Level 14, 77 Pacific Highway North Sydney NSW 2059

On behalf of

AVIATION IMPACT ASSESSMENT REPORT

AIRSPACE IMPLICATIONS DUE TO THE CONSTRUCTION OF THE

NEW SYDNEY CHILDREN'S HOSPITAL (SCH) STAGE 1/ CHILDREN'S COMPREHENSIVE CANCER CENTRE (CCCC)

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This Report on the Sydney Children's Hospital (SCH) (Stage1)/ Children's Comprehensive Cancer Centre (CCCC) development is prepared for NSW Health Infrastructure on behalf of PricewaterhouseCoopers by Resolution Response Pty. Ltd. ABN: 94 154 052 883, trading as 'AviPro'.

The Report relates to the coordination aspects associated with prescribed/protected airspace at Sydney (Kingsford-Smith) Aerodrome and the Helicopter Landing Sites (HLS) at the Randwick Hospitals Campus (RHC) due to the establishment and site design of the proposed new SCH Stage 1/CCCC. It is intended to inform design and planning.

Contents

1. BACKGROUND

1.1. Project Establishment and Context

PricewaterhouseCoopers (PwC) has been engaged by NSW Health Infrastructure to oversee the design of the Sydney Children's Hospital (SCH) Stage 1/Children's Comprehensive Cancer Centre (CCCC) development.

In 2019 the NSW and Federal Governments announced their intention to deliver new, state-of-the-art paediatric health and medical research facilities as part of the first stage of redeveloping Sydney Children's Hospital, Randwick. The redevelopment will bring world-leading clinical care, research and teaching together to deliver improved models of care for sick and injured children. The following services were announced as part of Stage 1:

- A new children's Emergency Department, accessible from Botany Street
- Short Stay Unit / Medical Assessment Unit
- Emergency Department patient drop off zone from Botany Street
- Main entry from Botany Street as well as front of house services
- Australia's first Comprehensive Children's Cancer Centre bringing together the Children's Cancer Institute and the Sydney Children's Hospital, Randwick's Kids Cancer Centre to deliver integrated, specialist cancer treatment and research
- Additional clinical services to be determined through the planning process.

The SCH Stage 1/CCCC development project team is aiming for a Final Business Case milestone of early 2021.

AviPro has been engaged to provide advice regarding the aviation specific impacts that the SCH Stage 1/CCCC development will have on the prescribed/protected airspace at Sydney (Kingsford-Smith) Aerodrome and the Helicopter Landing Sites (HLS) at the RHC. This includes an assessment of the impacts caused by cranes during construction, and also the building itself once complete.

1.2. Background Material

Reference material provided by PwC and others in support of the report include early planning designs and concept drawings.

1.3. Methodology

This report is an extension of work previously conducted for Health Infrastructure by AviPro. Criteria from all relevant references were assessed, with the Guidelines used as the primary tool.

1.4. Explanation of Terms

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

Approach/Departure Path (VFR). The flight track helicopters follow when landing at or departing from the FATO of an HLS. Updated standards to align with ICAO recommendations now has the VFR Approach/Departure path extending outwards from the edge of the FATO with an obstacle free gradient of 2.5º or 4.5% or 1:22 vertical to horizontal, measured from the forward edge of the FATO, to a height initially of 500 feet above the FATO at a distance of ~3,500 m. The flight path commences at the forward edge of the FATO at a width of 25 m., and increases in width uniformly to 150 m. at a distance of 3,500 m. 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 Westland 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.

Elevated Helicopter Landing Site. A 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 2.5 m. 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 Length Overall of the Design Helicopter is used and equates to 25 m 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 eye height (1.5 m.) above the forward edge of the FATO in the centre of the flight path, from which the PC1 survey at 2.5º (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).

Hover Taxi. The movement of a wheeled or skid-equipped 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.

Length (Overall) (L). 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.

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 on 1m 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 a 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. 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 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 VHF radio transmission on a pre-set frequency, to turn on the HLS and associated 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.).*

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 (0.3 x RD of the Design Helicopter). 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 m. beyond the FATO circumference forming a 33 m. diameter.

Safety Net. Surrounds the outer edge of a rooftop HLS. 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^{o}. Both 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 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 14 m. diameter.

Transitional Surfaces. Starts from the edges of the FATO parallel to the flight path centre line and extends outwards (to the sides) at a slope of 2:1 (two-units horizontal in one-unit vertical or 26.6°) from the outer edges of approach/departure surface. The outer sides are 75 m. from the centreline, i.e. the outer edges are 150 m wide. The transitional surfaces start at the forward edge of the FATO, overlaid over the approach/departure path (surfaces) and extend to the end of the approach/departure surface at 3,500 m.

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.

1.5. Applicable Abbreviations

Acronym	Meaning
AC	US FAA Advisory Circular
ACC	Aeromedical Control Centre (HQ Eveleigh). Responsible for control and tasking of HEMS
CAAP	Civil Aviation Advisory Publication (Australia)
CASA	Civil Aviation Safety Authority (Australia)
CAOs	Civil Aviation Orders (Australia)
CARs	Civil Aviation Regulations (1988) Australia
CASRs	Civil Aviation Safety Regulations (1998) Australia
CCCC	Children’s Comprehensive Cancer Centre
DDO	Design and Development Overlay
DIFFS	Deck Integrated Fire Fighting System
FAA	Federal Aviation Administration, USA
FATO	Final approach and Take-Off Area (1.5 x helicopter length)
FARA	Final Approach Reference Area
GPS	Global Positioning System
HEMS	Helicopter Emergency Medical Service
HLS	Helicopter Landing Site
HLSRO	HLS Reporting Officer (Airservices requirement)
HTH	Health Translation Hub (UNSW)
IASB	Integrated Acute Services Building
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions - requiring flight under IFR
L	Length (also referred to as Overall Length), in relation to a helicopter, the total distance between the main rotor and tail rotor tip plane paths when rotating
LDP	Landing Decision Point (Category A/Performance Class 1 operations)
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
MRI	Magnetic Resonance Imagers
MTOW	Maximum Take Off Weight
NOTAM	Notice to Airmen. Issued by Airservices 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

Acronym	Meaning
PC2	Performance Class 2
PC3	Performance Class 3
POW	Prince of Wales
RD	Main Rotor Diameter
RHC	Randwick Hospitals Campus
SACL	Sydney Airports Corporation Limited
SARPS	Standards and Recommended Practices developed by ICAO and promulgated in the Annexes to the Convention of International Civil Aviation
SCH	Sydney Children's Hospital
SEARs	Secretary's Environmental Assessment Requirements
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.
VFR	Visual Flight Rules
VHF	Very High Frequency radio
VMC	Visual Meteorological Conditions - allowing flight under VFR
V_{TOSS}	Take off Safety Speed

1.6. List of Figures

2. EXECUTIVE SUMMARY

The aim of this report is to provide insights into the impacts of constructing the SCH Stage 1/CCCC on the aviation operations into and out of Sydney Aerodrome and of the RHC HLS. The report analyses likely impact of cranes during construction, and how these impacts might be managed; as well as the impacts of the completed building on those same aviation activities.

The following key outcomes arose from the analysis:

- The SCH Stage 1/CCCC building will protrude permanently into the Sydney OLS and will require approval for this permanent protrusion. This is a common occurrence and approval should be anticipated.
- The SCH Stage 1/CCCC building will protrude permanently into the Sydney OLS and will require to be fitted with appropriate aviation-standard obstacle lighting if OLS protrusion is, as expected, approved.
- The SCH Stage 1/CCCC building will not protrude into the Sydney PANS-OPS surfaces once constructed.
- The SCH Stage 1/CCCC building will not impact the IASB HLS, its approach and departure paths, or the Parking Position.
- The northernmost proposed SCH Stage 1/CCCC construction crane (TC 1) will protrude through the Sydney OLS and will require approval in order to do so.
- The southernmost proposed SCH Stage 1/CCCC construction crane (TC 2) will protrude through the Sydney OLS and will require approval in order to do so.
- The northernmost proposed SCH Stage 1/CCCC construction crane (TC 1) will not protrude through the Sydney PANS-OPS surface.
- The southernmost proposed SCH Stage 1/CCCC construction crane (TC 2) will not protrude through the Sydney PANS-OPS surface.
- The northernmost proposed SCH Stage 1/CCCC construction crane (TC 1) will not impact the IASB HLS, its approach and departure paths, or the Parking Position.
- The southernmost proposed SCH Stage 1/CCCC construction crane (TC 2) will impact the IASB HLS, its approach and departure paths, and the Parking Position such that a helicopter operations management plan and alternate HLS will be required.

Approval will be required from Commonwealth Department of Infrastructure, Transport, Regional Development and Communications, via SACL to build (long-term) within the Sydney OLS and if approval is forthcoming, as expected, appropriate aviation standard obstacle lighting will be required on the building. There is no permanent protrusion into the PANS-OPS surface.

Approval will be required from the Commonwealth Department of Infrastructure, Transport, Regional Development and Communications, via SACL for temporary long-term protrusion into the Sydney OLS for the construction cranes.

