

ENVIRONMENTAL MANAGEMENT PLAN

AIRSTRIP IN NKASA RUPARA NATIONAL PARK, ZAMBEZI REGION



Prepared for Natural Selection Safaris (Pty) Ltd as part of an EIA process for the application for an Environmental Clearance Certificate for the construction and operation of an airstrip for Nkasa Linyanti Camp

January 2026

Application no: 6472

DECLARATION BY PRACTITIONER

The Environmental Assessment Practitioner, Henriette Potgieter, is married to the Operations Director of the proponent, Louis Nortjé.

I, Henriette Potgieter, declare that I have no additional connection with the proponent, monetary or otherwise. No conflict of interest exists in the execution of the terms of reference of this project and I am committed to impartiality and confidentiality.



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ABBREVIATIONS

Abbreviations used in this report.

COC	Concession Operator Contract
EAP	Environmental Assessment Practitioner
EAPAN	Environmental Assessment Professionals of Namibia
ECC	Environmental Clearance Certificate
EIA	Environmental Impact Assessment
EMA	Environmental Management Act
EMP	Environmental Management Plan
HCC	Head Concession Contract
IAP	Interested and Affected Party
IUCN	International Union for Conservation of Nature
JMC	Joint Management Committee
JV	Joint Venture
MAWF	Ministry of Agriculture, Water and Land Reform
MEFT	Ministry of Environment, Forestry and Tourism
NHC	National Heritage Council
Regulations	Environmental Impact Assessment Regulations, GN 30 of 2012
WBD	Wuparo, Balyerwa and Dzoti conservancies

1 INTRODUCTION

1.1 Background

The construction and operation of an airstrip is a listed activity that requires Environmental Clearance from the Ministry of Environment, Forestry and Tourism (MEFT). The proponent, Natural Selection Safaris (Pty) Ltd, plans to build and operate an airstrip on the Nkasa West Concession in Nkasa Rupara National Park (NRNP) in the Zambezi Region as part of a Joint Venture (JV) between the Wuparo, Balyerwa and Dzoti (WBD) conservancies, MEFT and Natural Selection Safaris (Pty) Ltd. The JV is regulated by a Head Concession Contract (HCC) and Concession Operator Contract (COC) and includes the right to renovate and operate an airstrip on Nkasa island to service the needs of the lodge.

The proponent is currently building the tented lodge stipulated in the COC under a valid Environmental Clearance Certificate (ECC), and it will open in June 2026. They now wish to construct the airstrip and Natural Selection Safaris will apply to the Directorate of Wildlife and National Parks (DWNP) and the Directorate of Environmental Affairs (DEA) of the MEFT for an ECC in terms of the Environmental Management Act of 2007 and the EIA Regulations of 2012.

A Joint Venture Management Committee (JMC) consisting of representatives from the WBD conservancies, the proponent and MEFT oversees the venture and is ultimately responsible for implementing the measures in this EMP.

1.2 Purpose of this document

This EMP is part of a scoping level Environmental Impact Assessment (EIA) and is submitted to MEFT in support of an application for an Environmental Clearance Certificate (ECC). It was compiled in accordance with the Environmental Management Act (7 of 2007) (EMA), the EIA Regulations of 2012, and provisions in the HCC and COC.

A Scoping study with impact assessment was conducted for this project and found no highly significant impacts that cannot be prevented and/or mitigated to a low significance. The potential impacts identified in the Scoping Report are listed in this EMP together with prevention and/or management actions.

1.3 Aims of the EMP

The Environmental Management Plan (EMP) has two main aims:

- propose measures to prevent or mitigate any potential negative impacts, and enhance positive impacts that were identified in the Scoping report
- detail the actions required to carry out the proposed mitigation measures

The EMP demonstrates the commitment of Natural Selection Safaris to follow current best practices for sustainable tourism. It constitutes an environmental contract between the proponent and the Government of the Republic of Namibia: MEFT in its capacity as guardian of the country's natural resources.

The EMP is a living document that will be updated as new information, policies, authority guidelines and technologies develop.

1.4 Permits and licences

The proponent will apply for all relevant permits and licences, and will keep them up to date. The requirements of the Namibia Civil Aviation Act (6 of 2016) and the Namibian Civil Aviation Regulations will be implemented.

2 PROJECT OVERVIEW

2.1 Location

The proposed airstrip will be located on an elevated portion of Nkasa Island that is not inundated by the annual floods, and where an airstrip of the South African Defence Force, defunct for the past 30 years, was situated. Figure 1 shows the location of the airstrip on Nkasa Island relative to the lodge and staff village that are currently being built.

