Attachment L – Referral comments, CASA

Jessica Hutley

From:	Airspace Protection <Airspace.Protection@casa.gov.au>
Sent:	Thursday, 1 June 2023 12:17 PM
To:	Nadelene Smith
Cc:	Planning and Environmental Health Support Staff; Airspace Protection
Subject:	RF17/5149-57 - CASA Assessment Response - Subdivision, DA 2022/721 - 550-578 River Street and 6 Burns Point Ferry Road West Ballina. [SEC=OFFICIAL]
Attachments:	550-578 River St, West Ballina - Google Earth.jpg; NSW Health Helicopter Landing Sites Guidelines 2020.pdf; advisory-circular-91-29-guidelines-for-helicopters-suitable-places-to-take-off-and-land.pdf

Good afternoon Nadalene,

I refer to your request for comments regarding the proposed residential (seniors housing community) subdivision at 550-578 River Street and 6 Burns Point Ferry Road West Ballina, NSW.

From Google Earth images, CASA is aware of a certified aerodrome - Ballina Byron Gateway Airport (YBNA), which is published in the AIPs that is within approximately 4.0km of this proposed subdivision development for which there is an Obstacle Limitation Surface (OLS) that requires protection - see attached. The aerodrome will need to undertake an OLS assessment to determine the level of any intrusion into the airspace. As Ballina Shire Council is the aerodrome operator, relevant aviation operations staff within your organisation will need to undertake this assessment.

The proposed residential (seniors housing community) subdivision development has been determined to not be a hazardous object under the *Regulation 139.370(1)* of the *Civil Aviation Safety Regulations 1998*, therefore there are no marking or lighting requirements for the residential (seniors housing community) development. This is based on the following:

- The individual lots having up to 2-storey dwellings being constructed which will be between approximately 6.5m and 8.5m AGL (as indicated in the Planning report) and in a residential area.
- The site being located in an area where there are other similar and/or taller structures such as other 2-storey dwellings, existing large trees and street-lighting poles.
- The site not being in a direct runway approach or departure splay.

CASA notes in Section 7.13 of the Planning Report that there is a proposal for *an emergency helicopter pad on top of the clubhouse* and *helicopter pad will be used for emergency aeromedical evacuation, retrieval or rescue purposes only*. A copy of the *NSW Health Hospital Helicopter Landing Sites in NSW (2020)* and *CASA Advisory Circular 91-29 V1.1(2022)* are included and can be used by the developer for guidance.

Should council aerodrome staff require any further assistance following their OLS assessment, do not hesitate to contact the Airspace protection team on airspace.protection@casa.gov.au.

Kind regards,

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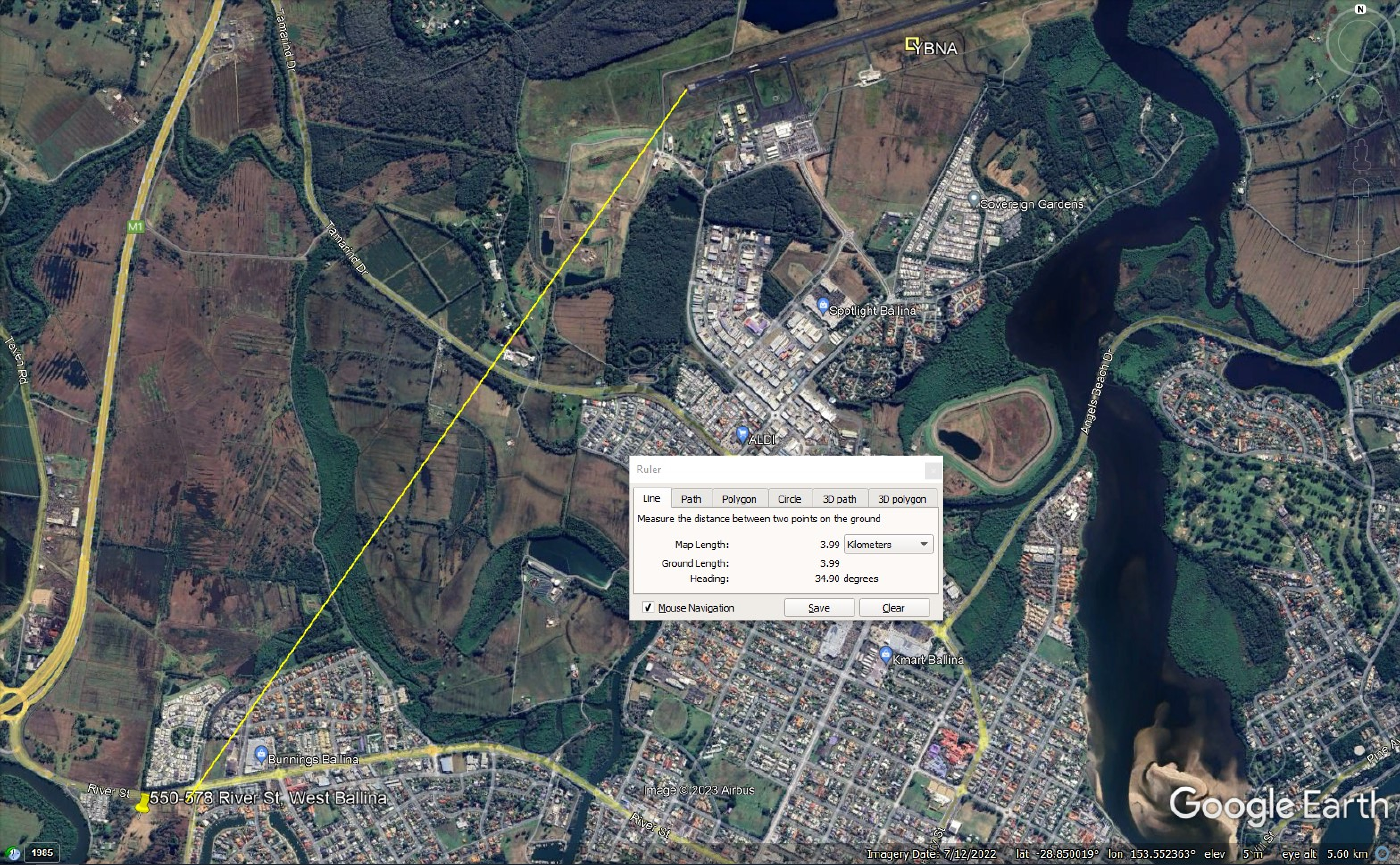


YBNA
Sovereign Gardens
Spotlight Ballina
ALDI
Tamarind Dr
Teven Rd
M1
Angels Beach Dr
Ruler
Line
Path
Polygon
Circle
3D path
3D polygon
Measure the distance between two points on the ground
Map Length: 3.99 Kilometers
Ground Length: 3.99
Heading: 34.90 degrees
Mouse Navigation
Save
Clear
Kmart Ballina
Bunnings Ballina
River St
550-578 River St, West Ballina
Image © 2023 Airbus
Google Earth
1985
Imagery Date: 7/12/2022 lat -28.850019° lon 153.552363° elev 5 m eye alt 5.60 km

Guideline

Hospital Helicopter Landing Sites in NSW

Summary	The revised Guidelines incorporates international experience and best practice in the establishment of HLS, both at ground level and on elevated structures.
Document type	Guideline
Document number	GL2020_014
Publication date	01 July 2020
Author branch	Health Infrastructure
Branch contact	(02) 9978 5405
Replaces	GL2018_010
Review date	01 July 2025
Policy manual	Not applicable
File number	A032603/1
Status	Active
Functional group	Clinical/Patient Services - Governance and Service Delivery, Transport Corporate Administration - Asset Management, Governance
Applies to	Local Health Districts, NSW Ambulance Service
Distributed to	Ministry of Health, Public Health System, NSW Ambulance Service
Audience	All NSW Health Organisations (including the Affiliated Organisations) and NSW Ambulance Ambulance staff

Secretary, NSW Health

HOSPITAL HELICOPTER LANDING SITES IN NSW

GUIDELINE SUMMARY

Helicopter Landing Sites (HLS) Guideline was first developed in 2005 to establish best practice of hospital-based HLS both at ground level and on elevated structures. The update to the Guideline reflects the opportunities to improve the safeguarding of strategically important helicopter landing sites in all hospital locations.

KEY PRINCIPLES

This Guideline has been developed to:

Support and inform the design or placement of hospital-based HLS to ensure any new strategic HLS are appropriately located.

Identify and incorporate international, national and statewide regulations that affect the planning and design of hospital-based HLS.

Provide a process for use by health services to assess the need for a HLS.

Provide guidance to health services regarding the ongoing management of HLS.

USE OF THE GUIDELINE

This Guideline is intended for hospital-based HLS operations only. For the purposes of this document, when reference is made to a HLS, it is assumed it is a hospital-based HLS. As this is a highly specialised area of health services operations, any works should involve the input of both NSW Ambulance Helicopter Retrieval Services and Health Infrastructure.

REVISION HISTORY

Version	Approved by	Amendment notes
July-2020 (GL2020_014)	Deputy Secretary, Health System Strategy and Planning Division	Replaces GL2018_010 Guidelines for Hospital Helicopter Landing Sites in NSW. Update reflects changes to planning framework aimed at protecting strategically important helicopter landing sites.
April 2018 (GL2018_010)	Deputy Secretary, Strategy and Resources Division	Replaces PD2005_128 Medical Helipads - Guidelines Replacement of fleet with 12 Agusta AW139 helicopters. Revised guideline will ensure refurbished landing sites are designed to accommodate the new fleet.
January 2005 (PD2005_128)	Director General, NSW Health	New Guideline

ATTACHMENTS

Guidelines for Hospital Helicopter Landing Sites in NSW: Guideline

CONTENTS

1 BACKGROUND

1.1 About this document

This Guideline reflects experience gained in the provision of infrastructure to support helicopter emergency medical retrieval in NSW over a 20 year period. The update includes information relating to recently introduced initiatives that seek to protect strategically important helicopter landing sites (HLS) in hospital-based locations.

This Guideline is intended for hospital-based HLS operations only. For the purposes of this document, when reference is made to a HLS, it is assumed it is a hospital-based HLS. It is not intended that existing HLS are upgraded to meet the requirements as detailed in this Guideline. Instead, all sites will be audited to ensure they are safe for continued use. In some cases, this may require some minor upgrades (e.g. lighting or site markings).

In 2017, NSW Ambulance (NSWA) replaced the existing fleet with 12 Leonardo AW139 helicopters. Offsite HLS development, use and operational requirements are the responsibility of the relevant land owner.

The Guidelines are intended for use by:

- health services that may be considering if their clinical role warrants the provision of hospital-based HLS in selected facilities
- hospitals with an identified need for a HLS (either a new build or refurbishment of a HLS where an upgrade is needed as part of a significant site redevelopment) and need information regarding planning, location, design, commissioning and selected operational considerations
- design teams engaged to document requirements.

1.2 Key definitions

Key definitions and explanation of terms are listed at Appendix 1.

1.3 Legal and legislative framework

In Australia, there is currently no established legislation applicable to the design, construction or placement of hospital-based HLS. However, Guideline H of the NASF – Protecting Strategically Important Helicopter Sites (May 2018) was developed in consultation with the Civil Aviation Safety Authority (CASA) to address this issue. The purpose of this guideline is to manage intrusions and activities in the flight paths of strategically important HLS, predominantly those associated with hospitals, and to ensure any new strategic HLS are appropriately located. There may also be other planning, location and movement approvals required.

The legislation describing the use of HLS is the Civil Aviation Regulation (CAR) 92 and places the onus on the helicopter pilot to determine the suitability of a landing site.

CASA as the regulator of aviation in Australia, 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. This document replaced CAAP 92-2 (1). CASA does not provide design or structural information or advice.

CASA currently has a Regulatory Reform Program in place to establish new regulations/rules for helicopter operations including HLS.

2 REQUIREMENTS FOR A HELICOPTER LANDING SITE

2.1 Assessing the need for a Helicopter Landing Site

Any hospital which either refers patients to another hospital or receives patients by helicopter should consider how access to their hospital is achieved.

Patients may arrive from non-hospital locations via scene response or be moved from other hospitals (inter-hospital transfer).

The choice of transportation (road, helicopter or fixed wing) is made using pre-determined criteria and based on clinical urgency, distance, accessibility, weather, transport requirements, optimum transport team and vehicle utilisation. Medical Retrieval Selection Guidelines are developed and maintained by the NSWA Helicopter Retrieval Service.

While tertiary hospitals receiving patients from other sites have the greatest need for a HLS, other hospitals may also need helicopter access owing to their location, number of patients transfers and services profile.

When hospitals are first built or redeveloped, it is essential that requirements for a HLS are considered. This may involve:

- inclusion of a HLS where not previously provided, either on-site or nearby
- relocating a HLS from a nearby site or on-site location
- retro-fitting an existing HLS.

When considering if a hospital should have access to a HLS, factors that need to be considered may include:

- the hospital's role in the statewide trauma network
- the hospital's role in statewide critical care network for adults, paediatrics and neonates
- local geography
- proximity to other hospitals.

Any decision to include a new hospital-based HLS, or change an existing HLS, should be made in consultation with the NSWA Helicopter Retrieval Services and a small group of expert clinicians involved in the management and operation of emergency retrieval services. This group will assess emergency medical retrieval requirements for the site and consider recent data and other clinical and situational factors that will impact on the provision of safe clinical care.

2.2 Types of Helicopter Landing Sites

Hospital-based HLS are defined as helicopter landing areas located within the grounds of a hospital with easy trolley access to and from the hospital's critical care areas. These critical care areas are the emergency department, intensive care units (adult and neonatal), operating and selected procedural suites. This access may be facilitated using lifts within the hospital. Ideally this access should be undercover beyond the HLS.

At some locations, a hospital-based HLS may not be practical due to the existing arrangement of buildings on the site, a lack of space or other situational factors. In such cases an off-site HLS may be the only alternative. An **off-site HLS** is defined as a helicopter landing area designed for Helicopter Emergency Medical Service (HEMS) use that requires the use of a vehicle to convey a patient between the landing area and the hospital.

Where a need can be established, a hospital-based HLS is preferable to an off-site location. The time saved by ready access between a hospital-based HLS and critical care services has been calculated to average 15 to 20 minutes. This time can be significantly increased in the off-site scenario.

The importance of maintaining appropriate clinical care and supervision throughout all phases of transport should be considered in HLS planning. An off-site HLS will ideally be accessible by trolley as this will save time and make better use of the retrieval team.

2.3 Operational Roles and Responsibilities

Once a hospital-based HLS has been commissioned and 'handed-over' to the health service, the management and maintenance of the HLS and approaches, both air and land, will be the responsibility of the Local Health District/ Specialty Health Networks (LHD/SHN) facilities manager (or equivalent). In practice, the HLS is much like an ambulance parking bay located at an emergency department. The NSWA will park in dedicated ambulance bays to transfer patients but the health service is responsible for the maintenance and upkeep of this area and associated routes into the hospital.

The LHD/ SHN facilities manager (or equivalent) will be responsible for:

- planned and ad-hoc maintenance of the hospital-based HLS including paint and surface condition, lighting, windsocks, fire suppression equipment, spill kits, door access control, signage and painted markings and devices specific to an elevated HLS such as fuel-water separation equipment
- ensuring that approaches to the HLS located on the hospital grounds are maintained (e.g. trimming trees)
- liaison with neighbours to ensure that approach and departure paths to the HLS located nearby the hospital are maintained
- providing written responses to proponents and/ or the relevant approval authority on any proposed encroachments or activities in the approach and departure paths of the HLS. The LHD/SHN should engage an aviation consultant to provide expert advice relating to any potential impacts that may affect the approach and departure paths of the HLS
- currency of the relevant entry in the ERSA through Airservices
- ensuring that any changes to the HLS or risks are communicated immediately to the Office of the Director Helicopter Operations, NSW Ambulance

(AMBULANCE-Helicopters@health.nsw.gov.au).

NSWA will undertake regular safety and compliance audits of hospital-based HLS. A HLS that is identified either by crew or by an audit as unsafe will not be used until issues are rectified.

3 REQUIREMENTS FOR PLANNING AND DESIGN

3.1 Legislation and Regulation

In Australia, there is currently no established legislation applicable to the design, construction or placement of hospital-based HLS. In order to address this issue, Guideline H of the NASF – Protecting Strategically Important Helicopter Sites (May 2018) was developed in consultation with the Civil Aviation Safety Authority (CASA). The purpose of this guideline is to manage intrusions and activities in the approach and departure paths of strategically important HLS, predominantly those associated with hospitals, and to ensure any new strategic HLS are appropriately located. There may also be planning, location and movement approvals required.

The legislation describing the use of HLS is the Civil Aviation Regulation (CAR) 92 and 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, 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. This document replaced CAAP 92-2 (1). CASA does not provide design or structural information or advice.

CASA currently has a Regulatory Reform Program in place to establish new regulations/rules for helicopter operations including HLS.

3.2 Design Standards

Considerable design work has been undertaken internationally by the International Civil Aviation Organisation (ICAO) and the US Federal Aviation Administration (FAA). The resulting documents on the subject provide excellent advisory material, guidelines and best practice standards.

ICAO describes international Standards and Recommended Practices (SARP) for the safe conduct of civil aviation activities in the Convention on International Civil Aviation (Chicago, 1944), with the annexes applicable to helicopter operations:

- Annex 6: Operation of Aircraft - Part III: International Operations – Helicopters, 6th Edition, July 2004
- Annex 14: Aerodromes - Volume II: Heliports, 4th Edition, 2013.

Additional guidance on the design of heliports and HLS is provided in ICAO's Heliport Manual (Document No. 9261-AN/903), although this document was last amended in 1995.

Whereas ICAO Annex 14 Volume II provides SARP for the planning, design, operation and maintenance of HLS for use by the providers of these facilities, CAAP 92-2 (2) provides only limited guidance material on the minimum physical parameters required to assist helicopter pilots and operators in meeting their obligations under CAR 92.

As a signatory to the Convention on International Civil Aviation, Australia has undertaken to apply the ICAO SARP, except where specific differences have been identified to ICAO.

The Supplement (Second Edition, Amendment No.1, 18 February 1999) to Annex 14 Volume II, lists seven CASA Australia recommended differences to the ICAO SARP relating to heliports. These differences are that Australia:

- specifies a larger size and overall slope, and different minimum spacing requirements for lighting, the final approach and take-off area (FATO) specifies a different size and overall slope for the TLOF
- refers to the touch down and lift off (TLOF) areas as the landing and lift off area or Landing and Lift Off Area (LLA)
- does not require a safety area
- does not specify the dimensions of an air transit route.

Subject to these differences, CASA supported the adoption of Annex 14 SARP for helicopters.

These differences, as recommended by CASA over 20 years ago, are no longer considered by NSWA or the HEMS contractors as best practice or appropriate.

CASA is currently undertaking a Regulatory Reform Program of rotary wing aircraft and it is assumed that the ICAO SARP, with differences removed, will form the basis of the proposed Civil Aviation Safety Regulations (CASR) Part 133 pertaining to Commercial Air Transport Operations, Part 138 pertaining to aerial work operations which incorporates the winching (hoisting) component of HEMS, and Part 139R (Aerodromes Rotary Wing).

Overseas experience has resulted in the production of comprehensive heliport design and operating procedures. The US Federal Aviation Administration (FAA) has produced an Advisory Circular detailing these requirements. Within the Advisory Circular is a comprehensive section devoted to hospital-based heliports and helicopter landing sites.

While CAAP 92-2 (2) is acknowledged, the relevant key reference and documents underpinning this Policy include:

- ICAO Annex 14, Volume II Heliports, 4th Edition, 2013
- ICAO Heliport Manual Doc 9261-AN/903
- US FAA Advisory Circular AC 150/5390-2C, Heliport Design, (covers both operational and design criteria; particularly for hospital-based HLS in Chapter 4, Hospital Heliports).

Guidelines for the dimensions, marking and lighting for the LLA, TLOF, FATO area and safety area for the Design Helicopter, plus the visual flight rules (VFR) approach/ departure transitional surfaces, are specified and based upon the FAA document AC 150/5390-2C Heliport Design.

Guidelines pertaining to structural requirements for static and dynamic loads to meet the design helicopter limitations are specified and based upon the ICAO Heliport Manual Document 9261-AN/903 recommendations.

3.3 Helicopter Performance

ICAO Annex 6 Part III defines three performance categories for helicopters. It is proposed that the ICAO performance classes are adopted for CASA Part 133 and Part 138. The definitions for each performance class are:

- **Performance Class 1** (PC1) for a Category A certified helicopter means the class of operations where, in the event of failure of an engine, performance is available to enable the helicopter 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** (PC2) for a Category A certified helicopter means the class of operations where, in the event of failure of an engine, performance is available to enable the helicopter to safely continue the flight except when the failure occurs early during the take-off manoeuvre or late in the landing manoeuvre, in which case a forced landing may be required.
- **Performance Class 2 with exposure** (PC2 Exp) can be designed to operate with a permitted exposure time for the periods where safe continuation of flight or landing is not assured, or alternatively at all times with a safe forced landing capability. The policy recommendations for PC2 operations include the maximum permitted exposure time concept (see definitions below).
- **Performance Class 3 (PC3)** for a helicopter means the class of operations where, in the event of failure of an engine at any time during the flight, a forced landing:
    - in the case of a multi-engine helicopter - may be required, or
    - in the case of a single-engine helicopter - will be required.

In NSW, the current HEMS fleet is operated to Category A performance requirements when possible and PC1 when approach and departure paths are appropriately surveyed.

ICAO Annex 14 Volume II notes that the minimum Take-Off Climb Surface gradient for PC1 operations of 1:22/4.5%/2.5° is steeper than the minimum achievable one engine inoperative (OEI) gradient for many helicopters. The ICAO OLS criteria define obstacle restriction requirements appropriate for normal helicopter operations, (i.e. with all engines operating). In emergency situations, such as with OEI, consideration must be given to the performance capabilities of the helicopter. Such considerations should include emergency landing areas and the location of objects within likely flight paths. Operational procedures for emergency situations will be determined by individual helicopter operators on a site-specific basis. Where possible, these factors should be considered in determining the nominal alignment of approach and departure paths.

Thus the maximum take-off climb gradient requirement acceptable under these guidelines, is a take-off climb gradient of 2.5° to take account of the limited single engine performance of numerous twin engine helicopters still providing HEMS and to meet the ICAO recommendations.

3.4 Helicopter Details

3.4.1 Design Helicopter – Leonardo AW139

The design helicopter, for the purposes of HLS size and structural design, is the Leonardo AW139, the larger of the two primary types contracted to the NSWA and the only type on contract from 2017. The AW139 is a new generation helicopter increasingly used in HEMS across Australia. The specification for this helicopter will underpin the maximum weight, maximum contact load/minimum contact area for hospital-based HLS developments. The AW139 is a Category A certified aircraft capable of operating with a working load under Category A criteria, to a maximum take-off weight (MTOW) of 6,800kg (refer to Figure 1).

