Level 8, 77 Pacific Highway North Sydney NSW 2059

AVIATION REPORT:

- HELICOPTER LANDING SITE STUDY

DUBBO BASE HOSPITAL REDEVELOPMENT

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14 June 2012

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1 ESTABLISHMENT

1.1 Background

Dubbo Base Hospital (DBH) is in the process of a redevelopment which is to involve the construction of new and refurbished hospital facilities. The master plan involves the replacement of most existing buildings in the longer term. At present there is a new single story Sub-Acute Mental Health Unit under construction to the western side of the hospital complex.

DBH has an existing surface level Helicopter Landing Site (HLS) in the north western corner of the hospital property. The HLS is operational 24 hours per day. The Master Plan has the HLS remaining in its current location for the foreseeable future.

The Redevelopment Stage 1 primarily involves a new one and two story building with potential expansion to three stories. This building is to house:

- A maternity unit;
- An Operating Theatre suite;
- Central Sterilising Department; and
- Day Surgery Unit.

Refurbishment is also to occur to the Admissions/Outpatients and Medical Records building, and the existing Theatre building. The existing Maternity building is to be demolished. Refer to drawings at Appendix A.

AviPro is to provide advice to Health Infrastructure regarding the current status of the DBH HLS, and the implications if any, of the construction and completed phases of Redevelopment Stage 1.

The primary considerations for the project include end user requirements, regulatory requirements, MoH HLS Guidelines, current international and Australian standards, size, shape, flight paths and obstructions etc.

1.2 HLS Terms of Reference and Applicability

Currently within Australia, there are no set rules or regulations applicable to the design, construction or placement of HLSs. There may however be local council planning, location and movement approvals required. The regulator of aviation in Australia, the Civil Aviation Safety Authority, effectively divested itself of responsibility in the early 1990s and now provides only basic operating guidelines via an out-of-date document [CAAP 92-2(1)], and as policy does not provide design or structural information or advice.

Considerable work has however been undertaken internationally in this area, particularly through the International Civil Aviation Organisation (ICAO) and the US Federal Aviation Administration (FAA). Additionally, the NSW MoH via ASNSW has current HLS documentation based on international standards. CASA is also working on Civil Aviation Safety Regulations (CASR 1998) Parts 133 and 138 pertaining to helicopter operations. Parts 133 and 138 are yet to be promulgated.

The resulting documents on the subject provide excellent advisory material, guidelines and best practice standards. Key current documents are as follows:

- ICAO Annex 14, Vol II, Heliports.
- ICAO Heliport Manual Doc 9261-AN/903.
- US FAA Advisory Circular *AC 150/5390-2B, Heliport Design*, (covers both operational and design criteria, particularly for hospital based HLSs in Chapter 4, Hospital Heliports).
- Australian Civil Aviation Safety Authority (CASA) Civil Aviation Advisory Publication (CAAP), *CAAP 92-2 (1), Guidelines for the Establishment and Use of Helicopter Landing Sites. (*covers essentially operational specifications only).
- NSW Ministry of Health (MoH) Guidelines for Hospital Helicopter Landing Sites in NSW Rev 06 of October 2011.

The guidelines and standards drawn from ICAO, the FAA and the NSW MoH, form the basis of this report.

Other guidelines/requirements of particular relevance include:

- Adherence to the performance requirements specified in the Rotorcraft Flight Manual (RFM) of the primary helicopter types used by ASNSW and ACT Ambulance;
- Acknowledgement of the proposed requirements of CASA CASRs Parts 133 and 138;
- The noise effect as a result of approaching and departing helicopters over particular flight paths, and thus the use of “Fly Neighbourly” techniques;

There is an additional very important consideration which is not aviation related, but medical. That is, that the HLS should be within easy reach and travel of the Emergency Department. This is generally considered to be not more than approximately 100 m. over a smooth path minimum of 1.8 m. wide and with an incline of less than 1:12, and thus easily traversed by a hospital trolley/gurney.

1.3 Background Material

Reference material provided by TSA Management Pty. Ltd. on behalf of Health Infrastructure in support of the report included:

- 120417-Request for Tender – Helicopter Consultant
- 11-232 DBH ACAD Model Survey
- 120201 Sub-Acute Mental Health
- A11-12 Option 2-Plans
- A11-22 Option 2-3D View
- DHS – PUGM Round 3
- DHS – Plan Render
- Site Houses of Operations Plan
- Site Plan Levels and Gradients
- Sub-Acute Bed Program Dubbo Mental Health Unit Plans
  - A0001
  - A1000
  - A1001
  - A2200
  - A2201
  - A2300
  - A2400
  - A2500
  - A2600
  - A2800
  - A2900
  - A3000
  - A3001
  - A3003
  - A3100
  - A3101
- Aerial DBH Site Picture

1.4 Methodology

Following an initial desktop assessment of the background material, a site visit was completed.

Criteria from all relevant references were assessed, with the NSW MoH Guidelines for Hospital Helicopter Landing Sites in NSW Rev 06 used as the primary assessment tool.

1.5 Explanation of Terms

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

Approach/Departure Path. The flight track helicopters follow when landing at or departing from the FATO of a HLS. Extends outwards from the edge of the FATO and has an obstacle free gradient of 7.5º (1:8 vertical to horizontal) measured from the edge of the FATO to a height initially of 500 feet above the FATO at a distance of ~1,250 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.

Both the CASA CAAP and FAA AC describe the approach/departure path and both commence with the width of the FATO. As the AC is more prescriptive, these guidelines are used. The AC extends the width of the approach/departure path from the edge of the FATO out to a distance of ~150 m. at 500 feet above the level of the HLS, and then out to a distance of ~1,250 m.

It should be noted however that the single engine performance of the Bell 412 which is currently operated by SouthCare in Canberra, may only allow for a ~2.5º (1:23 vertical to horizontal) obstacle free gradient.

Category A Performance. Similar to Performance Class 1 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.

Category B Performance. Similar to Performance Class 2 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 safety continue the flight, except when the failure occurs early during the take-off manoeuvre, in which case a forced landing may be required.

Design Helicopter. The selection of design, construction and location of a HLS is dependent on the choice of a “Design Helicopter”. In NSW, the Agusta AW139 contracted to the ASNSW is the Design Helicopter. The type reflects the new generation helicopters used in HEMS and reflects the maximum weight, maximum contact load/minimum contact area, overall length and rotor diameter, etc. of HEMS expected to operate to NSW hospital HLSs. The closest ASNSW HEMS to DBH is the Orange based EC145. This helicopter is slightly smaller than the AW139 and thus the Design Helicopter requirements accommodate all EC145 requirements.

Elevated Helicopter Landing Site (Heliport). A HLS located on a roof top or some other elevated structure where the Ground Effect Area/Touchdown and Lift-off Area (GEA/TLOF) is at least 76 cm. above ground level.

Final Approach. The reduction of height and airspeed to arrive over a predetermined point above the FATO of a 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 US FAA AC specification of 1.5 x Length Overall of the Design Helicopter is used.

Ground Effect Area. (**GEA** - Australia) [also known as the **Touchdown and Lift-off Area** (**TLOF** – US). A load bearing, generally paved area, normally centered 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.

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 a 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 Imaginary Surfaces. The imaginary planes, centred about the FATO and the approach/departure paths, which identify the objects to be evaluated to determine whether the objects should be removed, lowered, and/or marked and lit – or the approach/departure paths realigned.

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. A HLS limited to serving helicopters engaged in air ambulance, or other hospital related functions.

> **NOTE:** *A designated helicopter landing site located at a hospital or medical facility is a HLS and* ***not*** *a medical emergency site.*

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.

Landing Position. Also known as the **Landing and Liftoff Area** (**LLA**). A load-bearing, generally paved area, normally located in the centre of the GEA/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.

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). Also known as the **Landing Position**. A load-bearing, generally paved area, normally located in the centre of the GEA/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 Surfaces. The area below the approach/ departure and transitional surfaces where object separation is to be maintained and where objects should be marked if penetrating the surface, out to a horizontal distance of ~1,250 m.

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

Performance Class 1. 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.