A helicopter operations (crane) management plan will be required to protect the IASB HLS, Parking Position and approach and departure paths from crane intrusion during construction activities. This is a common occurrence during significant construction activities in congested inner-city hospital campuses. As mitigation, it is also common to use an alternate HLS or Parking Position if crane arrangements are such that concurrent construction and aviation activities cannot be conducted safely.

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 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 Sydney Airport Corporation Limited (SACL).

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, construction or placement of HLS'. The appropriate national regulatory guidance at present for the use of HLS' is Civil Aviation Regulation (CAR) 92 which places the onus on the helicopter pilot to determine the suitability of a landing site. The Civil Aviation Safety Authority (CASA) as the regulator of aviation in Australia divested itself of direct responsibility for regulating HLS' in the early 1990s and currently provides only basic operating guidelines via Civil Aviation Advisory Publication (CAAP) 92-2 (2) Guidelines for the Establishment and Operation of Onshore Helicopter Landing Sites.

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

Requirements emanate from the Airports Act 1996 and the Airports (Protection of Airspace) Regulations 1996. Clause 6.8 of the Randwick Local Environment Plan 2012 contains also a paragraph which states that its objective is to, in part "provide for the effective and ongoing operation of the Sydney (Kingsford Smith) Airport by ensuring that such operation is not compromised by proposed development that penetrates the Limitation or Operations Surface for that airport".

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 Department to approve 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 infringements to the Commonwealth Department of Infrastructure, Transport, Regional Development and Communications for approval. Long term intrusions of the PANS-OPS surface are prohibited.

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:

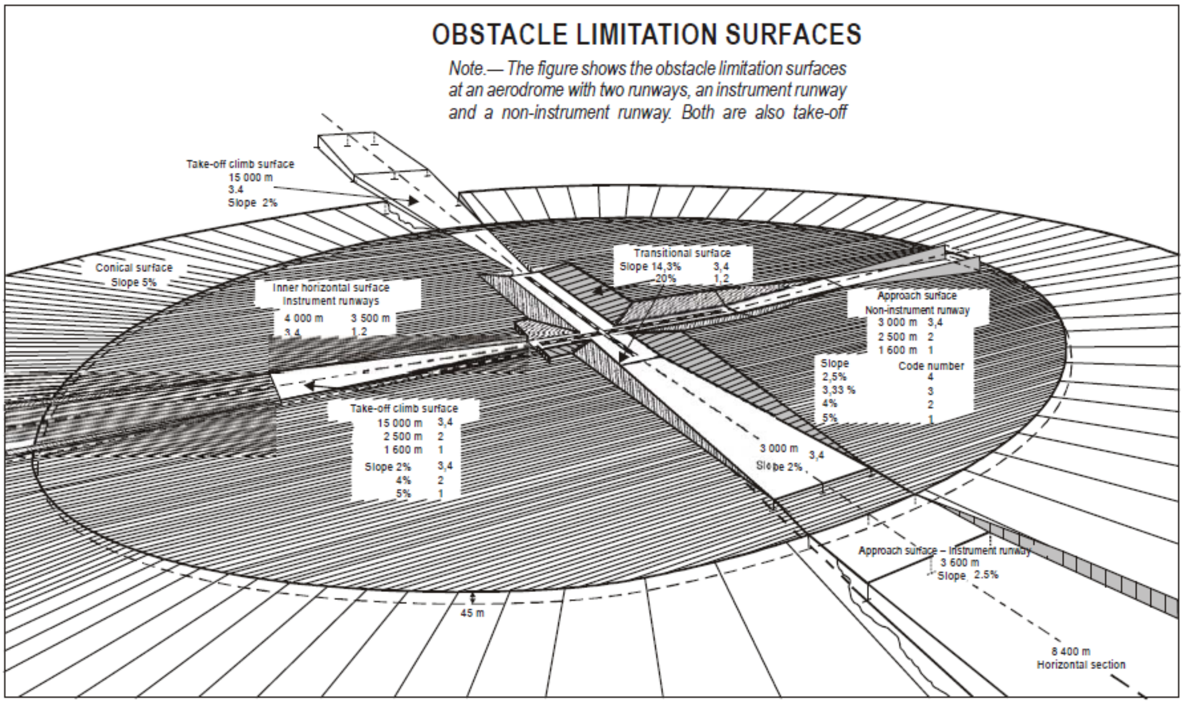

Figure 1: Example of Obstacle Limitation Surfaces

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:

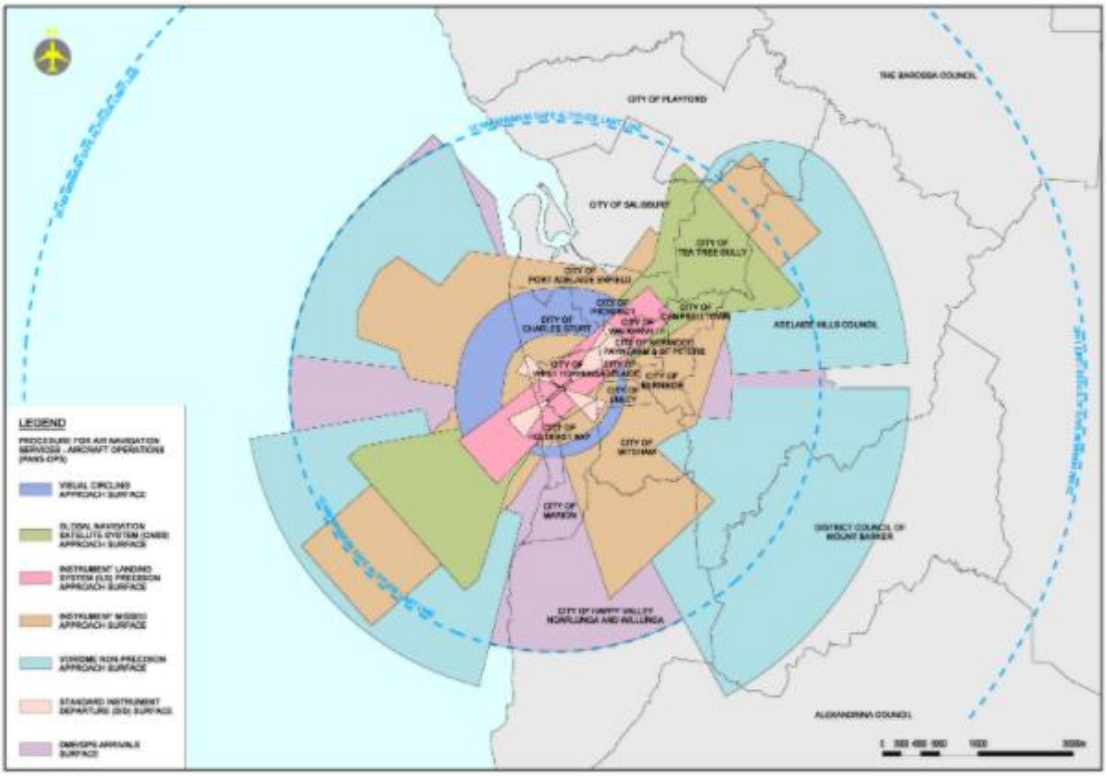

Figure 2: Example of PANS-OPS Surfaces

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:

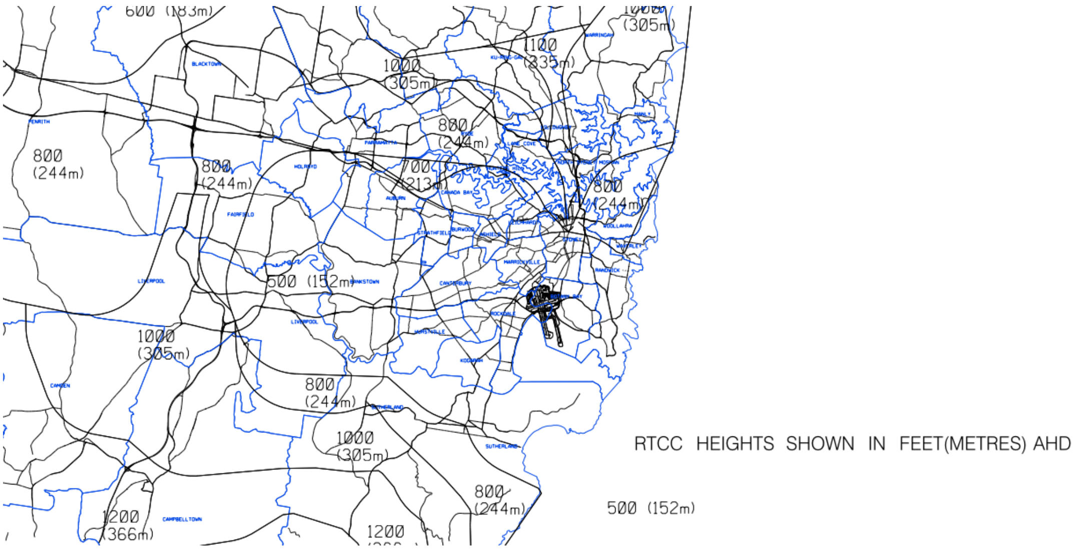

Figure 3: Example of a Radar Terrain Clearance Chart (RTCC)

3.9. VFR Approach/Departure Paths

The purpose of designating approach and departure paths is to provide sufficient airspace clear of hazards to allow safe approaches to, and departures from, an HLS.

