



ICAO

Circular 364

Water Aerodrome Design and Operations



Approved by and published under the authority of the Secretary General

INTERNATIONAL CIVIL AVIATION ORGANIZATION



| ICAO

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FOREWORD

PURPOSE

Annex 14 – *Aerodromes*, Volume I – *Aerodrome Design and Operations* defines that an aerodrome can be an area on land or water, but the provisions are basically applicable to land aerodromes. Operations of aeroplanes on water differ significantly from those conducted on land, and the provisions used for land aerodromes may not be appropriate for water aerodromes.

This circular aims to provide guidance for large water aerodromes open for public use serving seaplanes operating at a maximum take-off weight of 5 700 kilograms and below, which constitute most of the seaplane fleet globally, under visual flight rules during daylight time. The intent is to serve as a first step in the development of future Standards and Recommended Practices (SARPs) and Procedures for Air Navigation Services (PANS) dedicated to water aerodromes.

BACKGROUND

ICAO Member States have long recognized the importance of having water aerodromes serving commercial seaplane operations which can be the best mode of transportation of passengers and goods in isolated geographical areas, in addition to providing recreational access and emergency evacuations. Establishing international provisions related to water aerodromes is necessary to provide a level of safety that is consistent with that established for land aerodromes and heliports, as set out in the existing provisions of Annex 14, Volumes I and II – *Heliports*.

Several States have already developed their own regulations, standards or guidance material for water aerodromes. However, none of these individual efforts are coordinated or adhere to globally accepted provisions.

As there are no ICAO global provisions specifically related to water aerodromes, the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) took the lead in 2015 and established a small working group on water aerodromes, comprised of experts from Indonesia, the Maldives, New Zealand, Sri Lanka and the United States, to develop a model regulation for water aerodromes for use as a reference document in the Asia/Pacific region. This regional document provides guidance to assist operators in planning, designing and constructing water aerodromes and associated facilities. Although based on the existing land aerodrome criteria, the different operational and safety risks when operating on water are recognized and addressed in the regional guidance material.

During the 40th Session of the ICAO Assembly in 2019, Member States recognized the importance of having a harmonized solution regarding the development of water aerodromes, and adopted Resolution A40-8, which:

Requests the Council, within the current allotted budget, and as a matter of priority, to review existing SARPs related to aerodromes and to develop specific Standards and Recommended Practices in the appropriate Annexes to the Convention in order to address the design, certification, management, safety and reporting requirements for water aerodromes operations.

SARPs, PANS and related guidance material with respect to water aerodromes will:

- a) ensure that all States have access to internationally recognized provisions applicable to water aerodromes and will promote global harmonization in their implementation;
- b) support safe and reliable air transport via water aerodrome operations providing significant socioeconomic benefits for Member States and acts as a primary economic driver for many small island developing States (SIDS); and
- c) strengthen civil aviation and support the United Nations 2030 Agenda for Sustainable Development. This work will assist Member States in achieving the Sustainable Development Goals and help ICAO deliver on its commitments through the no country left behind initiative.

The Water Aerodromes Working Group (WAWG) was created under the Aerodrome Design and Operations Panel (ADOP) with members nominated by nine ICAO Member States and three International Organizations (Airports Council International (ACI), International Federation of Airline Pilots' Associations (IFALPA) and the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA)).

While Resolution A40-8 will result in the eventual development of SARPs that will improve safety around water aerodromes, many SIDS and other Member States that depend heavily on water aerodrome operations require ICAO guidance to develop their own water aerodromes requirements.

The WAWG reviewed the *Asia Pacific Regional Guidance on Requirements for the Design and Operations of Water Aerodromes for Seaplane Operations* developed by ICAO Asia and Pacific (APAC) Office and used it as a baseline for their work. The WAWG also reviewed former ICAO SARPs that were in force in the 1950s and 1960s and found that they were not adapted to the current state of the seaplane industry. Finally, the working group reviewed current and anticipated water aerodrome legislation and regulations of the following Member States: Canada, China, Italy, the Maldives, Spain and the United States. The WAWG also reached out to IALA to ensure that the content being developed is aligned with current maritime standards. While IALA officials contributed to this circular, their views do not constitute a formal approval from the organization at publication.

The efforts of the working group have resulted in this circular which provides guidance material on design and operations under visual flight rules during daylight time at large water aerodromes open for public use.

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GLOSSARY

The terms contained herein are used in the context of this circular and they have no official status within ICAO.

Critical seaplane. The type of aeroplane which is the most demanding for the relevant elements of the physical infrastructure and the facilities for which the water aerodrome is intended.

Fixed platform (dock). A platform extending from the shore or fixed land structure, on water and supported by pillars to hold it in position, intended to align alongside seaplanes for the purposes of embarkation and disembarkation of passengers, loading and unloading of cargo, or refuelling or parking of seaplanes.

Floating platform (dock). A platform placed on open water authorized for the purpose of embarkation and disembarkation of passengers, loading and unloading of cargo by seaplane.

Gangway. A movable walkway where people board and disembark, such as platforms, piers or shorelines.

Hazardous areas. Areas in the water where the operation or navigation of seaplanes is exposed to hazards, such as shallow waters, underwater obstacles, currents, floating debris or others.

Inland waterways. Water bodies like rivers, lakes or other stretches of water, whether linked to the sea or landlocked, which by natural or human-made features are suitable for navigation. In the case of river estuary, the boundary between sea and inland waterways is the established baseline in accordance with international law.

Low water level. The average low tide level during that month of the year when levels are lowest or, in the case of large water bodies, the average level of mean low water springs or lower low waters, depending on the water currents.

Marine aids to navigation. A device, system or service, external to vessels, designed and operated to enhance safe and efficient navigation of individual vessels and/or vessel traffic.

Mooring. A fixed permanent installation on the water surface used to secure seaplanes. The seaplane may be moored to a floating buoy, a pier, platforms, etc.

Mooring buoy. A buoy connected by chain or cable to a permanent unmovable anchor sunk deeply into the bottom of a body of water.

Seaplane. A fixed-wing aircraft which is designed for taking off and landing on water and includes amphibians operated as seaplanes.

Taxi channel. A defined path on a water aerodrome, intended for the use of taxiing seaplanes.