Performance Class 2. Similar to Category B 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 safety continue the flight, except when the failure occurs early during the take-off manoeuvre, in which case a forced landing may be required.

Performance Class 3. 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:

a) in the case of multi-engine rotorcraft – may be required; or
b) 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 lighting.

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

Prior Permission Required (PPR) HLS. A HLS developed for exclusive use of the owner and persons authorized by the owner.

> **NOTE:** *The HLS owner and 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 a 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. This translates to a diameter of 33 m. for the Design Helicopter.

Safety Net. Surrounds the outer edge of a rooftop or elevated HLS. Should be a minimum of 1.5 m. wide, not project more than 25 cm. above the HLS outer edge, have a load carrying capacity of not less than 122 kg/m^2., and be fastened to a solid structure.

Segment 1. Category A profile distance between TDP and $V_{TOSS.}$

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 GEA/TLOF, from which the helicopter takes off. Typically, there are two such positions at the edge of the GEA/TLOF, one for each of two takeoff or arrival directions.

Touchdown and Lift-off Area (TLOF – US**)** [also known as the **Ground Effect Area** (**GEA** – Australia)]**.** A load bearing, generally paved area, normally centered 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.

Transitional Surfaces. Starts from the edges of the FATO parallel to the flight path centre line, and from the outer edges of approach/departure surface, and extends outwards at a slope of 2:1 (2 units horizontal in 1 unit vertical) for a distance of ~75 m. from the centreline. The transitional surfaces start at the edge of the FATO opposite the approach/departure surfaces and extend to the end of the approach/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 lighted obstruction whose highest point is at the same or higher elevation.

1.6 Applicable Abbreviations

AC	US FAA Advisory Circular.
ASNSW	Ambulance Service of New South Wales.
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.
CTAF	Common Traffic Advisory Frequency.
FAA	Federal Aviation Administration, USA.
FATO	Final Approach and Take Off Area. (Australian CAAP = 2 x Length) (ICAO and US FAA AC = 1.5 x Length and is used)
FARA	Final Approach Reference Area.
FMS	Flight Manual Supplement.
GEA	Ground Effect Area (also TLOF) – min. 1 x main rotor diameter. Load bearing area.
DBH	DBH Health Service.
GPS	Global Positioning System taking its data from orbiting satellites.
HAPI-PLASI	Pulse Light Approach Slope Indicator (see VGI).
HEMS	Helicopter Emergency Medical Service.
HLS	Helicopter Landing Site (also Heliport).
ICAO	International Civil Aviation Organisation.
IFR	Instrument Flight Rules.
IMC	Instrument Meteorological Conditions - requiring flight under IFR.

L	Length (overall), 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 with undercarriage contact points + I x metre in all directions.
MRI	Magnetic Resonance Imagers.
MRU	Medical Retrieval Unit (HQ Eveleigh). Responsible for control and tasking of HEMS.
MTOW	Maximum Take Off Weight.
NDB	Non Directional Beacon providing a radio signal to an aircraft ADF.
RD	Main Rotor Diameter.
RMI	Remote Magnetic Indicator (magnetic compass with flux valve system).
TDP	Takeoff Decision Point (Category A/ Performance Class 1 operations).
TLOF	Touch Down and Lift Off Area (US FAA), also (Australia GEA) - min. 1 x main rotor diameter. Load bearing.
VFR	Visual Flight Rules.
VHF	Very High Frequency radio.
VGI	Visual glideslope indicator.
VMC	Visual Meteorological Conditions - allowing flight under VFR.
VOR	VHF Omni-directional Radio - a ground radio transmitter for aircraft navigation purposes.
V_{TOSS}	Takeoff Safety Speed.

1.7 List of Figures

1.8 List of Appendices

2 CONCLUSION and RECOMMENDATIONS

The scope of work required of AviPro includes advice on the current status of the DBH HLS, as well as the effect on the HLS during Redevelopment Stage 1 construction, and following completion of the Redevelopment.

2.1 Conclusion

The Redevelopment both during the works and on completion will have no substantial effect on the use of the HLS. Protocols are however required to be established to ensure that information pertaining to crane activity is provided to helicopter crews prior to all arrivals and departures. During the construction phase, care must be taken to ensure that no loose material remains in the vicinity of the HLS. At no time is the HLS to be used as a materials staging area.

The Redevelopment at it closest point is approximately 75 m. to the south east of the HLS perimeter. An existing concrete path leading to the south of the HLS, and then turning east to the Emergency Department, may require partial relocation during the redevelopment.

The scope also requires advice on the current status and standards of the HLS as they apply to the NSW Ministry of Health (MoH) Guidelines for Hospital Helicopter Landing Sites in NSW Rev 06.

Following a review of the current HLS facilities on site, AviPro has identified 10 recommendations from the aviation studies. Recommendations 1 to 8 (inclusive) relate to upgrades to the existing HLS and hospital facilities to ensure compliance with current aviation Guidelines. These recommendations are not directly linked to the Redevelopment and will not adversely impact on the Redevelopment. Recommendations 1 to 8 inclusive are the subject of a separate report to the Dubbo Base Hospital that does not form part of the current planning application process.

2.2 Recommendations

The two Recommendations directly linked to the Redevelopment are as follows:

9. Health Infrastructure to ensure that the construction contractor has a protocol in place in relation to helicopter movements, and in particular to advise when cranes are to be used, when they are to be lowered, and the operating height when they are active. (Sub-section 4.2 page 36)

10. Health Infrastructure to ensure that the construction contractor has a protocol in place to ensure that loose items dangerous to helicopter operations are either removed from the area or appropriately secured. The protocol should include inspections prior to every helicopter movement. (Sub-section 4.2 page 36)

3 AVIATION REQUIREMENTS AND CONSIDERATIONS

3.1 Design Helicopter

Although the most common helicopter type to use the DBH HLS is likely to be the Orange based Eurocopter EC145, the HLS must cater for the larger Design Helicopter, the Agusta AW139 with a MTOW of 6,400 kg. The other possible type to use the HLS is the Bell 412 series which have similar dimensions to the AW139, but have a Maximum Take Off Weight (MTOW) of 1,000 kg. less than the AW139. See Figures 1-3.

Figure 1: ASNSW EC145

Figure 2: ASNSW AW139 "Design Helicopter"

Figure 3: ASNSW Bell 412EP

The dimensions of the AW139 are seen at Figure 4.

Figure 4: AW139 Dimensions

3.2 Helicopter Landing Site Dimensions

The primary reference for the following information is the NSW MoH Guidelines for Hospital Helicopter Landing Sites in NSW Rev 06. All dimensions are based upon the Design Helicopter.

3.2.1 Ground/Surface Level HLS Strength

For surface level HLSs the advisory information recommends that the dynamic loads will be met with a sealed LLA constructed of 15 cm. thick reinforced Portland cement/concrete. The LLA dimensions for the Design Helicopter are a minimum of 6.35 x 6.35 m. It is advisable however to have a load bearing area equal to the size of the GEA/TLOF, and preferably to have the load bearing area covering the entire FATO area.

DBH HLS has a circular concrete HLS of approximately 15 m. diameter thus well exceeding the minimum LAA requirements. The load bearing capacity is unknown however is assumed to be satisfactory. The hospital engineering department may be able to assist with a statement referring to its construction and load bearing capability. See Figure 5 and **Recommendation 1** (DBH).

Figure 5: Dubbo Base Hospital HLS Looking East

3.2.2 FATO

Diameter minimum 1.5 x Length = 1.5 x 16.62 m. = 24.93 m., and a maximum slope in any direction not exceeding 3%. 2% is preferable. Rounded up, the FATO is required to be a diameter of **25** m. or **25** x **25** m. square.

DBH HLS does not have a defined FATO boundary marking. The area beyond the concrete helipad is grass covered to the FATO boundary and only load bearing during dry conditions. The level appears to be less than 2%.

3.2.3 GEA/TLOF

Diameter minimum 1 x main rotor dia. of 13.8 m. and load bearing. Rounded to a diameter of **14** m. or **14** x **14** m. square.