VFR approach/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 approach/departure path which provides an additional safety margin and operational flexibility.

The preferred flight approach/departure path should, where possible, be aligned with the predominant wind when taking account of potential obstacles. Other approach/departure paths should also be based on an assessment of the prevailing winds and potential obstacles. The separation between such flight paths should not be less than 150°, and preferably180°.

3.10. VFR Approach/Departure and Transitional Surfaces

An approach/departure surface is centred on each approach/departure path. Under the Guidelines, the approach/departure path starts at the forward edge of the Final Approach and Takeoff Area (FATO) and slopes upward at 2.5°/4.5%/22:1 (22 units horizontal in 1 unit vertical) for a distance of ~3,500 m. The approach/departure path commences at the FATO width of 25 m. and expands uniformly to a width of 150 m. at a distance of 3,500 m., where the height is 500 feet above the elevation of FATO surface. For PC1 survey purposes, the survey commences from the forward edge of the FATO in the flight path direction, from a datum point 1.5 m. above the FATO edge. The VFR approach/departure paths are to be obstacle free. It is important to achieve 2.5° obstacle free to account for the performance requirements of one engine inoperative (OEI) flight following an emergency.

The transitional surface starts from the edges of the FATO parallel to the flight path centre line and extends outwards (to the sides) at a slope of 2:1 (2 units horizontal in 1 unit vertical or 26.6°) from the outer edges of approach/departure surface. The outer sides are 75 m. from the centreline, i.e. the outer edges are 150 m. wide. The transitional surfaces start at the forward edge of the FATO, overlaid over the approach/departure path (surfaces) and extend to the end of the approach/departure surface at 3,500 m. See Figure 4.

> ***Note**: The transitional surface is not applied on the FATO edge opposite the approach departure surface.*

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

Figure 4 illustrates the VFR approach/departure and transitional surfaces.

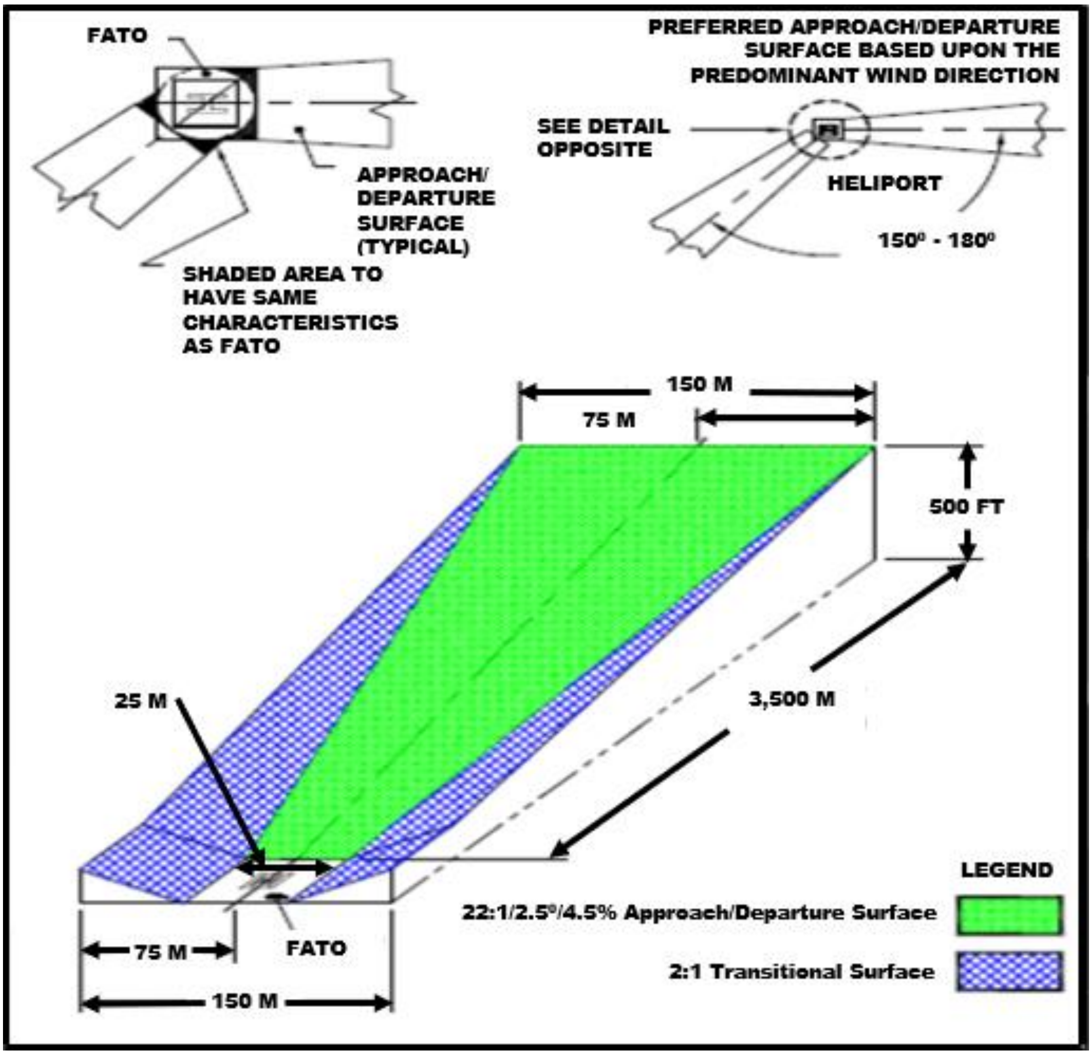

Figure 4: HLS VFR Approach/Departure and Transitional Surfaces

3.11. Object Identification Surfaces (OIS)

The OIS is used for the purpose of the Design and Development Overlay (DDO) and sits below each VFR approach and departure path to provide flight path protection. The OIS below a VFR approach and departure path is the limit for the penetration of obstructions below the flight path. That is, there should be no future development penetrating the OIS. The OIS extends out to 3.5 km. from the forward edge of the FATO. It is permissible under some circumstances to have minor penetration of the OIS, as long as the obstruction can be appropriately marked or lit.

Where possible, the OIS as specified in the Guidelines are to be met. However, at most hospital HLS, existing obstructions do not allow for this standard to be met. It can normally only be accommodated at a "new" rural hospital "green field" location or on a roof top HLS which is high above the surroundings

The OIS can be described as:

- In all directions from the Safety Area, except under the approach /departure paths, the OIS starts at the Safety Area perimeter and extends out horizontally for a distance of ~30 m.
- Under the approach/departure surface, the OIS starts from the outside edge of the FATO and extends horizontally out for a distance of ~700 m. From this point, the OIS extends out for an additional distance ~2,800 m. while rising on a 2.5º or 22:1 slope (22 units horizontal in 1 unit vertical). From the point ~700 m. from the FATO perimeter, the OIS is ~30 m. beneath the approach/departure surface.

- Safety surface width increases as a function of distance from the Safety Area. From the Safety Area perimeter, the OIS extends laterally to a point ~30 m. outside the Safety Area perimeter. At the upper end of the surface, the OIS extends laterally ~60 m. on either side of the approach/departure path. See Figure 5.

