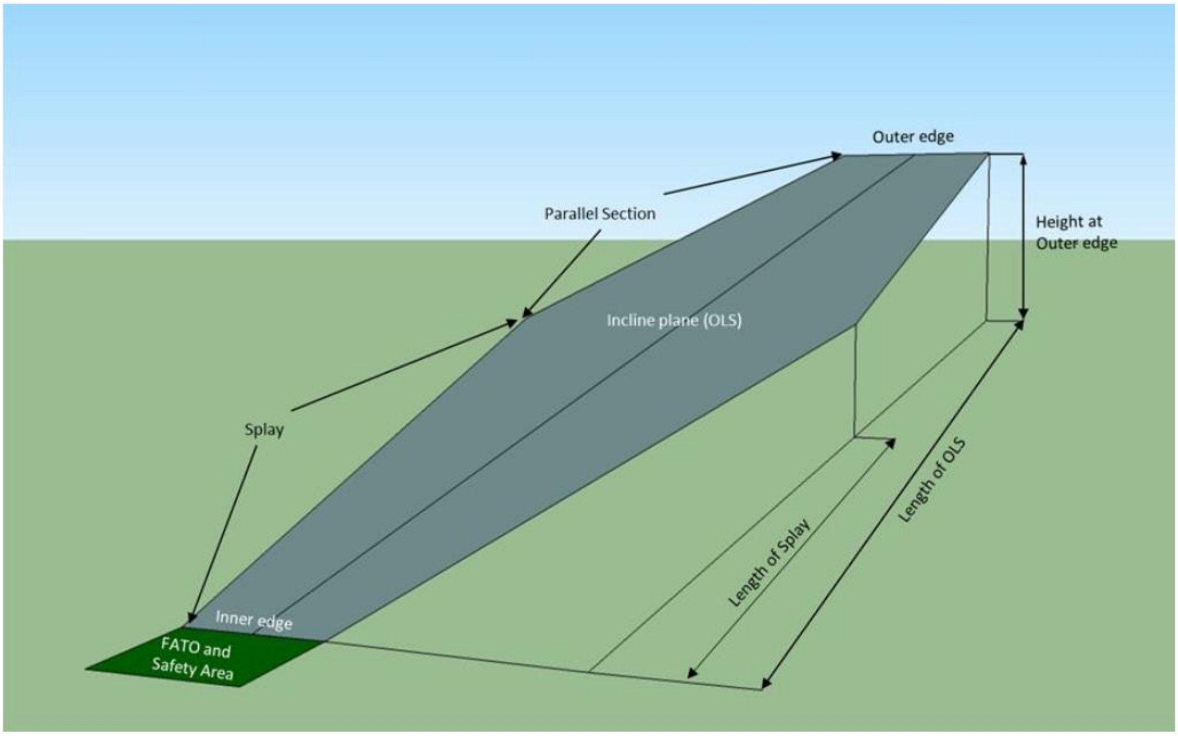

Figure 4: HLS VFR Approach and Departure Surfaces (1)

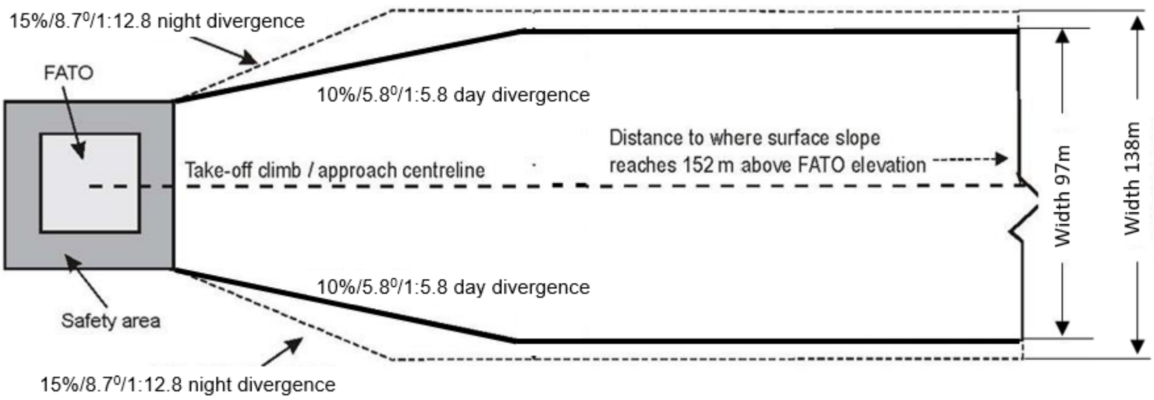

Figure 5: HLS VFR Approach and Departure Surfaces (2)

There are no transitional surfaces for VFR approach and departure paths.

3.11. Protected Side Slope

A VFR-only HLS is to be provided with at least one, and preferably two, protected side slopes, rising at 45^0 from the edge of the safety area and extending to a distance of 10m. See Figure 6 below. Due to the proximity of lift lobbies and other infrastructure, it is often difficult to provide the second protected side slope.

The surface of a protected side slope must not be penetrated by obstacles.