DBH HLS has a 15 m. diameter concrete helipad assumed to meet the load bearing requirements, and which meets the GEA/TLOF dimensions. There is however no defined boundary marking.

3.2.4 Safety Area

The FATO shall be surrounded by a Safety Area which is to be free of all obstacles.

The purpose of a Safety Area is to:

a. reduce the risk of damage to a helicopter caused to move off the FATO by the effect of turbulence or cross-wind, mislanding or mishandling; and
b. protect helicopters flying over the area during landing, missed approach or take-off by providing an area which is cleared of all personnel and obstacles except small, frangible objects which, because of their function, must be located on the area.

A Safety Area surrounding a FATO intended to be used in visual meteorological conditions (VMC) shall extend outwards from the periphery of the FATO for a distance of 0.3 times the rotor diameter (RD) of the Design Helicopter. This size assumes that all markings and lighting will be in place.

Therefore, 0.3 x L (13.8 m.) = 4.14 m. The Safety Area width surrounding the FATO is thus rounded to **4** m.

No fixed object shall be permitted on a Safety Area, except for frangibly mounted objects which, because of their function, must be located on the area. No mobile object shall be permitted on a Safety Area during helicopter operations.

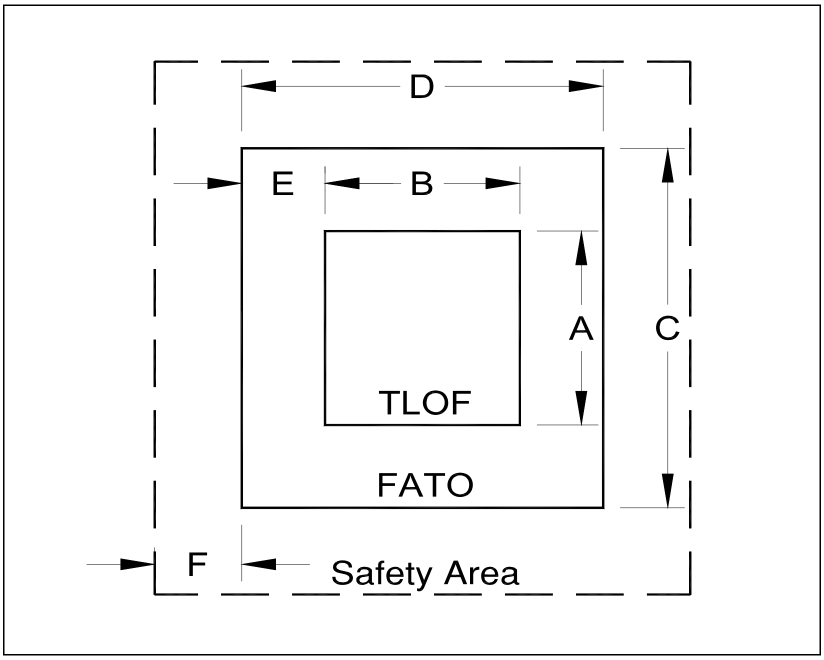
Objects whose functions require them to be located on the safety area shall not exceed a height of 20-25 cm. when located along the edge of the FATO, nor penetrate a plane originating at a height of 20-25 cm. above the edge of the FATO and sloping upwards and outwards from the edge of the FATO at a gradient of 5%. The surface of the Safety Area shall not exceed an upward slope of 4% outwards from the edge of the FATO.

The surface of the Safety Area abutting the FATO shall be continuous with the FATO and the whole of the Safety Area shall be treated to prevent loose items and any other flying debris caused by rotor downwash.

The minimum recommended Safety Area surrounding the FATO is dependent upon whether there are suitable markings for the FATO, the GEA/TLOF and the central "H".

DBH HLS has sufficient clear area surrounding the concrete helipad to meet the Safety Area requirements. The FATO, GEA/TLOF and the "H" are however to be appropriately marked. To meet night operations requirements, the necessary lighting must be installed. With such markings, the Safety Area minimum is to be **4** m. in width and surround the FATO. The total diameter of a round HLS including the Safety Area will therefore be (25 + 8 m.) = **33** m.

HLSs may be round or square. Figure 6 following is a diagram of an example square HLS showing the dimensions.[1]



Note: HLS design may be square or round. Length and Width dimensions also relate to diameter if round.

Design Helicopter: **Agusta AW139**

RD: Rotor diameter of the design helicopter
OL: Overall length of the design helicopter

A – Min GEA/TLOF Width: 1.0 x RD (14 m.) (if round, diameter is 14 m.)
B – Min GEA/TLOF Length: 1.0 x RD (14 m.)
C – Min FATO Width: 1.5 x OL (25 m.)
D – Min FATO Length: 1.5x OL (25 m.)
E – Min separation between perimeters of the GEA/TLOF and FATO: 0.5(1.5 x OL – 1.0 x RD) (5.5 m.)
F – Min Safety Area Width: 0.3 x RD (4 m.)

Figure 6: GEA/TLOF, FATO and Safety Area Relationships and Minimum Dimensions

[1] AC 150/5390-2B

3.3 Object Identification Surfaces (OIS)

Where possible, the object identification surfaces as specified in the Guidelines should be met. However at many NSW hospital HLSs the existing obstructions do not allow for this standard. It can normally only be met at a "new" rural hospital "green field" location. Unfortunately in common with most rural NSW hospitals, the DBH HLS does not allow for this standard. This however is not a major concern.

The OIS standard is as follows:

(1) In all directions from the Safety Area, except under the approach/departure paths, the object identification surface starts at the Safety Area perimeter and extends out horizontally for a distance of ~30 m.

(2) Under the approach/departure surface, the object identification surface starts from the outside edge of the FATO and extends horizontally out for a distance of ~250 m. From this point, the object identification surface extends out for an additional distance ~1,000 m. while rising on a 7.5º or 8:1 slope (8 units horizontal in 1 unit vertical). From the point ~200-250 m. from the FATO perimeter, the object identification surface is ~30 m. beneath the approach/departure surface.

(3) The width of the safety surface increases as a function of distance from the Safety Area. From the Safety Area perimeter, the object identification surface extends laterally to a point ~30 m. outside the Safety Area perimeter. At the upper end of the surface, the object identification surface extends laterally ~60 m. on either side of the approach/departure path. See Figure 7.

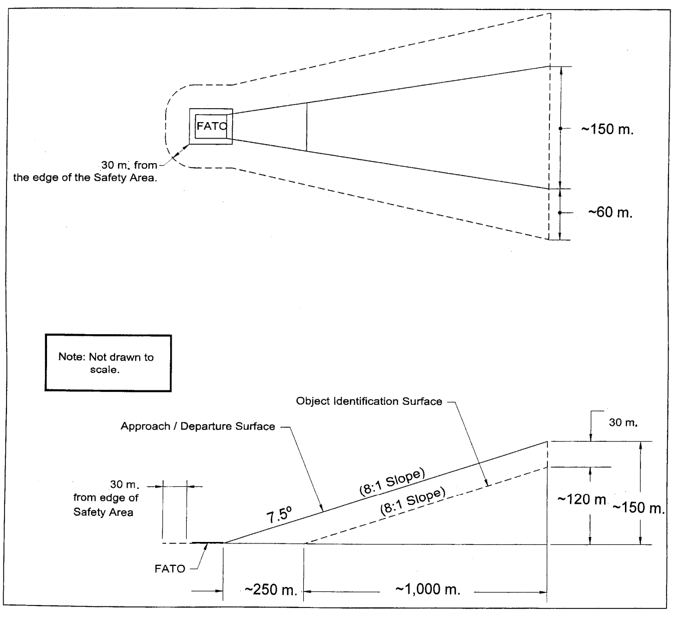


Figure 7: Approach/Departure and Object Identification Surface

3.4 VFR Approach and Departure Paths

The purpose of approach/departure airspace is to provide sufficient airspace clear of hazards to allow safe approaches to and departures from landing sites.

Approach/departure paths should be such that downwind operations are avoided and crosswind operations are kept to a minimum. To accomplish this, a HLS should 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 predominate 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 135º and preferably greater than 150º.