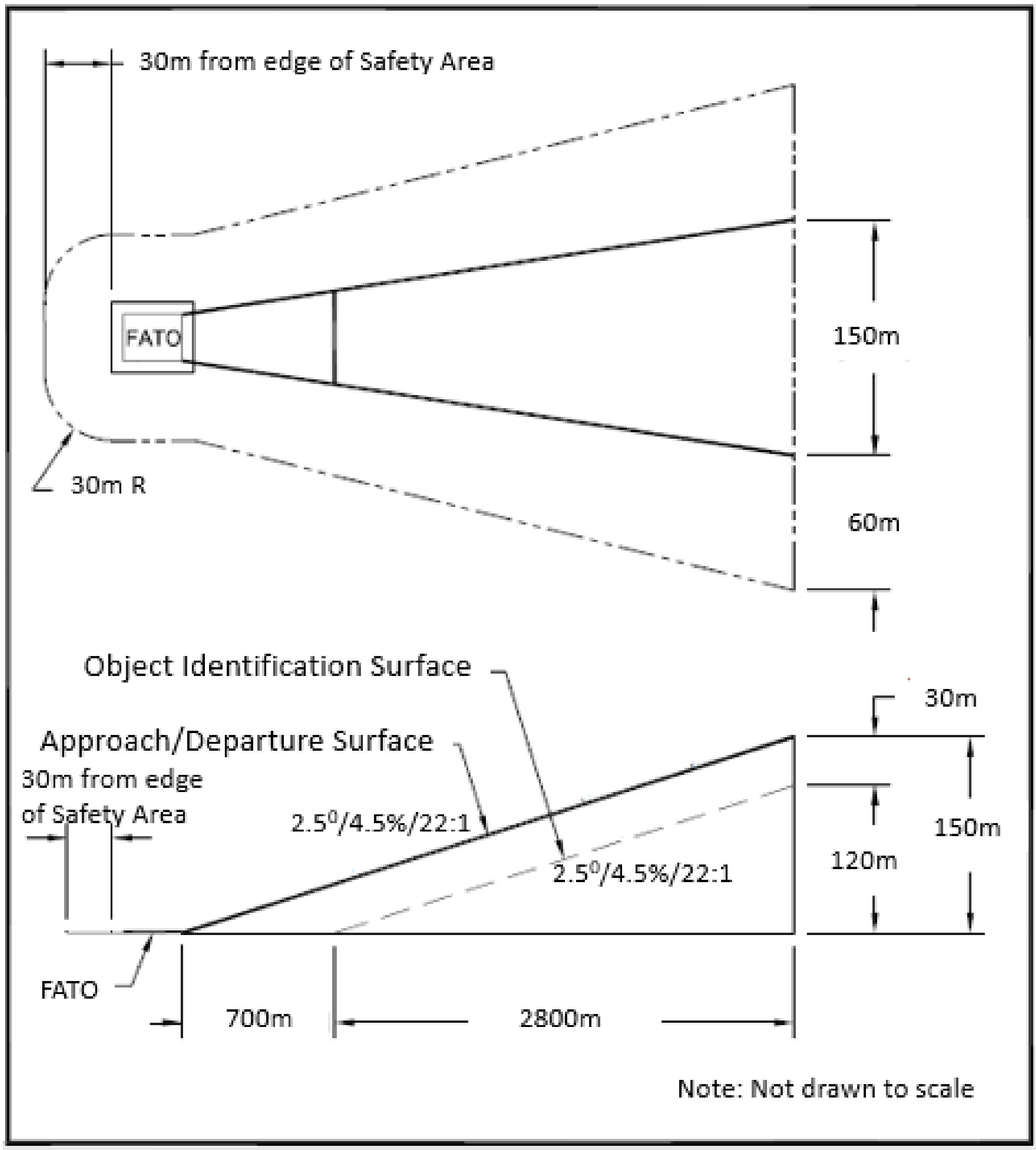

Figure 5: Object Identification Surfaces

3.12. Obstructions on or in the Vicinity of the HLS

The adverse effect of an object presumed or determined to be a hazard to air navigation may be mitigated by:

- Removing the object.
- Altering the object, e.g. reducing its height.
- Marking and/or lighting the object, provided that the object would not be a hazard to air navigation if it were marked and lit.

An example of an obstruction light required close to the HLS would be that required to be positioned on the top of the windsock. Other obstacles in close proximity to the HLS deck may include radio aerials or exhaust stacks etc. attached to the main building, other buildings in the vicinity such as a lift lobby, or stand alone. All such obstacles are required to have red obstacle lights fitted.

3.13. Obstructions in close Proximity but Outside/Below the Approach/Departure Surface

Unmarked wires, antennae, poles, cell towers, and similar objects are often difficult to see in time for a pilot to successfully take evasive action, even in the best daylight weather. Pilots can avoid such objects during enroute operations by flying well above them. Approaches and departures require operations where obstacles may be in closer proximity. Where possible, obstructions are to be moved however if this is impractical, markings and/or obstruction lighting is to be affixed.

3.14. All Round (360^0) HLS Airspace Protection is not Policy

Unlike HLS protection policy in Victoria, there is no NSW MoH policy to protect airspace in all directions around a hospital HLS with the exception of a 30m OIS distance to the sides and rear of an approach/departure path. See Figure 5.

The only requirements are those described in Sections 3.9 to 3.13 of this report. The protection requirements for approach/departure paths are actually very narrow corridors. The protection requirements discussed in this report are based upon the Guidelines for Hospital Helicopter Landing Sites in NSW, the basis for which was discussed in Sections 1 and 3.

4. SPECIFIC SCH STAGE 1/CCCC CONSIDERATIONS

4.1. The SCH Stage 1/CCCC Building Location

The SCH Stage 1/CCCC building is planned to be constructed in the north-western corner of the Randwick campus redevelopment area, adjacent to the Integrated Acute Service Building (IASB) and the UNSW Health Translation Hub (HTH). See Figure 6 below:

Figure 6: Location of the SCH Stage 1/CCCC

4.2. SCH Stage 1/CCCC Building Elevation

The SCH Stage 1/CCCC building is proposed to be built to 102.4 metres above sea level (RL102.4). Figure 7 below shows the SCH Stage 1/CCCC building in the context of the nearby IASB and HTH:

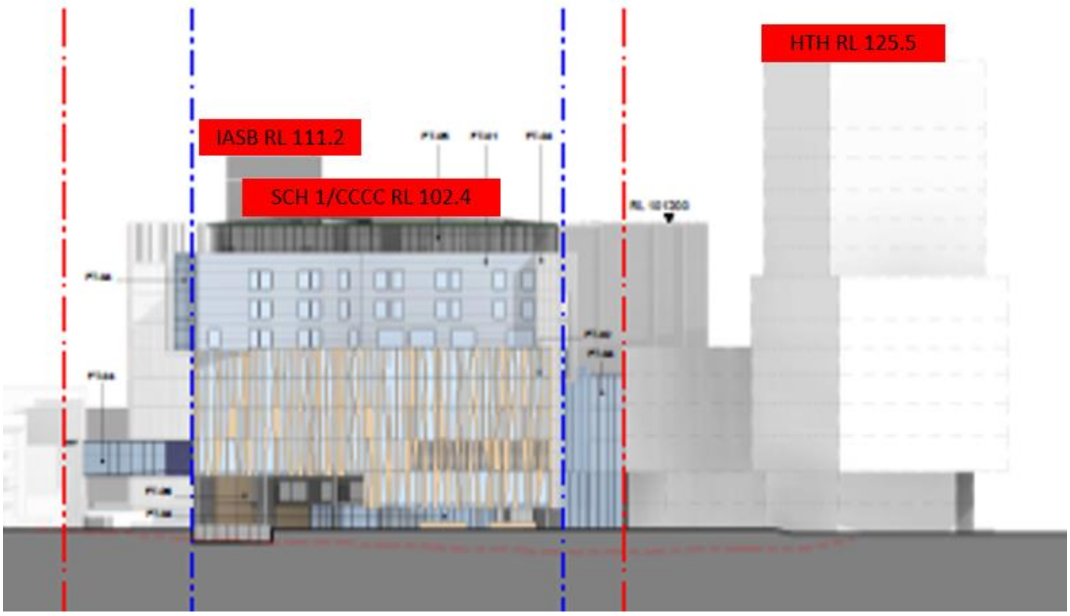

Figure 7: Elevation of the SCH Stage 1/CCCC

4.3. The Sydney OLS Overlay

The Sydney Aerodrome OLS is depicted in Figure 8 below. The approximate location of the RHC is also indicated.

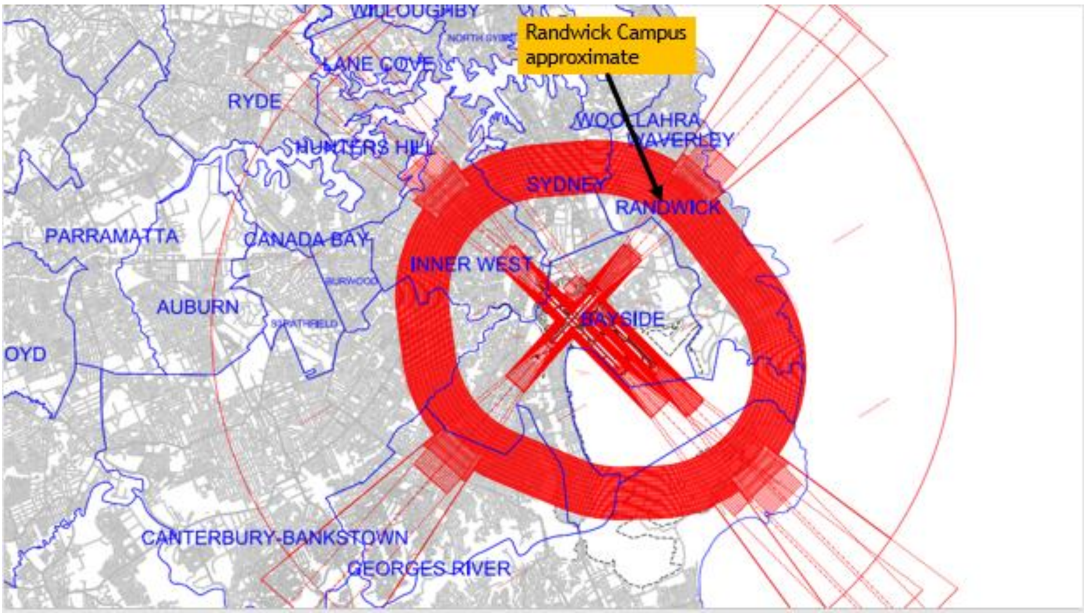

Figure 8: Sydney Aerodrome Obstacle Limitation Surfaces

4.4. The SCH Stage 1/CCCC within the Sydney Aerodrome OLS

At a proposed RL102.4, the completed SCH Stage 1/CCCC will be within the Sydney Aerodrome OLS. With appropriate obstruction lighting, this is permitted providing the correct processes are followed. It should be noted that the SCH Stage 1/CCCC will be "shielded" by the IASB. The concept of "shielding" is addressed later in this report. A more precise location of the SCH Stage 1/CCCC with permitted OLS building heights is at Figure 9 below:

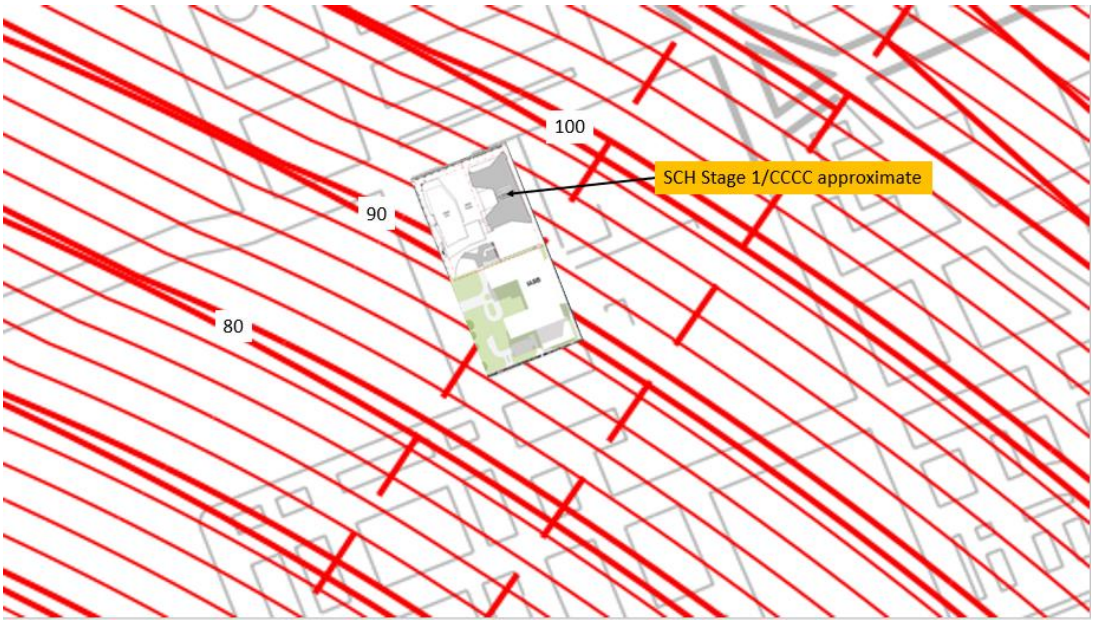

Figure 9: The SCH Stage 1/CCCC within the Sydney OLS

4.5. The Sydney PANS-OPS Overlay

The Sydney Aerodrome PANS-OPS overlay is depicted in Figure 10 below. The approximate location of the RHC is also indicated.

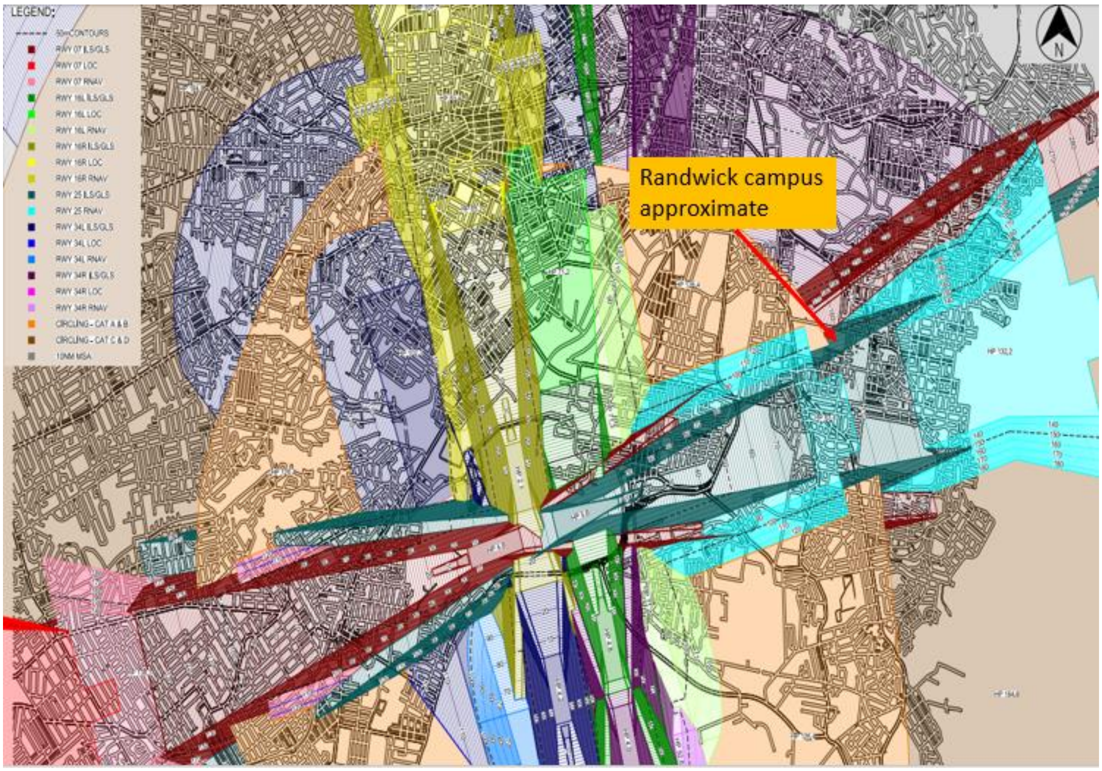

Figure 10: Sydney Airport PANS-OPS Surfaces

4.6. The SCH Stage 1/CCCC within the Sydney Aerodrome PANS-OPS Surfaces

At a proposed RL102.4, the completed SCH Stage 1/CCCC will be underneath the PANS-OPS surface, and will not protrude. Even with the addition of any tall plant or services such as antennae, satellite dishes, exhausts, vents, poles etc there will not be any protrusion. A more precise location of the SCH Stage 1/CCCC with permitted PANS-OPS levels is at Figure 11 below:

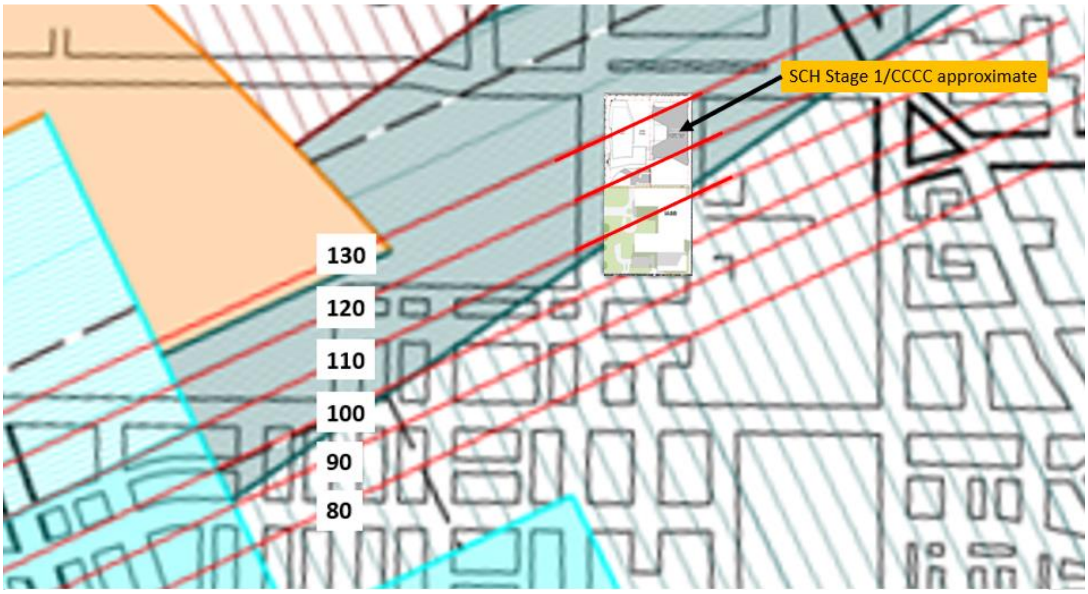

Figure 11: The SCH Stage 1/CCCC within the Sydney PANS-OPS Surfaces

4.7. The SCH Stage 1/CCCC within the Sydney Aerodrome RTCC

At a proposed RL102.4 the completed SCH Stage 1/CCCC will not protrude into RTCC. See Figure 12 below.