Threshold. The beginning of that portion of the water runway usable for landing.

Turning basin. A water area used for the water taxi manoeuvring of seaplanes along shoreline facilities and at the ends of a water runway.

Water aerodrome. A defined area, primarily on water, intended to be used either wholly or in part for the arrival, departure and movement of seaplanes, and any associated building and equipment on ground or water.

Waterways. A river, canal or other water body serving as a route or way of travel or transport.

ABBREVIATIONS AND ACRONYMS

ACI	Airports Council International
ADOP	Aerodrome Design and Operations Panel
APAC	Asia and Pacific Region
APANPIRG	Asia/Pacific Air Navigation Planning and Implementation Regional Group
ATS	Air traffic service
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IBIS	ICAO Bird Strike Information System
ICAO	International Civil Aviation Organization
IFALPA	International Federation of Airline Pilots' Associations
IMO	International Maritime Organization
MSL	Mean sea level
OLS	Obstacle limitation surface(s)
PANS	Procedures for Air Navigation Services
SARPs	Standards and Recommended Practices
SIDS	Small island developing States
SMS	Safety management system
VFR	Visual flight rules
WAWG	Water Aerodromes Working Group
WGS-84	World Geodetic System 84

REFERENCE DOCUMENTS

ICAO PUBLICATIONS

Annexes to the Convention on International Civil Aviation

Annex 14 – Aerodromes
Volume I – Aerodrome Design and Operations

Procedures for Air Navigation Services

Procedures for Air Navigation Services – Aerodromes (PANS-Aerodromes, Doc 9981)

Manuals

Airport Services Manual (Doc 9137)
Part 6 – Control of Obstacles

Safety Management Manual (Doc 9859)

Safety Intelligence Manual (Doc 10159) (forthcoming)

OTHER PUBLICATIONS

International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA)

The IALA Maritime Buoyage System (MBS), Edition 2.0, June 2023

Chapter 1

GENERAL

1.1 CERTIFICATION

1.1.1 States should consider certifying water aerodromes open to public use in accordance with this guidance and other relevant ICAO provisions through an appropriate regulatory framework.

1.1.2 The regulatory framework should include the establishment of criteria and procedures for the certification of water aerodromes.

1.1.3 As part of the certification process, States should ensure that a water aerodrome manual, which will include all pertinent information on the water aerodrome site, facilities, services, equipment, operating procedures, organization and management, is submitted by the applicant for approval or acceptance prior to granting the water aerodrome certificate.

1.1.4 The Standards in Annex 19 – *Safety Management* require certified aerodromes and certified heliports (applicable in November 2026) to implement a safety management system (SMS) and suggest that States should periodically review the need to extend SMS beyond the applicability in Annex 19 as a safety risk control. States should consider the need to require an SMS at large water aerodromes as a part of the certification process based on a cost-benefit analysis. The intent of an SMS is to have in place a proactive approach for the management of water aerodrome safety by the water aerodrome operator.

Note.— Guidance on SMS is provided in the Safety Management Manual (Doc 9859) and guidance on the development of safety intelligence to support safety management activities and processes as well as data-driven decision-making is provided in the forthcoming Safety Intelligence Manual (Doc 10159).

Chapter 2

WATER AERODROME DATA

2.1 DATA QUALITY REQUIREMENT

Except as specified, the determination and reporting of water aerodrome-related aeronautical data should be in accordance with the accuracy requirements set forth below taking into account the established quality system procedures:

- a) the water aerodrome elevation should be measured to the accuracy and rounded up to the next higher value of one-half metre with reference to mean sea level (MSL);
- b) linear dimensions should be measured to the nearest one-half metre;
- c) aeronautical geographical coordinates (indicating latitude and longitude) should be expressed in terms of the World Geodetic System 84 (WGS-84) reference datum;
- d) true bearings should be measured to the nearest degree;
- e) water depths should be measured and rounded down to the nearest one tenth of a metre;
- f) tides should be measured with respect to the lowest tides recorded for the location; and
- g) inland waterways should be measured to the lowest known water level recorded for the location.

2.2 GEOGRAPHIC DATA

2.2.1 The geometric centre of a water aerodrome should be determined and reported to the nearest one tenth of a second.

2.2.2 The average lowest elevation of the water runway should be measured with reference to MSL.

2.2.3 The magnetic variation for the water aerodrome geometric centre should be determined and given to the nearest degree from magnetic north.

2.2.4 Where radio navigation aids are installed for use at water aerodromes, the following information should be determined and given:

- a) bearing, geographic coordinates of the antenna or radiating centre to the nearest one tenth of a second; and
- b) elevation of the antenna or radiating centre.

2.3 DIMENSIONS AND RELATED INFORMATION

The following data should be measured or described and provided for each facility on a water aerodrome:

- a) water runways:
 - 1) true bearing;
 - 2) length;
 - 3) width; and
 - 4) depth of water.
- b) turning basins:
 - 1) location;
 - 2) dimension; and
 - 3) depth of water.
- c) taxi channels:
 - 1) width; and
 - 2) depth of water.
- d) shore facilities:
 - 1) type; and
 - 2) depth at shore.
- e) significant obstacles on and in the vicinity of the water aerodrome:
 - 1) location;
 - 2) top elevation to the nearest (next higher) metre or foot; and
 - 3) type.
- f) markings:
 - 1) water runways;
 - 2) taxi channels; and
 - 3) hazardous areas.

Note.— Any markings along the waterway should be in compliance with International Maritime Organization (IMO) and International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) standards.

2.4 PROVISION OF OPERATIONAL INFORMATION

2.4.1 Information on the condition of the movement area and the operational status of related facilities should be given to the appropriate aeronautical information service as follows:

- a) information of operational significance should be given to the appropriate air traffic service (ATS) units; and
- b) information should be kept up to date.

2.4.2 The condition of the movement area and the operational status of related facilities should be monitored and changes of operational significance or affecting seaplane performance should be notified to the appropriate ATS units in respect of:

- a) damage to shore facility;
- b) floating debris in the movement area that are hazards to the safety of operations;
- c) temporary hazards such as log booms, surface vessels or any other surface or below surface hazard;
- d) abnormally high or low water depth;
- e) water currents;
- f) tidal areas, depth of water at high and low tides or seasonal changes;
- g) fuel spills; and
- h) any other information that may have a safety impact on operations.