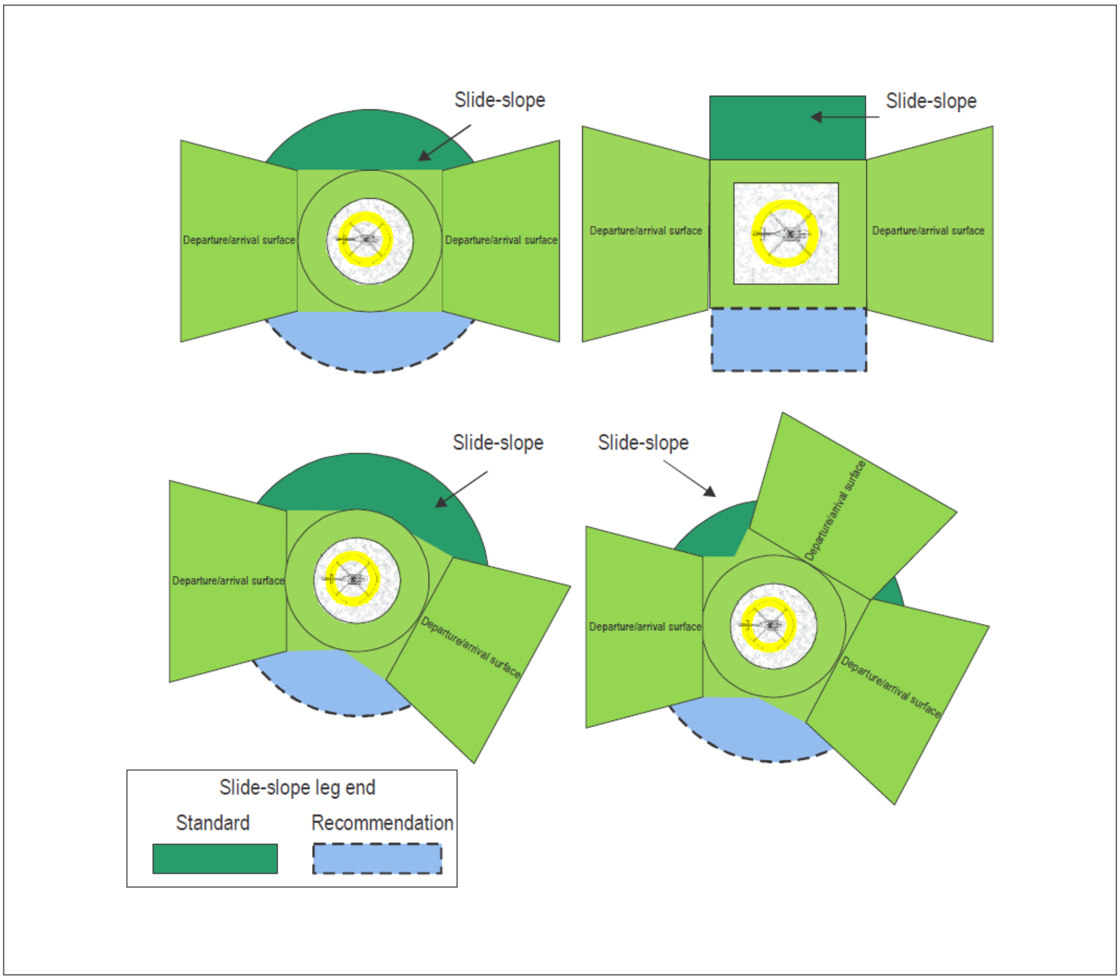

Figure 6: Protected Side Slopes

3.12. IFR Approach and Departure Paths

NSW has very few hospital HLS' with instrument approaches, however this can change at any time depending on needs and priorities. To that end, all NSW hospital HLS' should be surveyed so as to permit IFR operations, whether immediately or at some time in the future.

The IFR approach and departure surface, like the VFR approach and departure surface, commences at the safety area edge. They diverge uniformly to a width of 152m at 3,386m from the safety area edge (approximately 1:45).

The FATO transitional surfaces start from the edges of the FATO and safety area, parallel to the approach and departure path centre line, and extend outwards (from the sides of the FATO and safety area) at a slope of 1:2 (2 units horizontal in 1 unit vertical or 26.6°). They provide very similar protection at an IFR-capable HLS as the protected side slope does at a VFR-only HLS; but extend 45m above FATO level (rather than 10m). The approach and departure transitional surfaces commence at the forward edge of the safety area, overlaid over the approach and departure surface; and from the outer edges of the approach and departure surface. The outer sides are 76m from the centreline, i.e. the outer edges are 152m wide. The approach and departure transitional surfaces extend to the end of the approach and departure surface at 3,386m. See Figure 7.

Note:

The transitional surface is not applied on the safety area edge opposite the Approach/Departure surface.

The approach and departure surface is to be free of penetrations. Any penetration of the transitional surface is to be considered a hazard.

Figure 7 illustrates the IFR Approach/Departure and Transitional surfaces.

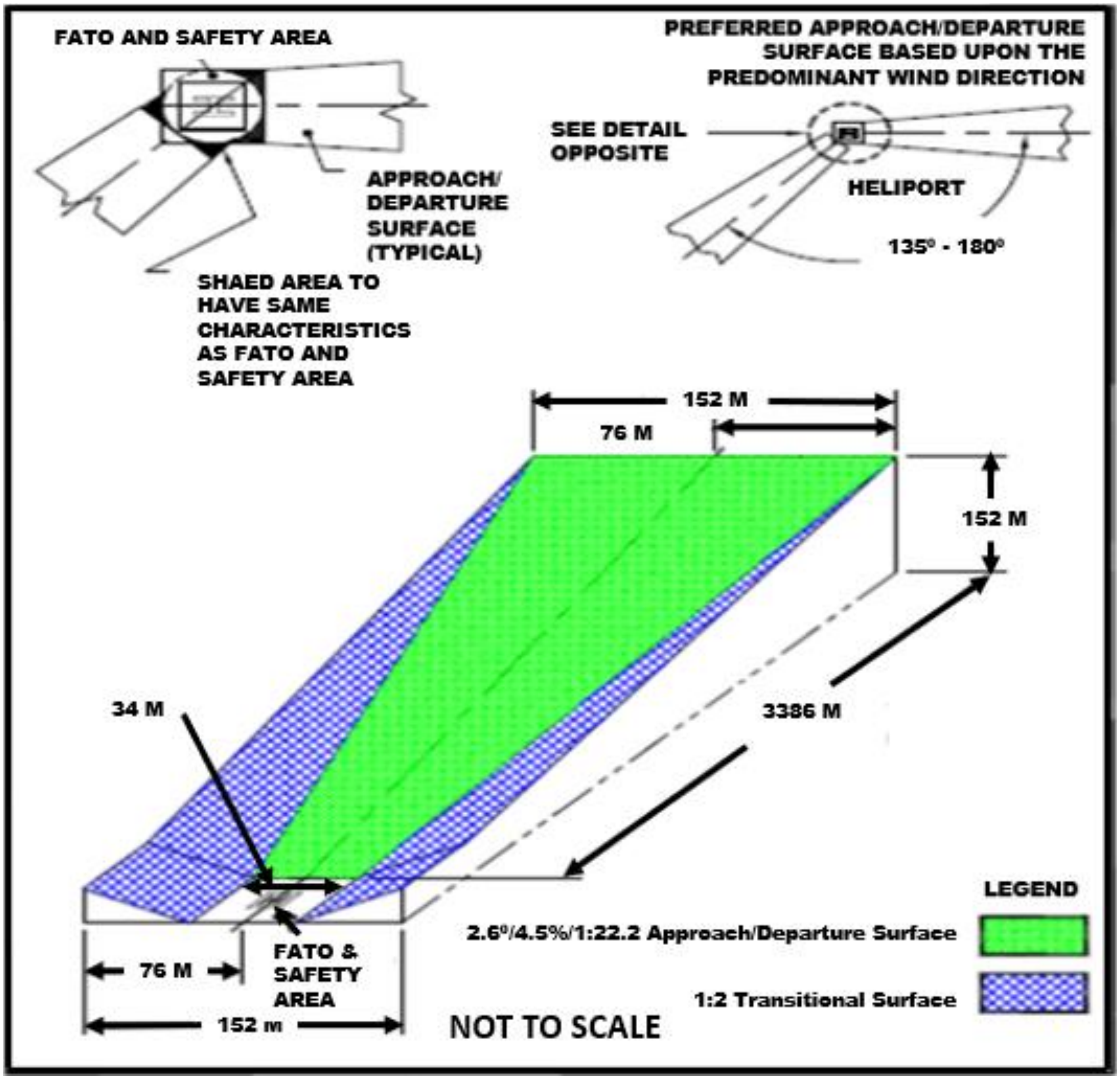

Figure 7: HLS IFR Approach/Departure and Transitional Surfaces

3.13. Visual Segment of a Point-in-Space Approach/Departure Procedure

ICAO Doc 9261 Heliport Manual, Part 2, Chapter 4, Section 4.2 addresses this highly specialised requirement. It will not apply at the majority of NSW hospitals.