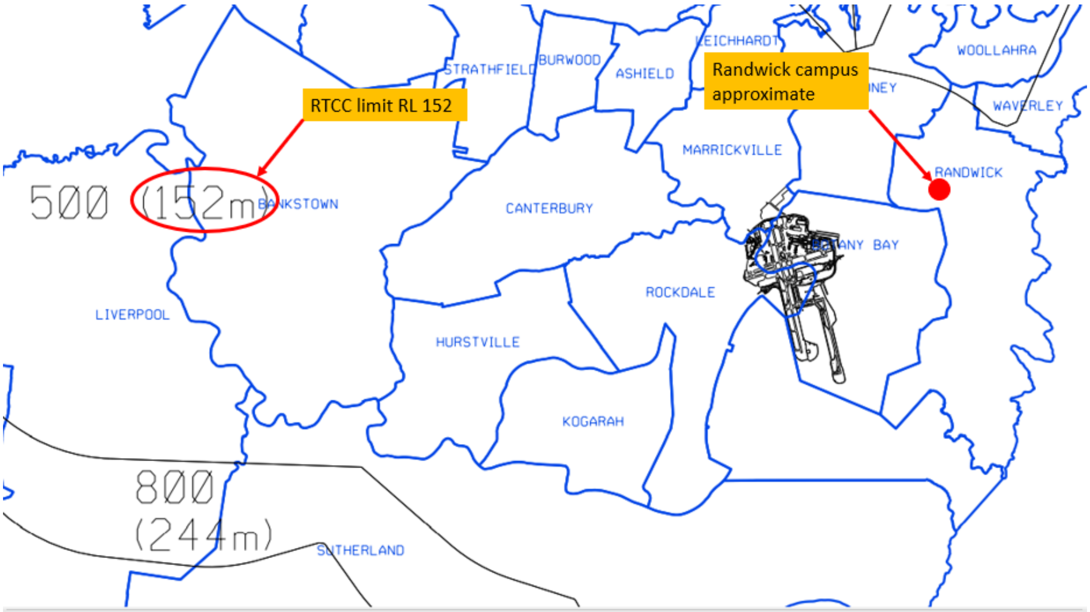

Figure 12: The SCH Stage 1/CCCC within the Sydney RTCC

4.8. Assessment of Building Impacts on Sydney OLS and PANS-OPS

At a proposed RL102.4 the SCH Stage 1/CCCC building will not protrude into PANS-OPS surface. See Figures 13-14 below. The building will protrude into the OLS and with the relevant approval, it is foreseen that the building may be constructed with a provision that it is lit appropriately with obstruction lighting.

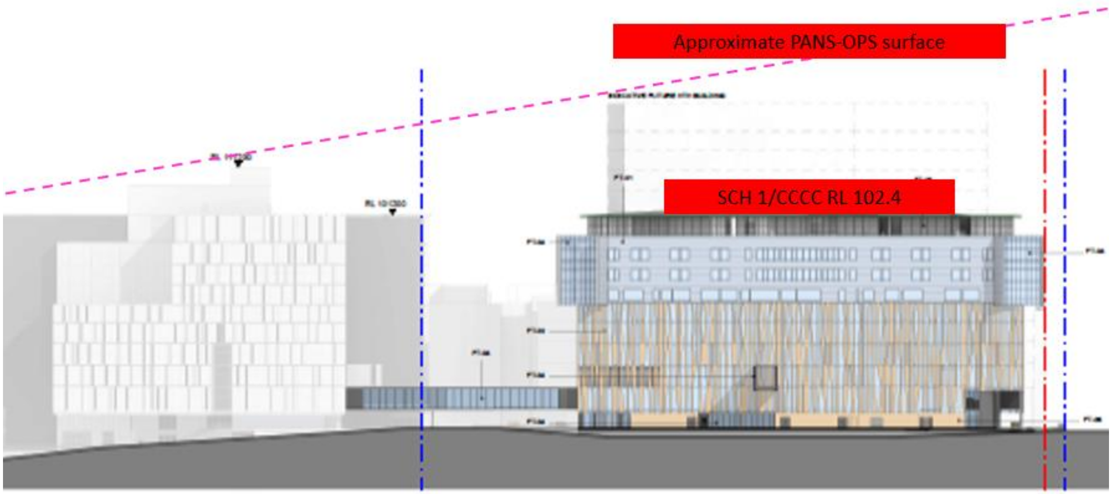

Figure 13: The SCH Stage 1/CCCC East Elevation showing Sydney PANS-OPS Surface

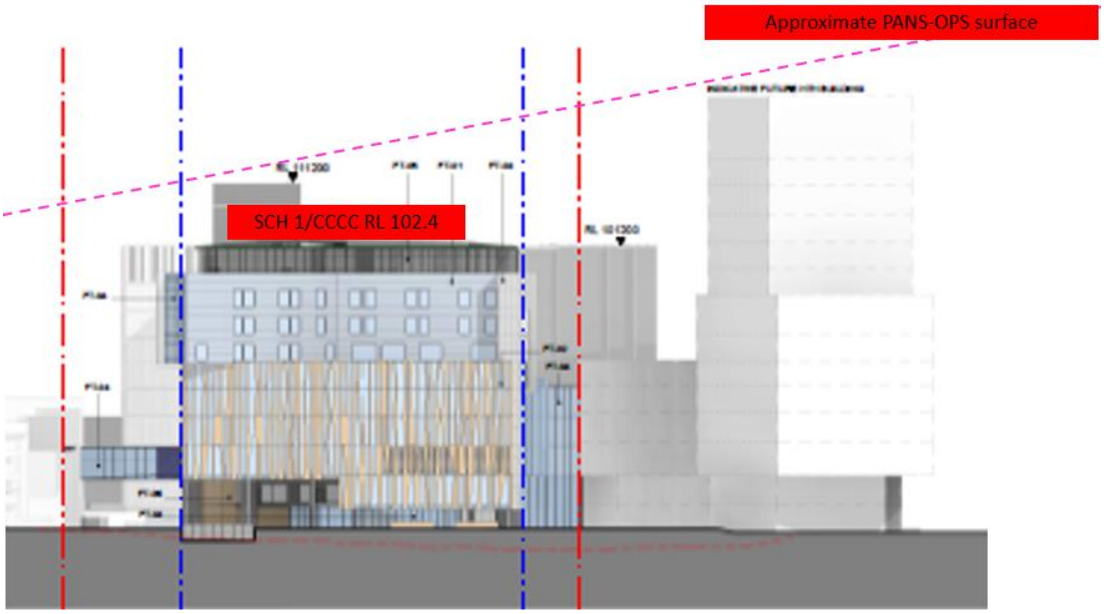

Figure 14: The SCH Stage 1/CCCC North Elevation showing Sydney PANS-OPS Surface

4.9. Location of the SCH Stage 1/CCCC Building in Relation to Campus HLS

As the Integrated Acute Services Building (IASB) is closer, it is the critical HLS for this analysis. The approach and departure paths for the existing and future IASB HLS are depicted in Figure 15 below:

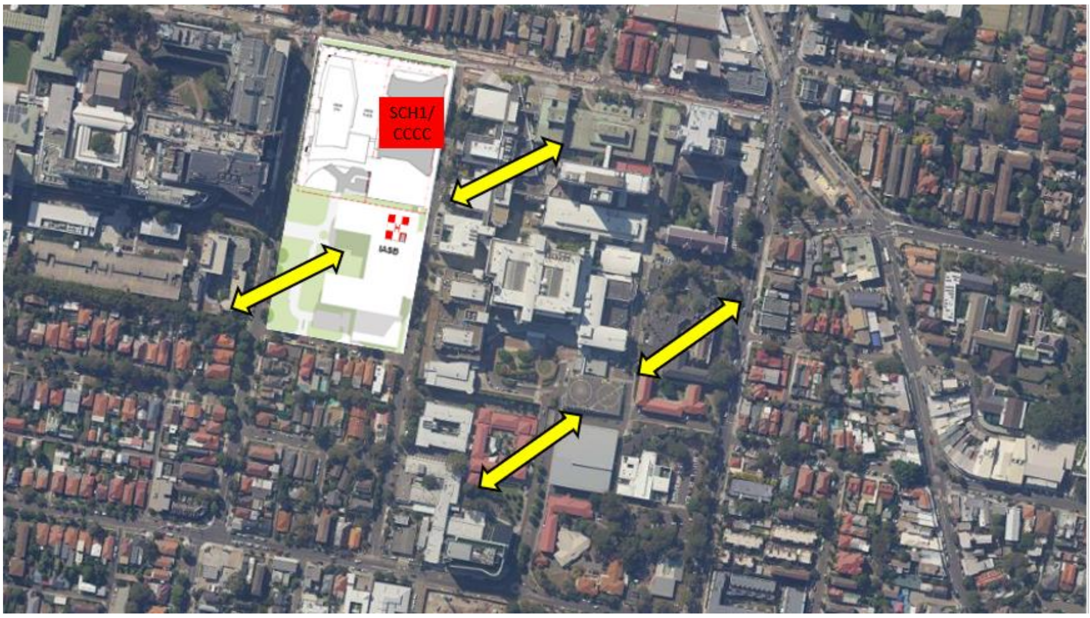

Figure 15: Current/Planned HLS Locations and Approach/Departure Paths

4.10. Impact of the SCH Stage 1/CCCC Building on Campus HLS

At a proposed RL102.4 the SCH Stage 1/CCCC building will not adversely impact the approach and departure paths into and out of the existing HLS or the new HLS to be constructed on the IASB. Survey modelling in Figure 16 below confirms this.