Figure 1: AW139 Dimensions

Source: Leonardo SPA, Construzioni Aeronautiche, Italy

3.4.2 Wheel Contact Area

The AW139 helicopter model certified MTOW is 6,800kg, and for engineering and design purposes, the maximum helicopter gross weight (static weight) is 6,800kg.

The following data, shown in the table below, has been provided by the aircraft manufacturer. Calculations are based at a MTOW of 6,800kg. Under most circumstances, Category A operations from an elevated HLS and a confined area surface level HLS, can be achieved to approximately 6,800kg. On most occasions however the weight of the aircraft would be somewhat below 6,800kg[1] as the helicopter would have burnt fuel before arriving at, or departing from, a hospital-based HLS.

The aircraft has a pair of nose wheels (together) and two single aft main wheels. Undercarriage layout is a triangle.

Table 1: Contact area and related data

Contact area and related data	Calculation
The contact area of the nose wheels	2 x 28.4cm^2 = **56.9cm^2**
The contact area of the aft main wheels	2 x 58.4cm^2 = **116.9cm^2**
The distribution percentage of gross weight	Nose wheels = **22%** Total of both main wheels = **78%**
The loading of the respective contact areas	Nose wheels = **173 psi** Each of the two main wheels = **239 psi**
Distance between contact areas	The width of the main wheels is 3m. The distance from the nose wheels to a line joining the aft main wheels at a right angle, is 4.35m.

Source: Leonardo SPA, Construzioni Aeronautiche, Italy

3.5 Site Location Considerations

3.5.1 Location

Hospital-based HLS may be either positioned on-grade (level or mounded) or as an elevated structure such as a section of hospital roof or a multi-story car park. The decision will depend on existing and planned facilities, available space / land availability and surrounding topography.

[1] Leonardo SPA, Construzioni Aeronautiche, Vergiate Italy

Helicopters offer the advantage of providing an efficient patient transport service from the pick-up point, wherever that may be, to the immediate vicinity of a hospital's critical care areas. These functional relationships should be considered during the design phase for new developments or redeveloped sites.

3.5.2 Management of Wind

Hospital-based HLS design and location should be such that downwind operations are avoided and cross-wind operations are kept to a minimum. HLS should have as a minimum two approach surfaces, separated by at least 150º. Additional approach surfaces may be provided, with the total number and orientation aimed at ensuring that the HLS usability factor will be at least 95% for the helicopters the HLS is intended to serve. These criteria should apply equally to on-grade and elevated helipads.

3.5.3 Management of Noise

To minimise noise disturbance, the ambient noise level should be considered noting that at the majority of hospitals, helicopter movements will be infrequent and landing and take-off procedures seek to minimise the time engines are left running. Typically, elevated/roof top hospital-based HLS provide a reduced noise profile for hospital residents and staff.

3.5.4 Air Traffic Considerations

Possible air traffic conflicts between helicopters using a HLS and other air traffic should be avoided where possible (i.e. below an airport approach/departure path). For HLS currently used by PC2 helicopters, the ground beneath the take-off climb and approach surfaces is required to permit safe one engine-inoperative landings or forced landings during which injury to persons on the ground and damage to property are minimised. The provision of such areas should also minimise the risk of injury to helicopter occupants. The main factors determining the suitability of such areas will be the most critical helicopter type for which the HLS is intended and the ambient conditions. Of critical importance is restricting the use of the hospital-based HLS to only helicopters contracted to NSW Health.

3.5.5 Existing Structures

The presence of large structures close to the proposed site may be the cause in certain wind conditions, of considerable eddies and turbulence that might adversely affect the control or performance of the helicopters operating at the HLS. Equally, the heat generated by large chimneys under or close to the approach and departure paths may adversely affect helicopter performance during approaches to land or climbs after take-off. It may therefore be necessary to conduct wind tunnel or flight tests to establish if such adverse conditions do exist and, if so, to determine possible remedial action.

3.5.6 Limitations to Future Development

Construction of a hospital-based HLS imposes limitations on future building development if approach and departure paths are to be preserved and operations are to be free of the effects of turbulence in all predicted wind conditions. The three-dimensional space represents an opportunity cost to a hospital or health precinct which may influence the choice of HLS location within a hospital campus. Generally, if an elevated HLS is intended, the higher its location amongst hospital buildings the better; consistent with maintaining functional relationships with the key critical care areas of the hospital.

Approach and departure path protection is accomplished via a Design Development Overlay (DDO) Survey in association with a required PC1 survey. Copies of both survey reports are to be forwarded to the relevant planning authorities (local government and the Department of Planning, Industry and Environment). Refer to Section 3.13.5.

In the absence of a survey, approach and departure path protection will still be afforded to hospital HLS using Guideline H of the NASF – Protecting Strategically Important Helicopter Landing Sites. Figure 1 of the Guideline provides a referral trigger for HLS that have not been surveyed or where the survey has not been provided to the relevant planning authority.

3.5.7 Other issues

Other factors to be considered in the selection of a site are:

- high terrain or other obstacles, especially power lines, in the vicinity of the proposed HLS
- impact on existing aviation operations
- impact on culturally, ecologically, environmentally and economically sensitive areas the availability of suitable airspace for instrument approach and departure procedures if instrument operations are planned
- the availability of suitable forced landing areas.

The essential components of a HLS are areas suitable for lift-off, or the take-off manoeuvre, for the approach manoeuvre and for touchdown. If these components are not co-located at a particular site, taxiways to link the areas will be needed.

3.5.8 Layout

Normally a HLS will have a simple layout which combines those individual areas with common characteristics. Such an arrangement will require the smallest area overall where the helicopter will be operating close to the ground and from which it is essential to remove all permanent obstacles and to exclude transient and mobile obstacles when helicopters are operating. When the characteristics or obstacle environment of a particular site do not allow such an arrangement, the component areas may be separated provided they meet their respective individual criteria. Thus a different direction may be used for take-off from that used in the approach and these areas may be served by a separate touchdown and lift-off area, located at the most convenient position on the site and connected to the other manoeuvring areas by helicopter ground or air taxiways.

3.5.9 Security

Elevated / roof top HLS are generally more secure sites than on-grade types.

An on-grade HLS may be located within a secure area with fencing and locked gates. However it may not be possible or practical to fully secure the location and thus the best that can be achieved is suitable perimeter fencing which defines the area, and at best restricts access. Such fencing should be consistent with swimming pool fencing so that it is not easily scalable. This fencing should be located at least 10m beyond the safety area perimeter of the HLS. It is important that the fence does not infringe the visual flight rules (VFR) approach/departure path and transitional surfaces.

Security fencing as described is only an aid to security and does not define any additional public exclusion zone around an operating helicopter. The public exclusion zone will be dependent on terrain and infrastructure. The downforce and lateral winds generated by a 6,800kg helicopter are substantial and require specialist advice to ensure safety of the public and public assets.

3.5.10 Links with the Hospital

An on-grade hospital-based HLS is to be connected to hospital buildings by a smooth sealed pathway at least 1.8m wide, with no cambers, gutters or gaps, and allowing for adequate space for maneuvering around corners. Stretchers or trolleys used to move life-support equipment with or without patients should be able to move along paths with one person required to push them. The maximum slope of the pathway should not exceed 1:20.

Where a vehicle is used, the ambulance trolley may traverse an unprepared surface from the ambulance to the helicopter. Such surfaces may be uneven, boggy, poorly lit or sloping. Ambulance vehicles, even when very carefully driven over gutters or ridges in off-site locations such as sports ovals, can suffer gross movement of their stretchers.

3.6 Planning Approval

Legislative requirements relating to the approval of a HLS in NSW are complex and no single source of information is available. The current legislation excludes emergency service HLS from the definition of a ‘designated development’ in the Environmental Planning and Assessment Regulation (which otherwise includes most HLS). Generally hospital-based HLS are considered ‘ancillary-use’ to the hospital purposes and are thus not a separate ‘development’. The same cannot necessarily be said of off-site emergency service HLS.

Where a new HLS or a major renovation or change to an existing HLS is proposed, a Development Application may need to be lodged with the relevant planning authority. The authority may also require an Environmental Impact Statement. HLS 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 any particular facility.

Any Development Application for a HLS should also be accompanied by an assessment of any potential encroachments from existing and/or approved development or natural features (for example landscaping) into the approach and departure path(s) of the proposed HLS. The approach and departure path should be identified either through a survey or as identified in Figure 1 of NASF Guideline H – Protecting Strategically Important Helicopter Landing Sites.

Currently, approval from CASA is generally not required, however the location of local airports, runway approaches and departure flight paths and other designated airspace must be taken into consideration. Consultation with the local CASA office is advisable.

Early approval from Air Services (Airport.Developments@AirservicesAustralia.com) should also be sought for sites that may be in or around aerodromes, under the approach and departure paths of existing airports, or at hospital HLS that have an associated instrument approach procedure attached. Notification periods of a minimum of eight weeks apply for gaining approval for obstructions near hospital HLS such as tower cranes or luffing cranes.

3.7 Helicopter Landing Site Design

3.7.1 Structural Design

The FAA Advisory Circular 150/5390-2C Heliport Design states that the minimum design static load is to be equal to the helicopter's maximum take-off weight applied through the total contact area of the wheels or skids. For dynamic loads, it specifies 150% of the maximum take-off weight and assumes a dynamic load of one-fifth of a second or less duration occurring during a hard landing with the weight applied equally through the contact area of the two rear or main wheels or rear of skids. These recommendations however are primarily applied to on-grade HLS and heliports.

The HLS FATO should be designed for the largest and/or heaviest type of helicopter that is anticipated to use the HLS. The design should consider all types of loading such as staff, medical equipment etc. In NSW, the AW139 is considered as the Design Helicopter. For HLS design loading, the MTOW is 6,800kg.

For the purpose of design, it is assumed that the helicopter will land on two main wheels, irrespective of the actual number of wheels in the undercarriage, or on two skids as fitted to other types of helicopter that may use the HLS. The loads imposed on the structure should be taken as point loads at the wheel centres. Refer to Table 1 for detail on load distributions.

The design must allow free movement of hospital trolleys and ambulance stretchers across the HLS. Concrete deck HLS are preferred. The use of aluminium prefabricated HLS is acceptable if it meets all design criteria of this policy. The deck surface of a prefabricated aluminium HLS must not include surface ridging (i.e. it must be smooth but with a non-slip surface).

3.7.2 On-grade Helicopter Landing Site

For an on-grade HLS, the advisory information recommends that the dynamic loads will be met with a sealed FATO area constructed of 150mm thick reinforced concrete slab base.

3.7.3 Elevated Helicopter Landing Site

The structural design advice from the ICAO Heliport Manual is considered to be the most appropriate for the construction of elevated, or roof-top, HLS.

When designing a FATO on an elevated HLS, and in order to cover the bending and shear stresses that result from a helicopter touching down, the following should be taken into account:

Dynamic load due to impact on touchdown

The dynamic load should accommodate a normal touchdown, with a rate of descent of six feet per second, which equates to the serviceability limit state. The impact load is then equal to 1.5 times the maximum take-off mass of the helicopter.

The emergency touchdown should also be covered at a rate of descent 12 feet per second, which equates to the ultimate limit state. The partial safety factor in this case should be taken as 1.66.

Hence, the ultimate design load is:

- 1.66 service load
- (1.66 x 1.5) maximum take-off mass
- 2.5 maximum take-off mass.

To this should be applied the sympathetic response factor discussed at 3.7.5.

Sympathetic response on the Final Approach and Take Off Area

The dynamic load should be increased by a structural response factor dependent upon the natural frequency of the roof top slab when considering the design of supporting beams and columns. This increase in loading will usually apply only to slabs with one or more freely supported edges.

It is recommended that the average structural response factor (R) of 1.3 should be used in determining the ultimate design load.

Other design considerations involving the overall superimposed load from staff and equipment on the HLS are in this case negligible, however the ICAO Heliport Manual does provide an allowance of 0.5 kW/m2.

In essence, the structural design of an elevated HLS should consider:

- static loads due to the helicopter at rest
- dynamic loads on particularly the TLOF and out to the FATO, due to impact of the helicopter on touchdown
- sympathetic response (resonance) of the HLS structure
- staff, freight and equipment loads
- wind loads
- lateral loading on supports

- the dead load of structural members
- punching shear.

It is strongly recommended that the structural design based on the ICAO Heliport Manual specifications be considered.[2]

3.8 Helicopter Landing Site Dimensions and Safety Criteria

A HLS may be at ground level or elevated. Preference is for a round HLS, however on occasions design constraints may require a square deck. In all cases however, the markings should represent a circular HLS. If it is elevated it will include a surrounding safety net, and be to the minimum dimensions and structural integrity required to meet the Design Helicopter specifications. It should be noted that elevated HLS generally provide better obstacle clearance, both present and future, particularly in urban areas. The minimum required dimensions are based on the AW139. The following information is relevant for a single HLS and thus a single FATO.

3.8.1 Final Approach and Take-Off Area

Diameter minimum 1.5 x length = 1.5 x 16.62m = 24.93m, rounded to a diameter of **25m** or **25** x **25m**.

3.8.2 Touch Down and Lift Off Area (TLOF)

Diameter minimum is the main rotor diameter of 13.8m, rounded to a diameter of **14m** or **14** x **14m**.

3.8.3 Landing and Lift Off Area (LLA)

Diameter minimum of **6.35m** or **6.35** x **6.35m**. As the FATO area is to be load bearing, it follows the both the TLOF and LLA will also be load bearing. In such cases, the LLA will not be defined on the HLS deck.

3.8.4 Safety Area

The FATO will be surrounded by a safety area which will be free of all obstacles. The safety area may project out into space for an elevated HLS.

The purpose of a safety area is to:

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

[2] Heliport Manual Doc 9261-AN/903

A safety area surrounding a FATO intended to be used in visual meteorological conditions (VMC) will 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 RD (13.8m) = 4.14m. The Safety Area width surrounding the FATO is thus rounded to **4m**.

No fixed objects will be permitted on a safety area, except for frangible mounted objects which, because of their function, must be located on the area. No mobile object will be permitted on a safety area during helicopter operations.

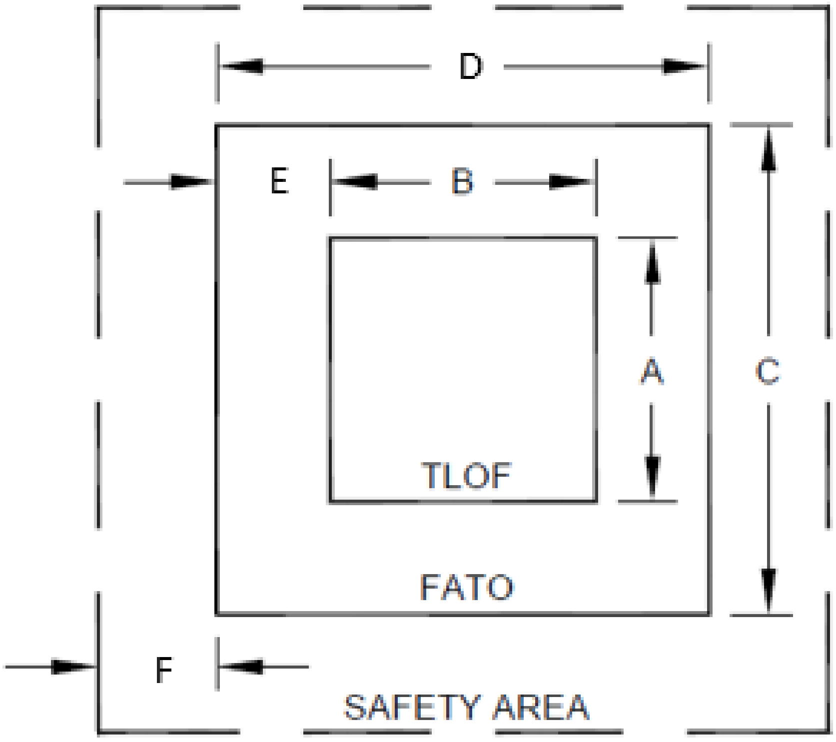
Where possible, no objects are to be located within the safety area. However, objects whose functions require them to be located on the safety area must not exceed a height of 250mm when located along the edge of the FATO, nor penetrate a plane originating at a height of 250mm above the edge of the FATO and sloping upwards and outwards from the edge of the FATO at a gradient of 5%. The surface of the safety area will not exceed an upward slope of 4% outwards from the edge of the FATO.

The surface of the safety area abutting the FATO will be continuous with the FATO and the whole of the safety area will 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 TLOF and the central 'H'. The FATO, TLOF and the 'H' are to be appropriately marked with paint, and lighting to support night operations requirements (refer Section 3.8). With such markings, the safety area minimum is to be **4m** in width and surround the FATO. If square, the FATO area will be **33** x **33 m**. If round, the diameter, including the safety area will be (25 + 8 m) = **33 m**. See Figures 2 and 3.[3]

[3] AC 150/5390-2B

Figure 2: TLOF and FATO/Safety Area Relationships and Minimum Dimensions

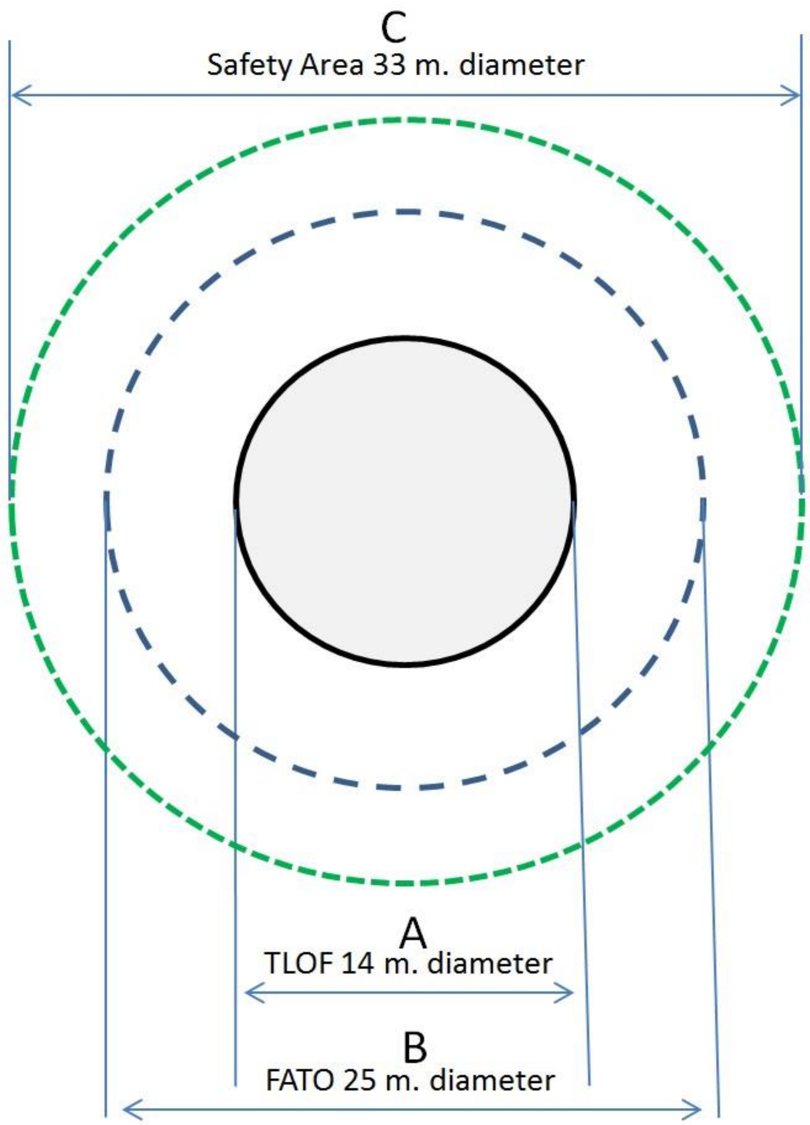


Source: AviPro

Notes:

Design Helicopter: Leonardo AW139
RD: Rotor diameter of the design helicopter
OL: Overall length of the design helicopter
A – Min TLOF Width: 1.0 x RD (14m) (if round, diameter is 14m.)
B – Min TLOF Length: 1.0 x RD (14m)
C – Min FATO Width: 1.5 x L (25m) (if round, diameter is 25m.)
D – Min FATO Length: 1.5 x L (25m)
E – Min separation between perimeters of the TLOF and FATO: 0.5(1.5 x OL – 1.0 x RD) (5.5m)
F – Min Safety Area Width: 0.3 x RD (4m)

Figure 3: TLOF, FATO, Safety Area – Round HLS



Source: AviPro

<u>Notes</u>:

Preference is for a round HLS.

Design Helicopter:	L AW139
RD:	Rotor diameter of the design helicopter
L:	Overall length of the design helicopter
A –TLOF diameter:	1.0 x RD (14m.)
B –FATO diameter:	1.5 x L (25m.). All load bearing.
C –Safety Area width:	0.3 x RD (4m.)

Min separation between perimeters of the TLOF and FATO: 0.5 (1.5 x OL – 1.0 x RD) (5.5m)

3.8.5 Non-Contiguous TLOF and FATO

It is permissible to design a FATO and TLOF that are separated. Such design parameters are highly specialised and require case by case consideration. Refer to the ACC for further advice.

3.8.6 Parking Position

A parking position is recommended where the HLS is to be made to accommodate a second helicopter. Ideally, a parking position will be provided in tertiary trauma centres:

- located in a regional area (e.g. John Hunter Hospital)
- at a few tertiary centres located within the Sydney metropolitan area. This will allow the Helicopter Retrieval Services to have some options should a HLS at a selected location be unavailable.

These types of requirements will be discussed at expert clinical review group meetings and during early Design Development discussions with Health Infrastructure projects.

3.8.7 Perimeter Safety Net

A perimeter safety net is required to surround the edge of an elevated/roof top HLS. It will not be less than 1.5m wide, have a minimum load carrying capability of 122 kg/ m^2 and not project above the HLS deck. Both inside and outside edges of the safety net are to be secured to a solid structure.

3.8.8 Slope and Drainage

Within the FATO, the maximum slope in any direction should not exceed a maximum of 3% and is recommended at 2%. Adequate water/spill drainage is required to account for prolonged heavy rain.