2.4.3 Information on water aerodromes that are temporarily closed should be made readily available to seaplane and vessel operators through an appropriate communication channel such as the ATS unit, NOTAM or an aeronautical information publication and appropriate marine communication channels.

Note.— The information on water aerodrome closures should also be made available to mariners if the water aerodrome surface area is shared with other vessels.

2.4.4 Information on water runway(s) should consist of:

- a) tidal charts; and
- b) the approximate speed and direction of water currents.

2.4.5 Information on hazardous areas should consist of geographical points and/or other visual references to designate the hazardous area appropriately.

Chapter 3

PHYSICAL CHARACTERISTICS

3.1 WATER RUNWAYS

3.1.1 Water runway orientation

The number of usable water runways at a water aerodrome and their orientation should minimize the effect of the local surface wind direction, velocity component, existing obstacles and noise pollution to neighbouring human habitats, as much as possible.

3.1.2 Length of water runways

The length of the water runway to be provided should be adequate for the safe take-off and landing of the critical seaplane for which the runway is intended and should be not less than the longest length determined by applying the corrections for local conditions to the operations and performance characteristics of the relevant seaplanes.

3.1.3 Width of water runways

The width of the water runway should be not less than 60 m wherever practicable.

3.1.4 Water depth

The depth of the water measured at low water level in the water runway should not be less than 1.8 m or less than 0.3 m below the hull or floats when the seaplane is stationary and loaded to maximum take-off weight.

3.1.5 Water runway strip

A water runway strip should, wherever practicable, extend on each side from the edge of the water runway to a distance of not less than 30 m and on each end of the water runway to a distance of 60 m.

3.1.6 Fixed objects

No fixed object should be permitted on a water runway or on a water runway strip unless it is being used for aeronautical purposes.

3.2 TURNING BASINS

3.2.1 Turning basins should be provided at the end of the water runway, whenever necessary.

3.2.2 When turning basins are provided, they should have:

- a) a diameter that is at least two times the wingspan of the critical seaplane that is intended to be used at the water aerodrome;
- b) the depth of turning basins measured at low water level should be at least that of the corresponding water runway; and
- c) a minimum clearance of 15 m between the edge of the turning basin and the nearest obstacle.

3.3 TAXI CHANNELS

3.3.1 Taxi channels should be provided to permit the safe, orderly and expeditious operation of aerodrome traffic.

Note.— Depending on the body and/or the depth of the water, taxi channels may not be required. Taxi channels could be provided to handle shallow areas and specific routing for the safety of the seaplane and to handle a large volume of traffic at busy water aerodromes.

3.3.2 Where provided, the taxi channels in the water aerodrome movement area should have a width of not less than 50 m, wherever practicable.

3.3.3 The minimum clearance between wingtips of taxiing seaplanes (in dual directional taxi channels) should be not less than half the wingspan of the largest seaplane using the water aerodrome or 15 m, whichever is greater, whenever practicable.

3.3.4 The depth of the water measured at low water levels in the taxi channel should not be less than 1.2 m.

3.4 MOORING AREAS

3.4.1 Mooring areas should be provided, whenever necessary, for the mooring of seaplanes and to permit the embarkation and disembarkation of passengers, loading and unloading of cargo and mail without interfering with aerodrome traffic.

3.4.2 When mooring areas are provided:

- a) the size of the mooring areas should permit expeditious handling of peak hour traffic;
- b) the depth of the water at the mooring area measured during low water levels should be at least 1.2 m; and
- c) the design should provide a minimum clearance of at least a half wingspan of the largest seaplane using the mooring area.

3.5 SHORE FACILITIES

3.5.1 A platform (fixed or floating), ramp, gangway or beach should be provided to permit the safe embarking and disembarking of passengers and crew, loading and unloading of cargo and for refuelling.

3.5.2 Where a platform is provided, it should:

- a) be in proper condition permitting constant use without causing injury to persons or damage to seaplanes;
- b) be securely attached or anchored in a manner that prevents it from shifting position or becoming detached;
- c) have access from the shore that provides for the safe movement of crew, water aerodrome staff and passengers; and
- d) have at least two bull rails or provisions for sufficient numbers of tie-down cleats at each seaplane parking position to secure the seaplane.

3.5.3 Where a platform is provided, it should:

- a) be built at 1.5 times the width between the float centrelines or the lateral distance between the landing gear of the largest seaplane intended for use at the facility; and
- b) be located in such a manner as to provide a minimum horizontal clearance of 1.8 m between a seaplane wing and any object it could come into contact with.

3.5.4 Where a gangway is provided, it should be constructed with a slope range of 6:1 to 12:1, as practicable, and should at least fulfil requirements for passengers with reduced mobility.

Chapter 4

OBSTACLE RESTRICTION AND REMOVAL

4.1 OBSTACLE LIMITATION SURFACES

4.1.1 Take-off climb/approach surface

Description

4.1.1.1 The take-off climb/approach surface is an inclined plane preceding the threshold for landing and beyond the end of the runway for take-off.

Characteristics

4.1.1.2 The limits of the take-off climb/approach surface should be comprised of:

- a) an inner edge of specified length, horizontal and perpendicular to the extended centreline of the water runway and located at a specified distance before the threshold for landing and beyond the end of the water runway for take-off;
- b) two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the extended centreline of the water runway;
- c) an outer edge parallel to the inner edge;
- d) the centreline defining the approach or take-off path, which could be:
 - 1) a straight line; or
 - 2) an arc of constant radius; or
 - 3) a combination of a straight line and an arc of constant radius; or
 - 4) an offset take-off climb/approach surface; and
- e) when offset or curved approaches or take-offs are utilized, the above surface is varied, specifically with two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the extended centreline of the offset or curved track.

Note.— See Figure 4-1.

4.1.1.3 The elevation of the inner edge should be equal to the elevation of the water aerodrome.

4.1.1.4 The slope(s) of the take-off climb/approach surface shall be measured in the vertical plane containing the centreline of the runway and shall continue containing the centreline of any lateral offset or curved track.

4.1.2 Offset take-off climb/approach surface

Where established, an offset take-off climb/approach surface should have a centreline that does not exceed 12 degrees offset from the centreline of water runway.