VFR approach/departure paths may curve in order to avoid objects or noise-sensitive areas. More than one curve in the path is not recommended. Changes in direction by day below 300 feet should be avoided, and there should be no changes in direction below 500 feet at night.

3.5 VFR Approach/Departure and Transitional Surfaces

An approach/departure surface is centred on each approach/ departure path. Under the current Guidelines, the approach/departure path starts at the edge of the FATO and slopes upward at 7.5º or 8:1 (8 units horizontal in 1 unit vertical) for a distance of ~1,250 m. where the width is ~150 m. at a height of 500 feet above the elevation of GEA/TLOF surface. Proposed changes in the CASA Regulations involve even more restrictive approach/departure angles down to 2.5º or 23:1. It they are incorporated within the new CASRs, they are most likely to be Guidelines as mandating them would preclude almost all existing NSW hospital HLSs other than a few roof top/elevated HLSs.

The transitional surfaces start from the edges of the FATO parallel to the flight path centre line, and from the outer edges of approach/ departure surface, and extend outwards at a slope of 2:1 (2 units horizontal in 1 unit vertical) for a distance of ~75 m. from the centreline. The transitional surfaces start at the edge of the FATO opposite the approach/departure surfaces and extend to the end of the approach/departure surface.

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

The approach/departure surface should be free of penetrations. Any penetration of the transitional surface should be considered a hazard. Refer to Sub-section 3.6.

Figure 8 following illustrates the approach/departure (primary and transitional) surfaces.

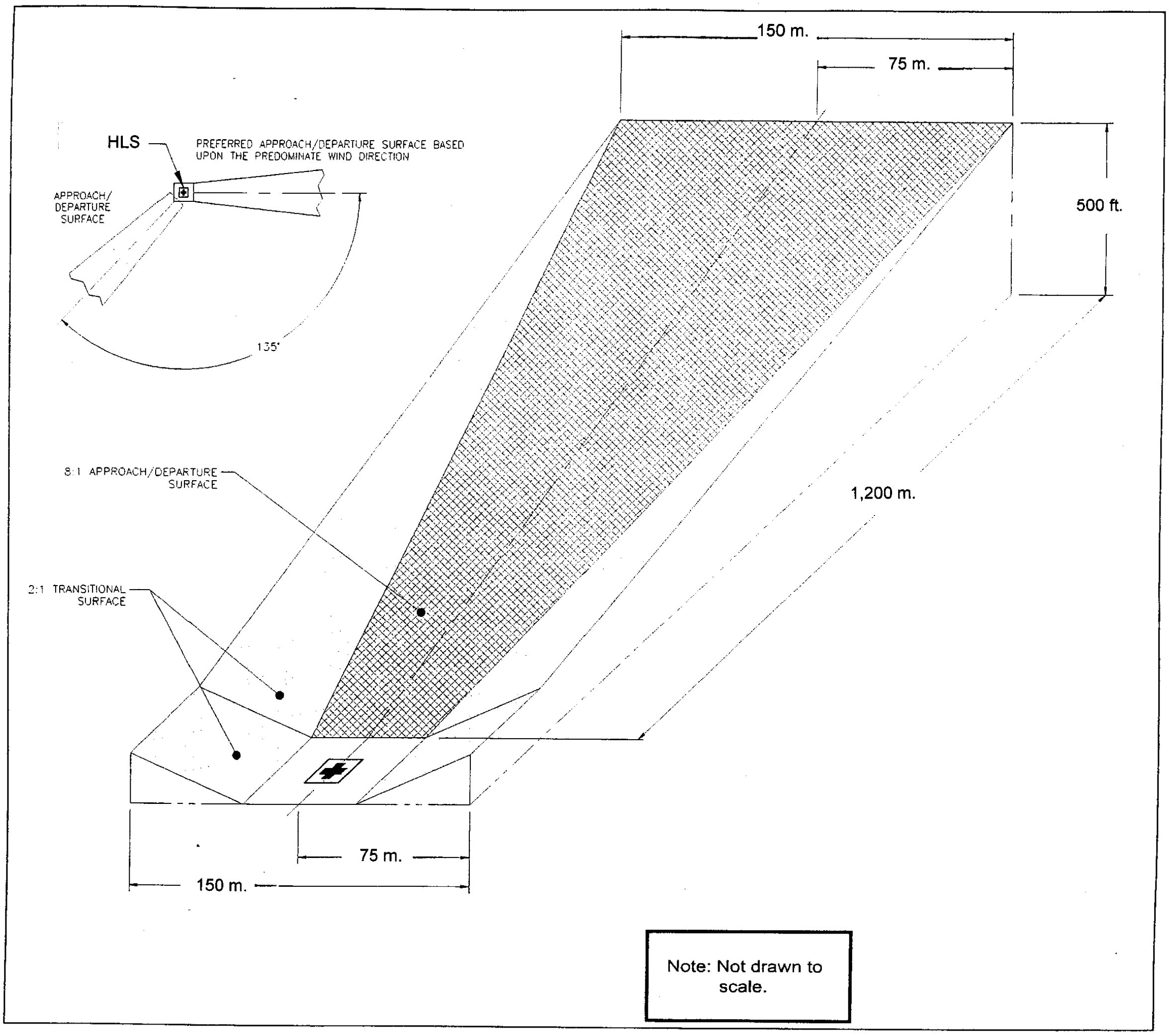


Figure 8: VFR Approach/Departure Transitional Surfaces

DBH HLS has two areas or arcs where potentially approaches and departures may be made which allow for obstacle free slopes of 7.5º. The larger arc is between south west and north and is approximately 120 degrees, and the smaller arc is between north east and east and is approximately 30 degrees. The larger arc in the westerly quadrant is currently obstacle free below 7.5º; however the easterly quadrant requires the removal of several trees approximately 50 m. from the HLS to allow it to be obstacle free below 7.5º. See Figures 9-11. The trees within the oval area require attention. See **Recommendation 2** (DBH).

Figure 9: Trees Requiring Removal in the Eastern Quadrant

Figure 10: Obstacle Free area Below 7.5º in the Western Quadrant

Figure 11: Obstacle Free area Below 7.5º in the North Western Quadrant

With the obstacles removed from the eastern quadrant, the requirement for two VFR Approach/Departure paths at least 150º apart is met. Additionally, the VFR Approach/Departure Transitional Surface requirements are essentially met. See Figure 12.

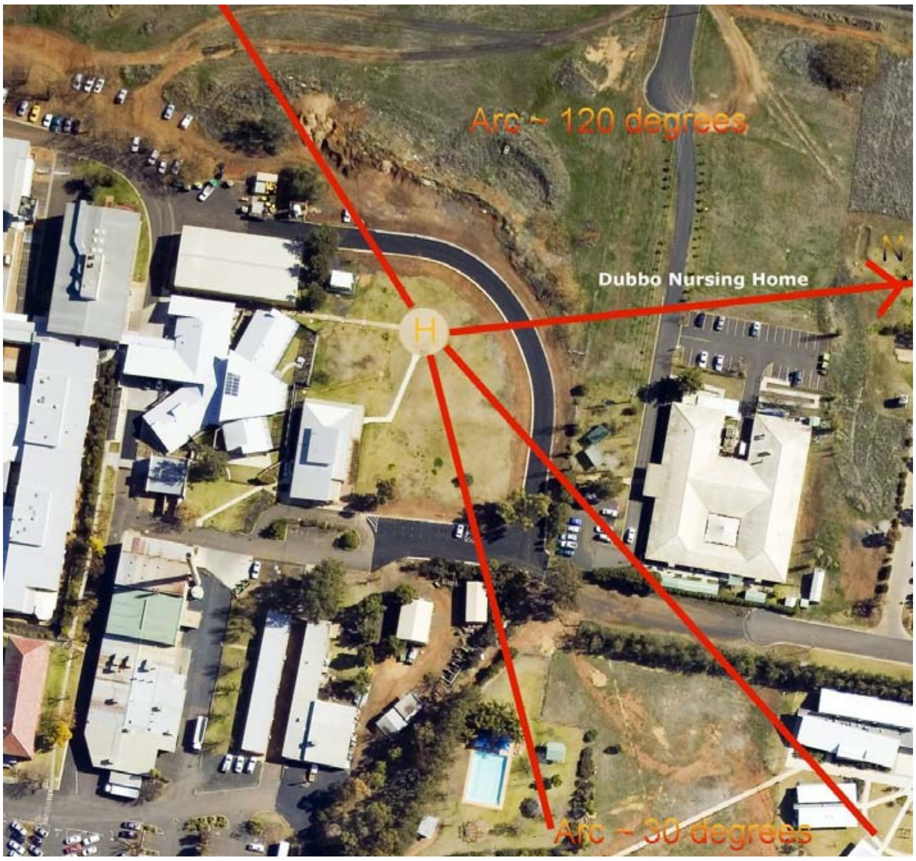


Figure 12: Dubbo HLS VFR Approach/Departure Arcs

3.6 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:

(1) Removing the object.