3.8.9 Fuel/Water Separator

Arrangements are required to ensure that any spilt fuel or lubricants do not enter the water drainage system. This is a relatively simple process at an on-grade HLS. It is however more complex for an elevated/roof top HLS and a recommended solution is a gravity-operated fuel/water separator of sufficient size (total capacity of ~2,700 litres (L) static holding capacity of ~1,500L and integral storage of 1,200L). It should be installed below the deck level to ensure that any fuel, oils and greases are appropriately collected in the event of spillage. The separator should have an adjustable oil draw-off, a contents indicator and integral baffle system. Stainless steel is recommended.

3.8.10 Access Points/Dimensions

Two access points are required for elevated HLS. The primary access point is at the same level as the HLS deck and should provide an access-controlled door or doors with a clear opening of at least 1.8m. This would normally lead directly (on-grade HLS) or via a lift to critical care areas of the hospital. The second access point is to be at the opposite side of the HLS to allow for emergency evacuation if required. This access would normally be in the form of stairs leading down from deck level to an emergency egress stairwell.

3.8.11 Windsock

A windsock, rated to 30 knots, is required to show the direction and magnitude of wind. The windsock should provide the best possible colour contrast to its background. To provide maximum contrast, yellow is preferred over white. It should give a clear indication of the direction of the wind and a general indication of the wind speed. The wind direction indicator is to consist of a truncated cone of lightweight fabric, 2.4m long with diameters of 0.6 and 0.3m at respective ends. It is to be located to provide the pilot with valid wind direction and speed information in the vicinity of the HLS under all wind conditions. It must be clearly visible to the pilot on the approach path and understandable from an operating height of not less than 500 feet above the HLS when the helicopter is at a distance of 150m from the HLS, and be clearly visible when on the HLS.

The windsock should also be clearly visible to the pilot from the cockpit when the helicopter is positioned (landed) on the HLS.

The windsock is to be located outside the safety area to avoid presenting an obstruction hazard. It will not penetrate the VFR approach/departure path but may penetrate the transitional surface.

For night operations, refer to Section 3.11.

3.8.12 Fuel

Hospital-based HLS intended for use as a permanent base of operations will require refuelling facilities. Such facilities will normally be bulk storage, either underground or in above ground storage tank. To avoid double handling, it is desirable to locate refuelling facilities on a parking apron sufficiently removed from the FATO as to allow another aircraft to land or take-off. A HLS with refuelling facilities should have a parking position. The anticipated fuel usage will dictate the bulk storage volume necessary. Professional advice will be needed.Where drum stock is used, provision for sufficient secure under cover storage is needed. Dangerous Goods Legislation governs the quantities allowed to be stored within a hangar and in other forms of storage accommodation. Unless an exceptional case is made, a hospital-based HLS will not require refuelling facilities. Refuelling will be conducted at nearby airports.

3.8.13 Magnetic Resonance Imaging Interference

Magnetic resonance imaging (MRI) scanners are located in hospitals for diagnostic purposes. An MRI creates a strong magnetic field when in operation which will cause temporary aberrations in the helicopter's magnetic compass and may interfere with other navigational systems. It is the responsibility of the relevant hospital to provide the helicopter operator/pilot with details of the location of the MRI and similar equipment. This information should be included in the ERSA entry for the HLS. A warning sign is to be placed on the HLS surface alerting pilots to the presence of an MRI, should there be a possibility of interference. A MRI marker is to be painted in black[4]. See the example at Figure 4.

[4] U.S. Department of Transportation SAFO 06-007. DATE: 7/20/06, Federal Aviation Flight Standards Service, Administration Washington, DC

Figure 4: Example MRI Direction and Distance Marker in Metres

Source: AviPro

3.8.14 Radio Communication

Good communications between the helicopter, the hospital and the NSWA Aeromedical Control Centre (ACC) is essential. This may be via cell phone, radio or both. It has become common hospital practice for the local security department to be responsible for HLS security, access, safety, lighting and communications.

Radio communications between the hospital HLS. This communication is facilitated by the hospital switch/ control room.

3.8.15 Fire Fighting Appliances

There are currently no regulatory standards in NSW for fire-fighting appliances at a HLS. The most appropriate fire protection involves foam making equipment such as a Fixed Monitor System (FMS) / oscillating monitor nozzle/s for a concrete HLS, or a foam Deck Integrated Fire Fighting System (DIFFS) for a prefabricated steel or aluminium HLS deck. The offshore resources industry requires foam DIFFS on manned HLS decks and the less effective and cheaper water-only DIFFS for unmanned HLS decks. Both on-grade and elevated hospital HLS decks are considered as manned HLS. A foam system (Fixed Monitoring System – FMS) is more important on an elevated HLS deck due to the potential collateral damage following a deck fire. Excellent reference material is contained within the US National Fire Protection Association publication NFPA 418 Standards for Helipads. This publication is called up by CASA in CAAP 92-2 (2). In all situations the advice of the local fire authorities is to be sought for the latest information. It is likely that future CASA Part 139R rules will detail specific firefighting equipment limits for both on-grade and elevated HLS.

The **minimum** standards currently are as follows:

- a fire water point with fire hose located adjacent to the primary HLS deck access point.
- firefighting appliances suitable for liquid and electrical fires located in the vicinity of the primary access point, including:
    - 1 x CO_2 3.5kg
    - 1 x dry powder, 9.0kg
    - 1 x foam, 90L
    - 1 x fire blanket.

Hospitals should note the weight and manoeuvre capability of the 90Lfoam extinguisher. In some cases, these are difficult to move and a four-wheel cart base could assist in the versatility of the extinguisher.

Similar appliances may be located within the emergency egress stair well on elevated HLS.

3.8.16 Instrument Approach Aids and Visual Glideslope Indicators

The use of satellite-based GPS approaches to the HLS should be considered when siting a hospital-based HLS. This requires consideration of the approach/departure path obstacles and their impact on future instrument approach minimum altitudes and also the reservation of space to install instrument approach lighting arrays which may be required for precision approach procedures.

There are also several glide slope indicator systems available, with details available through the office of the Deputy Director Helicopter Retrieval Services at NSWA.

3.8.17 Exhaust Gas Ingestion

Hospital air-conditioning air intake systems must not be positioned in the vicinity of an elevated HLS. The design helicopter burns almost 500L of kerosene per hour and presents a noticeable odour. In the event of the duct being in the vicinity to ingest exhaust gases a closure or redirection facility will be required for the relatively short period the aircraft turbines are exhausting. Under particular wind conditions the exhaust gases emitted from the helicopter engines exhausts can travel for some distance and if ingested into hospital ventilation systems, can cause considerable consternation; even if the gases involved are below noxious levels.

3.9 HLS Surface and Markings

All paint used on a HLS surface is to be hard wearing gloss, hydrocarbon resistant, UV resistant and non-slip. The HLS is to be painted neutral grey, out to at least the perimeter of the FATO. On a concrete surface, an appropriate sealer is required. Surface markings are to identify the facility as a HLS. Lines/markings for the FATO and TLOF are to be 30cm wide and painted in a white to make them conspicuous.

Colours required as based upon AS 2700 Colour Standards for General Purposes, and are as follows:

- Neutral Grey N23
- White N14
- Waratah Red R14
- Black N61
- Golden Yellow Y14

3.10 TLOF and FATO Perimeter Marking

3.10.1 Overview

The perimeter of the TLOF and the FATO is to be defined with markers and/or lines.

The perimeter of the TLOF is to be defined with a continuous white line 30cm wide.

The perimeter of the FATO is to be defined with a 30cm wide dashed white line. The corners of a square FATO should be defined, and the perimeter marking segments are to be 30cm in width, approximately 1.5m in length, and with end-to-end spacing of approximately 1.5m. Refer to Figure 5 Standard Hospital HLS Identification, Markings, Dimensions and Colours.

The identification marking is intended to identify the location as a hospital-based HLS, clearly identify the TLOF and FATO, and therefore provide visual cues to the pilot

The standard marking is a red ‘H’ in a white cross over a red square background, defined by the TLOF continuous white line. The ‘H’ is to be oriented to magnetic north. Yellow arrows and landing direction lights (refer Section 3.11.4 and Figure 9) are also to be used to indicate two preferred and PC1 surveyed approach/departure directions. Figure 5 illustrates the requirements of the standard hospital HLS marking, dimensions and paint colours.

3.10.2 Hospital Identifier

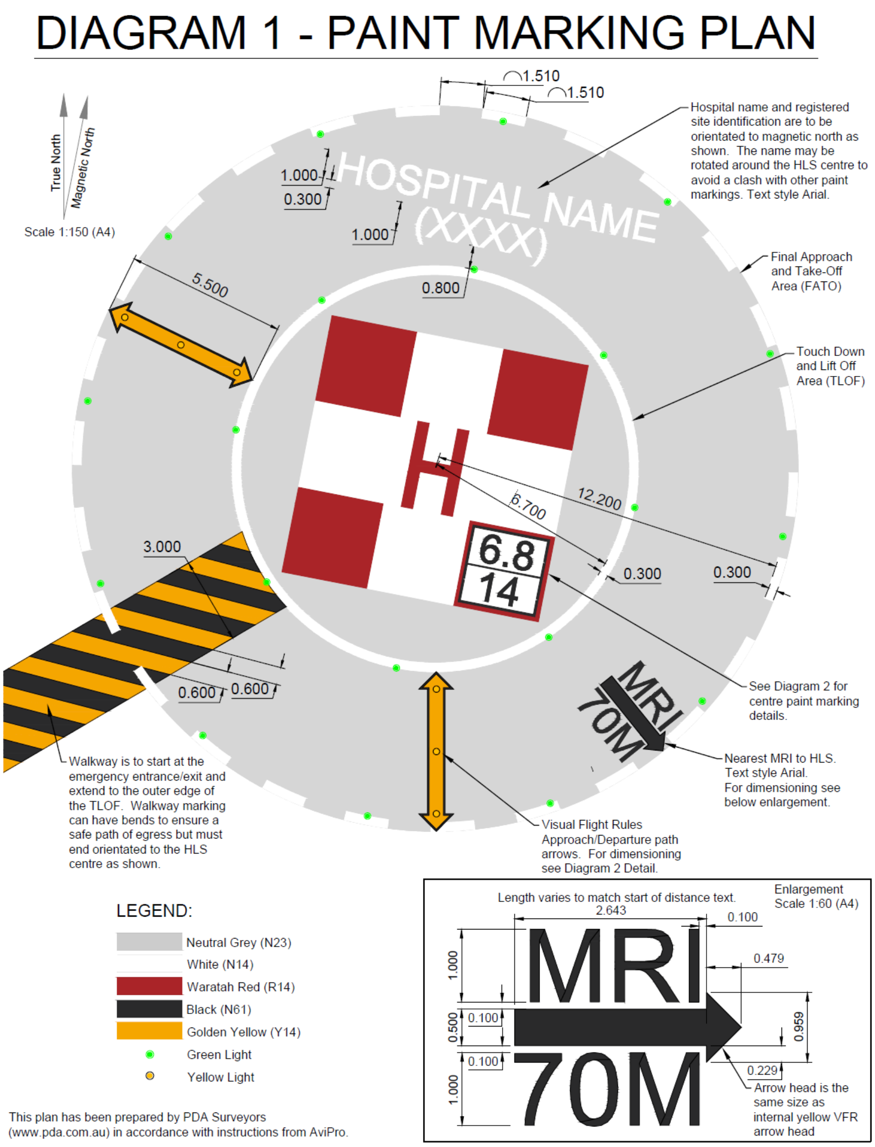
Each HLS will have the name of the hospital and a designated and unique four letter Airservices Location Code identifier painted on the HLS surface orientated to magnetic north, and normally positioned between the TLOF and FATO boundaries. If sufficient space exists beyond the FATO boundary, they may be placed on the outside of the FATO boundary. The letters if possible should be one metre high, in white and marked as shown in Figure 6.

3.10.3 Weight and Rotor Diameter Size Limitation Markings

Within the TLOF and at the lower right-hand side of the 9 x 9m red square beneath the white cross, is a white box surrounded by a black edge, containing in its upper half the Maximum static Take-Off Weight limit marking of the Design Helicopter in metric units.

The lower half is to contain the main rotor diameter of the Design Helicopter, i.e. above, a marking of “**6.8**” equating to 6,800kg, and below, “**14**”, equating to a rotor diameter the Design Helicopter. The numbers should be 0.9m high and black on a white background. Figure 6 following depict typical ground level HLS markings in colour.

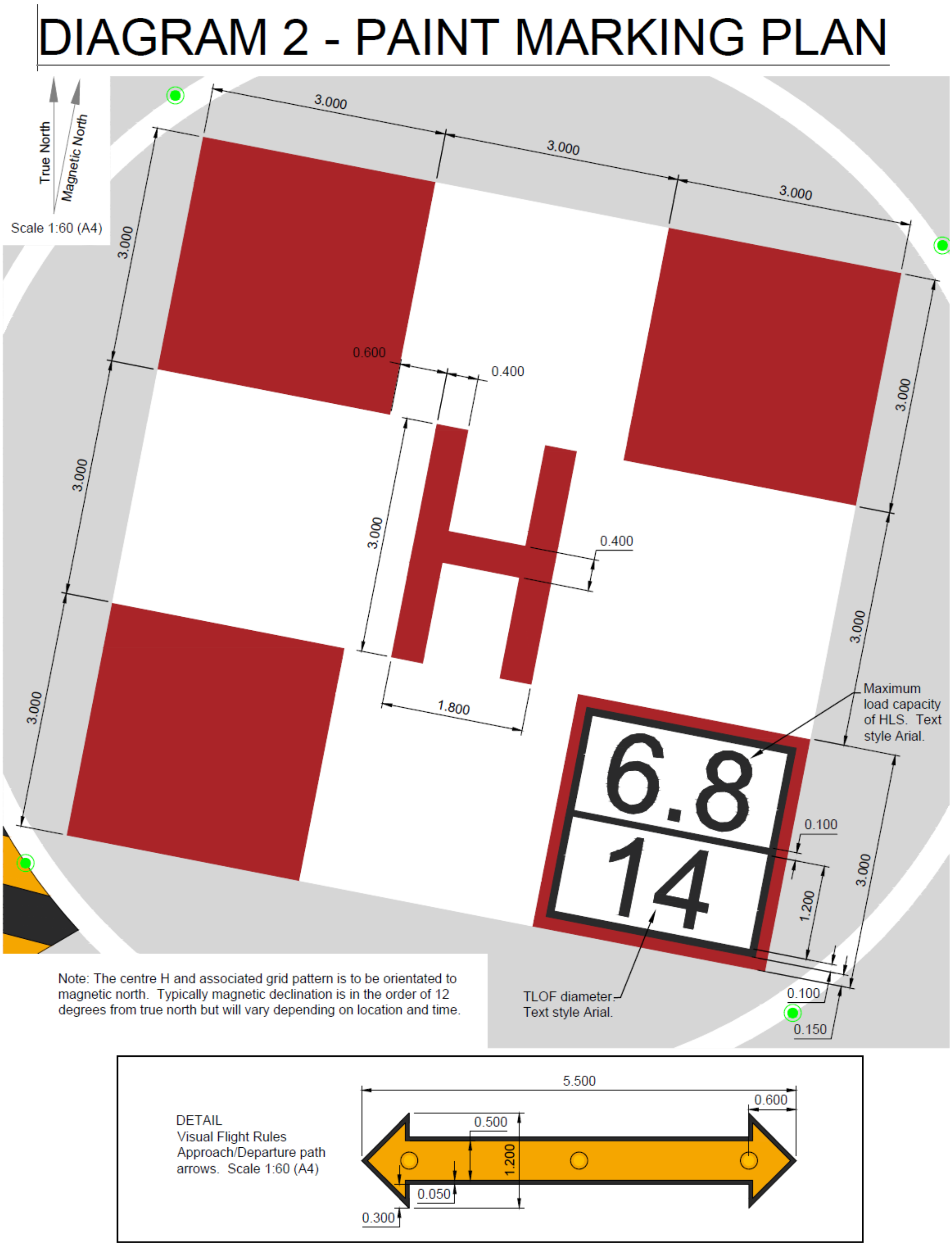
Figure 5: Standard Hospital HLS Identification, Markings, Dimensions and Colours



Source: AviPro

Note: The standard hospital identification is a red ‘H’ surrounded by a white cross over a red square, orientated to Magnetic North.

Figure 6: TLOF Colour Scheme, Maximum Weight and Rotor Diameter Limits



Source: AviPro

3.10.4 Helicopter Landing Site Deck Walkways

Painted walkway markings are to be positioned on the decks of HLS. They are to be direct from the primary deck access point entry doors on elevated HLS, and from at least the edge of the safety area on surface level HLS, to the edge of the TLOF. Walkways must be a minimum of 1.8m wide and be painted in hard wearing (road type), hydrocarbon resistant, UV resistant and non-slip yellow and black diagonal lines.

The pavement is to be designed so that spilled fuel or lubricants do not drain onto passenger walkways or toward a parked helicopter.

3.10.5 Surface Level Walkways and Paths

Surface level or on-grade walkways and paths will be sealed, not exceed a slope of 1:12, have no steps, and not less than 1.8m wide. If possible, they should be covered to within 20 metres of the HLS Safety Area boundary.

Surface level or on-grade walkways and paths are to be sealed with gentle sweeping turns, have no steps, and not less than 1.8m wide. If possible, they should be covered to within 20m of the HLS Safety Area boundary. A slope of 1:12 is considered the absolute maximum for a short distance i.e. < 10m If the path is longer than 10m, 1:20 or less is to be sought.

3.10.6 Magnetic North Orientation

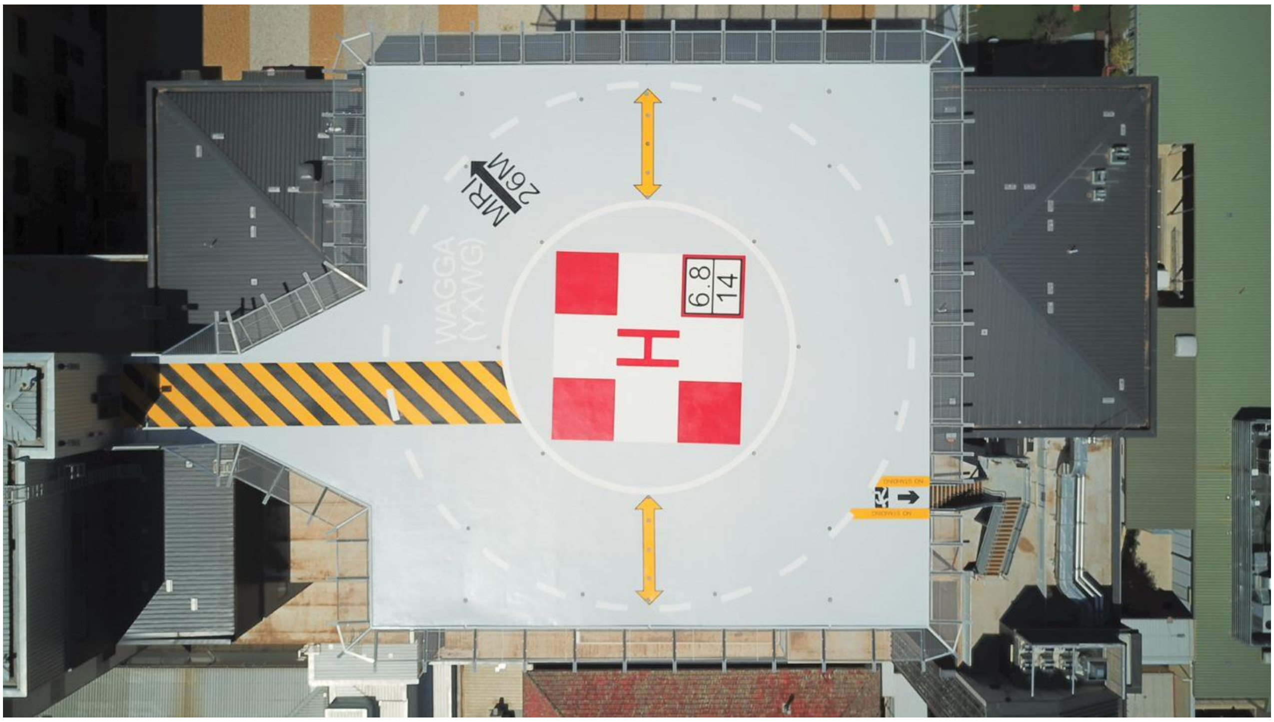
The ‘H’ marker and thus its white cross background are to be orientated towards magnetic north.

3.10.7 Roof Top Helicopter Landing Site Layout

Figure 7 provides an example of an elevated HLS layout incorporating:

- TLOF perimeter markings and lighting
- safety net and safety area
- maximum weight and rotor size limitation markings
- HLS deck walkway
- hospital identifier
- HLS identification ‘H’ oriented to magnetic north
- MRI direction
- preferred approach and departure direction
- secondary HLS deck emergency exit.

Figure 7: Example Roof Top HLS Layout



Source: AviPro

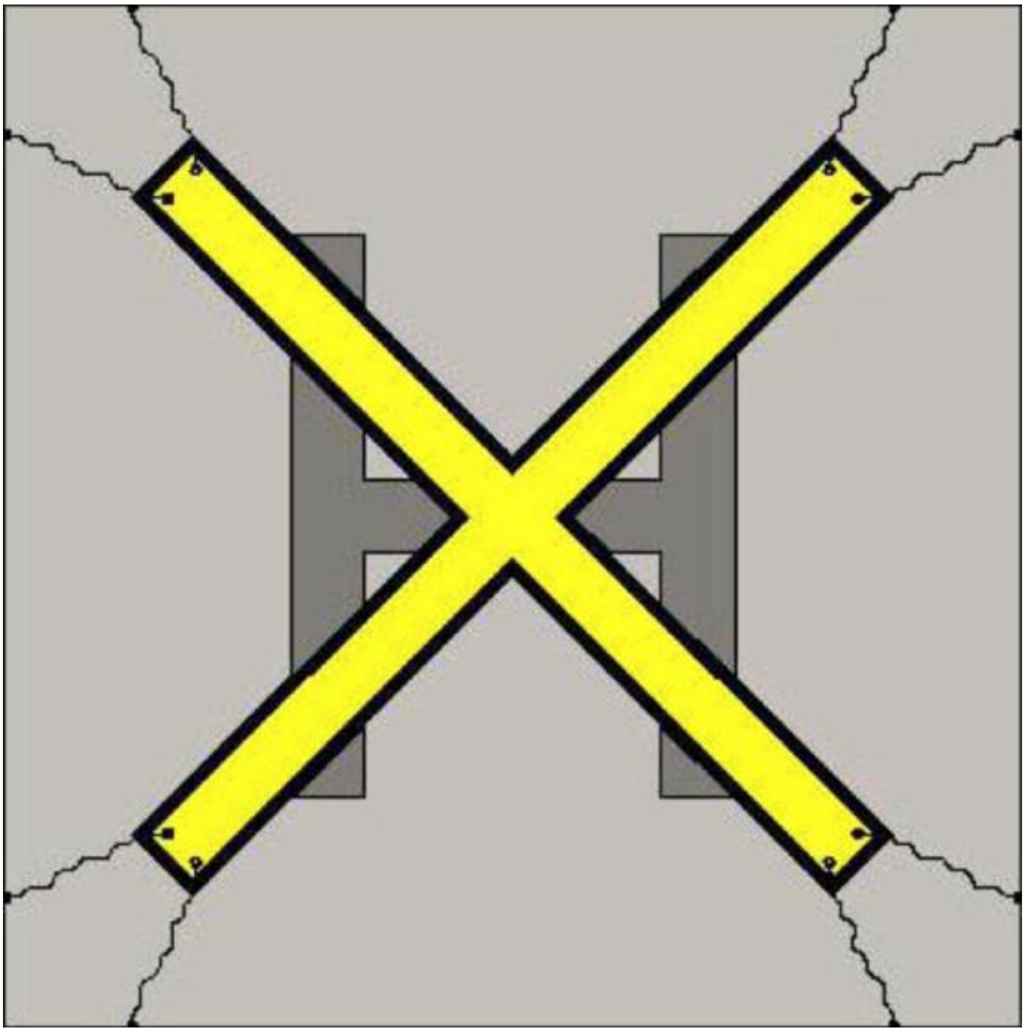
Notes

- HLS deck in light grey.
- The perimeter of the FATO is defined with a dashed white 30cm wide circle at 25m diameter, and with 12 flush mounted NVG Compliant green lights.
- The perimeter of the TLOF is defined with a continuous, white 30cm wide circle at 14 m diameter, and with eight flush mounted NVG Compliant green lights.
- The direction arrows are yellow, with a minimum of three flush mounted yellow lights.
- HLS identification marking is a red "H" on a white cross orientated to magnetic north.
- Walkway is in yellow and black stripes (chevrons).