Note.— See Figure 4-2.

4.1.3 Curved take-off climb/approach surface

4.1.3.1 Where established, a curved take-off climb/approach surface should not contain more than one curved portion.

Note.— See Figure 4-3.

4.1.3.2 A curved portion of a take-off climb/approach surface should not allow a change of direction greater than 90 degrees.

4.1.3.3 Where a curved portion of take-off climb/approach surface is provided:

- a) the straight portion originating at the inner edge should not be less than 1 300 m; and
- b) the radius of arc defining the centreline of the take-off climb/approach surface should not be less than 736 m.

4.1.3.4 A take-off climb/approach surface incorporating an offset or a curved portion should be established only where guidance, such as geographical points or other visual references, is available.

Note.— An offset or curved approach is normally established at a non-instrument water runway where it is necessary to avoid obstacles, terrain, noise sensitive areas or to utilize the airspace above public lands (for example, freeways, rivers, golf courses).

4.1.4 Transitional surface

Description

4.1.4.1 A transitional surface is a complex surface along the side of the water runway strip and part of the side of the take-off climb/approach surface, that slopes upwards and outwards to a specified height.

Characteristics

4.1.4.2 The limits of the transitional surface should be comprised of:

- a) a lower edge beginning on the side of the take-off climb/approach surface at the elevation of the upper edge and extending down the side of the take-off climb/approach surface and from there along the length of the water runway strip parallel to the water runway centreline; and
- b) an upper edge located at a specified height above the elevation of the water aerodrome.

Note.— See Figure 4-1.

4.1.4.3 The slope of the transitional surface shall be measured in a vertical plane at right angles to the centreline of the water runway.

4.1.5 Inner horizontal surface**Description**

4.1.5.1 An inner horizontal surface is a surface located in a horizontal plane above the water aerodrome and its vicinity.

Characteristics

4.1.5.2 The radius or outer limits of the inner horizontal surface shall be measured from a reference point, or points established for such purpose.

4.1.5.3 The height of the inner horizontal surface shall be measured above the elevation of the water aerodrome.

4.2 OBSTACLE LIMITATION REQUIREMENTS

4.2.1 The following obstacle limitation surfaces (OLS) should be established for a non-instrument water runway as shown in Figure 4-1:

- a) take-off climb/approach surface;
- b) transitional surface; and
- c) inner horizontal (when practicable).

Note.— It may not be possible or practicable in some locations to establish an inner horizontal surface due to terrain or local factors. In these cases, procedures could be established to ensure an acceptable level of safety.

4.2.2 The height and slope of the surfaces should not be greater than, and their other dimensions not less than, those specified in Table 4-1.

4.2.3 Existing fixed objects above the surfaces required in 4.2.1 should, as far as practicable, be removed except when the object is shielded by an existing immovable object, or after an aeronautical study, it is determined that the object would not adversely affect the safe operation of seaplanes.

Note.— Circumstances in which the shielding principle may reasonably be applied are described in the Airport Services Manual (Doc 9137), Part 6 – Control of Obstacles.

4.2.4 New fixed objects or extensions of existing fixed objects above the surfaces required in 4.2.1 should not be permitted, except when the object is shielded by an existing immovable object, or after an aeronautical study, it is determined that the object would not adversely affect the safe operation of seaplanes.

4.2.5 Mobile objects should not penetrate take-off climb/approach surfaces unless procedures are in place to ensure safety during approach and departure operations.

4.2.6 Any object inside the boundary or in the immediate vicinity of the water aerodrome which may, after an aeronautical study, adversely affect the safe operation of seaplanes, should be removed as far as possible.

Table 4-1. Dimensions and slopes of obstacle limitation surfaces – water aerodromes

Surface and dimensions*	Runway classification
	Non-instrument
TAKE-OFF CLIMB/APPROACH	
Length of inner edge	Width of water runway strip (120 m minimum)
Distance from threshold (approach)	60 m
Distance from water runway end (take-off)	60 m
Divergence (each side)	10 %
Slope	4 %
Length	2 500 m
TRANSITIONAL	
Slope	Vertical to 15 m and then 20 %
Height of upper edge	45 m
INNER HORIZONTAL	
Height	45 m
Radius	2 500 m

* All dimensions are measured horizontally unless specified otherwise.