(2) Altering the object, e.g. reducing its height.

(3) 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 may include radio aerials or exhaust stacks etc. attached to the main building or other buildings in the vicinity. All such obstacles are required to have red obstacle lights fitted.

The major obstacle at present is the de-commissioned chimney stack at the boiler house approximately 90 m. south east of the HLS. The stack has appropriate red obstacle warning lights placed on the top. The stack is to be demolished during Stage 1. See Figure 13.

Figure 13: De-commissioned Boiler Room Chimney Stack 90 m. from HLS

The windsock, floodlight pole and several pine trees are located on the southern side of the HLS next to a Telstra demountable and the Stores Depot. They are however outside of the approach/departure arcs. See Figures 14 and 15. Refer to Sub-section 3.8.4.

Figure 14: Windsock (lacking lighting), Floodlight and Pine Trees

Figure 15: Telstra Demountable

3.6.1 Obstructions in close Proximity but Outside and Below the Approach/Departure Surface

Unmarked wires, antennas, poles, cell towers, and similar objects are often difficult to see even in the best daylight weather, and in time for a pilot to successfully take evasive action. While pilots can avoid such objects during en route operations by flying well above them, approaches and departures require operations near the ground where obstacles may be in close proximity.

If difficult-to-see objects penetrate the OISs, these objects should be marked to make them more conspicuous.

There is a powerpole with a transformer and powerlines approximately 50 m. to the north of the HLS, with wires running to the west. It would be prudent to place warning balls on the wires in the vicinity of the HLS. See Figure 16 and **Recommendation 3** (DBH).

Figure 16: Powerpole and Wires Approximately 50 m. to the North

3.6.2 Turbulence

Turbulence is primarily associated with elevated HLSs. Surface level HLSs are far less prone to turbulence; however air flowing around and over buildings, stands of trees, terrain irregularities, etc. can create turbulence that may affect helicopter operations. Rotor downwash coming up against a close wall can also produce considerable turbulence and recirculation.

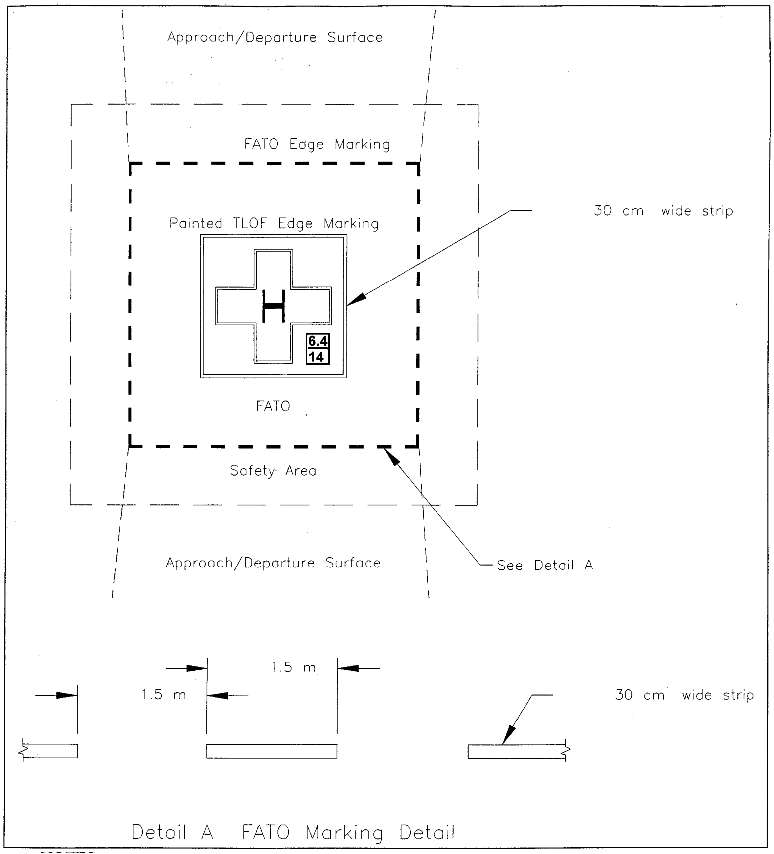
DBH HLS is surface level and does not have any large structures close enough to cause any significant turbulence. Minor turbulence is however possible under particular wind conditions.

3.6.3 Prevailing Winds

An analysis of the prevailing winds in the vicinity of DBH has not occurred. As the proposed HLS location allows for two approach/departure routes 180º apart, wind direction is not a significant factor.

3.7 HLS Marking

Sub-section 3.2.2 and 3.2.3 discuss FATO and GEA/TLOF dimensions. The dimensions are to be defined by markings, as well as marking of the hospital cross, the "H", the static weight limit and main rotor diameter of the Design Helicopter. Additionally, the name of the HLS and its Airservices identifier are to be marked on the surface. Figure 17 provides an example of the markings for a square HLS less the HLS name and identifier.



Note:

1. The "H" is orientated to Magnetic North.
2. The perimeter of the GEA/TLOF defined with a continuous, 30 cm. wide white line.
3. The perimeter of the FATO defined with a 30 cm. dashed white line approximately 1.5 m. in length, and with end-to-end spacing of approximately 1.5 m.
4. The corners of a square FATO to be defined.
5. The positions/directions of the Approach/Departure Surfaces are examples only.

Figure 17: GEA/TLOF, FATO, "H" and Static Weight/Rotor Diameter Markings

DBH HLS does not presently have the required HLS markings in place. See Appendix B and **Recommendation 4** (DBH).

3.8 HLS Lighting

For night operations, the GEA/TLOF, the FATO, and the windsock must be illuminated. All lights other than flood lights must be Night Vision Goggle (NVG) compatible. It is also desirable that the approach/departure direction have the appropriate NVG compatible lights over yellow arrows. See **Recommendation 5** (DBH).

3.8.1 GEA/TLOF Perimeter Lights

The GEA/TLOF perimeter is to be lit with NVG compatible green lights. Flush mounted lights are to be used, and they should be located within 30 cm. of the outside edge of the GEA/TLOF perimeter. Lighting on the outside edge provides better visual cues to pilots when at a distance from the HLS, since they outline a larger area.

DBH HLS has a 15 m. diameter concrete helipad. This is a metre wider than that required, however it is acceptable to place the GEA/TLOF perimeter lighting around the circumference of existing concrete helipad. DBH HLS does not presently have GEA/TLOF perimeter lights.

3.8.2 FATO Perimeter Lights

NVG compatible Green lights are to define the perimeter of the FATO. For a round HLS, lights should be no more than 8 m. apart. If square, a light should be located at each corner with additional lights uniformly spaced between the corner lights. An even number of lights (at least eight should be used) uniformly spaced with a maximum interval of 8 m. between lights.