3.10.8 HLS Unserviceability

A HLS which is unserviceable must be notified immediately to the ACC by phone and completing the (via online helipad notification form. Non-urgency matters will be communicated using the online helipad notification form. For extended periods of unserviceability, the HLS is to be appropriately marked by a yellow "X". See Figure 8.

Figure 8: HLS Unserviceability marker



3.11 Lighting

3.11.1 Helicopter Landing Site Lighting

For night operations, the TLOF, the FATO, approach/ departure directions, and the windsock are to be illuminated. Additionally, there are to be appropriately positioned obstruction lights. To accommodate night vision goggles (NVG) operations, all HLS lighting other than the flood lights, must be NVG compatible/compliant/friendly and must be visible from a distance of at least 3km at the prevailing Lowest Safe Altitude (LSALT) in clear conditions. That is, all lighting must be visible both with and without the use of NVG under these conditions.

To meet NVG requirements, all lights must operate within the wavelength range of 600 and 900 nanometre (nm). Current generation LED lights have been found noncompliant, unless they are equipped with additional IR LEDs providing a wavelength of approximately 850nm. Only NVG compliant lights are acceptable.

A statement acknowledging NVG compliance is required from the lighting contractor.

3.11.2 TLOF Perimeter Lights

The TLOF perimeter is to be lit with green lights. Flush mounted lights are to be used, and they are to be located within 30cm of the outside edge of the TLOF perimeter (14m diameter). If lights cannot be aligned with the TLOF painted marking, positioning on the outside edge provides better visual cues to pilots when at a distance from the HLS, since they outline a larger area. A minimum of eight uniformly spaced lights is required.

3.11.3 Load Bearing FATO Perimeter Lights

The FATO perimeter is to be lit with flush mounted green NVG compliant lights. They are to be located within 30cm of the outside edge of the FATO perimeter (25 m diameter). It lights cannot be aligned with the FATO painted marking, positioning on the outside edge provides better visual cues to pilots when at a distance from the HLS, since they outline a larger area. A minimum of 12 uniformly spaced lights is required.

3.11.4 Landing and Take-Off Direction Lights

Landing and take-off direction lights are required for both surface and elevated HLSs. They are to be installed on the deck to provide landing and take-off directional guidance at night. Landing direction lights are a configuration of three yellow, flush mounted omni-directional lights on the centreline of a yellow two headed arrow with black borders painted on the deck. The arrows show the preferred VFR approach/departure path/s, which ultimately will all be surveyed to meet PC1 requirements. The arrows are to be positioned on the deck between the TLOF and FATO markings. An example of a correctly positioned VFR approach/departure path arrow with NVG compliant yellow lights follows at Figure 9.

Figure 9: Approach/Departure Directional Arrow and Lights

Source: AviPro

3.11.5 Taxi Route and Taxiway Lighting

Taxiways may be required in some situations such as where the FATO and TLOF are not contiguous. Refer to the ACC for advice.

3.11.6 Windsock Lighting

The windsock is to be illuminated by four closely mounted white lights to ensure that it is seen clearly from all directions. A red obstruction light is also to be positioned on the top of the mast. Refer to Figure 10.

Figure 10: Windsock and Lighting

3.11.7 Flood Lights

Flood lights are to be positioned to illuminate the TLOF and the FATO for the purposes of aiding in helicopter patient 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 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 take-off 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. Low level (deck level) low intensity flood lights do not meet the purpose and present unacceptable obstacles and are not to be used.

3.11.8 Walkway and Pathway Lighting

Lighting will be required to illuminate walkways and pathways and must be directional so as not to create a hazard for NVG operations.

3.11.9 HLS Identification Beacon

A HLS identification beacon is to be located as close as is practical to the HLS and on the highest point of the hospital reasonably available. The beacon is to be capable of flashing white/green/yellow at the rate of 30 to 45 flashes per minute. Recommended candelas range is 600 to 1,000 to provide a low intensity beacon visible between 10 and 12nm by night. When pilot activated lighting (PAL) is in use, the beacon is to be on the PAL circuit. Beacon systems utilising three independent lights must position each light at 12-15° above the horizontal. There are currently only two manufacturers with approved beacon lights. Refer to NSW Ambulance for advice.

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

All but flood lighting may also be activated via a PAL system. This utilises a hospital based VHF radio and a 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 will operate for a period of 45 minutes. Lights may be manually turned on and may be manually turned off within the 45 minutes, or they automatically turn off at 45 minutes after a 10 minute flashing warning. The installation of PAL equipment is recommended.

The manual activation switching must be readily accessible to the HLS attendant staff, and on an elevated HLS, is normally located within the lift lobby/ HLS deck reception room adjacent to the PAL controller.

3.11.10 Stand-by Power Supply

HLS lighting requires a stand-by electrical power supply. An uninterrupted power source is not required. Helicopter Landing Site Lighting Suppliers

There are a number of aerodrome and HLS lighting equipment suppliers. Advice can be sought from the NSW Ambulance Deputy Director Helicopter Retrieval Services.

3.12 Obstructions

3.12.1 Object Marking

HLS maintenance and servicing equipment, as well as other objects used in the airside operational areas, should be made conspicuous with paint, reflective paint, reflective tape, or other reflective markings.

Particular attention must be given to marking objects that are hard to see in marginal visibility, such as at night, in heavy rain, or in fog.

3.12.2 Obstruction Lighting

Marking and lighting of obstructions relates to those objects considered an obstruction on or in the vicinity of the HLS and within the approach/ departure airspace, and obstructions in close proximity but outside and below the approach/ departure surface. Obstruction lights are red. Low intensity steady red lights are suitable.

Obstruction lights should be linked with photo-electric (PE) cells and illuminate in poor/low light conditions regardless of the use of the HLS. They should be placed on the highest obstruction associated with the HLS and on corners of adjacent buildings. Advice needs to be sought from an appropriate aviation advisor for safety compliance requirements of obstruction lights.

3.12.3 Obstructions on or in the vicinity of the Helicopter Landing Site

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. Refer to Figure 10. Other obstacles in close proximity to the HLS deck may include radio aerials, cell towers, lightning arrestors or exhaust stacks attached to the main building or other buildings in the vicinity. All such obstacles are required to have red obstacle lights fitted.

3.12.4 Obstructions in close proximity but outside and below the Approach/Departure surface

Unmarked wires, antennae, 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. Where power lines or wires present a potential obstacle threat to a HLS, the positioning of power line hazard markers (balls) may be necessary. Reflective marker flags are recommended.

If difficult-to-see objects penetrate the object identification surfaces as illustrated in Figure 11 (Section 3.11.1), these objects should be marked to make them more conspicuous.

3.12.5 Shielding of Objects

If there is a number of obstacles in close proximity to the HLS, it may not be necessary to mark/light all of them if they are shielded. To meet the shielding guidelines an object would be shielded by existing structures of a permanent and substantial character or by natural terrain or topographic features of equal or greater height, and would be located in the congested area of a city, town, or settlement where it is evident beyond all reasonable doubt that the structure so shielded will not adversely affect safety in air navigation.

3.12.6 Positioning of Hospital Gas Storage Cylinders/Containers

Inflammable hospital gasses such as bulk storage LPG and oxygen cylinders/containers are not to be positioned below the VFR approach/departure paths and are to be at least 30m beyond the approach and departure paths and safety area boundary.

3.12.7 Cranes in the vicinity of the Helicopter Landing Site

Most sites will experience the requirement for a crane within the vicinity of the HLS during a hospital or adjacent development. The significance of this, on service delivery impact cannot be understated and there will be positioning and lighting requirements that need to be addressed in addition to the Civil Aviation Safety Authority (CASA) Manual of Standards (MOS) Part 139 requirements.

The illumination requirements for cranes in the vicinity of a Hospital HLS are detailed below.

As a minimum for all tower cranes:

- top of crane A frame or cabin: medium intensity flashing red obstruction light.
- both ends of Jib: medium intensity flashing red obstruction light
- along Jib: line of white LED fluoro on a PE cell along the full length of the jib, and
- tower section: stairway lights or spot lights attached to the top of the tower pointing down and onto the tower (not up into pilot eyes).

As a minimum for all luffing cranes:

- top of crane A-frame or cabin: medium intensity red obstruction light
- end of Jib: medium intensity red obstruction light
- along Jib: line of white LED fluoro on a PE cell along the full length of the jib
- tower section: stairway lights or spot lights attached to the top of the tower pointing down and onto the tower (not up into pilot eyes)
- the LED jib fluoro lights are to be LED weather proof emergency fluoros controlled via a PE cell with a minimum 90 minute battery back-up.

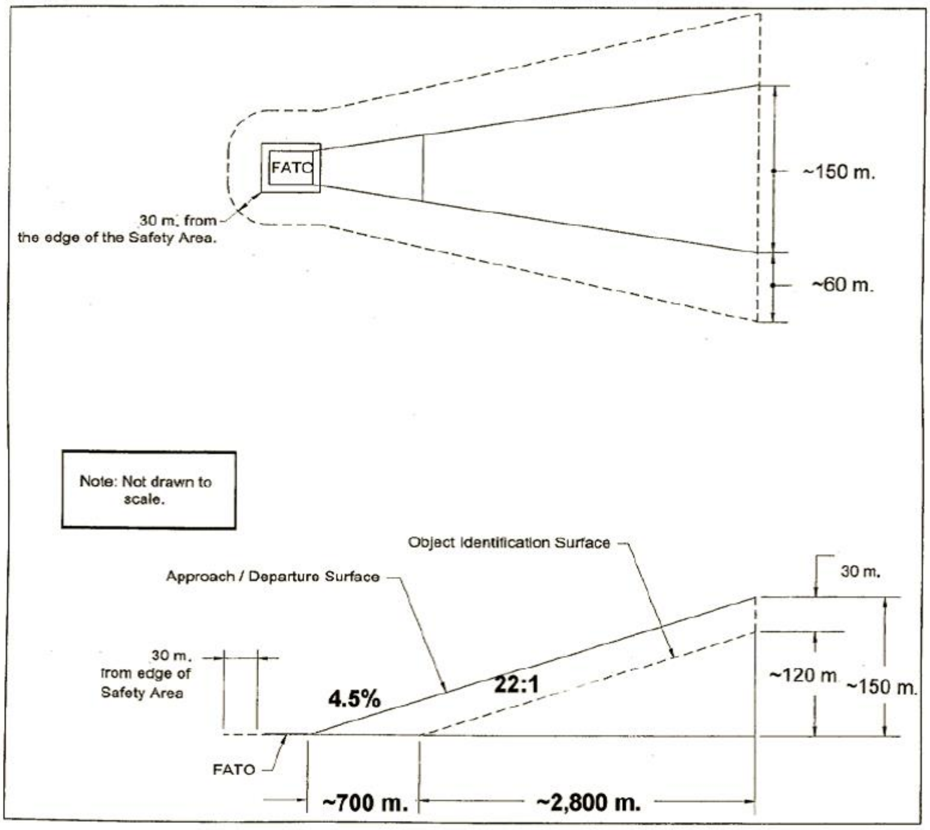
3.13 Object Identification Surfaces

The object identification surfaces (OIS) can be described as:

- 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 ~30m
- under the approach/departure surface, the object identification surface starts from the FATO outside edge and extends horizontally out for a distance of ~700. From this point, the object identification surface extends out for an additional distance ~2,800m while rising on a 2.5º or 22:1 slope (22 units horizontal in one unit vertical). From the point ~700m from the FATO perimeter, the object identification surface is ~30m beneath the approach/ departure surface
- 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 ~30m outside the safety area perimeter. At the upper

end of the surface, the object identification surface extends laterally ~60m on either side of the approach/departure path.

Figure 11: Airspace Where Marking and Lighting are recommended



Source: AviPro

For the purpose of the Design Development Overlay (DDO), the OIS below the VFR approach and departure paths are the limit for the penetration of obstructions. That is, there should be no future development penetrating the OIS, which extends out to 3.5km from the forward edge of the FATO.

3.14 Operational Requirements

3.14.1 Visual Flight Rules Approach and Departure Paths

The purpose of approach and departure path airspace is to provide sufficient airspace clear of hazards to allow safe approaches to and departures from landing sites. Refer to Guideline H of the NASF – Protecting Strategically Important Helicopter Sites (May 2018)

VFR approach and departure paths should be such that there are no downwind operations and crosswind operations are kept to a minimum. To accomplish this, a HLS must have more than one approach/ departure path which provides an additional safety margin and operational flexibility. The preferred 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 approach and departure paths should not be less than 150°, and preferably 180°.

3.14.2 Visual Flight Rules Approach/Departure and Transitional Surfaces

An approach/ departure surface is centred on each approach/departure path. Figure 12 illustrates the approach/departure (primary and transitional) surfaces.

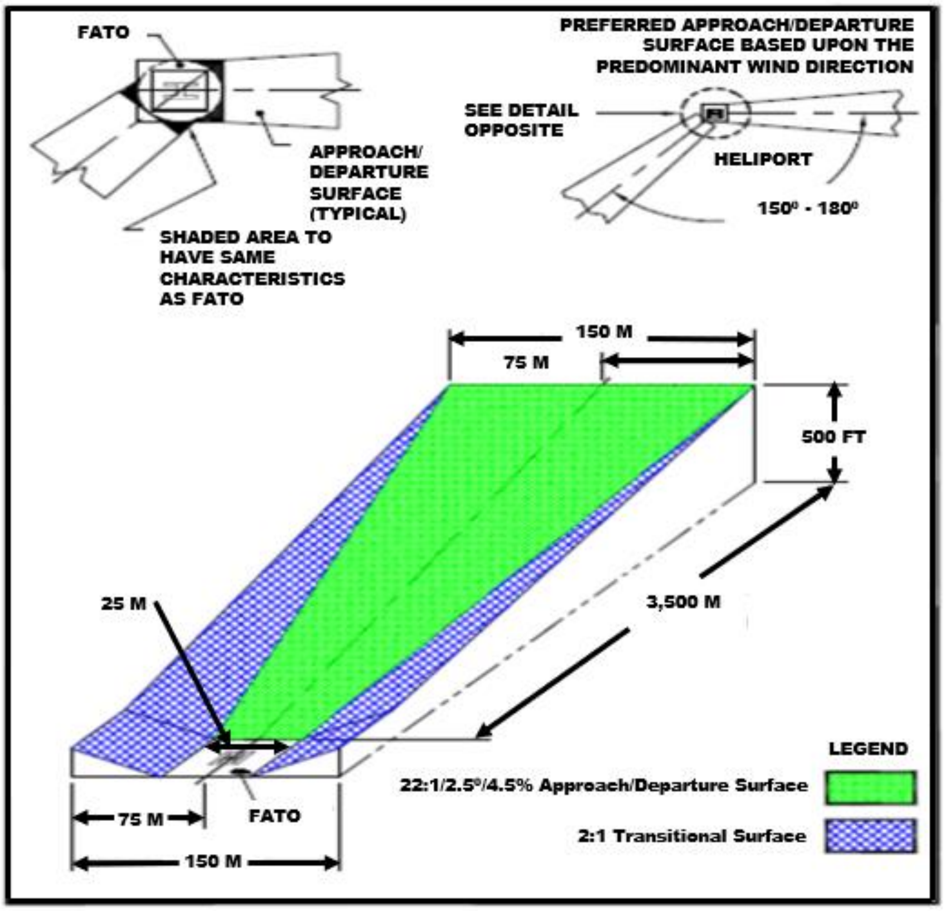
The approach/departure path starts at the forward edge of the FATO and slopes upward at 2.5º/ 4.5%/ 22:1 (22 units horizontal in 1 unit vertical) for a distance of ~3,500m where the width is ~150m at a height of 500 ft above the elevation of TLOF surface. For PC1 survey purposes, the survey commences from the forward edge of the FATO in the approach and departure path direction, from a datum point 1.5m above the FATO edge.

The transitional surfaces start from the edges of the FATO parallel to the approach and departure path centre line, and from the outer edges of approach/departure surface, and extend outwards at a slope of 2:1 for a distance of ~75m 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. Refer to Figure 12.

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 considered a hazard.

Figure 12: VFR HLS Approach/Departure Transitional Surfaces



Source: AviPro

3.14.3 Helicopter Landing Site Approach Plans

During the planning phase, potential HLS approach paths are to be studied and applied to paper to confirm there are no buildings or other projections forming obstructions with the VFR approach/departure and transitional surfaces, and that there is no or limited potential for future obstructions within this area. It is strongly recommended that the required three-dimensional space is fully documented; preferably with three dimensional models to show current and future planners the restrictions imposed on future building construction.

3.14.4 VFR Approach and Departure Path and Transitional Surface Survey

NSWA requires HEMS contractors to meet Category A performance requirements when circumstances allow. The AW139 helicopter allows for Category A operations to be undertaken at almost all times. The vast majority of urban hospital based HLS do not have 'suitable forced landing areas' within the first segment (path 1) and thus the use of Category A operations becomes an imperative.

Under proposed changes to CASA Rules, HEMS operations will fall under Medical Transport, an extension of a new Air Transport category. Operations are proposed to be undertaken to Performance Class 1 or 2 (PC1/2). Both PC 1 and PC2 require a Category

A certified helicopter meeting the relevant Category A requirements, approaching and departing a PC1 accredited HLS along VFR approach and departure paths which have been surveyed for obstacles. The survey must be ‘current’ and be provided to the operator so that appropriate Category A procedures may be planned.

To meet PC1 requirements, VFR approach and departure paths are to have no obstacles penetrating 2.5º/ 4.5%/ 22:1. Likewise obstacles should not be penetrating the adjacent transitional surface; however some penetration may be accepted depending on the amount of penetration and the proximity to the relative approach and departure path.

The following however is considered adequate when prepared by a licensed surveyor:

- a survey covering the entire VFR approach and departure path and transitional surface area for each chosen direction. The entire area is a rectangle 150m x 150m, commencing from the forward edge of the FATO at eye height (1.5m) extending out at 2.5º for 3.5km. At 3.5km, the approach and departure path is approximately 500ft above HLS elevation. The width of the approach and departure path at the commencement (FATO edge) is 25m, expanding uniformly to 150m at a distance of 3.5km. The transitional surface extends laterally from the outer edges of the approach and departure paths at 2:1.
- a written report. Refer to NSWA for advice on content.
- a plan drawing out to the limit of any obstruction along the approach and departure path/s accompanied by a statement to the effect that no obstructions exist beyond the relevant distance.
- a side elevation drawing out to the extent of the obstructions along the approach and departure path/s. Drawings are to clearly show the horizontal distance to obstructions, the height of the obstruction above the HLS elevation and the height of the penetration above 2.5º.
- 3D modelling along the paths is a very effective method of showing obstacles and their relative position etc., and if possible this should be provided.

3.14.5 Approach and Departure Path Protection/Design Development Overlay

Currently no Federal or NSW State legislation is in place to protect VFR approach and departure paths and the transitional surfaces associated with hospital HLS. In Victoria there is legislation through Planning, requiring a DDO to be prepared to protect the area below hospital HLS approach and departure paths. This is completed in association with a required PC1 survey. In Victoria, any Development Application to planning authorities that could have an effect on a hospital HLS approach and departure path must be reviewed the Department of Health & Human Services (DHHS) for a determination. The planning authority are then required to follow the direction of the DHHS.

In the absence of formal legislation, it is recommended that a DDO be prepared at the time of the PC1 VFR approach and departure path and the transitional surface survey. Subsequently, the survey report is to be passed to the local government authority with advice that the approach and departure paths require protection and that any proposed development in the vicinity be referred to NSW Health Ministry of Health (Ministry). In essence, the DDO provides for a 30 m buffer below the approach and departure path and transitional surface, through which no obstructions are to penetrate. Refer to OIS.

Refer to NSWA for advice on the DDO format.

3.14.6 Curved Visual Flight Rules Approach/Departure Paths

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 ft should be avoided, and there should be no changes in direction below 500 ft at night.

3.14.7 Periodic Review of Obstructions

The relevant hospital, in association with NSWA should re-examine obstacles in the vicinity of approach/departure paths on at least an annual basis. This re-examination should include an appraisal of the growth of trees and new building constructions in close proximity to approach and departure paths. Hospitals must advise the ACC as soon as there is knowledge of any potential local obstructions such as cranes etc.

The NSWA will at its discretion, undertake periodic HLS safety audits at periods normally not exceeding 24 months.

3.14.8 Turbulence

Air flowing around and over buildings, stands of trees, terrain irregularities can create turbulence that may affect helicopter operations. Rotor downwash coming up against a close wall can also produce considerable turbulence and recirculation.

Turbulence from wind effect is usually more pronounced on aa elevated/roof top HLS, when compared with a HLS which is elevated 1.8m or more above the level of the roof top. The reason is that the turbulent effect of air flowing over the roof edge is minimised if the HLS is elevated.

Strong winds however can cause considerable up-drafting on the windward side of a building supporting an elevated HLS.