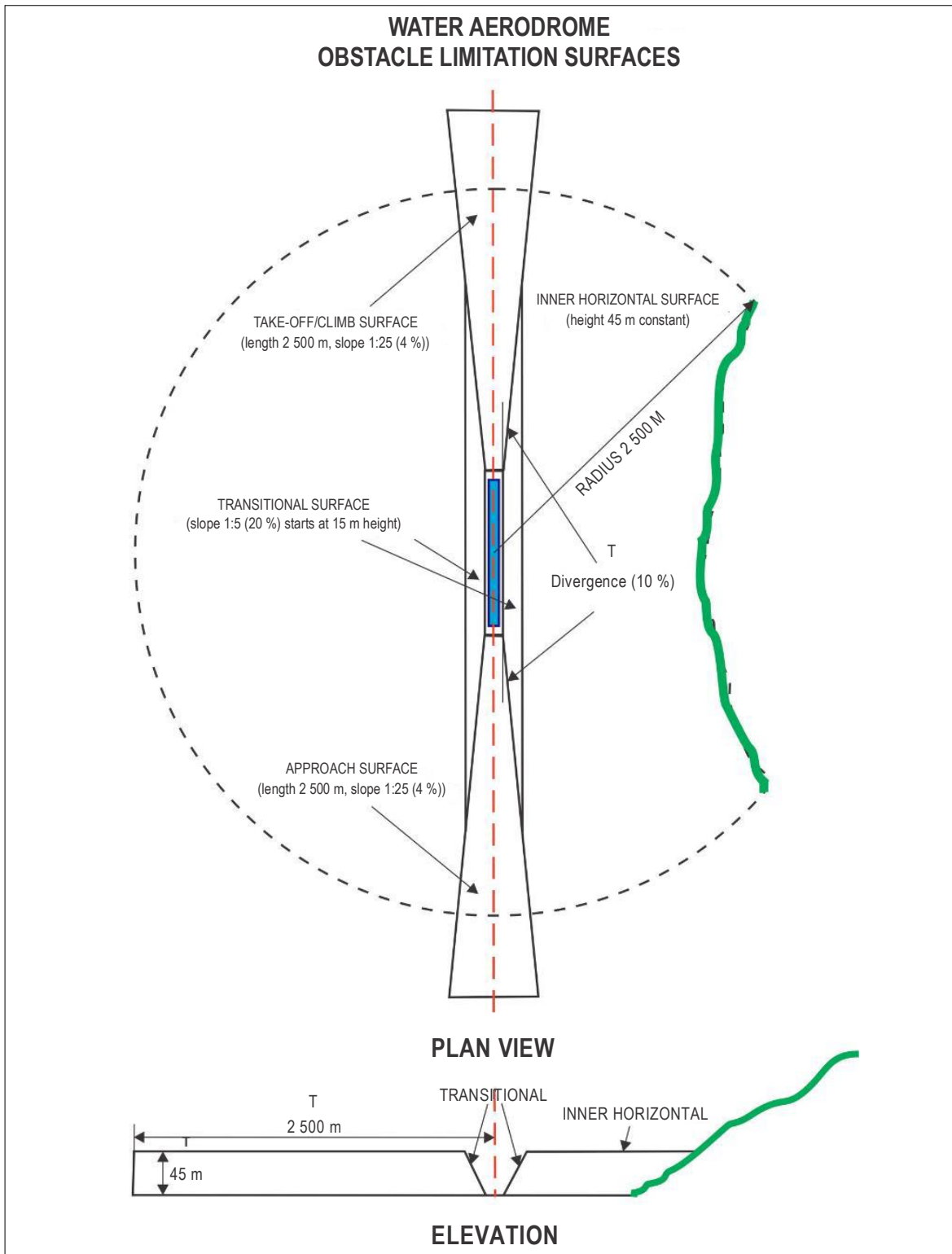


Figure 4-1. Obstacle limitation surfaces

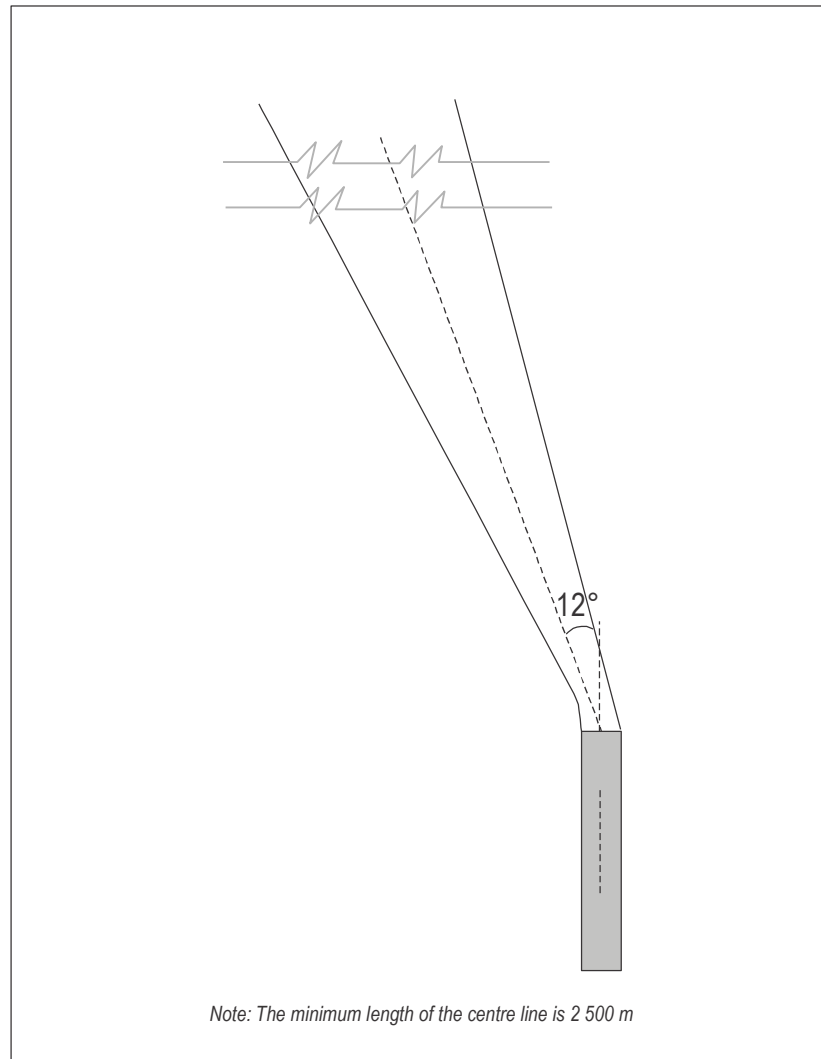


Figure 4-2. Offset take-off climb/approach surface

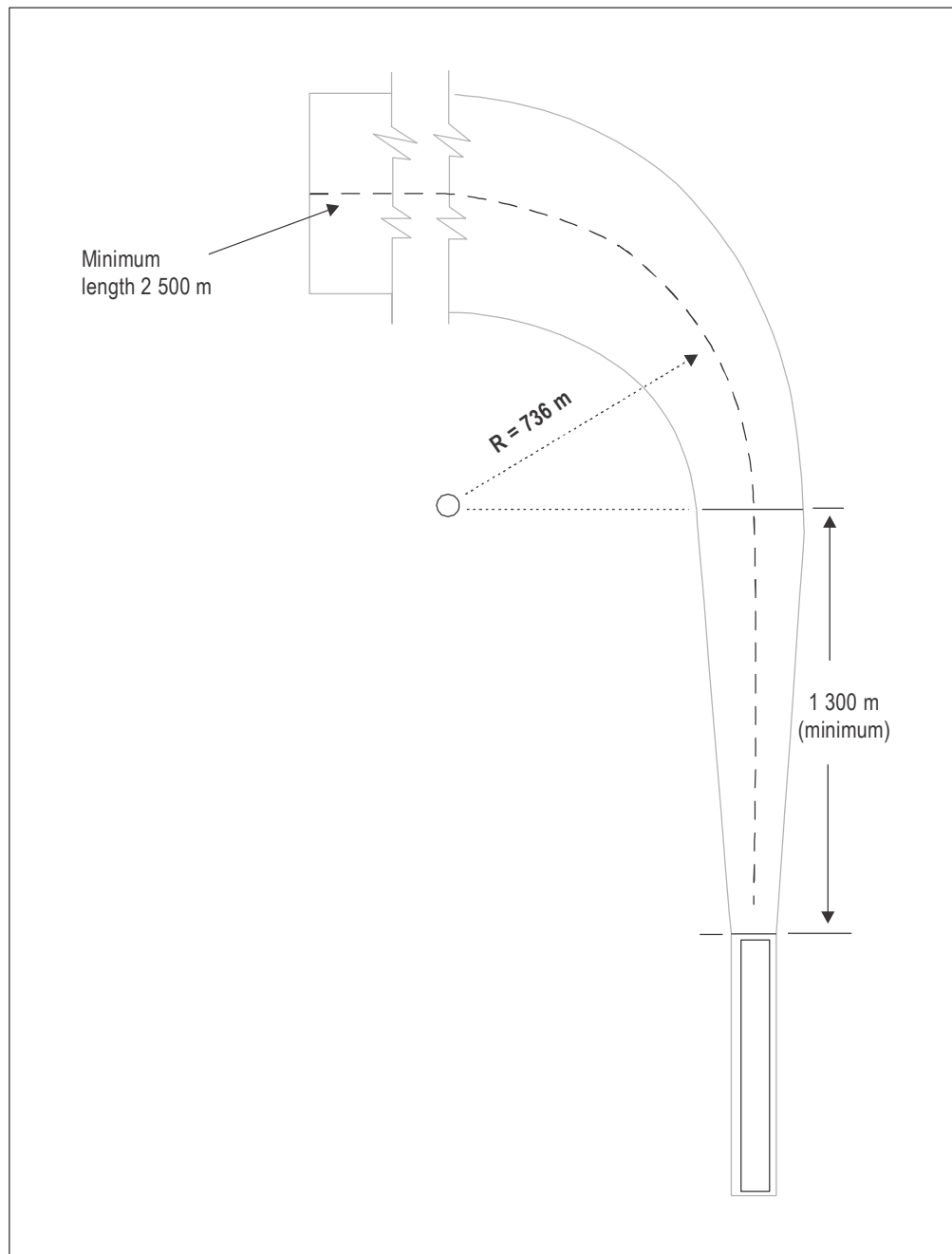


Figure 4-3. Curved take-off climb/approach surface

Chapter 5

VISUAL AIDS

5.1 WIND DIRECTION INDICATOR

5.1.1 Unless the direction of the wind can be obtained by radio communication, at least one wind direction indicator should be installed.

5.1.2 Where a wind direction indicator is installed, it should be:

- a) painted orange and white or red and white in colour; and
- b) in the form of a truncated cone made of fabric and should have a length of not less than 3.6 m and a diameter, at the larger end, of not less than 0.9 m.

5.1.3 The wind direction indicator should be visible:

- a) at a height of 300 m above the water runway; and
- b) from any portion of the manoeuvring area.

5.2 MARKINGS AND MARKERS

5.2.1 Water aerodrome identification buoys

When the water aerodrome is solely reserved for seaplane operations, the area of the water surrounding the water aerodrome should be identified with buoys in accordance with International Maritime Organization (IMO) and International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) maritime buoyage system standards.

5.2.2 Dock identification markings

Characteristics

5.2.2.1 Where dockside identification markings or markers are used, they should appear as follows:

- a) a triangle in accordance with Figure 5-1 should be displayed on the upper surface of the dock so as to be visible from 300 m above the landing area;
- b) painted bull rails as specified in 5.2.2.3;
- c) dock edge markings, as depicted in Figure 5-1, should be installed on all sides where docking is possible;

- d) dock edge markings should be painted in alternating red and white stripes;
- e) identification markings displayed on the upper surface of the dock should be of non-slip material; and
- f) where the docks could be used by vessels other than seaplanes or vessels used for water aerodrome operations, maritime markings as designated by the appropriate authority.

Note.— If more than one dock is in use at a water aerodrome, each dock should be identifiable.