Note:

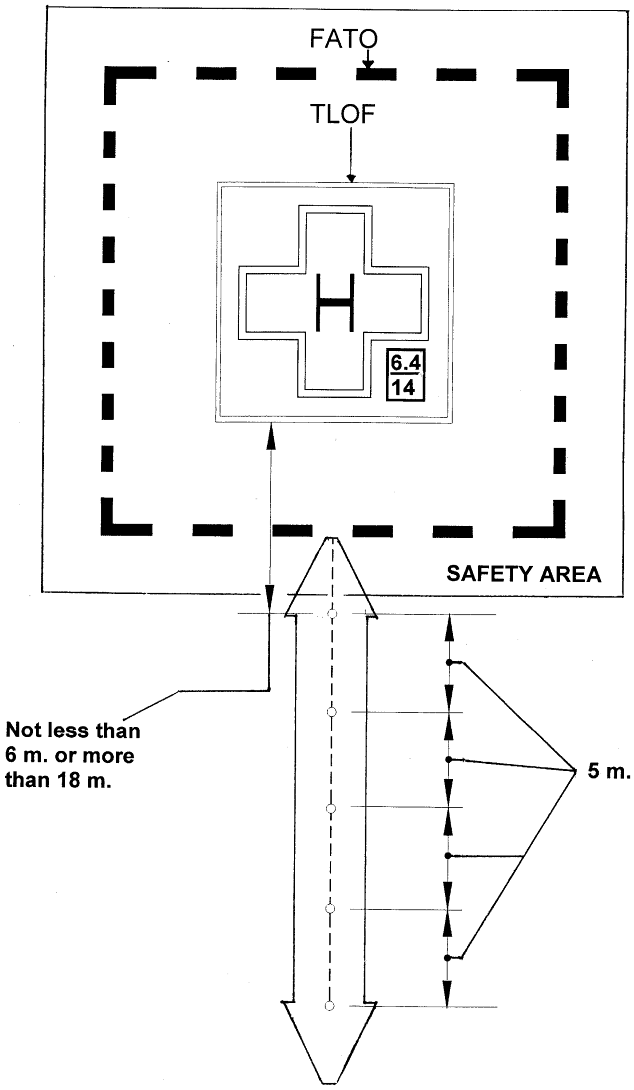
At a distance during night operations, a square pattern of FATO perimeter lights provides the pilot with better visual cues than a circular pattern, however either is acceptable.

Although raised lights are acceptable, flush lights are recommended, and they should preferably be located within 30 cm. of the outside of the FATO perimeter.

DBH HLS does not presently have FATO perimeter lights. Refer to **Recommendation 5** (DBH).

3.8.3 Landing and Take-Off Direction Lights

Landing and Take-Off direction lights are a preferable feature for both surface and elevated HLSs. They should where possible, be installed beyond the FATO to provide landing and take off directional guidance at night. Landing direction lights are ideally a configuration of five NVG compatible yellow, flush mounted omni-directional lights on the centreline of a yellow two headed arrow with black borders painted on the HLS, and showing the preferred approach/departure path/s. These lights are normally spaced at 5 m. intervals beginning at a point not less than 6 m. and not more than 8 m from the GEA/TLOF perimeter and extending outward in the direction of the preferred approach/departure path. See Figure 18. If however the area does not allow for such a size, the arrow/s may be proportionally reduced in size and less lights may be used.



Note:

1. The direction of arrow and lights are an example only.
2. Lights are flush mounted yellow omni-directional.
3. Arrow is yellow with a black border.
4. FATO and GEA/TLOF lights not shown.

Figure 18: Approach/Departure Directional Arrow and Lights on a Square HLS

DBH HLS does not presently have approach/departure directional lights. Refer to **Recommendation 5** (DBH).

3.8.4 Windsock Lighting

The windsock is to be illuminated by four closely mounted white lights to ensure that it may be seen clearly from all directions. A red obstruction light is also to be positioned on the top of the mast. See Figure 19.

Figure 19: Example Windsock Lighting

At present the DBH HLS windsock does not have appropriate lighting. There is a flood light close by, however the flood light must be turned off for all approaches and departures when the required FATO and GEA/ TLOF lighting is in place. See Figure 20 and refer to **Recommendation 5** (DBH).

Figure 20: DBH HLS Windsock Lacking Necessary Illumination

3.8.5 Flood Lights

Flood lights may be positioned to illuminate the GEA/TLOF and the FATO for the purposes of aiding in helicopter loading and unloading. To eliminate the need for tall poles, these flood lights may be mounted on a co-located building wall if it is high enough. The flood lights are to be clear of the GEA/TLOF, the FATO, the Safety Area, and the approach/departure surfaces and any required transitional surfaces. Care should be taken to ensure that flood lights and their associated hardware do not constitute an obstruction hazard. Flood lights should be aimed down and provide a minimum of 3-foot candles (32 lux) of illumination on the HLS surface. Flood lights can interfere with pilot vision during takeoff and landings and are therefore to be capable of being independently manually turned off. They are to be on a separate circuit to that of all other lights.

DBH HLS currently has one flood light on the southern side of the HLS.

With the appropriate FATO and GEA/TLOF lighting in place, all flood lights are to be extinguished during helicopter arrivals and departures. See **Recommendation 6** (DBH).

3.8.6 HLS Identification Beacon

A HLS identification beacon is recommended equipment. The beacon is to be located as close as is practical to the HLS, and on the highest point of the hospital reasonably available. The AC recommends a beacon capable of flashing white/green/yellow at the rate of 30 to 45 flashes per minute. Such a beacon may be activated via a PAL system, which is also recommended for frequently used HLSs.

At present, DBH HLS does not have a HLS identification beacon. At the time the required lighting is added, consideration should be given to installing an identification beacon.

3.8.7 Lighting Activation

All HLS lighting must be capable of manual activation and deactivation. Flood lighting is to be on a separate circuit to that of the FATO, GEA/TLOF, approach/departure directional lighting, windsock, local obstruction lighting and any visual glideslope indicator installed. These latter lights may be on a common circuit.

With the exception of flood lighting and obstruction lights, all other HLS lighting may be activated via a Pilot Activated Lighting (PAL) system. This utilises a hospital based VHF radio and timed switching device. The pilot is able when within range (~20 nm.), to activate via a VHF radio transmission from the aircraft, on a pre set frequency. The PAL system allows for 30 minutes duration. Lights may be manually turned on and may be manually turned off within the 30 minutes, or they automatically turn off at 30 minutes prior to a flashing warning. The installation of PAL equipment is recommended for regular use HLSs.

The manual activation switching must be readily accessible to the HLS attendant staff. See **Recommendation 7** (DBH).

At present DBH HLS does not have a PAL system.

3.9 Airspace

Civil Aviation Safety Authority approval is normally not required however the location of local airports and runway approach and departure flight paths must be taken into consideration.

DBH HLS falls within the Dubbo Airport CTAF and is surrounded by Class G airspace which presents no issues and no CASA approvals are required.

3.10 Noise and Vibration

Helicopters generate both noise and vibration. Where possible, all flights are conducted on a "Fly Neighbourly" basis with overflight of buildings, particularly those occupied, avoided whenever possible. A combination of helicopter noise and downwash created by the main rotors can cause vibration. Local building codes and Australian Standards should be consulted for guidance in this area. There is no guidance information provided within the MoH HLS Guidelines.

3.11 Fire Fighting Equipment

Fire fighting equipment is to be available at all hospital HLSs. This is to consist of:

- a fire water point with fire hose attached;
- 1 x CO_2 3.5 kg;
- 1 x Dry Powder 9.0 kg;
- 1 x Foam 90 litres; and
- 1 x Fire Blanket.

No fire fighting equipment was sighted in the vicinity of the HLS. See **Recommendation 8** (DBH).

3.12 Security

Appropriate security measures are required to restrict access to the HLS, to manage the HLS on a day-to-day basis, to manually activate lighting and to coordinate maintenance. This is the responsibility of DBH.

3.13 Approvals

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

Where a HLS or major renovation or change to an existing HLS is proposed, a Development Application may be required to be lodged with the local Council. The Council may also require an Environmental Impact Statement. HLSs are “scheduled premises” under the Noise Control Act and thus may require a “noise licence” and “pollution control approval”. Specialist advice should be sought about the statutory requirements for the DBH HLS.

4 STAGE 1 CONSTRUCTION IMPLICATIONS ON DUBBO BASE HOSPITAL HLS

4.1 Location of DBH Redevelopment Stage 1 in Relation to the HLS

DBH Redevelopment Stage 1 involves the demolition of the existing boiler house, laundry/linen service building, and the staff/nurse accommodation. Additionally, part of an existing adjoining car park on the eastern side of the area will be resumed for the new construction.