3.14. Category A Backup Procedure

A Category A back-up procedure, i.e. without a lateral component, is one of the PC1 helipad profiles provided in RFMs along with the dimensions of the backup area. Category A The backup procedure is depicted in Figure 8 below.

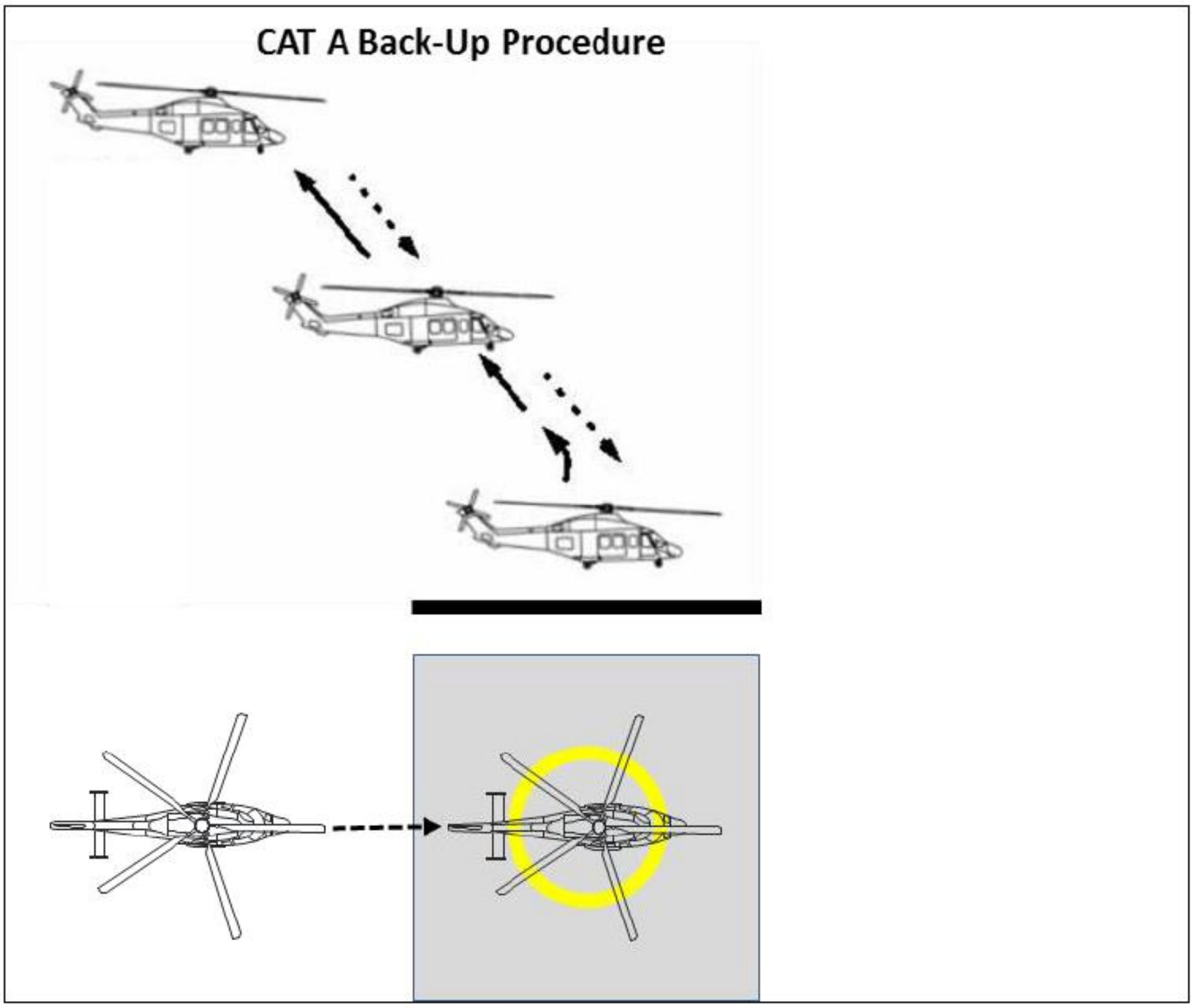

Figure 8: Category A Backup Procedure Profile

The back-up area should consist of two elements: an ascent/descent path/surface and an obstacle limitation surface. The dimension of these are normally contained in tabular form in the Category A supplement of the RFM. For NSW hospitals which are to be both day and night capable, the splay is to be 15%. Where the backup area is coincident with a reciprocal VFR approach and departure surface, no additional airspace protection measures will be required. Where the back-up area does not overlay the VFR approach and departure surface, a generic ascent/descent path/surface and obstacle limitation surface will need to be surveyed. See Figure 9 below.