5.2.2.2 Markings as per 5.2.2.1 a) and b) should be affixed to the upper surface of the dock so as to be horizontally visible from 300 m above the water runway.

Bull rails

5.2.2.3 Where bull rails are installed, they should be painted in alternated bands of orange and white stripes.

Gangways

5.2.2.4 Gangways should be painted in red or signage provided indicating seaplane access only.

5.2.3 Marker buoys

Characteristics

5.2.3.1 Marker buoys should be in accordance with IMO and IALA maritime buoyage system standards and be visible to seaplanes as follows:

- a) manoeuvring on the surface of water; and
- b) 300 m above the water runway.

Water runway markers

5.2.3.2 Except as specified in 5.2.3.3, at water aerodromes where there is no conflict with other vessels or procedures are in place to mitigate traffic conflict as per marine regulations:

- a) each water runway threshold should be marked with fixed or floating markers;
- b) the markers should be visible from a distance greater than two nautical miles;
- c) each marker should be in accordance with IMO and IALA standards; and
- d) where the water runway threshold is displaced permanently or temporarily, the floating or fixed markers should be provided on the displaced water runway threshold location.

5.2.3.3 Where it is impracticable to mark the water runway as specified in 5.2.3.2, guidance such as geographical points and/or other visual references should be provided to designate the water runway.

5.2.4 Hazardous areas markers

Marker buoys for delineating hazardous areas should be distinctly marked from water runway markers in colour and shape and be in accordance with IMO and IALA standards.

5.2.5 Restriction to the dockside

If the operator of a water aerodrome has determined that there is a need to place a restriction on a dockside, the operator should display a sign that identifies the restriction and the portion of the dockside to which it applies.

Note.— Restrictions could include, but are not limited to, relevant seaplane operations including propellers, fueling operation and possible wildlife concerns.

5.3 LIGHTING

Beacon lights

5.3.1 When operationally necessary, water aerodromes should be identified by a beacon alternating white and yellow flashes at the rate of 20 to 30 flashes per minute.