The closest edge of the development is 75 m. to the south east of the concrete helipad.

Figure 21 is an aerial view of the DBH complex where the HLS may be seen relative to the area due for Stage 1 development.

Figure 21: DBH Site

Figure 22 shows the boundary of Stage 1. Buildings within the black dashed lines are to be demolished.

Figure 22: Stage 1 Development to be within the Black Dashed Lines

Figure 23 is a schematic drawing of the proposed Stage 1 Development bordered by the blue lines. As above, the existing buildings within this area are to be demolished.

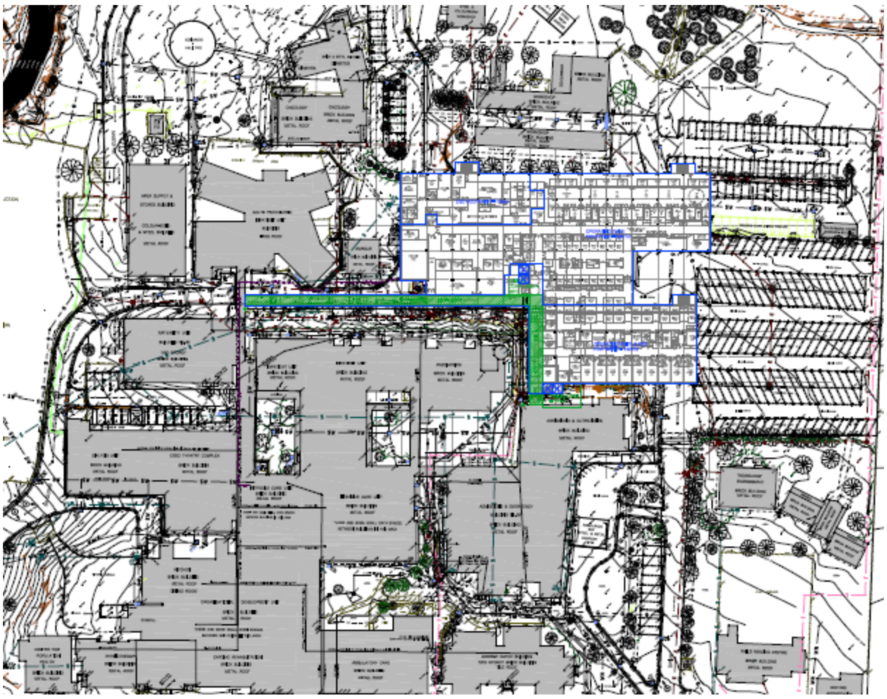


Figure 23: Boundary of Stage 1 Development within the Blue Lines

4.2 Effect on Helicopter Operations During Construction

During construction it is assumed that cranes will be required. It is incumbent upon the construction management to prepare a protocol whereby ASNSW is advised when cranes are to be used and the approximate maximum height. The protocol may also involve a system to lower cranes to the ground on advice that a helicopter is inbound on a medical mission. See **Recommendation 9**.

The rotor downwash from the EMS helicopters may be felt when the aircraft is airborne and up to 50 m. It is important that all loose and particularly light material is appropriately secured. Items such as tarpaulins, sheets of ply wood, corrugated iron, plaster board, roofing material and empty cement bags etc., are particularly vulnerable to becoming airborne if close to a manoeuvring helicopter. The outcome can be disastrous as the items tend to recirculate and come back down through rotor systems. A clearing check of the HLS and building site areas are to be made prior to all helicopter movements.

The HLS area should at no time be used as a staging point for building materials etc. See **Recommendation 10**.

During construction there will be an effect on the path used to trolley/gurney patients between the Emergency Department and the HLS. No building materials are to impede the path between the Emergency Department and the HLS.

4.3 Effect on Helicopter Operations Following Construction

The position and the height of the Stage 1 development is well outside the helicopter VFR approach/departure arcs and thus the new building when completed will have no effect on the operation of the HLS. There may however be a requirement to modify the access path between the emergency department and the HLS as a component of the development.