3.15 Airspace

Airspace above and around the relevant hospital is to be considered as it may be either within an aerodrome Control Zone and/or under a flight path involving airport Obstacle Limitation Surfaces (OLS) (also Known as Object Identification Surfaces). In the Sydney area, consideration of the CASA Building Control Regulations and the Sydney Kingsford Smith Airport OLS, Bankstown OLS, Camden OLS, Western Sydney Airport OLS and Richmond OLS are required. Further information on OLS for Sydney basin aerodromes may be found at: https://www.planningportal.nsw.gov.au/opendata/dataset/epi-obstacle-limitation-surface.Refer also to the MOS Part 139 - Aerodromes, Chapter 7. If infringements are likely, a submission is required and should be submitted to, and coordinated by, the Airport Design section at Sydney Airport Corporation Limited (SACL). Assessment will require input from a number of parties, including SACL, CASA, Airservices and the major airlines. Final determination is provided by the Federal Department of Infrastructure, Transport, Cities and Regional Development in Canberra.

Additional information may be found within the current Airservices ERSA, including advice on special helicopter routes in the Sydney area.

3.16 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.

Hospital-based HLS can be made more secure from the general public than landing areas in a nearby park or sports ground. Control of the public for HEMS activities can often involve not only ambulance but police, local government officers and/or local fire brigade. Such measures are unnecessary for a well-planned hospital-based HLS. Elevated HLS are more easily secured and have the added advantage of decreasing the noise impact of helicopter movements.

The design helicopter generates considerable rotor downwash that can easily topple people who are unsteady on their feet; and move substantial, unsecured objects. The responsible, attending hospital personnel are to ensure the safety of the HLS and to the greatest degree possible, nearby areas.

4 COMMISSIONING THE HLS

4.1 Design and Construction Advice

Hospital HLS are to be designed to meet the requirements of this policy document. It will be necessary for the design architects for each HLS project, to work closely with an aviation advisor with a sound knowledge of helicopter operations, in particular HEMS and helicopter landing site requirements. Close contact with the aviation advisor throughout the project will ensure that costly mistakes do not occur.

4.2 Building Commissioning

Throughout the design and construction phase, the design architect and construction engineer, are to liaise with NSWA. This may involve reviewing drawings, specifications and approach and departure path details prepared during the design phase. At an appropriate time, the nominated project director is to organise a meeting with the engineering project manager, the Deputy Director Helicopter Retrieval Service and the project's nominated aviation consultant. The overarching purpose is to test that the HLS is being delivered as specified.

As the project nears completion, the project director is to liaise with NSWA via the Deputy Director Helicopter Retrieval Service, to arrange for the HLS Safety and Compliance Acceptance Audit inspection. This inspection will be for the purpose of operational commissioning.

4.3 Operational Commissioning

The hospital HLS will be operationally commissioned via a HLS Safety and Compliance Acceptance Audit inspection. This inspection will include a review of specifications, and detailed testing of major systems including dimensions, surface coverings, markings, lighting, electrical equipment testing, emergency facilities, firefighting equipment, navigational aids, compliance certificates, and the HLS Operations Manual. A generic template for an Operations Manual is available from the Deputy Director Helicopter Retrieval Services. This template will be further developed to outline site specific requirements. A go-live checklist is provided at Appendix 2.

Each hospital HLS is required to hold a **HLS Operation Manual**. Under proposed incoming CASA legislation for HLS, CASA refer to this document as a HLS Exposition. The purpose of the HLS Operations Manual, is to document the personnel responsibilities, activities and procedures necessary for the efficient and safe operation of the Hospital HLS. The contents will include:

- relevant staff contact list including the hospital HLS officer and Airservices HLS reporting officer
- access to the HLS
- design criteria
- helicopter types in use and performance requirements

- HLS location information including coordinates and elevation
- HLS specifications including dimensions, weight limits, markings, lighting, and wind direction indicator advice
- HLS identification, orientation, and VFR approach and departure path information
- operation of HLS lighting system include PAL operations
- notification procedures of impending HEMS arrival
- clinical actions prior to arrival of the helicopter, on the HLS deck during loading/unloading of patients and within the hospital after a patient arrival
- HLS safety, firefighting and specialist equipment
- VFR approach and departure path PC1 survey information and biannual requirements
- any adjacent airspace restrictions
- daily HLS inspection Requirements
- aircraft pre-arrival HLS inspection requirements
- management of lighting, access to the deck and deck control during operations
- HLS weekly inspection
- HLS quarterly maintenance inspection requirements
- training of relevant staff in the use of and procedures associated with the use of the HLS
- HLS emergency procedures including emergency exits

The HLS will not be approved for operations until the Operations Manual has been signed off by the hospital and the staff appropriately trained and approved for their respective activities.

NSWA will provide a template to the relevant hospital to be used for the preparation of the HLS Operations Manual. It will be necessary for the hospital to liaise with the Deputy Director Helicopter Retrieval Service during the preparation period, to ensure that procedures are acceptable.

During the latter stages of the HLS construction, the health service using the template, should begin to document procedures relating to:

- the transfer in and out of patients using the HLS including security and clinical management issues
- arrangements for ‘overflow’ should the HLS not be available
- a schedule for the ongoing inspection and maintenance of the HLS.

Once the HLS has been accepted operationally by NSWA and ‘handed over’ to the health service, a series of test flights will be conducted by day and night. The health service will also implement staff training to ensure that local staff are equipped to manage their roles.

4.4 Operational Check Flights

Where possible during the HLS Safety and Compliance Acceptance Audit inspection process, helicopter check flights will be undertaken by both day and night, to test the functioning of the HLS lighting, test the PAL activation, familiarise the HEMS crew with the hospital and the HLS deck, and familiarise the hospital staff with the requires deck activities, and check the safety and firefighting equipment.

5 MONITORING AND MAINTAINING THE HLS

5.1 General

Hospital HLS are to be designed to meet the requirements of this policy document. It is essential that the facility is monitored and maintained to ensure that the safety of patients, staff and hospital assets is not compromised.

5.2 Schedules for monitoring and maintenance

The following tasks are only required where a HLS is located on a healthcare site. Three suggested checklists are included to assist LHDs to plan routine monitoring and maintenance of the HLS. LHD/ SHN facilities may choose to tailor the checklist their local needs

LHD/ SHN facilities manager (or equivalent) are designated as HLS Officers and are responsible for the three activities, which include:

- HLS Daily Inspection (refer Appendix 3)
- HLS Arrival and Departure Inspection Checklist (refer Appendix 4)
- HLS Three Monthly Maintenance Checklist (refer Appendix 5).

Should issues be detected, maintenance staff should raise the issue in the maintenance system and apply a criticality rating to the task.

6 APPENDIX LIST

Appendix 1: Abbreviations and Explanation of Terms

Abbreviations	
AC	United States of America Federal Aviation Administration Advisory Circular
ACC	Aeromedical Control Centre. (HQ Eveleigh). Responsible for control and tasking of the Helicopter Emergency Medical Service in NSW
ARO	Airport Reporting Officer
ADF	Automatic direction finder
AW139	Leonardo AW139 (the helicopter on which the design requirements are based)
AWIS	Automatic Weather Information Service
CAAP	Civil Aviation Advisory Publication (Australia)
CASA	Civil Aviation Safety Authority (Australia)
CAOs	Civil Aviation Orders (Australia)
CARs	Civil Aviation Regulations (Australia)
CASR	Civil Aviation Safety Regulations
DIFFS	Deck Integrated Fire Fighting System
DDO	Design Development Overlay
EC	Eurocopter (now Airbus)
ERSA	En Route Supplement Australia
FAA	Federal Aviation Administration, USA.
FATO	Final Approach and Take-Off Area = 1.5 x Length
FARA	Final Approach Reference Area
FMS	Fixed Monitor System
TLOF	Touchdown and Lift-off Area
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
HLSRO	HLS Reporting Officer
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
LEP	Local Environment Plan

LLA	Landing and Lift Off Area. Solid surface with undercarriage contact points + I x metre in all directions
LED	Light emitting diode
LPG	Liquid petroleum gas (in Bulk Storage Tank)
LSALT	Lowest safe altitude
LUX	The SI unit of illumination and luminous emittance, measuring luminous flux per unit area
MRI	Magnetic resonance imaging
MTOW	Maximum Take-off Weight
NASF	National Airports Safeguarding Framework
NDB	Non directional beacon providing a radio signal to an aircraft ADF
NETS	Newborn and paediatric Emergency Transport Service
nm	Nautical miles
NSWA	New South Wales Ambulance
NVG	Night vision goggles
OEI	One engine inoperative
OIS	Object identification surfaces
OLS	Obstacle Limitation Surface
PAL	Pilot activated lighting
PC1	Performance Class 1
PC2	Performance Class 2.
PC3	Performance Class 3
PAL (system)	Pilot activated lighting
RD	Main rotor diameter
RMI	Remote magnetic indicator (magnetic compass with flux valve system)
SARP	Standards and Recommended Practices developed by ICAO and promulgated in the Annexes to the Convention of International Civil Aviation
SACL	Sydney Airport Corporation Limited
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

Explanation of Terms	
Aircraft	Refers to both aeroplanes (fixed wing) and helicopters (helicopter).
HLS (Aerodrome) Reporting Officer	A health service nominated single point of contact for all non-clinical related hospital-based HLS matters, reporting to Airservices. Airservices us Australia's air navigation service provider.
Approach/Departure Path (VFR)	The flight track helicopters follow when landing at or departing from the FATO of a HLS. The VFR Approach/Departure path extends outwards from the edge of the FATO with an obstacle free gradient of 2.5º or 4.5% or 1:22 measured from the forward edge of the FATO (25m) , extending uniformly to a width of 150m , and to a height of 500 feet above the FATO at a distance of ~3,500m.
Category A	Category A with respect to helicopters means a multi-engined helicopter designed with engine and system isolation features specified in the applicable airworthiness codes and capable of operations using take-off and landing data scheduled under a critical engine failure concept that assures adequate designated surface area and adequate performance capability for continued safe flight or safe rejected take-off in the event of engine failure.
Design Helicopter	The Leonardo AW139 contracted to the NSWA. The type reflects the new generation Performance Class 1 helicopters used in HEMS and reflects the maximum weight and maximum contact load/minimum contact area. The overall length and rotor diameter are similar to the Bell 412 models.
Elevated Helicopter Landing Site (Heliport)	A HLS on a raised structure on land with a FATO and a TLOF surface 2.5m or higher above the ground in the immediate vicinity.
Exposure time	The actual period during which the performance of the helicopter with an engine inoperative in still air does not guarantee a safe forced landing or the safe continuation of the flight.
Final Approach	The reduction of height and airspeed to arrive over a predetermined point above the FATO of a HLS.
Final Approach and Take-off 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 take-off is initiated. FATO size is determined by the specification of the Design Helicopter and is set at 1.5 x length overall. The area of the FATO is 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)	An area of land or water, or an area on a structure on land, intended for use wholly or partly for the arrival or departure: (a) helicopters; or (b) a helideck; or (c) a heliport. For the purposes of this Policy the HLS refers to a hospital location. HLSs not located on hospital property are outside the scope of this Guideline.

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.
Heliport	HLS with associated infrastructure such as aircraft hangar, refuelling facilities etc.
Hospital Helicopter Landing Site (HHLS)	A HLS limited to serving helicopters contracted to NSW Health. Hospital-based HLS are located within the grounds of a hospital with easy trolley access to and from the hospital's critical care areas.
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 Lift-off Area** (**LLA**). A load-bearing, nominally paved area, normally located in the centre of the TLOF, on which helicopters land and lift off. Minimum dimensions are based upon a one 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. ICAO reference to overall length is "D".
Landing and Lift Off Area (LLA)	Also known as the **Landing Position**. A load-bearing, nominally paved area, normally located in the centre of the TLOF, on which helicopters land and lift off. Minimum dimensions are based upon a one 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.
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)	Performance Class 1 for a helicopter means the class of operations where, in the event of failure of an engine, performance is available to enable the helicopter 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 (PC2)	Performance Class 2 for a helicopter means the class of operations where, in the event of failure of an engine, performance is available to enable the helicopter to safely continue the flight except when the failure occurs early during the take-off manoeuvre or late in the landing manoeuvre, in which case a forced landing may be required.
Performance Class 2 with	Performance Class 2 operations can be designed to operate with a permitted exposure time for the periods where safe continuation of flight

exposure. (PC2 Exp)	or landing is not assured, or alternatively at all times with a safe forced landing capability. The policy recommendations for PC2 operations include the maximum permitted exposure time concept. See definitions below.
Performance Class 3 (PC3)	Performance Class 3 for a helicopter means the class of operations where, in the event of failure of an engine at any time during the flight, a forced landing: - in the case of a multi-engine helicopter, may be required; or - in the case of a single-engine helicopter, will be required.
Pilot Activated Lighting (PAL)	A PAL system utilises a ground-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.
Prior Permission Required (PPR) HLS	A HLS developed for exclusive use of the owner and persons authorised by the owner (i.e. a hospital-based emergency services HLS). To ensure the safety of the hospital as critical infrastructure, only helicopter contracted to Health and managed by NSW Ambulance may use the Hospital Helicopter Landing Site. In the event of uncertainty any requests from other users are to be forwarded to the Deputy Director Helicopter Retrieval Services for advice.
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.
Safety Net	Surrounds the outer edge of a rooftop or elevated HLS. It is to be a minimum of 1.5 metres wide, not project 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.
Shielded Obstruction	A proposed or existing obstruction that does **not** need to be marked or lit due to its close proximity to another obstruction whose highest point is at the same or higher elevation.
Standard HLS	A place that may be used as an aerodrome for helicopter operations by day and night.
Take-off	To accelerate and commence climb at the relevant climb speed.
Take-off Position	A load bearing, generally paved area, normally located on the centreline and at the edge of the TLOF, from which the helicopter takes off. Typically, there are two such positions at the edge of the TLOF, one for each of two take-off or arrival directions.
Touchdown and Lift-off Area (TLOF)	A load bearing, generally paved area, 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 one main rotor diameter of the 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, extends outwards at a slope of 2:1 (two units horizontal in one unit vertical) for a distance of ~75m 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 lit obstruction whose highest point is at the same or higher elevation.

Appendix 2: New or Re-opened HLS – Go live Checklist

Insert hospital name: ________________

Note: NSW Hospital Landing Sites cover a range of facilities and environments. Not all items apply to all hospitals. If uncertain Contact the Office of the Director Helicopter Operations, NSW Ambulance (AMBULANCE-Helicopters@health.nsw.gov.au).

New or Re-opened HLS – Go live Checklist		
All approach and departure flight paths have been reviewed and are appropriate with all relevant documentation updated and available.		
Name and Position	**Signature**	**Date**
Local Health District representative endorsement Name: Position:		
Independent Aviation Safety Auditor endorsement Name: Position:		
NSW Ambulance (Southern) Chief Pilot approval Name: Position:		
NSW Ambulance (Northern) Chief Pilot approval Name: Position:		
NSW Ambulance endorsement Name: Position:		

Appendix 3: HLS Daily Inspection Template

HLS Daily Inspection Checklist

Insert hospital name: ______________________

Note: NSW Hospital Landing Sites cover a range of facilities and environments. Not all items apply to all hospitals. If uncertain Contact the Office of the Director Helicopter Operations, NSW Ambulance (AMBULANCE-Helicopters@health.nsw.gov.au).

Date/Time: **Completed By:** **Position: Facilities Manager (or equivalent)**

HLS Daily Inspection Checklist	Yes	No
Keys		
Lift priority swipe card present		
HLS access key present		
HLS Deck / Landing Area		
HLS clear of any loose items		
Safety Net serviceable		
HLS lights functional check		
• FATO (final approach and take-off area)		
• TLOF (Touch down and lift-off area		
• Approach and departure paths		
• Windsock		
• Obstruction lights		
• Hospital HLS beacon		
• Flood lights (separate circuit)		
Functional manual check of pilot activated lighting (PAL) and flood lights circuit		
Windsock present and in good condition		
HLS Lift Lobby/Foyer		
All lifts serviceable		
Sliding doors serviceable		
Foyer is clean and equipment is stored correctly		
Motion sensor lights turn **ON** when entering foyer		
Trolley present and operational		
1 x full D portable oxygen cylinders present, and if NETS arriving 1x DAir		
PPE:		
• Disposable gloves present (small, medium, large)		
• Eye protection x 5 sets		
• Hand hygiene present • High visibility vest x 3		
Lobby lighting		
Air isolation button if present		

Fire Suppression Systems		
Fire extinguishers (lift lobby): • 1 x 90L Foam • 1 x CO_2 3.5kg • 1 x Dry Powder 9.0 g		
Fire extinguishers (lift lobby): • 1 x 90 Foam • 1 x CO_2 3,5kg • 1 x Dry Powder 9.0kg		
Fire blanket (lobby)		
Deck drains		
Deck integrated fire-fighting system (DIFFS) spray head x 19 (Lismore and Westmead Children's Hospitals only)		
Fire hose (lobby)		
Fire hydrant		

The results from the Daily Checklist are to be checked and recorded in the maintenance system with a criticality rating applied. Any issues identified are to be reported to the PFC or After Hours Nurse Manager for action. If any issues present a potential or actual risk to the helicopter operations, notify the Office of the Director Helicopter Operations, NSW Ambulance (AMBULANCE-Helicopters@health.nsw.gov.au).

Add Comments:

Appendix 4: HLS Arrival/Departure Inspection Template

HLS Arrival and Departure Inspection Checklist

Insert hospital name: ______________

Note: NSW Hospital Landing Sites cover a range of facilities and environments. Not all items apply to all hospitals. If uncertain Contact the Office of the Director Helicopter Operations, NSW Ambulance (AMBULANCE-Helicopters@health.nsw.gov.au).

Date/Time: **Completed By:** **Position: Facilities Manager (or equivalent)**

HLS Arrival and Departure Checklist	Yes	No
Keys		
Lift priority swipe card present		
HLS access key present		
HLS Deck / Landing Area		
HLS clear of any loose items		
Safety Net serviceable		
HLS lights functional check		
• FATO (final approach and take-off area)		
• TLOF (Touch down and lift-off area		
• Approach and departure paths		
• Windsock		
• Obstruction lights		
• Hospital HLS beacon		
• Flood lights (separate circuit)		
Functional manual check of pilot activated lighting (PAL) and flood lights circuit		
Windsock present and in good condition		
HLS Lift Lobby/Foyer		
Check lifts serviceable		
Sliding doors serviceable		
Foyer is clean and equipment is stored correctly		
Motion sensor lights turn **ON** when entering foyer		
Trolley present and operational		
1 x full D portable oxygen cylinders present, and if NETS arriving 1 x DX Air		
PPE:		
• Disposable gloves present (small, medium, large)		
• Eye protection x 5 sets		
• Hand hygiene present		
• High visibility vest x 3		
Lobby lighting **OFF**		
Air isolation button		

The results from the HLS Arrival/Departure Checklist are to be checked and recorded in the maintenance system with a criticality rating applied. Any issues identified are to be reported to the ED Clinical NUM. If any issues present a potential or actual risk to helicopter operations, notify the Office of the Director Helicopter Operations, NSW Ambulance (AMBULANCE-Helicopters@health.nsw.gov.au).

Add Comments:

Appendix 5: HLS Three Monthly Maintenance Inspection Template

Three Monthly Maintenance Checklist

Insert hospital name: ________________

Note: NSW Hospital Landing Sites cover a range of facilities and environments. Not all items apply to all hospitals. If uncertain Contact the Office of the Director Helicopter Operations, NSW Ambulance (AMBULANCE-Helicopters@health.nsw.gov.au).

Date/Time: **Completed By:** **Position: Facilities Manager (or equivalent)**

HLS Three Monthly Maintenance Checklist	Yes	No
Keys		
Lift priority swipe card present		
HLS access key present		
HLS Deck		
Surface undamaged		
Painted marking serviceable (check for peeling or loose paint)		
Tie down serviceable if present		
Safety net and attachments serviceable		
HLS lights functional check		
• FATO (final approach and take-off area)		
• TLOF (Touch down and lift-off area		
• Approach and departure paths		
• Windsock		
• Obstruction lights		
• Hospital HLS beacon		
• Flood lights (separate circuit)		
Functional manual check of pilot activated lighted (PAL) and flood lights circuit		
Lower windsock and inspect for condition		
Windsock swivel bearing lubricate		
Windsock illumination lights serviceable		
Windsock obstruction light serviceable		
Hospital HLS beacon service as necessary		
HLS Lift Lobby/Foyer		
Check lifts serviceable		
Sliding doors serviceable		
Motion sensor lights turn **ON** when entering foyer		
PAL controller serviceable		
Manual PAL override serviceable		
Flood light serviceable		
Lobby lighting serviceable		
Carbon filter bypass switch serviceable		

Fire Suppression Systems (all to be confirmed in-date and serviceable)		
Fire extinguishers (lift lobby):		
• 1 x 90L Foam		
• 1 x CO_2 3.5kg		
• 1 x Dry Powder 9.0kg		
Fire extinguishers (emergency stairs):		
• 1 x 90L Foam		
• 1 x CO_2 3.5kg		
• 1 x Dry Powder 9.0kg		
Fire blanket		
Fire hose (lobby)		
Fire hydrant		
Deck drains		
Deck integrated fire-fighting system (DIFFS) spray heads x 19 confirm serviceable (Lismore and Westmead Children's Hospitals only)		
DIFF storage tank, pump and plumbing functional check and confirm 20,000L. water tank full (Lismore and Westmead Children's Hospitals only)		
DIFFs diesel pump engine serviceable, with lubricants and fuel satisfactory		
Fuel/water separator and plumbing serviceable		

The results from the Three Monthly Maintenance Inspection are to be checked and recorded in the maintenance system with a criticality rating applied. Any issues identified are to be reported to the ED Clinical NUM. If any issues present a potential or actual risk to the helicopter operations, notify the Office of the Director Helicopter Operations, NSW Ambulance (AMBULANCE-Helicopters@health.nsw.gov.au).