Strobe lights

5.3.2 When required, strobe lights should be provided to alert marine and air traffic in the area to indicate seaplane operations are underway or about to commence.

5.3.3 Where installed, the strobe lights should be:

- a) white and constantly flashing;
- b) located in an area that is easily and constantly seen by both marine and air traffic; and
- c) have a characteristic which cannot be confused with any other marine lighthouse, buoy or beacon in the area.

Note.— Radiofrequency have proven to be an efficient method of the activation and control of strobe lights.

Platform lighting

5.3.4 Appropriate lighting should be installed on the shore to illuminate ramps, docks and aprons wherever necessary. Care should be taken in locating and aiming lights to avoid affecting the vision of pilots during landing or taking off or creating glaring distractions. This lighting must not obscure marine aids to navigation in the vicinity.

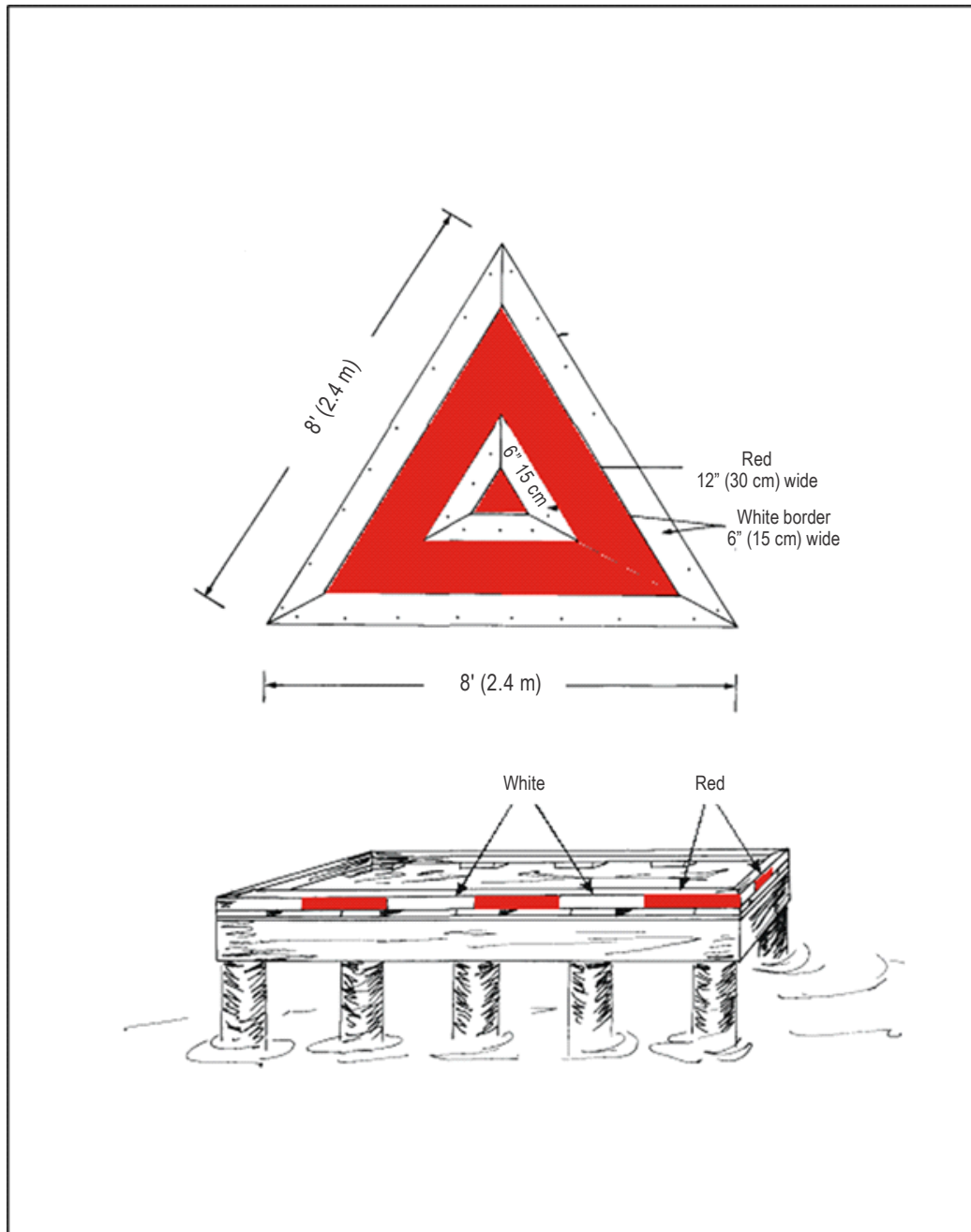


Figure 5-1. Seaplane dock identification marking

Chapter 6

VISUAL AIDS FOR DENOTING OBSTACLES

6.1 MARKING OF OBJECTS

6.1.1 A fixed obstacle that extends above a take-off climb, approach or transitional surface should be marked unless the object is conspicuous by its shape, size or colour.

6.1.2 When an inner horizontal surface is provided, and obstacles extend over the surface, a safety risk assessment should be made to determine what obstacles should be marked.

Note.— Provisions on safety assessment for aerodromes can be found in the Procedures for Air Navigation Services – Aerodromes (PANS-Aerodromes, Doc 9981), Part I, Chapter 3.

6.1.3 Objects should be marked in accordance with the marking of objects covered under International Maritime Organization (IMO) or International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) standards.

Note.— When the marking of objects is not addressed by IMO or IALA standards, the objects should be marked as specified in 6.2.

6.2 MARKING OF OBJECTS NOT ADDRESSED BY THE INTERNATIONAL MARITIME ORGANIZATION OR THE INTERNATIONAL ASSOCIATION OF MARINE AIDS TO NAVIGATION AND LIGHTHOUSE AUTHORITIES STANDARDS

6.2.1 Except as specified in 6.1, all fixed objects should be marked in a conspicuous colour.

6.2.2 Where it is not possible to colour the objects, markers or flags should be displayed on or above the objects.

Use of colours on markers and markings

6.2.3 Elongated objects should be marked with alternating contrasting bands, visible from a range of 300 m, preferably red and white or orange and white, with the bands on the extremities of the object being of the darker colour.