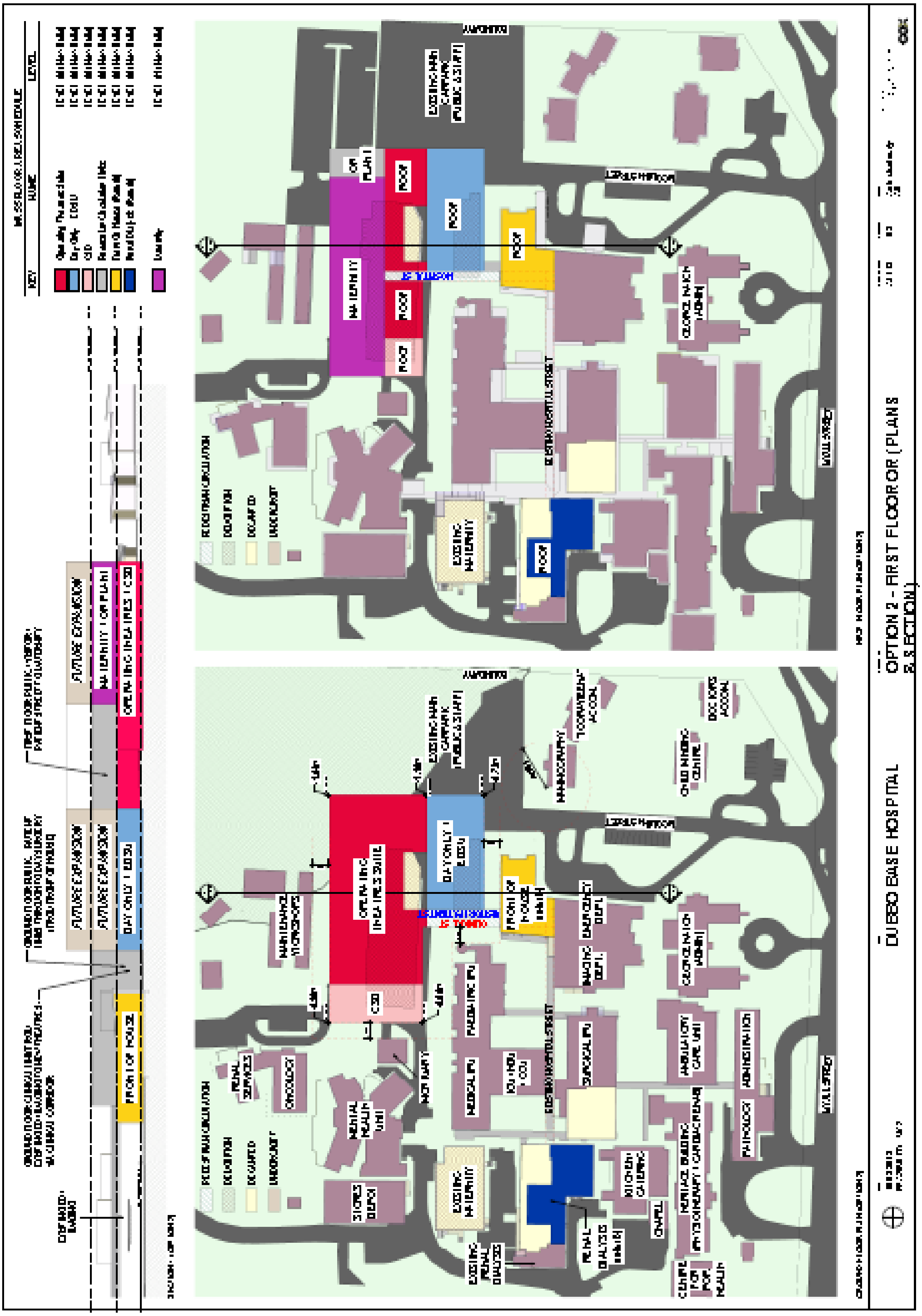
APPENDICES

A. Proposed Site Plan Drawings – DBH Redevelopment Stage 1.

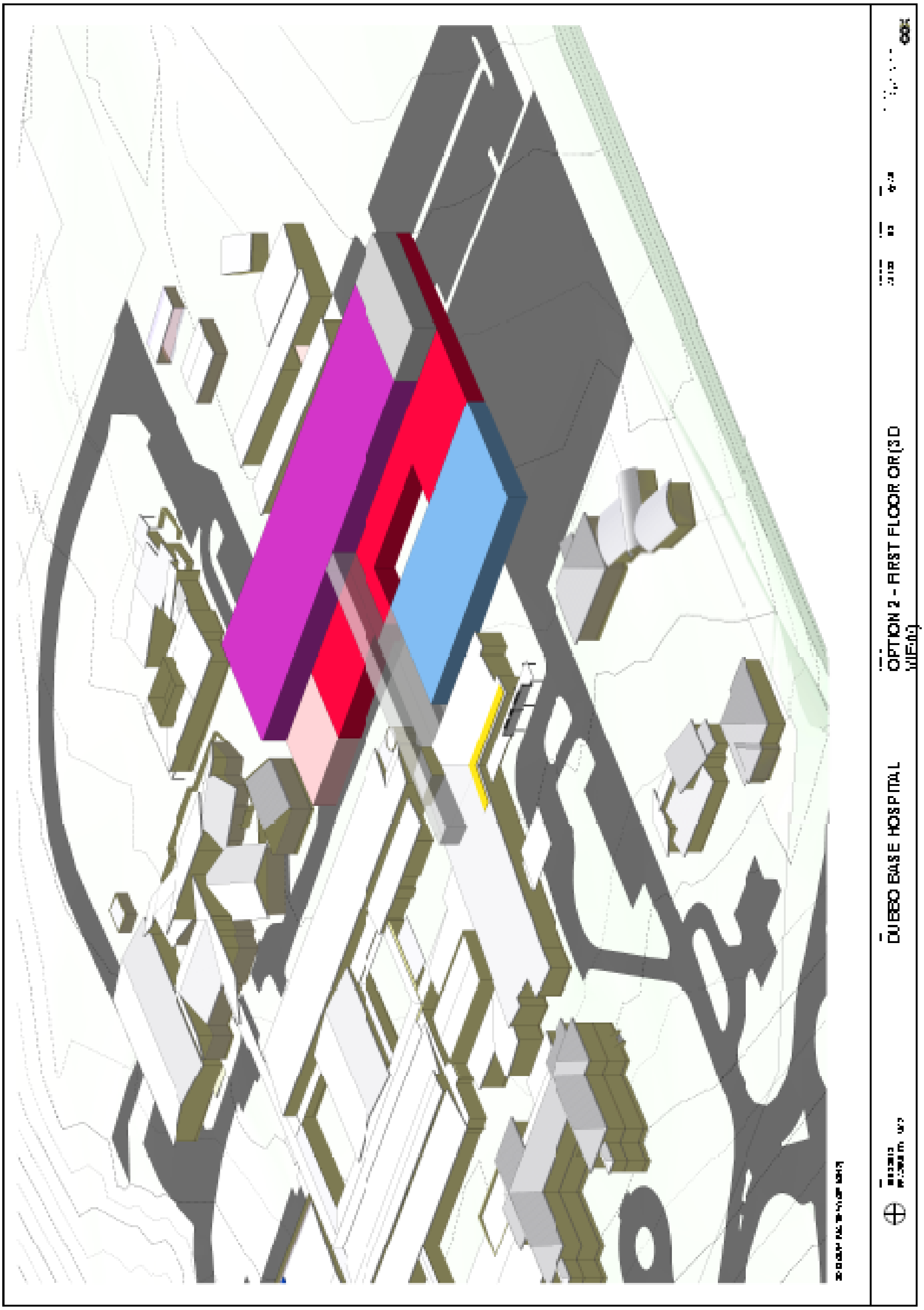
B. Example HLS Markings.

APPENDIX A

PROPOSED SITE PLAN DRAWINGS
– DBH REDEVELOPMENT STAGE 1



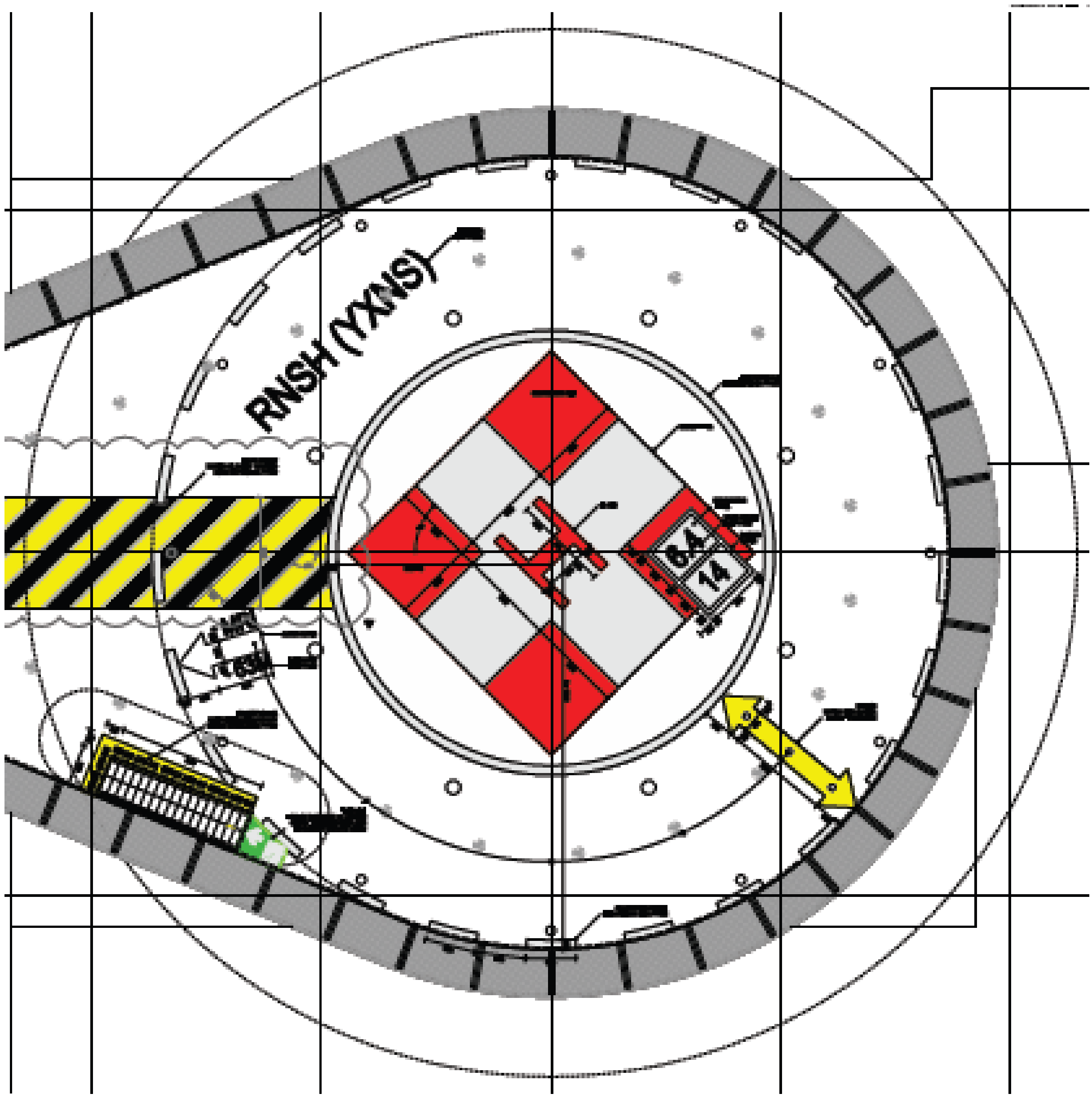
Proposed Operating Theatres and Maternity Unit A11-12 Rev. 03



3D View of Proposed Operating Theatres and Maternity Unit A11-22 Rev. 03

APPENDIX B

EXAMPLE HLS MARKINGS



Example of the Markings for a Typical Roof Top Elevated HLS
(a surface level HLS does not require the safety net or the escape stairs shown in this diagram)