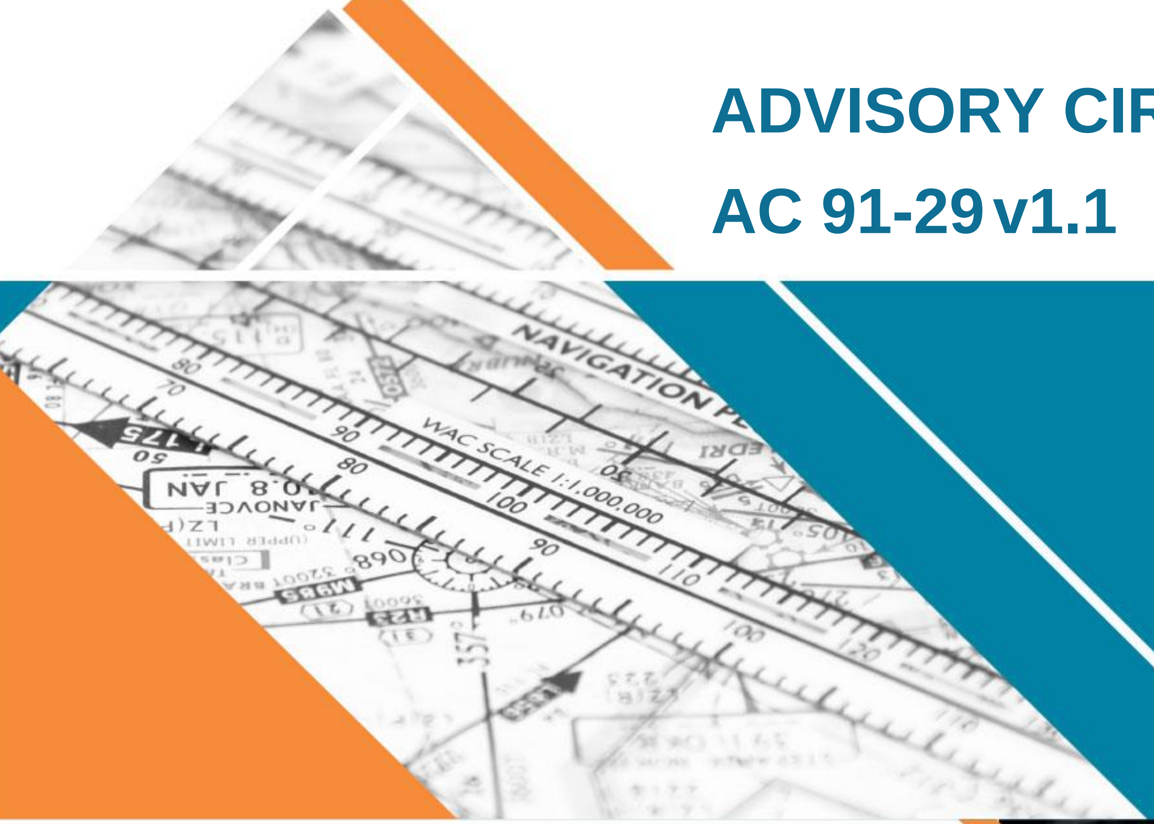
A copy of the completed Three Monthly Maintenance Checks should be sent to the Office of the Director Helicopter Operations, NSW Ambulance (AMBULANCE-Helicopters@health.nsw.gov.au)

Add Comments:

Australian Government
Civil Aviation Safety Authority

ADVISORY CIRCULAR

AC 91-29 v1.1



Guidelines for helicopters - suitable places to take off and land

Date	July 2022
Project number	OS 99/08
File ref	D22/229533

Audience

This advisory circular (AC) is for pilots and operators of helicopters.

Purpose

This AC provides guidance to assist pilots in assessing the suitability of a place for a helicopter to safely take off and land. It provides an overview of the pilot's responsibilities and discusses some, but not all, circumstances, including prevailing weather conditions, that are recommended to be considered. It also provides general information and advice to enhance the safety of taking off and landing at any place.

While this AC primarily highlights general principles related to the selection and use of places for helicopters to take-off and land, it does not cover the application of the rotorcraft performance class rules required to be used by an Australian air transport operator under Part 133 or able to be used by a person conducting an aerial work operation under Part 138.

For locations that are not certified aerodromes, the pilot may not be able to solely rely on published information and may need to seek information from the owner or operator of the land in question to ensure a safe outcome.

The pilot in command (PIC) is ultimately responsible for the safe conduct of their flight. In some circumstances, the responsibility is shared with the aircraft operator, particularly in air transport operations. CASA recommends that pilots and operators (where applicable) consider the advice in this AC when determining whether it is safe to take off from or land at any place/aerodrome.

For further information

For further information, contact CASA’s Flight Standards Branch (telephone 131 757 or email flightstandards@casa.gov.au).

Unless specified otherwise, all subregulations, regulations, Divisions, Subparts and Parts referenced in this AC are references to the *Civil Aviation Safety Regulations 1998 (CASR)*.

Status

This version of the AC is approved by the Branch Manager, Flight Standards.

Note: Changes made in the current version are annotated with change bars.

v1.1	July 2022	This revision replaces the existing references to ICAO Annex 14 in relation to heliport standards with reference to the new AC 139.R-01 *Guidelines to heliports - design and operation* and amends the definition for "Heliport".
v1.0	October 2021	Initial AC. This AC supports regulation 91.410 and replaces helicopter operational information in CAAP 92-2(2) from 2 December 2021 when the CAAP will be repealed.

Contents

1 Reference material

1.1 Acronyms

The acronyms and abbreviations used in this AC are listed in the table below.

Acronym	Description
AC	advisory circular
AFM	aircraft flight manual
AGL	above ground level
AWIS	Aerodrome Weather Information Service
CASR	*Civil Aviation Safety Regulations 1998*
D	D (see Definitions)
DLB	Dynamic Load Bearing
EASA	European Aviation Safety Agency
FAR	*Federal Aviation Regulations* of the United States of America
FATO	final approach and take-off area
HIGE	hover in ground effect
HLS	helicopter landing site
HOGE	hover over ground effect
ISA	International Standard Atmosphere
ICAO	International Civil Aviation Organization
LDR	landing distance required
LSALT	Lowest Safe Altitude
MLW	maximum landing weight
MOS	Manual of Standards
MTOW	maximum take-off weight
NAA	National Aviation Authority
OEI	one engine inoperative
PA	pressure altitude
PIC	pilot in command
POH	pilot operating handbook
QNH	regional or airfield pressure setting
RD	Rotor Diameter
TD/PM	touchdown/positioning marking
TLOF	touchdown and lift-off area

Acronym	Description
TODR	take-off distance required
VMC	visual meteorological conditions

1.2 Definitions

Terms that have specific meaning within this AC are defined in the table below. Where definitions from the Regulations have been reproduced for ease of reference, these are identified by grey shading. Should there be a discrepancy between a definition given in this AC and the Regulations, the definition in the Regulations prevails.

Term	Definition
Basic HLS	a place that may be used as an aerodrome for infrequent, opportunity and short-term operations other than Air Transport operations by day under helicopter Visual Meteorological Conditions (VMC).
D	for a rotorcraft, means the maximum dimensions of the rotorcraft
Final approach and take-off area (FATO)	for the operation of a rotorcraft at an aerodrome, means the area of the aerodrome: a. from which a take-off is commenced; or b. over which the final phase of approach to hover is completed
Helicopter Landing Site (HLS)	means an aerodrome, including a heliport, intended for use wholly or partly for the arrival, departure or movement of helicopters and where designed to and capable of accommodating them, other rotorcraft.
Heliport	A helicopter landing site that meets or exceeds the specifications contained in AC 139.R-01 0 Guidelines for heliports - design and operation.
Lift-off	in relation to a helicopter, means to raise the helicopter from a position of being in contact with the surface of the HLS into the air.
Secondary HLS	A place suitable for use as an aerodrome for helicopter operations by day or night that does not conform fully to the standards for a heliport set out in AC 139.R-01 0 Guidelines for heliports - design and operation.
Take-off	in relation to a flight of a helicopter from a HLS, means the phase of flight where the helicopter accelerates into forward flight and commences climb at the relevant climb speed, or if not intending to climb, enters level flight for the purposes of departure from the helicopter landing site.
RD	means the diameter of the main rotor with the engine/s running.
Touchdown	means lowering the helicopter from a flight phase not in contact with the surface of the HLS into a position which is in contact with the surface of the HLS for a landing.
Touchdown and Lift-off Area (TLOF)	touchdown and lift-off area and is the surface over which the touchdown and lift-off is conducted. .
R	for a rotorcraft, means the largest radius of the rotorcraft's main rotor disc, as mentioned in the rotorcraft's flight manual.
$V_{TOSS\ (FAA)}$	means take-off safety speed for a category A rotorcraft
V_{TOSS} (Part 133)	V_{TOSS}, for a rotorcraft, means the minimum speed at which climb of the rotorcraft is achieved with 1 engine inoperative and the remaining engines

Term	Definition
	operating within the operating limits mentioned in the rotorcraft's flight manual for a take-off.
V_X	best angle of climb speed the airspeed at which the aircraft gains the greatest amount of altitude in a given distance.
V_Y	best rate of climb speed–the airspeed that provides the most altitude gain in a given period of time.

1.3 References

Legislation

Legislation is available on the Federal Register of Legislation website https://www.legislation.gov.au/

Document	Title
Civil Aviation Act 1988	
Part 91	General operating and flight rules
Part 133	Australian air transport operations – rotorcraft
Part 139	Aerodromes

Advisory material

CASA's advisory materials are available at https://www.casa.gov.au/publications-and-resources/guidance-materials

Document	Title
AC 139.R-01	Guidelines for heliports - design and operation

Other material

International Civil Aviation Organization (ICAO) documents are available for purchase from http://store1.icao.int/

Document	Title
AIP Australia	Aeronautical Information Publication
EASA	Off Airfield Landing Site Operations
FAA-H	Helicopter Flying Handbook
FAR Part 27	Airworthiness Standards: Normal Category Rotorcraft
FAR Part 29	Airworthiness Standards: Transport Category Rotorcraft
ICAO Annex 14 Volume II	Heliports

2 Introduction

2.1 Definition of aerodrome in the Civil Aviation Act

2.1.1 The *Civil Aviation Act 1988* defines an *aerodrome* as 'an area of land or water (including any buildings, installations and equipment), the use of which as an aerodrome is authorised under the regulations, being such an area intended for use wholly or partly for the arrival, departure or movement of aircraft'.

2.1.2 This means any place able to be taken off from, or landed at, in accordance with the regulations, is an aerodrome if authorised by the legislation for use as an aerodrome. Terms such as *landing place* or *authorised landing area* are not used in the regulations. For a place that is not a certified or registered aerodrome, a place is authorised for use as an aerodrome by regulation 91.410 if it is suitable for the landing and taking-off of aircraft.

2.1.3 For example:

- A body of water used by a float equipped helicopter is an aerodrome if it is a place that is suitable for the landing and taking-off of aircraft.
- A carpark or football oval used by a helicopter is an aerodrome if it is a place that is suitable for the landing and taking-off of the helicopter.
- The side of the road at a car accident site used by a medical transport helicopter is a specifically defined aerodrome, known as a medical transport operating site, if it is a place that is suitable for the landing and taking-off of aircraft.

2.2 Use of aerodromes

2.2.1 Regulation 91.410 authorises a place for use as an aerodrome if it is suitable for the landing and taking-off of aircraft and that the aircraft can land at or take off from the place safely, having regard for all of the circumstances of the proposed landing or take-off including the prevailing weather conditions.

2.2.2 Because helicopters are operationally extremely versatile compared to aeroplanes, not every departure or arrival location will be from either an AC 139.R-01 compliant surface level, elevated heliport, helideck, or a normal aerodrome based on a runway with a protected obstacle environment.

2.2.3 The generic term for an aerodrome for helicopter operations is a helicopter landing site (HLS). Operations to HLS that are not purpose-built present safety challenges to the (PIC) which have to be considered, risk assessed and managed by the PIC for safe operations.

2.2.4 When taking off or landing, different helicopters often have similar generic operational considerations although the specific requirements may differ for particular designs, such as single engine verses multi-engine capability. For example, final approach and take-off area (FATO) length and width and obstacles in the take-off and initial climb phase or the approach and landing phase are common considerations, but what specifically constitutes a safe FATO length and width is usually different for different helicopter types, especially when other circumstances are taken into account (such as category A capability or the need for avoidance of the avoid area of the HV diagram).

Transport/large helicopters often have more stringent requirements in their aircraft flight manual (AFM) compared to normal/small helicopter types.

2.2.5 On any day, a place previously considered suitable may become unsuitable due to changes in prevailing weather conditions.

2.2.6 There is no legal obligation on helicopter pilots operating solely under Part 91 to apply safety margins to the take-off or landing distance, take-off performance and obstacle avoidance ability which has been determined when using the helicopter manufacturer's data.

2.2.7 A safety margin can be applied by ensuring required distances are greater than required by a set distance, or the take-off weight is limited to a percentage less than the MTOW for the requirements of the day and location, or power requirements and ensuring performance is available to allow obstacles to be avoided by an adequate vertical margin appropriate for the helicopter.

2.2.8 Pilots are required under regulation 91.055 to operate the aircraft in a manner that does not create a hazard to another aircraft, a person or property. Therefore, pilots should remain cognisant that, due to various circumstances, the aircraft may not meet the manufacturer's optimum performance standards during normal operations.

2.2.9 It is recommended that reasonable safety margins be applied to a helicopter's performance requirements that make allowance for the potential for degraded performance or degraded pilot reaction time and which allow enhanced manoeuvrability of the aircraft, particularly where there is potential for a hazard to be created to third parties not associated with the operation.

Note: See the standard safety margins recommended for smaller helicopter below in Table 1, Section 8.

Note: For smaller helicopters, where the information available to the pilot can sometimes be quite non-specific or not fully available, the use of reasonable safety margins is extremely important.

2.3 HLS size characteristics

2.3.1 The helicopter is one of the more versatile kinds of aircraft and can, if required under special and rare circumstances, operate to and from a space little larger than its overall D. The smaller the HLS, and the less knowledge a pilot / operator has about the hazards presented by obstacles and surface conditions, the greater the risk associated with its use. The risk presented by such hazards can be reduced when:

- the size of the defined areas of the HLS are greater than the minimum required size
- the pilot-in-command has access to accurate, up-to-date information about the site, which is presented in a suitable and easily interpretable form
- visual information, cues and positional markings are present for the defined areas at the site.

2.3.2 Defined areas are the basic building blocks of a HLS. They are based on the basic design requirements of a compliant AC 139.R-01 heliport but can be applied to any place to be used as a HLS from the perspective of the applicability of their attributes. Defined areas have a set of attributes that persist even when co-located or coincidental with another defined area. In such cases, the defined area with the more limiting standard would apply.

2.3.3 Defined areas belong to one of four main categories:

- FATO – the area over which the final approach is completed, and the take-off conducted.
- Touchdown and lift-off area (TLOF) – the surface over which the touchdown and lift-off is conducted.
- Stand(s) – the area for parking and within which positioning takes place.
- Taxiways and associated taxi routes – the surfaces and areas for ground or air taxiing.

2.3.4 A defined area on a landing site may have one or more of three basic attributes:

a. **Containment** – an attribute that affords protection to the overall helicopter and its undercarriage and permits clearance from obstacles to be established. Containment is of two types: undercarriage containment and helicopter containment. Where a defined area (such as a TLOF or taxiway) provides only undercarriage containment, it should be situated within, or co-located with, another defined area (i.e., a FATO, stand or taxi-route). This additional defined area will provide protection to the overall helicopter.

b. An **additional safety/protection area**:
   i. for a FATO – a safety area surrounds the FATO and compensates for errors in manoeuvring, hovering and touchdown
   ii. for a stand – a protection area surrounds the stand and compensates for errors of manoeuvring
   iii. for a taxiway – a protection area incorporated in the taxi-route, which compensates for errors of alignment and/or manoeuvring.

c. **Surface loading capability** – this attribute ensures adequate surface strength to permit a helicopter to touchdown, park or ground taxi without damage to the surface of the HLS or helicopter. Surface loading is either:
   i. static – where only the mass of the helicopter is considered, although elevated heliports/helidecks may include additional factors to protect the building/structure

   or

   ii. dynamic – where the apparent weight (i.e., a force comprised of multiples of gravitational force) of the helicopter is used. Two types of dynamic loading need to be considered:
      A. dynamic loading due to normal operations.
      B. dynamic loading due to a heavy landing, determined by an ‘ultimate limit state’ test (i.e., touchdown at a rate of descent of 12 ft/s for surface-level heliports).

2.4 Types of aerodromes for use of helicopters

2.4.1 From a high-level perspective, from highest level of safety assurance to lowest level of safety assurance, these are the common kinds of HLS:

- AC 139.R-01compliant heliport
- Secondary HLS: a HLS that does not fully conform to AC 139.R-01 standards but meets the recommended standards outlined in section 2.4.2 below

  Note: The specific lack of conformance is normally individual to the specific location, but could include matters such as a lack of, or different, markings, different lighting specifications or different limited obstacle environments.

- Basic HLS: a HLS that does not meet the Secondary HLS recommended standards.

2.4.2 Secondary HLS

2.4.2.1 The term 'secondary HLS' is not defined in the regulations.

2.4.2.2 For a HLS to be categorised as a secondary HLS, it is recommended that it meet the following standards:

- The FATO should, at a minimum, be:
  - o capable of enclosing a circle with a diameter equal to one-and-a-half times the D-value (1.5 x D) of the largest helicopter intended to use the site
  - o capable of including a safety area extending a distance of at least 0.25 x D or 3 m around the FATO, whichever is larger
  - o free of obstacles
  - o provide ground effect
  - o capable of at least dynamic load bearing (DLB) for the helicopters being operated.
- The TLOF, being a clear and stable area capable of bearing the dynamic loads which may be imposed by the helicopter on the site by a heavy landing, should, at a minimum, be an area at least 0.83 x D and may or may not be located within the FATO.

  Note: If the TLOF is not located within the FATO, it will need to be protected by an additional safety/protection area such as a stand.

- Stands should be of sufficient size to contain a circle with a diameter of at least 1.2 x D, plus a 0.4 x D protection area for the largest helicopter that the stand Is intended to serve.
- No fixed objects should be permitted within the stand and protection area and all non-essential moveable objects should be removed, so as to not present a hazard.
- Approach and departure paths should be in accordance with the AC 139.R-01 recommendations and take into account matters such as, but not limited to, approach and take-off climb surfaces lengths and slopes.
- There should be a minimum of two approach and departure paths.

  Note: CASA does not recommend operations to mobile platforms on land as this is an operator-based aircraft manoeuvring decision, and guidance on operations to these appliances is not given in this AC. The use of ground handling appliances should normally be limited to pre-start and post-shutdown actions and comply with AFM requirements.

2.4.2.3 From an operational perspective, unlike a basic HLS, a secondary HLS:

- is recommended for use in night operations in addition to day operations
- is recommended for use in air transport operations
- includes touchdown/positioning markings (TD/PM) which provide the visual cues that permit a helicopter to be placed in a specific position and, when necessary, orientated such that, when the pilot's seat is above the marking the undercarriage will be inside the load-bearing area and all parts of the helicopter will be clear of any obstacles by a safe margin.

2.4.3 Basic HLS

2.4.3.1 The term 'basic HLS' is not defined in the regulations.

2.4.3.2 For the purposes of this AC, it is a HLS that, by its lack of design elements, or its lack of operational information, does not provide the safety margins of a secondary HLS and therefore increases operational risk. It is recommended that pilots and helicopter operators carry out thorough risk and hazard assessments for a proposed operation to a basic HLS and apply appropriate controls to any hazards identified during this process.

2.4.3.3 It is recommended that passengers, crew and operational personnel carried into a basic HLS should be briefed on the hazards of the site and any site-specific safety procedures needed to ensure safe loading and unloading at the HLS.

2.4.3.4 To use a basic HLS, it is recommended that the HLS:

- be large enough to incorporate a safety margin, on top of the absolute minimum size required to accommodate the helicopter, sufficient to enable the safe conduct of the proposed operation

  Note: The size of the safety margin is recommended to be determined via a specific risk assessment conducted by the PIC or the operator.

- have a TLOF with surface characteristics that are strong enough to withstand the dynamic loads imposed by the helicopter

  Note: Dynamic load bearing capability assumes all static load limits imposed by the helicopter and any other structure or vehicle will also be met. Operators and pilots should ensure this is the case prior to using the site.

- have sufficient obstacle free approach and departure gradients to provide for safe helicopter operations into and out of the site under all expected operational conditions
- have approach and departure paths that:
  - minimise the exposure of the helicopter to meteorological phenomena which may endanger the aircraft, and
  - provide escape flight paths that, if a non-normal situation arises, maximise the potential for using suitable forced landing areas
- only be used for day operations where the weather is VMC.

3 Explanation of aerodrome suitability considerations

3.1 Overview

3.1.1 The suitability of an aerodrome (which is a helicopter landing site (HLS) however defined) depends on many factors, including its characteristics, the surrounding terrain and obstacles, the helicopter being used, as well as the pilot's formal qualifications and personal skills.

3.1.2 A pilot is authorised by virtue of their licence to assess these factors before deciding whether a particular flight or movement should take place. If a pilot fails to discover or consider any significant factor affecting the safety of a take-off or landing, they may contravene regulation 91.410.

3.1.3 For helicopters, there are many aerodromes all around Australia whose information is not published in any guide. Obtaining information about these aerodromes can be difficult, and pilots should take every available step to satisfy themselves of the suitability of the aerodrome.

3.1.4 Some aerodromes may be managed by persons who have limited ability to assess the aerodrome's operational status. A pilot could obtain information from the manager of such an aerodrome but not have full confidence in the quality of the information received.

3.1.4.1 HLS surfaces can be highly variable. Some examples are concrete, bitumen, coral, gravel, soil, grass on soil or sand, hard-packed sand or a dry salt-lake. Each of these kinds of surfaces has its own characteristics, many of which vary with the weather and season.

3.1.4.2 In the case of natural surfaces, the soil's moisture content could give rise to subsurface softness and inability to sustain dynamic loads. Except for beach sand, a very wet surface almost invariably gives rise to an unsatisfactory surface. Grass density and length will have a significant effect on the pilot's ability to detect obstructions, holes, water, stones, anthills, erosion trenches or loose objects that could cause damage to engines or rotor systems. Landing on dry grass or vegetation in some helicopters can be a serious fire hazard.

3.2 Legal considerations

3.2.1 Performance

3.2.1.1 The rules relating to take-off and landing performance are contained in Chapters 24 and 25 of the Part 91 Manual of Standards (MOS). A closely related requirement are the rules associated with take-off and landing minima which are contained in Chapter 15 of the Part 91 MOS.

3.2.1.2 It should also be noted that if a HLS is located in a populous area and the HLS is not a certified aerodrome or a place used for the regular take-off and landing of aeroplanes, then specific take-off performance and landing performance requirements apply which can be found in sections 24.04, 24.05, 25.04 and 25.05 of the Part 91 MOS.

3.2.2 Local rules

3.2.2.1 There may be other local legislation that also applies to operations at a HLS. It is the responsibility of pilots and operators to check and adhere to any local rules.

3.2.3 Noise or environmental considerations

3.2.3.1 Where noise or other environmental considerations make helicopter operations undesirable, the proposal may be subject to the provisions of the Commonwealth Environment Protection (Impact of Proposals) Act 1974 and parallel State legislation.