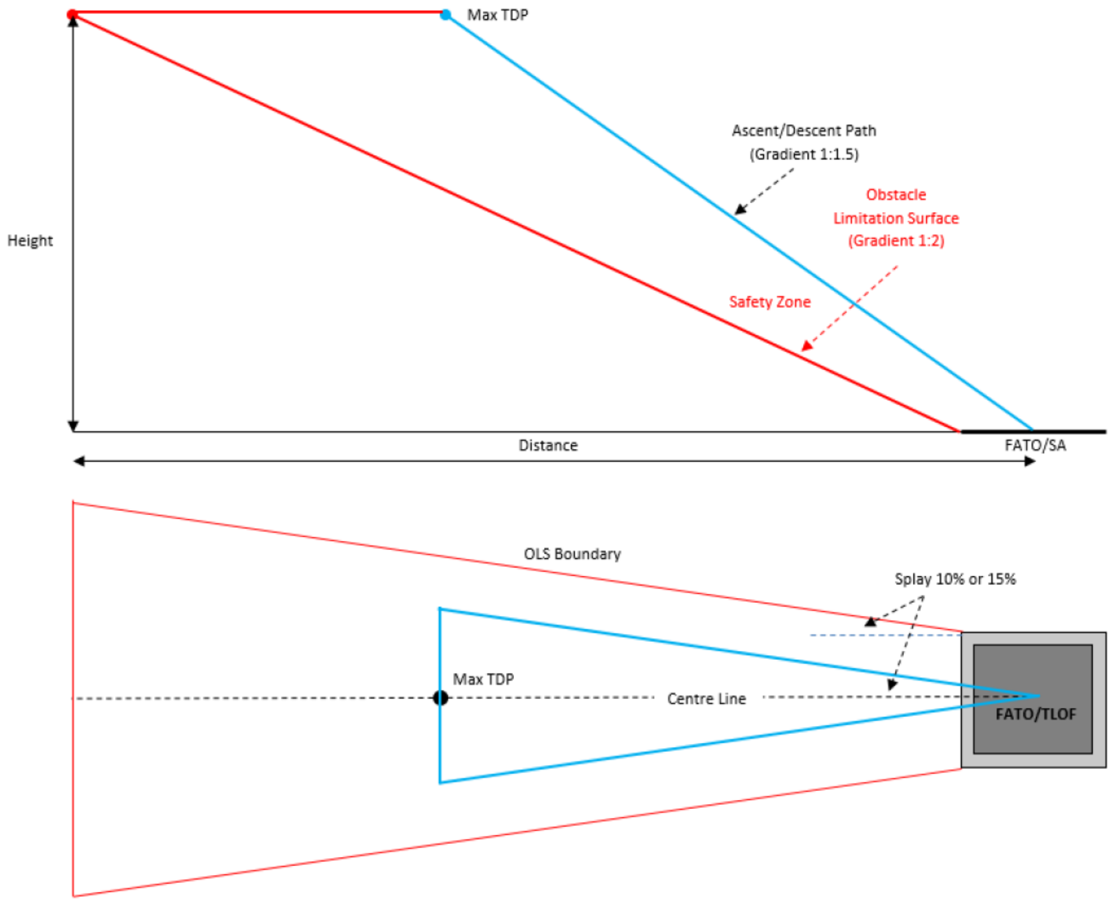

Figure 9: Category A Backup Procedure Surfaces

4. SPECIFIC BATHURST HOSPITAL CAMPUS CONSIDERATIONS

4.1. The Bathurst Hospital Campus Location

The location of the Bathurst Hospital campus is shown in Figure 10 below. It is approximately 7.5km west of the Bathurst Aerodrome.

Figure 10: Location of the Bathurst Hospital Campus

4.2. Location of the Bathurst Hospital HLS

The Bathurst Hospital HLS (**elevation: RL686.24**), with approach and departure path arrows, is depicted in Figure 11 below:

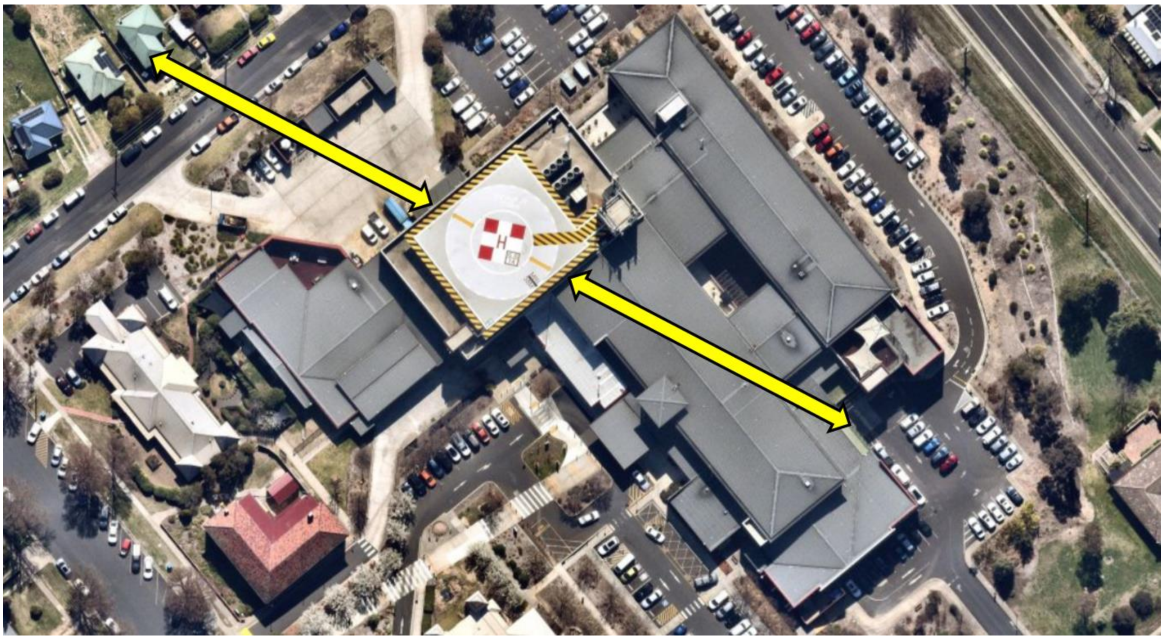

Figure 11: Bathurst Hospital HLS Approach and Departure Paths

4.3. The Proposed BHR Key Locations

The proposed BHR consists of three key locations. The redevelopment of the Cancer Services Building (Daffodil Cottage) will take place within the immediate proximity of the HLS. The expansion of the health services building will be remote from the HLS but will fall directly under one of the two surveyed Performance Class 1 (PC1) approach and departure paths for the HLS. The expansion of the Emergency Department (ED) and Theatres will also be remote from the HLS and largely offset to the surveyed Performance Class 1 (PC1) approach and departure path that is directly overhead designated space for the health services building expansion. See Figure 12 below:

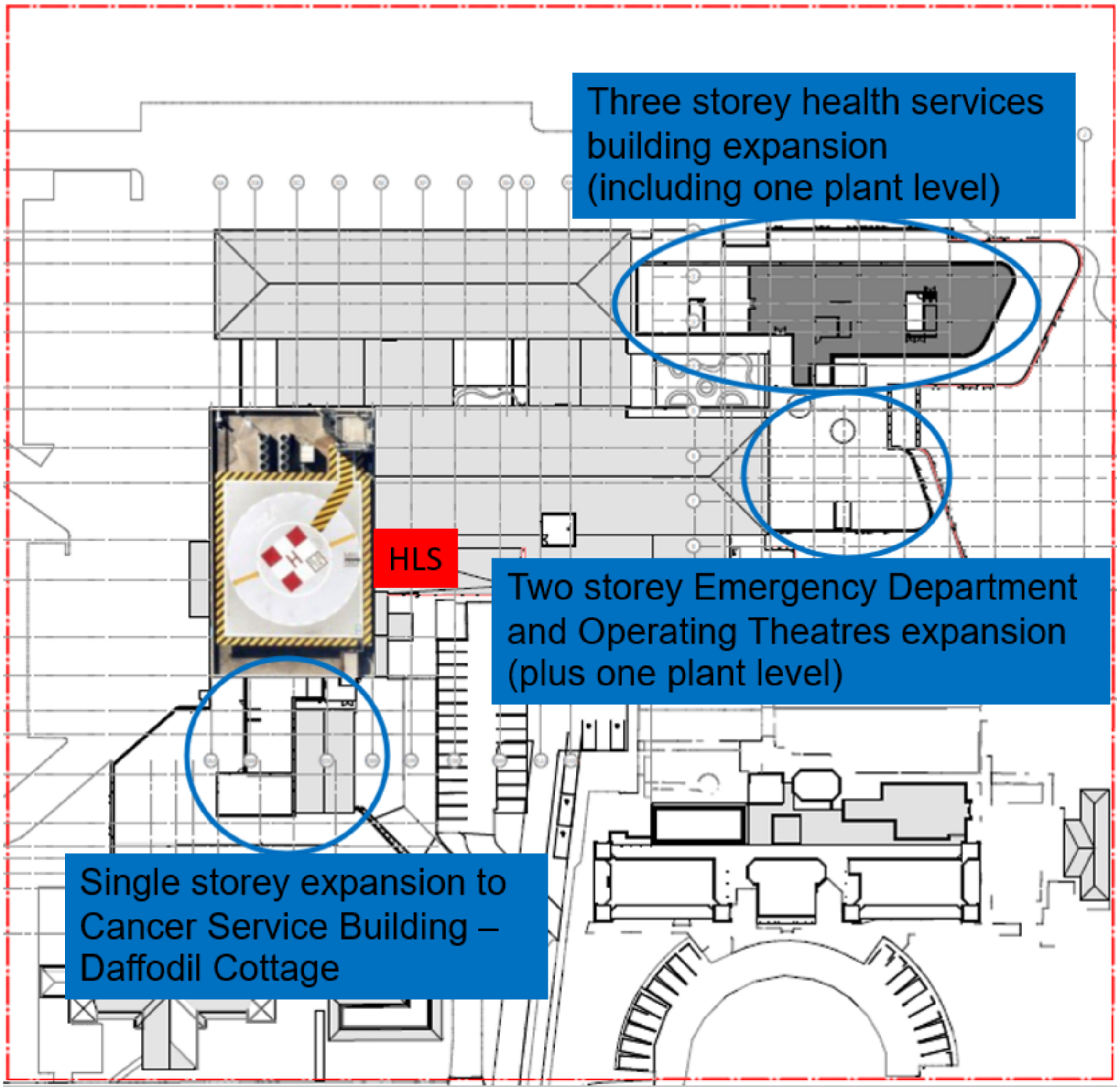

Figure 12: Proposed BHR Key Locations

4.4. The Bathurst OLS Overlay

At approximately 7.5km west of the Bathurst Aerodrome, Bathurst Aerodrome OLS will be approximately 140m above ground level overhead the Bathurst Hospital Campus. Provided all buildings and cranes are kept to approximately 140m above ground level or lower, the BHR will not impact the Bathurst Aerodrome OLS. See Figure 13 below.

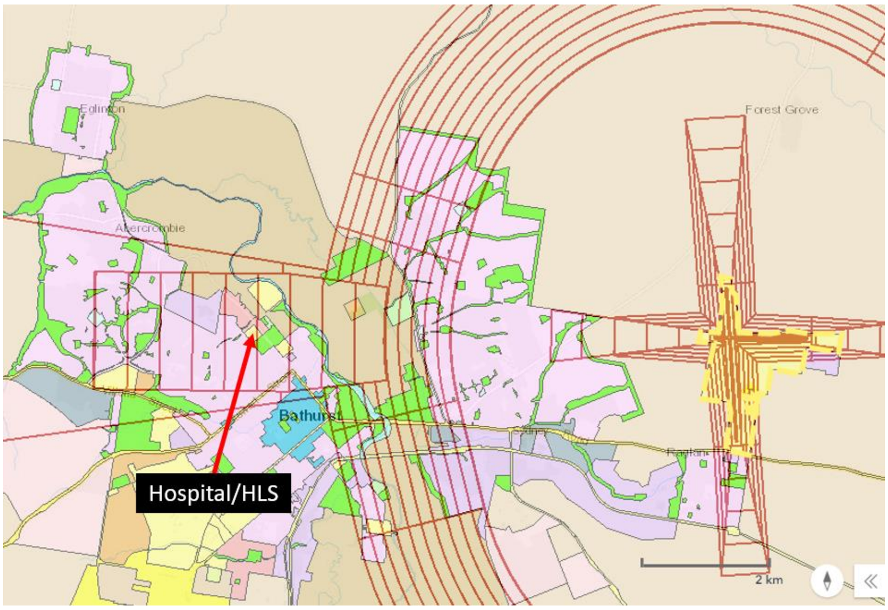

Figure 13: Bathurst Aerodrome OLS and Bathurst Hospital/HLS

4.5. The Bathurst PANS-OPS Overlay

At approximately 7.5km west of the Bathurst Aerodrome, and offset to the main runway centreline alignment, and thus the alignment of the primary instrument approaches for Bathurst Aerodrome, the BHR will not impact the Bathurst Aerodrome PANS-OPS (Instrument Flight Procedures) surfaces.

4.6. The Bathurst Radar Terrain Clearance Chart (RTCC) Overlay

There is no RTCC for Bathurst Aerodrome.

4.7. Bathurst Hospital HLS Approach and Departure paths

The surveyed Bathurst Hospital HLS approach and departure paths are now out of date. They have been superseded by requirements contained in CASA Advisory Circular (AC) 139R.01 Guidelines for heliports - design and operation issued in mid-2022. The existing (old) survey, relative to the BHR, is shown Figure 14 below:

Figure 14: Bathurst Hospital HLS Approach and Departure Path Survey (old)

4.8. Updated Bathurst Hospital HLS Approach and Departure paths

The latest requirements of CASA Advisory Circular (AC) 139R.01 Guidelines for heliports – design increase the width of the start point of the protected area from 25m to 34m and commence the start point 4.5m further out from the HLS centre. See Figures 4 and 5 above. The red lines in Figure 15 below are an approximate representation of where the extremities of the protected approach and departure surface for the Bathurst Hospital HLS would be if the HLS was to be re-surveyed today.