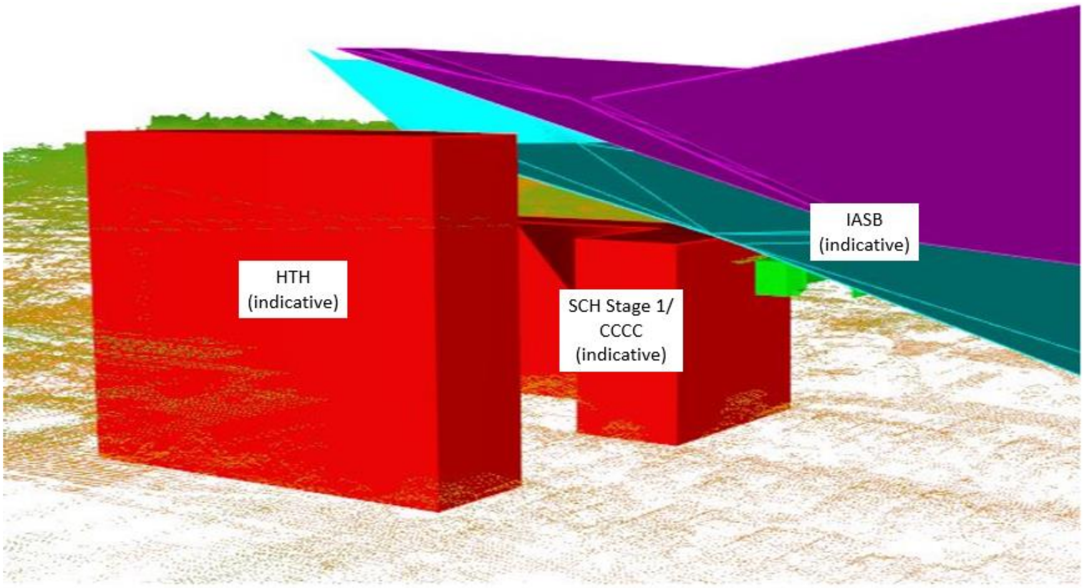

Figure 16: Survey modelling of the IASB HLS Approach/Departure Paths

4.11. Planned Locations of SCH Stage 1/CCCC Construction Cranes

The approximate locations of proposed construction hammerhead tower cranes, TC 1 and TC 2 for the SCH Stage 1/CCCC are depicted in Figure 17 below:

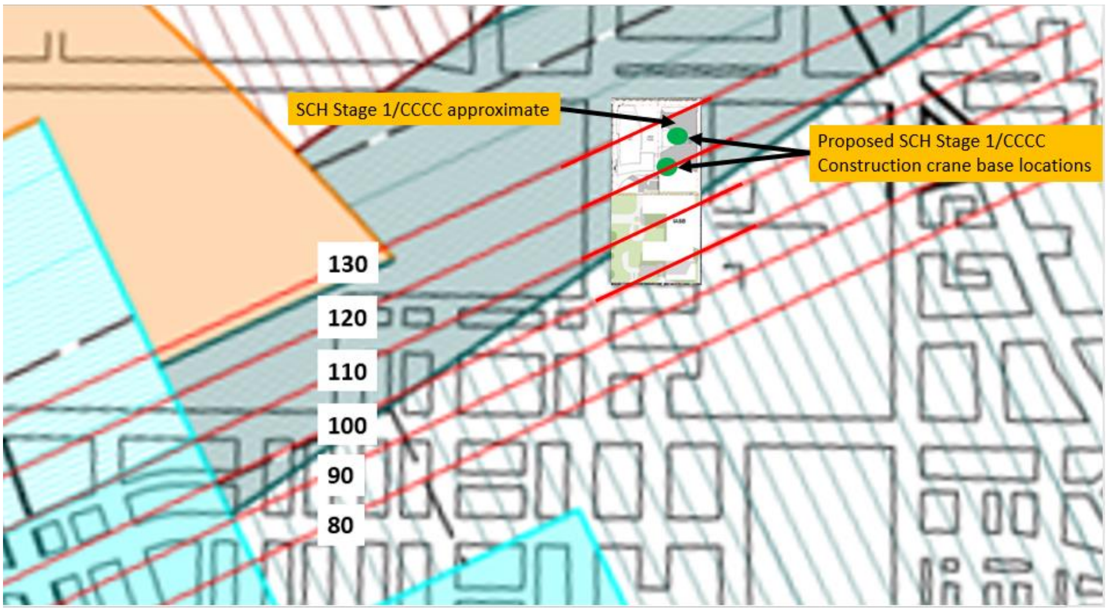

Figure 17: Proposed SCH Stage 1/CCCC Construction Crane Locations

4.12. Proposed Construction Crane Elevations

The proposed northernmost crane (TC 1) will top out at RL 116.0 with a 70m jib. The proposed southernmost crane (TC 2) will top out at RL 109.0 also with a 70m jib. The tip of the jibs will be two metres below the maximum elevation of the crane mast (tower). Therefore, the top of the jib tip of TC 1 will be RL 114.0 and the top of the jib tip of TC 2 will be RL 107.0. These elevations become important when the jibs slew freely to the south/south-east when unattended. The arcs of the jibs of TC 1 and TC 2 in relation to the PANS-OPS surface are shown in Figure 18 below:

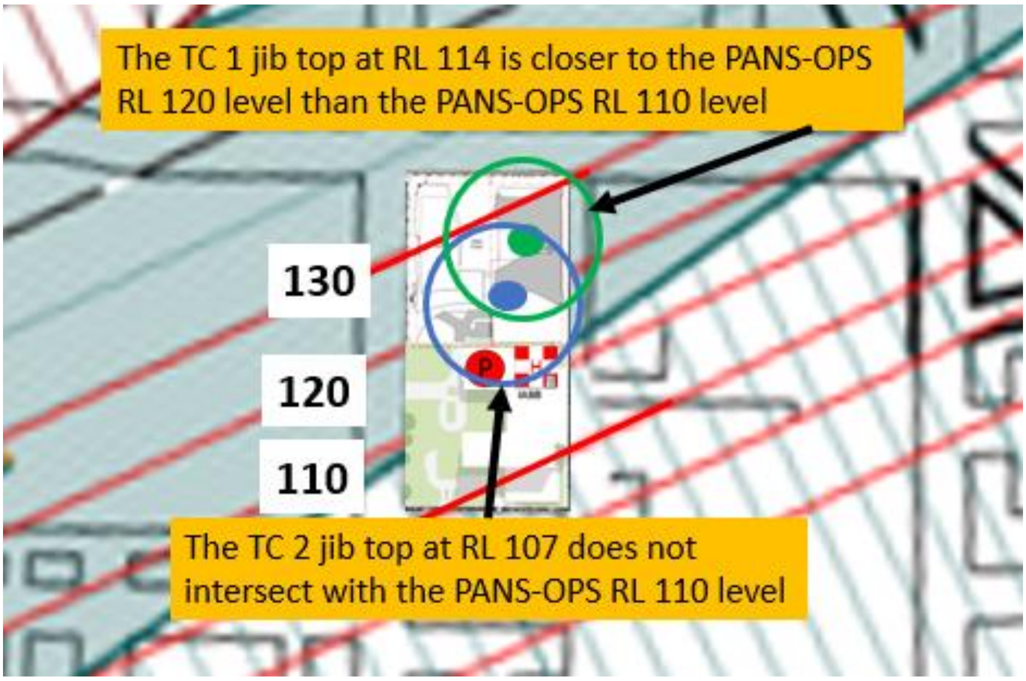

Figure 18: Proposed SCH Stage 1/CCCC Construction Crane Arcs in Relation to the PANS-OPS Surfaces

4.13. Impact of Proposed SCH Stage 1/CCCC Construction Cranes on OLS, PANS-OPS and RTCC

As the SCH Stage 1/CCCC at a proposed RL102.4 will clearly protrude into the Sydney OLS, so too will the proposed construction cranes. This is permissible, with the relevant approvals, as long as appropriate aviation-standard lighting is fitted.

4.14. Impact of Proposed Northern-most Crane on OLS and PANS-OPS

At RL116, the tower of the northernmost crane, TC 1, will not protrude into PANS-OPS surfaces and neither will the top of its jib at RL114 as it slews freely to the south/south-east towards lower PANS-OPS limits. Both the crane tower and jib will protrude into the OLS and will therefore require approval and appropriate lighting.

At RL109, the tower of the southernmost crane, TC 2, will not protrude into PANS-OPS surfaces and neither will the top of its jib at RL107 as it slews freely to the south/south-east towards lower PANS-OPS limits. Both the crane tower and jib will protrude into the OLS and will therefore require approval and appropriate lighting.

The construction cranes will not impact on the RTCC lower limit of RL 152.