6.2.4 Objects not elongated should be marked with a chequered pattern, visible from a range of 300 m, preferably red and white or orange and white, the corners being of the darker colour.

Use of markers

6.2.5 Markers displayed on or adjacent to objects should be:

- a) located in conspicuous positions to retain the general definition of the object;

- b) recognizable in day visual flight rules (VFR) weather from a distance of:
 - 1) 1 000 m for an object to be viewed from the air;
 - 2) 300 m for an object to be viewed from the surface of the water in all directions in which a seaplane is likely to approach the object; and
 - c) compatible with IMO and IALA standards, when applicable.
- 6.2.6 The shape of the markers should:
- a) be distinctive to the extent necessary to ensure that they are not mistaken for markers employed to convey other information; and
 - b) not increase the risk of the object they mark.
- 6.2.7 The colour selected should contrast with the background against which it will be seen.

Overhead objects

- 6.2.8 Overhead wires, catenaries or other similar objects of operational significance located in the vicinity of the water aerodrome should be marked.
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Chapter 7

WILDLIFE HAZARDS

- 7.1 A list of wildlife that are present on or in the vicinity of water aerodromes should be inventoried.
- 7.2 A wildlife risk assessment should be conducted at water aerodromes.
- 7.3 High-risk wildlife activity should be effectively communicated to pilots.
- 7.4 Action should be taken to decrease the risk to seaplane operations at or in the vicinity of water aerodromes by adopting measures to reduce the likelihood of a collision between wildlife and seaplanes.

Note.— Wildlife management programmes should consider a State's environmental policies in regard to pollutants and the protection of aquatic species.

- 7.5 Wildlife strike reports should be collected and forwarded to ICAO for inclusion in the ICAO Bird Strike Information System (IBIS) database.

Note.— In addition to the above recommendations, water aerodrome operators can consider using general concepts found in the Procedures for Air Navigation Services – Aerodromes (PANS-Aerodromes, Doc 9981), Part II, Chapter 6, as appropriate, for additional provisions.

Chapter 8

INITIAL RESCUE AND FIREFIGHTING RESPONSE

Note.— The main objective of the rescue and firefighting service at water aerodromes is to protect human life by providing initial assistance to passengers during a seaplane accident or incident until the arrival of the agencies that are responding to the emergency. The initial assistance should include rescue and protection of passengers from adverse environments and possible fire hazards.

- 8.1 Rescue and firefighting services should be provided at water aerodromes.
 - 8.2 Rescue and firefighting service can be provided by the water aerodrome operator or by an agreement with an external agency capable of providing such service.
 - 8.3 Rescue and firefighting personnel and adequate equipment that is sufficient for the type of seaplanes and operations that use water aerodromes should be provided.
 - 8.4 Appropriate extinguishing agents that are compatible with seaplanes and operations should be provided at water aerodromes.
 - 8.5 Vessels should be adequately equipped and personnel well informed to enable effective navigation between the accident or incident site. Vessels should have sufficient capacity to carry rescue and firefighting personnel, equipment, extinguishing agents, and either space or life rafts to accommodate the maximum number of passengers and flight crew carried by the critical seaplane serving the water aerodrome.
 - 8.6 For water aerodromes, the operational objective of the vessel should be to achieve a timely response in case of an accident or incident. An alerting system should be provided where appropriate.
 - 8.7 Appropriate communication systems should be provided between the vessel, water aerodrome operator, emergency services, ATS and other appropriate agencies.
 - 8.8 The impact of environmental conditions on rescue and firefighting equipment and services should be considered.
 - 8.9 Rescue and firefighting personnel should receive relevant training to perform their duties and be provided with appropriate personal protective equipment.
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Chapter 9

EMERGENCY PLANNING

9.1 An emergency plan should be established at a water aerodrome, commensurate with the seaplane operations conducted.

9.2 The aerodrome emergency plan should provide coordination for the actions to be taken and the agencies that are responding to an emergency occurring at an aerodrome or in its vicinity.

Note 1.— Examples of emergencies could include seaplane emergencies, sabotage including bomb threats, unlawfully seized seaplanes, dangerous goods occurrences, building fires, natural disaster and public health emergencies.

Note 2.— Examples of agencies could include air traffic control units, rescue and firefighting services, medical services, aerodrome administration, seaplane operators, security services, police, military, harbour patrol, coast guard or local community fishing fleets.

9.3 The plan should provide for cooperation and coordination with the aerodrome emergency control centre or the marine rescue coordination centre as necessary.

9.4 The emergency plan should consider the particular hazards associated with seaplane operations, which could include, but are not limited to, the following:

- a) hazards related to the environment of the emergency such as deep water, cold water, exposure to the elements and its associated effects; and
- b) the immediate toxicity and respiratory effects on survivors in the water following the ingestion of floating fuel and oils and their associated vapours, and fire suppressant foams, powders and gases.

9.5 The emergency plan should contain, at a minimum, provisions for:

- a) water rescue;
- b) land rescue;
- c) fire response; and
- d) recovery of disabled seaplane from the movement area.

9.6 The emergency plan document should include the types of emergencies, agencies involved, responsibilities of the agencies, contacts and phone numbers of the people to be contacted and a grid map of the water aerodrome and its vicinity.

9.7 Adequate communication systems and/or procedures between the agencies participating in an emergency should be provided.

9.8 The emergency plan should be tested by conducting a full-scale aerodrome emergency exercise at intervals not exceeding four years and partial emergency exercises or tabletop exercises every year to ensure that any deficiencies found during the full-scale aerodrome emergency exercise have been corrected.

Chapter 10

OPERATION AND MAINTENANCE

10.1 A maintenance programme should be established at a water aerodrome to maintain facilities in a condition which does not impair the safety or efficiency of water aerodrome operations.

Note.— Facilities includes all movement and manoeuvring areas.

10.2 Docks, apron and gangways and platforms should be maintained to allow for the safe embarking and disembarking of passengers and staff, as well as the loading and unloading of cargo.

10.3 The water aerodrome movement area should be inspected regularly with the objective of monitoring and eliminating any objects or contaminants on the water that can be a hazard to the operations.

Access control

10.4 Suitable means of protection should be provided to deter the inadvertent or premeditated access of unauthorized persons into the installations and facilities of the water aerodrome.

— END —

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