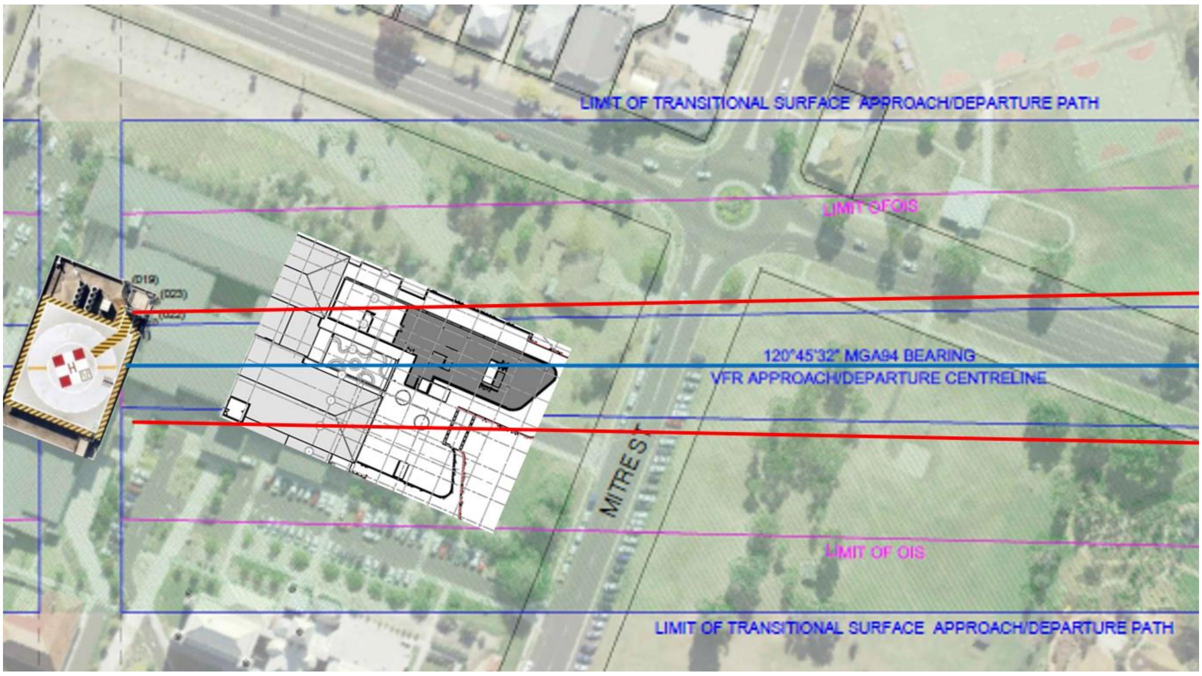

Figure 15: Bathurst Hospital HLS Approach and Departure Path Survey (updated)

4.9. Plume Rise under HLS Approach and Departure paths

The primary source for information on plume rise impacting aircraft operations is CASA AC 139.E-02 v1.0 Plume rise assessments issued March 2023. This document states:

"2.1.2 Aircraft operations in various stages of flight may be affected by a plume rise. A light aircraft in approach configuration is more likely to be affected by a plume rise than a heavy aircraft cruising at altitude. Helicopters and light recreational aircraft may be severely affected by a high temperature plume and the altered air mixture above an exhaust plume.

2.1.3 Regulation 139.180 of the *Civil Aviation Safety Regulations 1998* (CASR) provides that CASA may determine that a gaseous efflux having a velocity in excess of 4.3 metres per second (m/s) will be a hazard to aircraft operations because of the velocity or location of the efflux.

2.1.4 In addition to Regulation 139.180, Regulation 6A of the Airports (Protection of Airspace) Regulations 1996 defines 4.3 m/s as the level of turbulence that may be capable of affecting normal flight..."

It is therefore very important to try to position plume rises in excess of 4.3 m/s outside of protected approach and departure surfaces i.e. outside of the red lines in Figure 15 above.

4.10. Impact of the BHR on the Bathurst Hospital HLS Approach and Departure paths

The BHR buildings, once completed, will not adversely impact the approach and departure paths into and out of the Bathurst Hospital HLS. This is evidenced by the elevations in Figure 16-18 below. In the case of the Cancer Services Building and the ED/Operating Theatres expansion, the new buildings are lower than the HLS. The health services building expansion is 1.2m higher than the HLS. With a requirement for a 2.6^{0}/4.5%/1:22.2 obstacle free slope, this would allow the health services building expansion to be no closer than 26.64m from the HLS safety area edge. It is much further way than this.