4.15. Impact of Proposed SCH Stage 1/CCCC Construction Cranes on IASB HLS and Parking Position

Only TC 2 would impact the IASB HLS and its planned Parking Position. The jib of TC 2 will slew well across the IASB HLS and its Parking Position when unattended. When trailing in a north-westerly wind, the tip of the TC 2 jib will be almost over the centre of the HLS. The underside of TC 2's jib tip will be approximately RL 106 and the IASB HLS deck is RL 101.2 therefore there is insufficient space for a helicopter to land under the slewing jib. This situation will require a management plan and an alternate HLS for times when TC 2 is unattended and slewing across the IASB HLS. The relationships between the cranes and the IASB HLS and Parking Position are depicted in Figure 18 below:

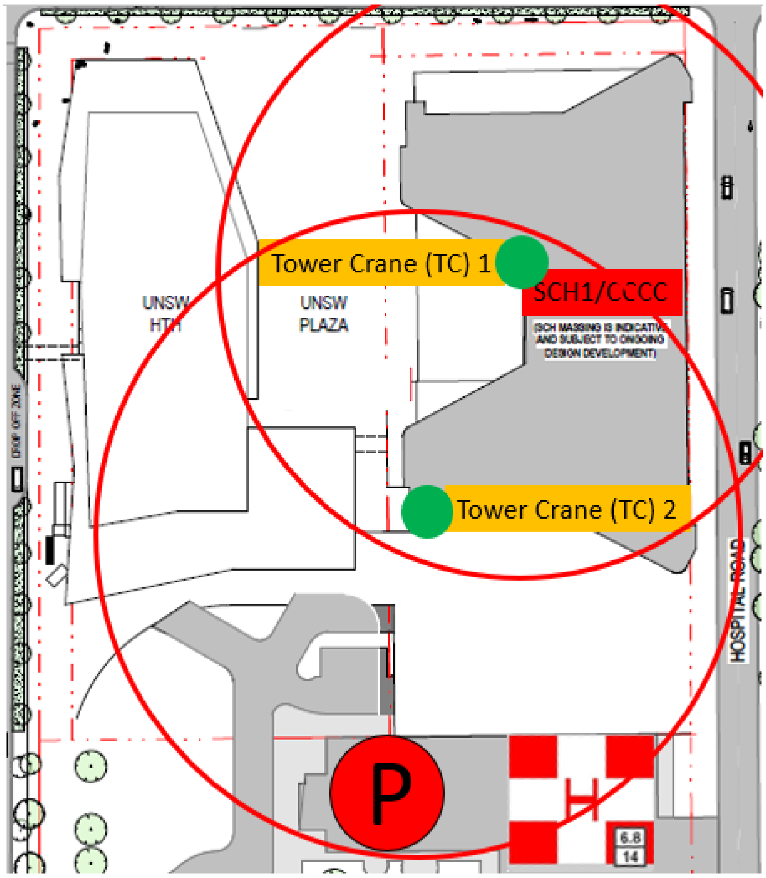

Figure 18: Relationship of SCH Stage 1/CCCC Construction Cranes and IASB HLS and Parking Position

4.16. Impact of Proposed SCH Stage 1/CCCC Construction Cranes on IASB HLS Approach and Departure Paths

The jib of the southernmost crane, TC 2 will impede the approach and departure paths for the IASB HLS when slewing to the south and south-east. This will require a management plan.

4.17. Deductions: Airspace, Cranes, Survey, Obstructions and HLS and Parking Position Usage

The following key deductions can be made:

- The SCH Stage 1/CCCC building will protrude permanently into the Sydney OLS and will require approval for this permanent protrusion. This is a common occurrence and approval should be anticipated.
- The SCH Stage 1/CCCC building will protrude permanently into the Sydney OLS and will require to be fitted with appropriate aviation-standard obstacle lighting if OLS protrusion is, as expected, approved.
- The SCH Stage 1/CCCC building will not protrude into the Sydney PANS-OPS surfaces once constructed.
- The SCH Stage 1/CCCC building will not impact the IASB HLS, its approach and departure paths, or the Parking Position.
- The northernmost proposed SCH Stage 1/CCCC construction crane (TC 1) will protrude through the Sydney OLS and will require approval in order to do so.

- The southernmost proposed SCH Stage 1/CCCC construction crane (TC 2) will protrude through the Sydney OLS and will require approval in order to do so.
- The northernmost proposed SCH Stage 1/CCCC construction crane (TC 1) will not protrude through the Sydney PANS-OPS surface.
- The southernmost proposed SCH Stage 1/CCCC construction crane (TC 2) will not protrude through the Sydney PANS-OPS surface.
- The northernmost proposed SCH Stage 1/CCCC construction crane (TC 1) will not impact the IASB HLS, its approach and departure paths, or the Parking Position.
- The southernmost proposed SCH Stage 1/CCCC construction crane (TC 2) will impact the IASB HLS, its approach and departure paths, and the Parking Position such that a helicopter operations management plan and alternate HLS will be required.

4.18. Additional Risk Mitigation

It is a common occurrence during significant construction activities in congested inner-city 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 or Parking Position if crane arrangements are such that concurrent construction and aviation activities cannot be conducted safely.

4.19. Process to Follow in Order to Obtain Relevant Approvals

Once precise crane details are known, the approval process can begin. Sydney Airport Corporation Limited (SACL) is the organisation that acts as the agent for all prescribed airspace applications associated with Sydney Aerodrome and its airspace. Links to relevant forms are below. On receipt of the Application Forms SACL seeks comment and assessment from:

- Sydney Aerodrome based airlines
- Air Services Australia
- Civil Aviation Safety Authority

Once these stakeholders have reviewed the impact of the requested penetration of the prescribed airspace, the responses are submitted to the Department of Infrastructure, Transport, Regional Development and Communications by SACL's airspace protection team (point of contact details are below).

Decisions on simple cases take approximately six weeks on average with more complex cases taking approximately three months. Each specific case is different.

4.20. Links to Relevant Forms

Application for Development Approval (link)
https://assets.ctfassets.net/v228i5y5k0x4/5ANcgf7qFiakke6SUYASSU/a5d8915cfbdb8f18e95eedde9a8d685f/Airspace_Protection_Form.pdf

Application for Approval of Crane Operation (link)
https://assets.ctfassets.net/v228i5y5k0x4/2ID4yo6olW4Y8oUiQ4eIu8/80cabbc2d221eda3a35723c4385f1e14/Crane_Enquiry_Form.pdf

Once completed, the forms can be submitted online. Ensure all attachments are sent through to the SACL point of contact.

4.21. SACL Point of Contact

The SACL Point of contact is detailed below. It is well worth a call prior to submission of the application to ensure the correct information is provided.

Peter Bleasdale
Airfield Design Manager
Sydney Airport
Tel: +61 2 9667 9246
Mob: +61 408 479 192
Email: peter.bleasdale@syd.com.au

Email: airspaceprotection@syd.com.au

Regular follow-up is advised. SACL receives hundreds of applications every year and difficult cases can often be held up.

4.22. Supporting Information for Penetration of Prescribed Airspace

Supporting details will be required to remove ambiguity and delays in the assessment of the submission. It is recommended drawings showing the following are created:

- Building information:
  - Site coordinates (MGA94)
  - Date the building will progress into prescribed airspace (if applicable)
  - Building coordinates (the corners of the 'as built' building in prescribed airspace)
  - Elevations of the buildings
  - Drawing of the building with the above information is recommended
- Crane information:
  - Centre of the base coordinates (MGA 94)
  - Date the crane/s will progress into prescribed airspace (if applicable)
  - Crane types (tower/luffing)
  - Crane elevations
  - Ensure the stages into prescribed airspace are drawn with accompanying dates
- Mobile crane information:
  - Dates (timings essential for notification of airspace users)
  - Location
  - Height of lift

4.23. Decisions on Temporary Protrusions into PANS-OPS surfaces

Approvals for temporary penetration of the PANS-OPS surface (less than three months) and long-term penetrations of the OLS (more than three months) can only be given by the Commonwealth Department of Infrastructure, Transport, Regional Development and Communications. They act under the Airports Act 1996 and the Airports (Protection of Airspace) Regulations 1996 and will take into account advice from CASA, Airservices Australia and SACL.

There is a significant lag in gaining approvals for cranes planned to penetrate PANS-OPS surfaces for up to three months and for OLS penetrations of more than three months. To help minimise the time taken for a decision, it is very important that the exact type, location, heights and jib lengths of cranes intended to be used in the development are determined very early in the planning process; as well as the period during which they will protrude into the relevant airspace.

4.24. Principle of Shielding not Applicable for Temporary Structures

"Shielding" is a principle whereby one tall structure acts as a barrier for another tall structure such that the level of hazard or risk to aviation safety is not actually increased. It is used in some cases by the relevant Regulators and Delegates involved in granting approvals for OLS and PANS-OPS penetrations, however, the CASR Part 139 (Aerodromes) Manual of Standards 2019 (MOS 139) states in a note to Chapter 7, Division 4 Part 7.25 General that: "A new obstacle, located in the vicinity of an existing obstacle, and assessed as not being a hazard to aircraft, would be considered to be shielded. Only existing permanent obstacles may be considered in assessing the applicability of shielding of new obstacles."

4.25. Conclusion

Approval will be required from Commonwealth Department of Infrastructure, Transport, Regional Development and Communications, through SACL, to build within the Sydney OLS and if approval is forthcoming, appropriate aviation standard obstacle lighting will be required on the building. It is very common for buildings in inner city areas to protrude into the OLS. As long as appropriate aviation-standard obstacle lighting is fitted, approval for the protrusion is normally routine.

There will be no need for any approvals from the Commonwealth Department of Infrastructure, Transport, Regional Development and Communications for temporary protrusion into the Sydney PANS-OPS surfaces.

A helicopter operations management plan will be required to protect the IASB HLS from manned crane intrusion during construction activities. It would be necessary, once the IASB HLS becomes operational, to keep the existing HLS available as an alternate HLS for periods when TC 2 is unmanned and its jib slews across the IASB HLS and Parking Position.