3.3 Ambient conditions

3.3.1 Overview

3.3.1.1 There is a strong correlation between satisfactory helicopter performance and the correct assessment and application of environmental factors. It should be of utmost importance when planning to operate to or from an area, whether the area is prepared or unprepared, that careful performance consideration is given in relation to the MTOW of the rotorcraft and the accurate assessment of prevailing ambient conditions.

3.3.2 Wind speed and direction

3.3.2.1 Regulation 91.380 requires the pilot to take off and land into wind to the extent practicable unless the aircraft flight manual/pilot operating handbook (AFM/POH) allows the aircraft to land or take off downwind or crosswind, and the pilot is satisfied that traffic conditions at the aerodrome enable such a landing or take-off to be carried out safely. Even if downwind operations are permitted by the AFM CASA does not recommend operations with a downwind component for take-off or landing. Pilots must at all times remain aware of the impacts on performance of downwind operations and in particular the effect of turn from into wind to downwind operations at low airspeed and low level.

3.3.2.2 Pilots should be aware that wind affects hover, take-off and climb performance. Headwinds are most desirable as they contribute to the greatest increase in performance. Crosswinds and tailwinds require more tail rotor thrust to maintain directional control. This increased tail rotor thrust means there is less power available to the main rotor to produce lift. When taking off into a headwind, effective translational lift is achieved earlier, resulting in more lift and a steeper climb angle. When taking off with a tailwind, more distance is required to accelerate through translation and results in a faster run-on speed in the event of an engine failure on take-off. Therefore, downwind operations are not recommended.

3.3.2.3 For non-controlled aerodromes, and aerodromes without an Aerodrome Weather Information Service (AWIS), pilots will need other visual cues to determine the take-off and landing direction. The windsock has, for many years provided pilots with wind direction and strength at the aerodrome surface.

3.3.2.4 While other systems are now routinely available to pilots that provide wind information, considerable useful information can be obtained by observing the windsock(s) before taking off or landing.

Note: It is recommended that, where possible, pilots observe and interpret the behaviour of a relevant windsock prior to taking off or landing.

3.3.2.5 Windsock interpretation:

a. A windsock at a 45º angle to the horizontal indicates a windspeed of approximately 15 kts.
b. A windsock that is horizontal indicates a windspeed of 25–30 kts.
c. A windsock at a 30º angle to the direction of the runway indicates that half of the total windspeed will be crosswind.
d. A windsock at a 45º angle to the runway indicates at least a 15 kt crosswind.
e. Gusting conditions will be indicated by the windsock varying rapidly in direction or angle. These conditions should be treated with caution.

Note: Pilots are recommended to consider both the possibility and effects of wind shear, and whether the conditions remain within the maximum crosswind limit of the aircraft.

3.3.2.6 Where two windsocks are available, a difference in direction or speed between them can show a transient change or the influence of mechanical interference, such as trees or buildings. It is not unusual during the passage of frontal weather to have windsocks at either end of the runway showing completely opposite wind directions.

3.3.2.7 At uncertificated aerodromes, it is recommended that, prior to flight, pilots establish whether there are any windsocks and whether they are functional. Windsocks at uncertificated aerodromes do not need to meet Part 139 standards; therefore, they may not be able to be interpreted in accordance with the guidance in these paragraphs.

3.3.2.8 When operating into unfamiliar uncertificated aerodromes or HLSs, it is recommended that, in addition to windsocks, pilots use secondary methods to judge the windspeed and direction, such as observing aircraft drift, tree movements, glassy water on dams, directions of windmills, blowing dust or smoke.

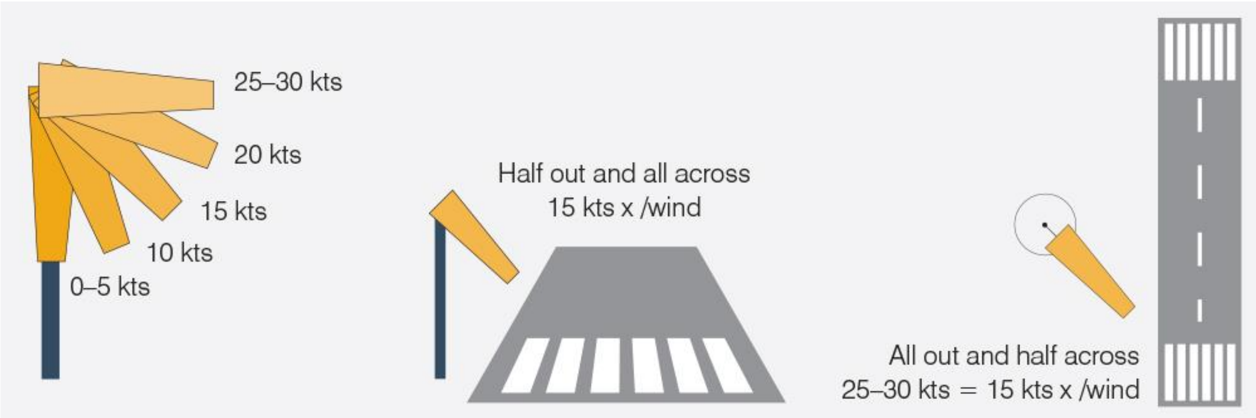


Figure 1: Windsock interpretation

3.3.3 Pressure altitude considerations

3.3.3.1 Pressure altitude (PA) is the height above a standard datum, which is a theoretical level where the pressure of the atmosphere is 1013.2 hectopascals (hPa) as measured by a barometer. An altimeter is essentially a barometer calibrated to indicate altitude in the International Standard Atmosphere (ISA). As the atmospheric pressure changes, the standard datum may be below, at or above sea level. Pressure altitude is important as a basis for determining aircraft performance.

3.3.3.2 The reduction of ambient air pressure with height increases the true air speed (TAS) required for a given indicated air speed (IAS), which affects take-off and landing distance requirements.

3.3.3.3 The pressure altitude for an aerodrome can be determined using two methods:

a. With the aircraft parked on the aerodrome, set the barometric scale of the altimeter to 1013 hPa. The indicated altitude read is the pressure altitude.
or

b. Applying a correction factor to the aerodrome altitude above sea level according to the reported sea level pressure.

3.3.3.4 Put simply, pressure altitude is the height above the ISA datum of 1013 hPa.

3.3.3.5 To determine pressure altitude at a sea level aerodrome, apply the regional or airfield pressure setting (QNH) to the aerodrome elevation as compared to 1013h Pa. A 1 000 ft aerodrome elevation with a QNH of 1003 hPa would be 10 hPa above 1013. Where 1hPa is equal to approximately 30 ft, 10h Pa x 30 ft gives a pressure altitude of 300 ft above the aerodrome elevation (or 1 300 ft above 1013 hPa). Refer to Figure 3 below.

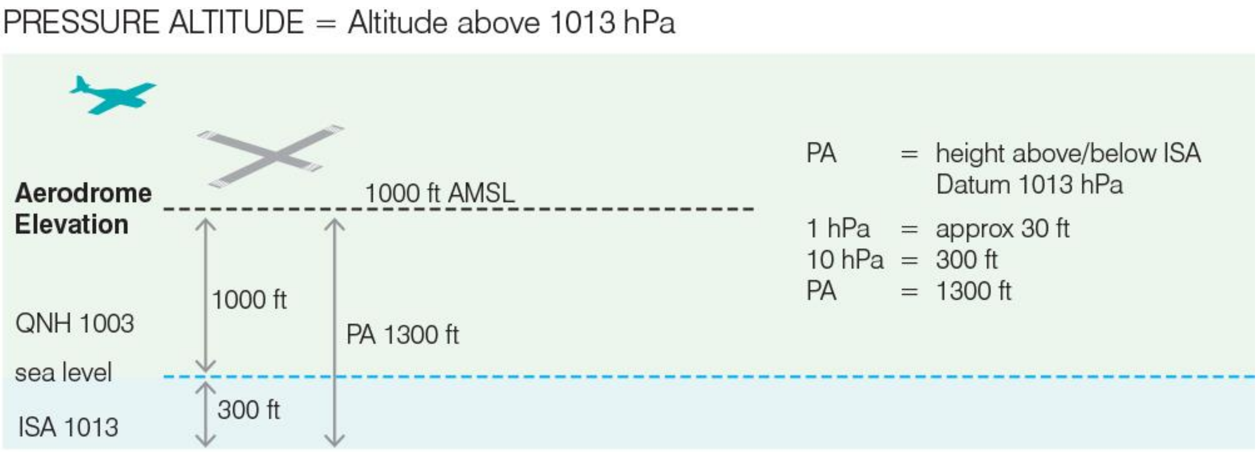


Figure 2: Pressure altitude calculation

3.3.3.6 As stated above, without making the above calculation, a pilot is also able to read pressure altitude on the altimeter for the aerodrome (1 300 ft) of the aircraft at the aerodrome directly by setting standard pressure 1013 hPa on the altimeter subscale.

3.3.4 Density altitude considerations

3.3.4.1 It is imperative pilots are aware that the hotter the day gets, the greater the decrease in air density. This decrease in air density markedly reduces engine power output, and aerodynamic performance. This effect can be delayed if an aircraft is fitted with a turbocharger or by using derated engines, which can maintain performance to higher density altitudes. However, in all cases with an increase in temperature, not only is engine power reduced, but the volume or density of the air over the aerofoil that generates lift is reduced.

3.3.4.2 The term for correlating aerodynamic performance in the non-standard atmosphere is density altitude. That is, the altitude in the standard atmosphere corresponding to a particular value of air density.

3.3.4.3 Density altitude can be determined by correcting the outside air temperature (OAT) compared to the ISA temperature value against the aerodrome elevation. With a higher than normal ambient temperature, the aircraft performance will be less than that of a standard ISA temperature. Conversely, if it is colder, the performance will be improved.

3.3.4.4 Determining the aircraft take-off or landing performance is predicated on knowing the density altitude. The pilot does not always have to make a separate density altitude calculation because take-off and landing performance charts normally provide integral solutions for density altitude through entries of pressure altitude and temperature.

3.3.4.5 However, experimental aircraft do not always have performance charts that allow for the of performance when operating in other than ISA conditions. Although some pilot operating handbook (POH) suggest corrections are to be made, the pilot is often left with scant information to make such determinations. Pilots should be acutely aware of the performance loss at high-density altitudes and apply factors to make allowance for the variation to the take-off and landing performance in these conditions when compared to ISA conditions.

3.3.4.6 Density altitude can be determined by applying an ambient temperature correction to the pressure altitude. Each 1°C variation from ISA is equivalent to a 120 ft variation in density altitude. Thus, for a 1 000 ft aerodrome elevation in the example above having a 1 300 ft PA, ISA equals approximately 12°C. If the aerodrome has a 30°C outside air temperature, this is 18°C hotter than ISA. Therefore, 120 x 18 equals 2 160 ft, plus PA 1 300 ft, equals a density altitude of 3 460 ft. So, the performance of the aircraft will be degraded. It will perform as if the aircraft were at 3 460 ft and not at 1 000 ft aerodrome level.

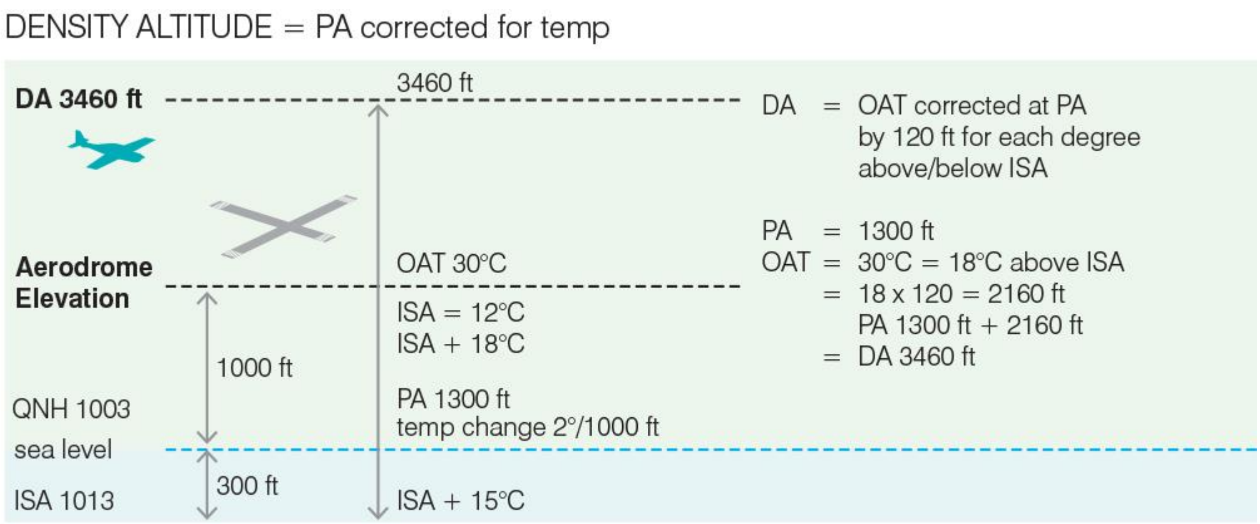


Figure 3: Density altitude calculation

3.3.5 Humidity

3.3.5.1 Performance data for smaller aircraft does not usually include a humidity correction, but pilots should be aware that all engines are adversely affected to some degree by high humidity. This is due to water vapour displacing oxygen, thus reducing the temperature rise during combustion. If a helicopters documentation provides relevant information related to humidity, the pilot should allow for the effects of humidity during operation.

3.3.5.2 Remember that, when operating at high density altitudes and weights, the ‘four Hs’ (High, Hot, Heavy, and Humid) all combine to reduce helicopter performance.

3.3.6 Light conditions

3.3.6.1 Pilots should not underestimate the difficulties associated with taking off or landing directly into a low sun and should take into consider, haze, smoke or low light when manoeuvring in the vicinity of an aerodrome or looking for other traffic. If a take-off or landing into the sun is known to be likely, it is recommended that the pilot ensure the windscreen is clean for all operations.

3.4 Weight altitude temperature (WAT) limitations

3.4.1 It is important to remember there is more to performance than the ability to take off and land within the space available. Terrain and obstacles must be cleared after take-off and during the approach to land.

3.4.2 For FAR Part 27certified helicopters, the take-off distance in the AFM has been determined from the commencement of the take-off to climb over a 50 ft obstacle. For landing, the horizontal distance required to land and come to a complete stop from 50 ft above the landing surface. For a helicopter certified under FAR Part 29, the normal take-off distance is the horizontal distance along the take-off path from the start of the take-off to the point at which the helicopter attains and remains at least 35 ft above the take-off surface, attains and maintains a speed of at least V_{TOSS}, and establishes a positive rate of climb, whilst landing distance is the same for Part 27.

3.4.3 To ensure that climb performance does not fall below prescribed certification minimums, most AFMs give take-off and landing weights that should not be exceeded at the prevailing altitude and temperature. For multi-engine aircraft, climb performance is predicated on meeting the weight limitations specified under the aircraft’s certification status.

3.5 Obstacles on and in the vicinity of an aerodrome

3.5.1 It is recommended that pilots have a thorough awareness of the obstacles in the approach and climb-out flight paths. Where a pilot does not have experience with non-standard approach and departure angles, it is recommended the pilot consider alternative aerodrome options, or receive training in the special techniques necessary for these kinds of circumstances.

3.5.2 Aerodromes where there is an extended surface beyond the normal runway length provide additional margins of safety. Even where the surface of the obstacle-free area is not sound enough to permit normal operation of a helicopter, it may, nevertheless, minimise structural damage if a forced landing is required.

3.5.3 For low-powered twin-engine helicopter, where an engine failure just after take-off would result in a significantly reduced rate of climb, runways that have obstacle-free, low-angle departure areas will significantly lower the risk of the aircraft striking obstacles in the climb-out flight path.

3.6 Emergency alighting areas and climb – engine failure during take-off

3.6.1 It is recommended that before conducting a take-off from any aerodrome, pilots of single-engine helicopters make themselves aware of the areas that would be suitable, from the lift-off point to a safe manoeuvring height, to conduct a forced landing in the event of engine failure after take-off. These are known as suitable forced landing areas in the CASR - see Part 1 of the CASR dictionary and section 1.06 of the Part 138 MOS.

3.7 Foreign object damage, gravel and dust

3.7.1 Foreign object damage (FOD) to a turbine engine may cause loss of power or complete failure. FOD frequently arises when gravel is sprayed into the engine intake by the rotor downwash.

3.7.2 Dust will damage both piston and turbine engines but can be reduced in piston engines by use of filtered air or using particle separators or FOD screens in turbine engines.

4 Aircraft certification and performance

4.1 Basics of certification

4.1.1 The performance of every certificated aircraft has been evaluated as part of the certification process. This process allows the manufacturer to determine the take-off and landing performance under average conditions. There are two different classifications of airworthiness certificate: Standard Airworthiness Certificate and Special Airworthiness Certificate.

4.1.2 Standard Airworthiness certification falls under either:

- FAR Part 27 – Airworthiness Standards: Normal Category Rotorcraft, and specifies fewer comprehensive take-off, flight and landing performance standards than FAR Part 29. (EASA CS-27 is the European equivalent).
- FAR Part 29 - Airworthiness Standards: Transport Category Rotorcraft, includes certification categories A and B. (EASA CS-29 is the European equivalent). Most helicopter above 3175 kg MTOW, are certified under Part 29.

4.1.3 Special Airworthiness certification encompasses, primary, intermediate, restricted, limited or amateur built rotorcraft. Special certificates of airworthiness often have strict conditions regarding operation of the aircraft.

4.1.4 The performance data required for type certification allows the pilot to understand how the aircraft will perform through a range of conditions and plan accordingly. Performance figures in the AFM are derived from flight test averages of many flights, must be able to be achieved by a pilot of average ability without exceptionally favourable conditions, throughout the ranges of altitude from standard sea level conditions to the maximum altitude for which take-off and landing certification is requested for the aircraft. Average ability means, a pilot, capable of conducting each task correctly and at the appropriate time. Certain other assumptions are made, such as, calm wind, the engine is developing its rated power, normal operating procedures are being followed and the helicopter is in good condition.

4.2 Aircraft flight manual/pilot operating handbook

4.2.1 Each certification standard specifies what operational information and limitations must be provided in the AFM/POH.

4.2.2 Amateur-Built Experimental aircraft are not required to be certified to specific airworthiness standards and may operate without NAA or manufacturer approved AFM/POHs. The owners of these aircraft are responsible for establishing the aircraft limitations during tests, and they must show not only that the aircraft is controllable throughout its normal range of speeds and throughout all the manoeuvres to be executed, but that it also has no hazardous operating characteristics or design features.

Note: Regulation 91.095 requires the pilot to operate in accordance with the AFM instructions (this is a defined term in the CASR dictionary).

4.3 Performance information

4.3.1 The AFM/POH, owner's manual, or placarding should provide relevant performance information, but presentations are not standardised. Learning how to find and interpret a particular aircraft's performance information should be part of a pilot's familiarisation with the helicopter.

4.3.2 Regulations 91.795 and 91.800 stipulate that an aircraft must not take off or land above the maximum all up weight of the aircraft from the AFM (or equivalent), or a more limiting weight due to the aircraft performance requirements specified in the Part 91 MOS.

4.3.3 Although helicopters manufactured under the special certification process, are required to provide performance information in the AFM/POH, it can be limited in detail and may lack the rigour and accuracy of tests required for a helicopter under FAR Part 27 certification. It may contain a proviso advising, 'performance can depend on aircraft condition, environment and pilot skill'.

4.3.4 Although not within the scope of this AC, regardless of whether the helicopter has been certified under Part 27 or 29, helicopters operated under Part 133 require performance data to provide appropriate safety margins. Even if the requirements are already reflected in their take-off and landing performance charts, pilots must be familiar with any additional safety margins applicable to their operation.

4.3.5 An example of a factoring requirement applicable to large or commercial helicopter is:

> In pre-flight calculation of performance for take-off and landing, the pilot must factor for a headwind or a tailwind. If the headwind is more than 5 knots, then only 50% of the headwind component may be used. If the AFM allows a tailwind component for take-off or landing, then a 150% of the tailwind component must be factored into the calculation

4.4 Take-off and landing distances in the AFM/POH

4.4.1 Each helicopter operation calls for an aerodrome of certain dimensions. The AFM/POH normally shows the dimensions required for a take-off at a given combinations of weight, altitude and temperature.

4.4.2 Pilots should be aware that AFM/POH helicopter performance is tested and calculated under strict criteria. For example, landing certification for a single-engine rotorcraft requires that:

- it must be able to land with no excessive vertical acceleration, no tendency to bounce, nose over, ground loop, porpoise, and without exceptional piloting skill or exceptionally favourable conditions; with approach or autorotation speeds appropriate to the type of rotorcraft and selected by the applicant,
- the approach and landing made with, power off, and entered from steady state autorotation.

4.4.3 When landing at an aerodrome with minimum dimensions, it is recommended that appropriate safety margins be applied before attempting the take-off or landing. See Table 1 in Section 8.