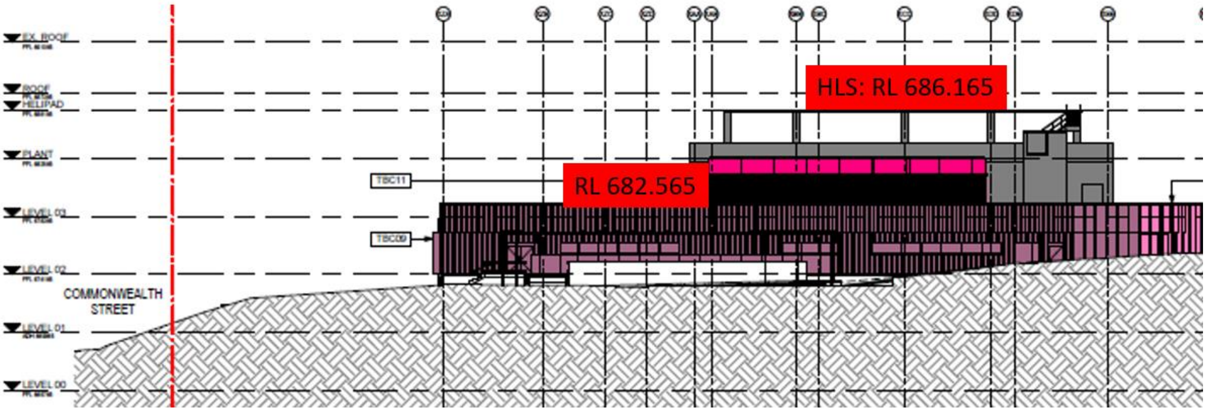

Figure 16: Elevation of the Cancer Services Building

Figure 17: Elevation of the ED/Operating Theatres Expansion

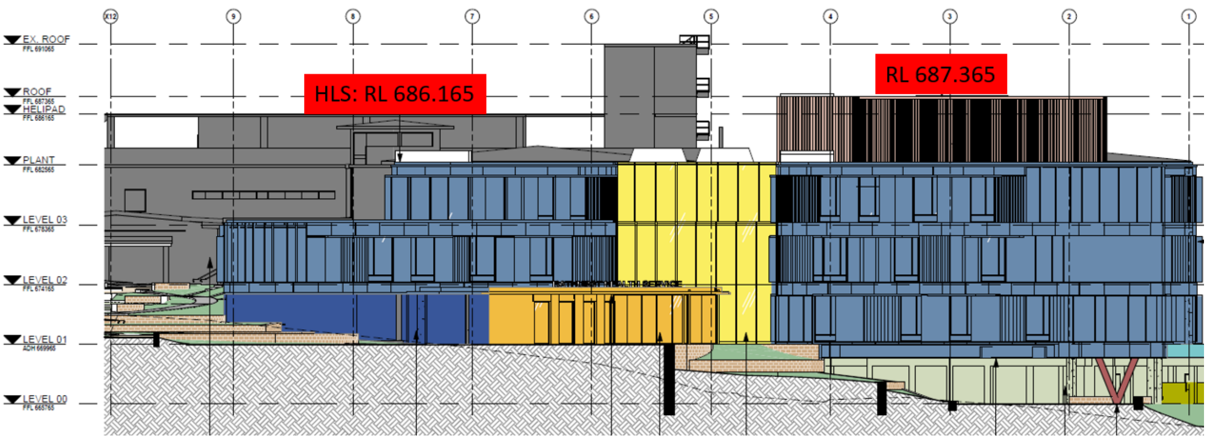

Figure 18: Elevation of the Health Services Building Expansion

4.11. Alignment of the East-South-East Approach and Departure Path

It can be seen in Figure 19 below that the alignment of the east-south-east approach and departure path runs towards the area of the health service building expansion.

Figure 19: Alignment of the East-South-East Approach and Departure Path

4.12. Impact of Helicopter Operations on the BHR Buildings

When manoeuvring at slow speeds, especially during take-off and landing, helicopters generate significant rotor downwash extending out to a distance of two to three rotor diameters below the generating aircraft. The AW 139 helicopter used by NSW Ambulance has a main rotor diameter of slightly less than 14m so two to three rotor diameters equates to approximately 30-45m. This downwash produces effects comparable to high and gusty wind conditions which may cause light or insecure cladding and other light objects and structures to become detached.

Helicopters generate high noise levels and the overflight of even infrequent helicopter operations can generate a significant disturbance to third parties. Helicopters may generate vibration either through transmission of the engine and rotor mechanical vibrations or through the buffeting of the rotor airflow against surrounding horizontal or vertical building surfaces. Vibration effects can be exacerbated by reverberation due to the pressure waves emitted by a helicopter reflecting off, and being amplified by, surrounding vertical surfaces.

Helicopter operations therefore may have detrimental impact on construction activities on the health services building expansion and the ED/Operating Theatres expansion due to problematic main rotor downwash, noise, vibration, or exhaust fumes. Helicopter operations will not have any negative effect on fresh air intakes for these two buildings however it would be prudent to position any of these intakes away from direct line of sight to the HLS. Helicopter operations will severely impact construction activities on the Cancer Services Building. It will be unsafe for construction activities to be undertaken on this building during helicopter operations.

4.13. Local Government Requirements

Read this section in conjunction with Section 3.5.

Clause 7.3 of the Bathurst Regional Local Environment Plan 2014 contains a requirement to consider protection of the airspace in proximity to the Bathurst aerodrome. One of the objectives of the Clause is: "to provide for the effective and on-going operation of the Bathurst Airport by ensuring that such operation is not compromised by proposed development that penetrates the Limitation or Operations Surface for that airport." The Clause states that "The consent authority may grant development consent for the development if the relevant Commonwealth body advises that… the development will not penetrate the Limitation or Operations Surface." For the purposes of this Clause, "***Limitation or Operations Surface*** means the Obstacle Limitation Surface or the Procedures for Air Navigation Services Operations Surface as shown on the *Obstacle Limitation Surface Map* or the *Procedures for Air Navigation Services Operations Surface Map* for the Bathurst Airport " and "***relevant Commonwealth body*** means the body, under Commonwealth legislation, that is responsible for development approvals for development that penetrates the Limitation or Operations Surface for the Bathurst Airport ."

4.14. The BHR Construction Cranes

The details of the construction cranes for the BHR have not been settled. A number of assumptions are used to therefore determine likely impacts on the approach and departure paths into and out of the Bathurst Hospital HLS. The following assumptions are made:

- There will be at least one hammerhead crane which will be erected to construct either the health services building expansion and/or the ED/Operating Theatres expansion.
- The jib of the closest hammerhead crane will be a minimum of 50m in length and its arc will extend well outside the building footprint.
- The maximum height of any hammerhead tower crane will be a minimum of 12m above the highest point of the building it is being used to construct.
- The highest point of the jib top of any hammerhead tower crane will be approximately 2m below the maximum height of the crane.
- The erection of any type of crane to build the health services building expansion will make the HLS east-south-easterly approach and departure path unsafe and unusable during the period of the construction.

4.15. Probable Impact of Cranes on OLS, PANS-OPS and RTCC

Based upon the information provided, intrusion into the OLS and PANS-OPS surfaces will not occur. Specific assessment/approval will not be required.

4.16. Probable Impact of Cranes on the Bathurst Hospital HLS

Any type of crane working above the maximum elevation of health services building expansion, or above HLS level on the Cancer Services Building will negatively impact helicopter operations to/from the Bathurst Hospital HLS.

4.17. Viability of a Temporary Approach and Departure Path

The Bathurst Hospital HLS has suffered from numerous difficulties with helicopter main rotor downwash over many years. It is not practicable to rearrange approach and departure paths to avoid crane positions as this will most likely introduce significant negative unintentional consequences.

4.18. Solar Panels

From an aviation safety perspective, there are three key issues to be considered in relation to solar PV panels in the vicinity of an HLS. These are:

- Shine, glare and reflection affecting the pilot's vision,
- Structural considerations i.e. whether their attachment points can withstand the forces of compressed rotor downwash, and
- Electromagnetic interference from the cabling connecting the photovoltaic cells to their inverters/batteries/storage affecting the helicopter's electronic flight control mechanisms.

None of these issues has proven to be insurmountable at other sites, and thus there are basically no restrictions on where solar panels may be positioned around an HLS.

Reflective properties of solar PV panels have been reduced significantly in modern designs using anti-reflective (AR) glass, and generally now reflect less sunlight than standard window glass, water surfaces and bare steel. The US Federal Aviation Administration (FAA), in its most recent policy "Review of Solar Energy System Projects on Federally-Obligated Airports" dated 11 May 2021 "has subsequently concluded that in most cases, the 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."