4.5 What must a rotorcraft flight manual contain as a minimum

4.5.1 FAR §27.1587 sets out the information required in the Rotorcraft Flight Manual for a normal category, small rotorcraft, determined in accordance with §§27.49 through 27.87 and 27.143(c) and (d). This information includes:

- The hover in ground effect (HIGE) ceiling, determined over the ranges of weight, altitude, and temperature for which certification is requested, with:
  - Take-off power and landing gear extended.
  - For reciprocating engine powered helicopters at maximum weight, with a standard atmosphere, the ceiling must be at least 4000 ft.
  - For turbine engine powered helicopters at maximum weight, with a standard temperature plus 22° C, the ceiling must be at least 2500 ft pressure altitude.
- The hover out of ground effect (HOGE) performance, determined over the ranges of weight, altitude, and temperature for which certification is requested, with:
  - Take-off power and landing gear extended.
- Take-off weight maximum at sea level through to the highest altitude requested for certification at:
  - Take-off power and r.p.m;
  - The most critical centre of gravity; and
  - Must not require exceptional pilot skill or exceptionally favourable conditions; and
  - Must be able to safely land after engine failure at any point, up to a minimum of 7000 ft DA.
- V_Y must be determined in standard sea level conditions at:
  - Maximum continuous power on each engine
  - Maximum weight.
  - Steady rate of climb on both engines with maximum continuous power, at selected speeds from sea level to maximum altitude with corresponding weights and temperatures.
  - Steady rate of climb or descent on one engine at V_Y with maximum weight; and
  - The critical engine inoperative and the remaining engine at 30 minute one engine inoperative (OEI) maximum continuous power, or continuous OEI power depending on certification request.
- Autorotational performance for single-engine helicopters and multi-engine helicopters that don't meet the Category A engine isolation requirements of Part 29, that determines minimum rate of descent and the best angle-of-glide speed at:
  - Maximum weight; and
  - Rotor speeds selected by the applicant.
- Landing must be demonstrated with no excessive vertical acceleration, no tendency to bounce, nose over, ground loop, porpoise, or water loop, and without exceptional piloting skill or exceptionally favourable conditions at:
  - approach or autorotation speeds appropriate to type
  - for single-engine rotorcraft, power off, from steady autorotation
  - for multi-engine rotorcraft OEI, the operating engine within approved operating limits from an established OEI approach, or from complete power failure.
- A height and forward speed envelope must be established to indicate which combinations would prevent a safe landing, from sea level to the maximum altitude

capability of the rotorcraft or 7000 ft, whichever is less; and from the maximum weight at sea level to selected weights at the maximum altitude. This weight may not be less than the maximum weight that allows HOGE. The applicable power failure conditions are:
   - For single-engine helicopters, full autorotation.
   - For multiengine helicopters, OEI (where engine isolation features ensure continued operation of the remaining engines) and the remaining engine(s) within approved limits and at the minimum installed specification power available for the most critical combination of approved ambient temperature and pressure altitude resulting in 7000 ft density altitude or the maximum altitude capability of the helicopter, whichever is less.
- Demonstrated controllability in winds from all azimuths up to 17 ks in any manoeuvre close to the ground, or out-of-ground effect, through the range from sea level to 7000 ft or maximum altitude capability with:
   - critical weight (HIGE) or applicant select weight (HOGE)
   - critical centre of gravity
   - critical r.p.m. (HIGE) or applicant selected r.p.m. (HOGE)

4.5.2 The powerplant cooling system must demonstrate the ability to maintain components within the established limits under critical surface and flight operating conditions for which certification is required, and after normal shutdown. Powerplant components to be considered include, but may not be limited to engines, rotor drive system components, auxiliary power units, and the cooling or lubricating fluids used with these components. The components must be tested in maximum ambient atmospheric temperature, corresponding to sea level conditions of at least 100° F, (38° C). For reciprocating engines, the fuel used during the cooling tests must be of the minimum grade approved for the engines, and the mixture settings must be those normally used. The temperature must be stabilised (rate of change, less than 2° F) before commencing the next stage of flight to be investigated. (FAR Part 27.1041 to 27.1045).

5 Information about aerodromes publications

5.1 Aerodrome standards

5.1.1 Standards that apply for certified aerodromes can be found in Part 139.

5.1.2 Standards for military aerodromes have a number of commonalities with the civil rules and are contained in the Defence Aviation Safety Regulations (DASR).

5.1.3 There are no standards for aerodromes that are not certified (listed in En-route Supplement Australia (ERSA) as an uncertified aerodrome). CASA has published recommended criteria for landowners or operators of these aerodromes, but these recommended guidelines are not required to be followed.

5.1.4 Similarly, there are no mandatory standards for heliports. CASA has published recommended criteria for landowners or operators of heliports, but these recommended guidelines are not required to be followed.

5.2 Publications containing aerodrome data

5.2.1 All aerodromes that are certified (CERT) under Part 139 are listed in the ERSA. The ERSA also contains all military aerodromes (MIL) and a significant number of uncertified (UNCR) aerodromes. A certified aerodrome must meet certain criteria and is required to provide full information in the ERSA. An aerodrome must be certified if there is an instrument approach at that aerodrome. Certified aerodromes are subject to inspection and NOTAM action.

5.2.2 The ERSA only provides limited information for uncertified aerodromes and these aerodromes are not subject to NOTAM action except in certain circumstances (refer to ERSA for further details).

5.2.3 Take-off and landing guides are also commercially available which provide information for pilots about many aerodromes not included in the ERSA. Pilots should note that the information in these guides may not be subject to regular updating, and these aerodromes are not supported with NOTAM information. Pilots should therefore consider ways of mitigating the risk of such a document's information being out of date or inaccurate.

5.2.4 The examples below are two of the many possible considerations to be made. A pilot should consider whether:

- the obstacles surrounding the aerodrome have been accurately described and are still up to date (e.g., have the trees on final grown taller since last reported), and
- the information provided enables the pilot to judge whether a landing approach can be made from both runway directions.

6 Permission to operate

6.1 Ownership and management

6.1.1 Pilots and operators must consider ownership and management requirements for aircraft operations into any aerodrome. Unless a landing place is unambiguously open to public use for aviation, the pilot should assume that approval is required before using land or water for take-off and landing. General examples of places where approval is required are:

- an uncertified aerodrome managed by local council or private organisation/landowner (check if published in ERSA in the first instance)
- private farmland
- roads, parks or fairways owned by local authorities or private interests
- water, land or dry lakes managed by a state authority such as National Parks, Waterways Authority, Lands Department etc.

6.2 Penalties and liability

6.2.1 Use of a public facility, such as a road or park, for landing may be an offence under State or territory legislation even if the physical requirements for a landing area are satisfied. An unauthorised landing on property might also be a trespass.

6.2.2 While the law generally recognises a person's right to take any reasonable action to save themselves in an emergency, pilots should remember that nothing in the CASR provide immunity against civil liability in the case of damage to persons or property.

7 Pilot responsibilities

7.1 Compliance with the flight manual

Note: Regulation 91.095 requires the pilot to operate in accordance with the 'aircraft flight manual instructions'. This is a legally defined term in the CASR dictionary and is effectively an umbrella term to encompass 'aircraft flight manual' plus placards and other documents that might not be legally part of the AFM.

7.1.1 Pilots are able to develop their own personal operating minimums that are more conservative than the AFM minimums (for performance or operating limits etc). Pilots should be honest when assessing their own experience, recency and personal skills. If a pilot knows they have not been flying recently or frequently, or that they do not have vast experience conducting landings into smaller congested or confined areas or they have not flown frequently in marginal weather conditions, the pilot should consider using personal limits which are more conservative than the AFM minimums.

7.1.2 Special rules exist for Part 133 or Part 138 operations to, in a particular circumstance, not comply with the AFM. Refer to regulations 133.030 and 138.210.

7.2 Deciding to use an aerodrome or HLS

7.2.1 It is the pilot's responsibility to be satisfied the helicopter is able to take off or land safely. When operating at a certified or other aerodrome authorised by the regulations (such as an HLS), the pilot needs to know not only the location of the aerodrome, but also the features that can be used to positively identify it as the aerodrome intended for landing, and any potential hazards.

7.2.2 Some operational factors that pilots and operators are recommended to consider prior to using a HLS are:

- the FATO and TLOF are clear of all objects and animals likely to be a hazard to the helicopter, other than objects essential to the helicopter operation
- no person is within 30 m of the closest point of a hovering or taxiing helicopter, other than persons who are essential to the safe conduct of the operation or the specific nature of the task and who are trained and competent in helicopter operational safety procedures
- appropriate information from the owners and authorities is obtained to confirm the suitability of the HLS for the proposed operation
- where the performance information in an AFM details greater or additional limitations for defined areas or the approach and departure paths (compared to those set out in these guidelines), then the greater and/or additional requirements are available for the flight.

7.2.3 Section 3 of this AC discusses certain considerations in detail; however, the following is a summary list of matters a pilot may wish to consider when deciding to use an aerodrome.

- aircraft type
- aircraft weight
- prevailing weather conditions
- the kind of operation being conducted

- the means of identifying the boundaries of the manoeuvring area
- the length of (suitable) FATO available
- the width of the FATO
- the nature of the FATO and TLOF surface including its pavement strength
- the FATO elevation
- the FATO direction
- the TLOF and FATO (if solid) slope
- recency and type of usage: e.g., use as agricultural strip, any current fixed-wing, gliding or parachute operations etc.
- surface type: e.g., sealed, broken seal, black soil, sandy loam, naturally soft, naturally hard, gravel, small/larger stones
- surface conditions: e.g., cracked, sandy, soft gravel, muddy, recently ploughed, hardened mud (rutted or stock-pitted), heavily grassed, lightly grassed
- surface moisture levels: e.g., dry, moist, wet, muddy
- ambient conditions: temperature, wind, general conditions
- are people, machines, stock/wildlife likely to be present at the time of movement
- obstructions in the approach, take-off and lateral transition areas
- any other obstacles in the vicinity of the aerodrome (such as power lines)
- any management limits on the use of the landing place
- any special procedures applicable at the landing place (e.g., one-off activities, noise abatement considerations etc.)
- NOTAMs or AIP Supplements applicable to the area
- for night operations: availability, type and means of operating the aerodrome lights
- for IMC or night operations: the terrain in the vicinity of the aerodrome.

7.3 Accuracy of calculations

7.3.1 Given the considerable effect of different aircraft weights on helicopter performance, it is very important that the pilot take into account all relevant information and accurately make the necessary calculations to ensure the helicopter can take off or land safely.

7.4 No-go situations

7.4.1 Every pilot must learn to resist personal and external pressures to proceed without essential safety information, or when evidence suggests safety is not reasonably assured.

7.4.2 It is also important that other persons involved in the operation be made aware that no decision to proceed will be made until all required information has been assessed. Unless and until the operation is potentially safe, both common sense and regulatory requirements mean the take-off or landing must not be attempted.

8 Recommended safety margins

8.1.1 As discussed earlier in section 4 of this AC, performance figures in the AFM are derived from flight test averages of many flights and must be able to be achieved by a pilot capable of conducting each task correctly and at the appropriate time. The manufacturer does not test the helicopter under each, and every condition shown on a performance chart, but mathematically derives the remaining data. Certain other assumptions are made, such as, calm wind, the engine is developing its rated power and normal operating procedures are being followed.

8.1.2 As engine performance can degrade over time, it is important to conduct regular power assurance checks to ensure that the engine is still achieving the manufacturers specifications, and that the AFM performance graphs can be relied on. The AFM will have a section detailing how the power assurance check is to be performed.

8.1.3 Before committing to a take-off or landing, particularly in a confined area, a power check to determine excess power should be conducted. This can be achieved by noting the power required to hover IGE. Confirm the maximum allowable power to be used for the ambient conditions from the placard or AFM. Slowly start a vertical climb until the maximum power is achieved. Note the corresponding MAP or torque reading. The difference represents the power margin available and indicates what type of take-off will be possible, i.e., cushion-creep or towering.

8.1.4 While it is not a legal requirement for Part 91 operations to use safety margins when determining whether an area can be taken off from, or landed at, safely, the use of safety margins is highly recommended. For example, a pilot should always plan an OGE hover when landing in an area that is uncertain or unverified.

8.1.5 Once the AFM/POH helicopter performance is calculated for the prevailing density altitude and wind conditions, it is recommended that a contingency of 10% be factored into your calculations.

8.1.6 It is recommended that minimum standard margins for Part 91 operations in helicopters be applied as shown in the Table 5 below.

8.1.7 After applying the relevant margins in accordance with Table 1, it is recommended that the pilot apply further factors in accordance with guidance given in the AFM.

Table 1: Recommended minimum standard safety margins

Take-off and Landing	Minimum standard safety margins
Headwind components above 5 knots	u**se** no more than 50% of the headwind component
If tailwind component permitted in AFM	use at least 150% of the tailwind
Where excess power requirements are looking marginal	Subtract 10% from MTOW derived from WAT calculations.
Operating to or from a confined area.	Allow at least 2 x D value.
Operating to or from an unverified area.	Plan using HOGE performance.

9 Critical operations

9.1 Obstructions and mechanical turbulence

9.1.1 Local terrain, buildings and trees, will create mechanical turbulence in windy conditions near the ground, and may become marked in the lee of the obstruction. Operating in close proximity to obstructions can lead to recirculation and loss of performance. Aerodromes, geographically situated in hilly, mountainous areas, including certain coastal regions, can be subject to hazardous turbulent conditions in moderate to strong wind conditions. Pilots should be aware that, in certain cases, aircraft performance can be severely affected. History has shown, in extreme cases, that turbulence has prevented the aircraft from climbing or being controlled near the ground and has also caused structural damage.

9.1.2 In winds below 15 kts, the turbulence may be experienced in the lee of an obstruction, vertically to about one third higher than the height of the obstruction. Above 20 kts, turbulence may be experience on the leeward side of an obstruction to a distance of 10-15 times the obstruction height and up to twice the obstruction height above the ground.

9.1.3 During take-off or landing in gusty wind situations where wind shear is likely to be present, may require a greater power margin to deal with varying power demands or an unexpected loss of airspeed and accompanying sink. Large anti-torque pedal inputs to maintain directional control also act to reduce the excess power available.

10 Take-off and approach and landing technique

10.1 General

10.1.1 Take-offs and landings in more constrained areas require practised pilot technique. Take-offs and landings in helicopters from aerodromes that have long runways and open clear areas are generally relatively easy and routine. The take-off or landing performance as prescribed in the AFM/POH is rarely achieved because the aircraft is not flown to the criteria as detailed. When taking off, it is not as critical whether the pilot applies full power slowly, accelerates slowly, maximises hover-in-ground effect or does not position the aircraft to maximise the use of all available area, as there is plenty of runway/clear area ahead and obstacles rarely pose a problem. Likewise, when landing, if the approach is flown faster, or with higher rates of descent that prescribed, the initial aiming point can always be replaced with another whilst trying to arrest the helicopter's inertia.

10.1.2 Prior to approach or departure, to or from an HLS, a thorough 'recce' of the landing area should be undertaken, noting wires, obstacles, wind velocity, sun position, possible safe departure routes and safe forced landing areas.

10.1.3 If a HLS is only just suitable (smaller area, multiple obstructions), then the technique adopted is said to be a confined area take-off or landing. This is where the speeds prescribed in the AFM/POH, such as Vx after take-off and HIGE/HOGE graphs become critical in identifying whether a take-off or landing can be conducted safely. The Height Velocity diagram should also be carefully considered before operating from these areas.

10.1.4 Confined area technique requires demonstration of competency for the issue of a pilot licence. However, following the grant of a pilot licence, this technique may be rarely used or practised because more regularly we operate from long runways or much larger areas.

10.2 Take-off

10.2.1 Prior to take-off it is advisable to conduct a power check to confirm the amount of excess power available. As mentioned earlier, conditions at the take-off site may differ from the conditions used when determining performance calculations. Checking the excess power available prior to take-off is a useful tool to indicate a departure from 'expected' performance values. Due consideration of prevailing wind, terrain, forced landing areas and escape routes will assist in selecting an appropriate take-off profile.

10.2.2 A decision point should be nominated where the take-off will be rejected if the helicopter is not accelerating or performing as expected. If the technique described in the AFM/POH is varied, it will affect the take-off performance, hence, the need for safety factors.

10.2.3 Take-off:

- Pre-take-off checks
- Lookout – take-off using sloping ground techniques.
- After-take-off checks to include power check
- Confirm or reselect take-off path.

- Reposition within area if required.
- Select forward and lateral markers as appropriate.
- Lookout above – check for overhead obstructions, overflying aircraft.
- Accelerate to V_X and maintain until clear of obstacles, accelerate to V_Y or recommended climb speed in AFM/POH and continue climb.
- At appropriate time, set max continuous power
- Continue scan for overflying arriving/departing aircraft
- At a safe height, complete the after take-off checks.

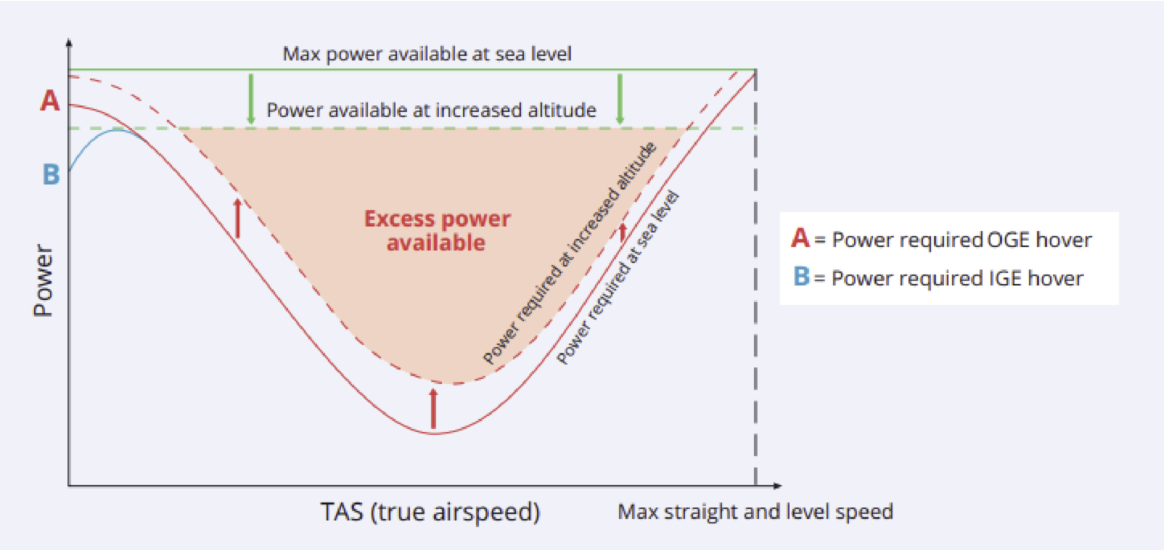


Figure 4: Effect of increasing altitude on HPA/HPR (available horsepower/required horsepower)

10.3 Landing

10.3.1 Most landings are preceded by a hover. Typically, it requires more power to hover than that required for forward flight, therefore, a high degree of care is required when landing, particularly at high gross weights in high density altitudes. Keeping the nose into wind in such circumstances is essential. Due consideration of all the circumstances and prevailing weather conditions is required. Prior to landing at an unfamiliar HLS, a thorough 'recce' of the landing area should be undertaken, noting wires, obstacles, wind velocity, sun position, people or livestock, possible safe approach and go-round routes and safe forced landing areas.

10.3.2 As discussed previously, a power check should be accomplished to assess the power in hand before commencing an approach, as insufficient power could result in a heavy landing. A pilot should always plan an OGE hover when landing in an area that is uncertain or unverified.

10.3.3 As every flight instructor will attest, the execution of a good, safe landing starts with a stabilised approach. This is particularly important when the transition from translational lift to ground effect is made. If too slow too early, the helicopter may develop a high rate of descent, too fast, and large or rapid control inputs may be required to overcome the helicopter inertia, where 'power settling' [1] may occur. It cannot be overly emphasised

[1] Not to be confused with 'settling with power' (vortex ring).

that a go-around should be carried out as soon as you recognise your landing configuration is not stable.

10.3.4 A stabilised approach occurs when the aircraft is in the landing configuration, all pre-landing checks have been performed, the aircraft is aligned on the final approach path and the pilot maintains a constant rate of descent/speed combination towards the aiming point on the runway or HLS, as determined from the AFM/POH.

10.3.5 Landing:

- prior to commencing the approach, conduct a thorough recce of the area between 300’ and 500’ agl and a speed of V_Y
- stabilise the configured aircraft on final, maintaining V_Y initially
- monitor ROD/Speed/Power margin and – beware VORTEX RING STATE.
- consider a go-round using planned path if:
  - o the rate of descent becomes excessive
  - o the closing speed becomes excessive (possible downwind component)
  - o the airspeed falls below 30 kts with an excessively high rate of descent
  - o the power ‘in hand’/power margin insufficient to safely continue approach.
- check to confirm the information gained in the recce is accurate
- reduce groundspeed in final stages ensuring a safe clearance from obstacles
- at approximately 50 ft, commence a flare, introducing power to establish a hover
- land using sloping ground technique.

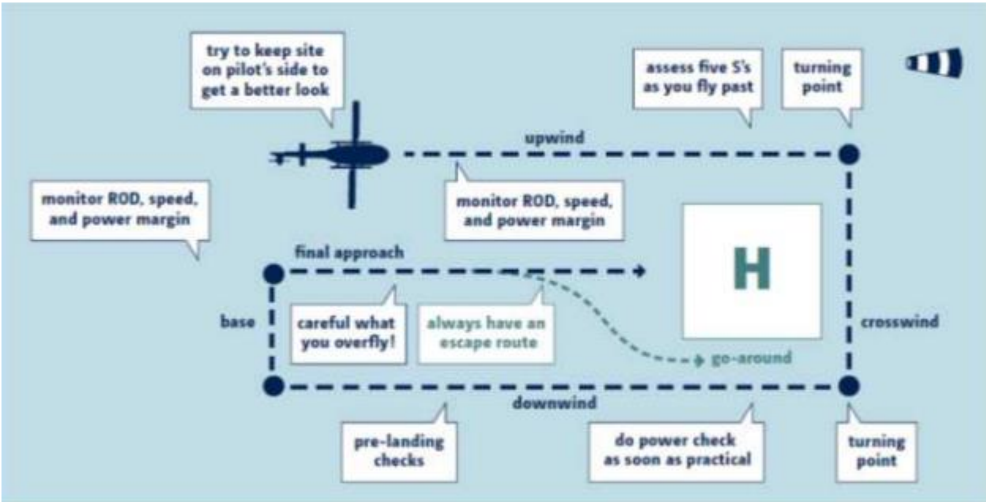


Figure 5: Typical example of a recce to land in an unfamiliar area

11 Precautionary search and inspection procedure

11.1.1 The helicopter's ability to approach, manoeuvre, land and take-off from an unprepared landing site is one of the most important aspects of helicopter operations. Whilst these sites can vary in their dimensions, approaches, hazards, elevation, and location, the same basic principles should be employed. An unprepared landing site that has obstructions that require a steeper than normal approach, where the manoeuvring space in the ground cushion is limited, or whenever obstructions force a steeper than normal climb-out angle is often defined as 'Confined Area'. While a pilot can land at a Confined Area, they still have to apply all the basic principles.

11.1.2 In the event of unforeseen circumstances, such as a "precautionary or "forced landing" that is made in response to an aircraft malfunction/emergency or deteriorating weather, it will invariably be an unprepared landing site. However, if the pilot is faced with an unplanned landing, the decision to conduct a precautionary procedure/recce and land safely when there is still adequate time, under full control and before conditions deteriorate, is essential and cannot be over-emphasised. An abbreviated format will be required for a "forced landing".

11.1.3 The ability to accurately assess the prevailing environmental conditions, potential obstacles, wires, surface conditions, dimensions and ultimate suitability of a landing area, will be enhanced by utilising a previously practised procedure to maximise the opportunity of a safe landing outcome.

11.1.4 It will be particularly important to consider appropriate heights to be able to conduct such a procedure safely, while cognisant of potential engine failure considerations, especially if the requirement for a precautionary procedure was initially necessitated by an aircraft malfunction, low fuel state, or other related issue.

11.1.5 The private pilot licence syllabus requires training in confined area landing procedures.