Solar panels coming loose have a number of possible impacts, both on the helicopter and its occupants; as well as third party individuals below the HLS. Panels must be secured against the maximum rotor downwash and also against the potential build-up of rotor downwash pressure which could lift a panel loose from its bracket if not sufficiently secured.

If solar panels were to be set-up near the HLS in such a way where a similar pressure build-up could occur, they would need to be secured so as to eliminate the possibility of one of more becoming loose and creating a debris or missile hazard to patients, helicopter crews, staff, visitors or even catastrophic damage to the helicopter/hospital structure. This is an engineering design responsibility. Further, a strict inspection program would need to be established and maintained to ensure the integrity and robustness of any panels, fixings or associated energy paraphernalia.

Some types of panels can be constructed to withstand wind speeds of 62.5 metres per second compared with the final velocity of the AW 139 helicopters final main rotor velocity of 26.43 metres per second. These panels will be more than secure upon installation. The key issue in an aviation environment is to ensure that over the life of each item, the security of its mount is rigorously checked on a scheduled inspection program and any looseness addressed immediately. A loose mount can "work" very quickly if subject to ongoing wind/downwash and may fail under repetitive load.

Electromagnetic Interference (EMI) has long been a hazard to aviation. It occurs when radio frequency (RF) waves send erroneous signals to aircraft fly-by-wire systems, radars and radios etc. Impacts can be from mild to severe. Electromagnetic compatibility (EMC) is the ability of electrical equipment and systems to function acceptably in their electromagnetic environment, by limiting the unintentional generation, propagation and reception of electromagnetic energy which may cause unwanted effects such as EMI or even physical damage in operational equipment. The way of providing assurance that solar electricity systems will not cause EMI to aviation systems is to firstly: assess the likelihood that EMI will occur, and then, if necessary, ensure that all elements of the solar electricity system provide EMC with those aviation systems. This is achievable through compliance with appropriate standards.

There are three potential areas of EMI within a solar electricity system. The first is the PV panels, the second is the associated cabling and the third is the inverter/battery system that converts and stores the electricity. In 2017, a paper titled “Electro-Magnetic Interference from Solar Photovoltaic Arrays” was prepared for the US Navy by the National Renewable Energy Laboratory (NREL), a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy to review these areas. Overall, the paper states “The Federal Aviation Admiration (FAA) has indicated that EMI from PV installations is low risk. PV systems equipment such as step-up transformers and electrical cables are not sources of electromagnetic interference because of their low-frequency (60 Hz) of operation and PV panels themselves do not emit EMI. The only component of a PV array that may be capable of emitting EMI is the inverter. Inverters, however, produce extremely low frequency EMI similar to electrical appliances and at a distance of 150 feet from the inverters the EM field is at or below background levels. Also, proper inverter enclosure grounding, filtering, and circuit layout further reduce EM radiation. Photovoltaic inverters are inherently low-frequency devices that are not prone to radiating EMI. No interference is expected above 1 MHz because of the inverters’ low-frequency operation. In addition, interaction at lower frequencies (100 kHz to1 MHz) is also very low risk because of the poor coupling of these extremely long wavelengths to free space, limiting propagation of the signal.”

A compliance certificate for the proposed inverters serving the PV array on the buildings should be provided. The certificate should state compliance with European Standards EN 61000.6.2:2005 and EN 61000.6.3:2021. The current Australian and New Zealand Standards (AS/NZS) that address EMC are: AS/NZS 61000.6.2:2006 Electromagnetic compatibility (EMC) - Generic standards - Immunity for industrial environments AS/NZS 61000.6.3:2021 Electromagnetic compatibility (EMC) - Generic standards - Emission standard for equipment in residential environments; AS/NZS 61000.6.4:2020 Electromagnetic compatibility (EMC) - Generic standards - Emission standard for industrial environments; and AS/NZS 61000.6.8:2020 Electromagnetic compatibility (EMC) - Generic standards - Emission standard for professional equipment in commercial and light-industrial locations.

The PV panels, cabling and inverters/battery comprising the solar electricity system on the BHR buildings (and other Bathurst Hospital campus buildings) will not be a hazard to aviation activities within the Bathurst Hospital campus and will not represent a risk to aviation safety. If the inverters are positioned at least 150 feet or approximately 50 metres away from the HLS, risk will be minimised so far as is reasonably practicable.

4.19. Deductions: Airspace, Cranes, Obstructions and HLS

The following key deductions can be made:

- Helicopter operations to and from the Bathurst Hospital HLS will not adversely impact the new BHR buildings following their construction.
- The BHR buildings will not intrude into any protected airspace for the Bathurst Aerodrome.
- The BHR buildings, once constructed, will not impact the Bathurst Hospital HLS approach and departure paths provided services with plume rises greater than 4.3 m/sec are not erected inside those approach and departure paths.
- Any construction crane(s) for the Cancer Services Building and the health services building expansion which are significantly higher than HLS elevation will force closure of the HLS.
- Construction of the Cancer Services Building will require closure of the HLS due to the unacceptable risks posed to personnel on and around that site by helicopter operations.
- All cranes erected in the vicinity of the Bathurst Hospital HLS when it is operational will require to be fitted aviation-standard lighting obstacle lighting.
- Helicopter operations will not restrict the positioning of solar (photovoltaic) panels on rooftops within the Bathurst Hospital campus provided some cautionary principles are observed.
- Fresh air intakes should be placed as far as possible from the HLS and not in line of sight.

4.20. Additional Risk Mitigation Options

It is common during significant construction activities in congested hospital campuses that cranes will impact safe Helicopter Emergency Management Service (HEMS) activities. A crane management plan or a helicopter operations management plan is normally developed in such circumstances. As additional risk mitigation, it is also common to use an alternate HLS if crane arrangements are such that concurrent construction and aviation activities cannot be conducted safely. Additionally, an HLS Notification can be issued for the duration of the build, and comments or documents can be placed into the Ozrunways data base listing for the HLS (see Bathurst Hospital | Helipads (ozrunways.com)).

4.21. HLS Out of Service

If an HLS is placed out of service, it is a requirement of the Guidelines that a yellow cross is placed over the centre of the HLS. (See Figure 8 on page 29 of https://www1.health.nsw.gov.au/pds/ActivePDSDocuments/GL2020_014.pdf) This should not be required for the Bathurst development.

The method of advising that an HLS is closed or out of service is to issue an HLS Notification. The URL for the HLS Notification is: https://docs.google.com/forms/d/e/1FAIpQLSe41HwB0cw9HdCxxJ0tPlIVg2Dqyl00ZEbvrm36nGne4nXxkw/formResponse