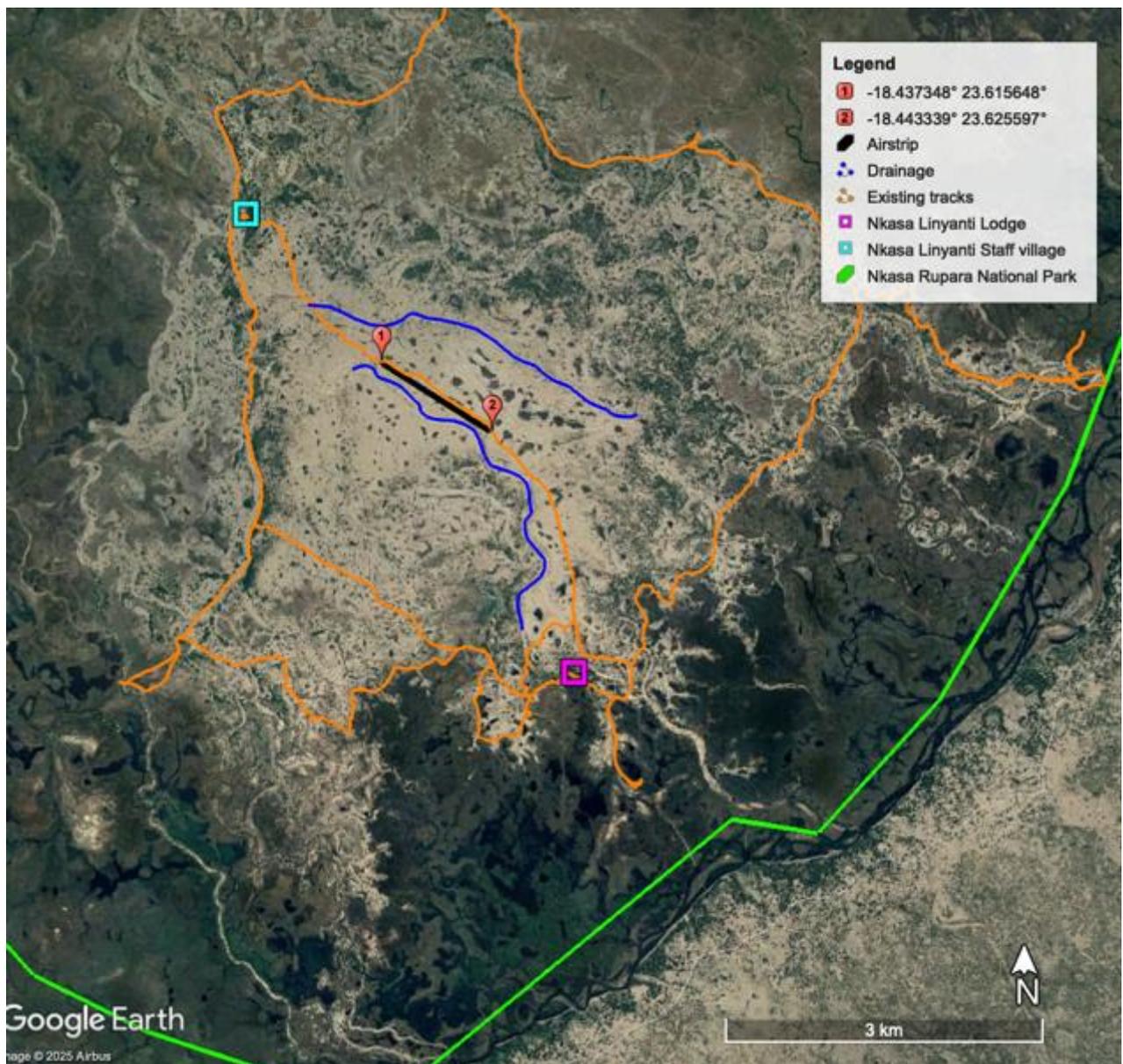


Figure 1. Proposed location in Nkasa Rupara National Park.

2.2 Infrastructure

The airstrip will measure 1,200 m long and 20 m wide, and will have a turning circle at each end with a diameter of 30 m. The landing strip will be 10 m wide and will have a 5 m wide run-off area on each side (Figure 2). On both sides of the airstrip a 5 m wide construction and maintenance margin will be allowed, bringing the total footprint of the project to 36,180 m² (3.6 ha).

A 10 m x 10 m gazebo type structure consisting of canvas wrapped around a wooden frame with a canvas and latte roof will be erected to provide shade to waiting guests. The gazebo will sit on the ground and no concrete will be used in its construction.

Figure 2 shows a plan view of the airstrip with its layout and dimensions, and Figure 3 presents a section view with the dimensions and gradients of the runway and the water run-off areas.

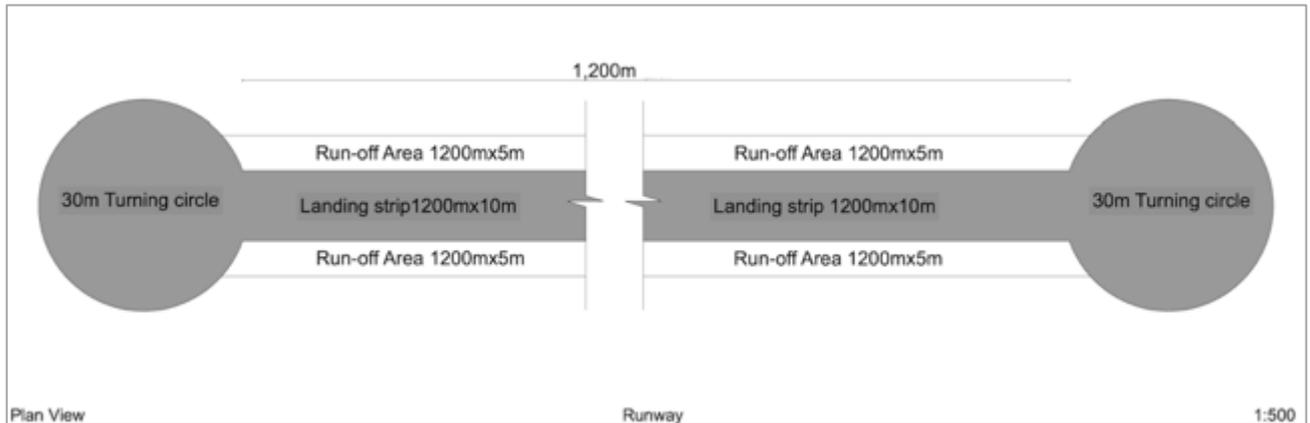


Figure 2. Plan view of the airstrip with the dimensions of the runway and turning circles.

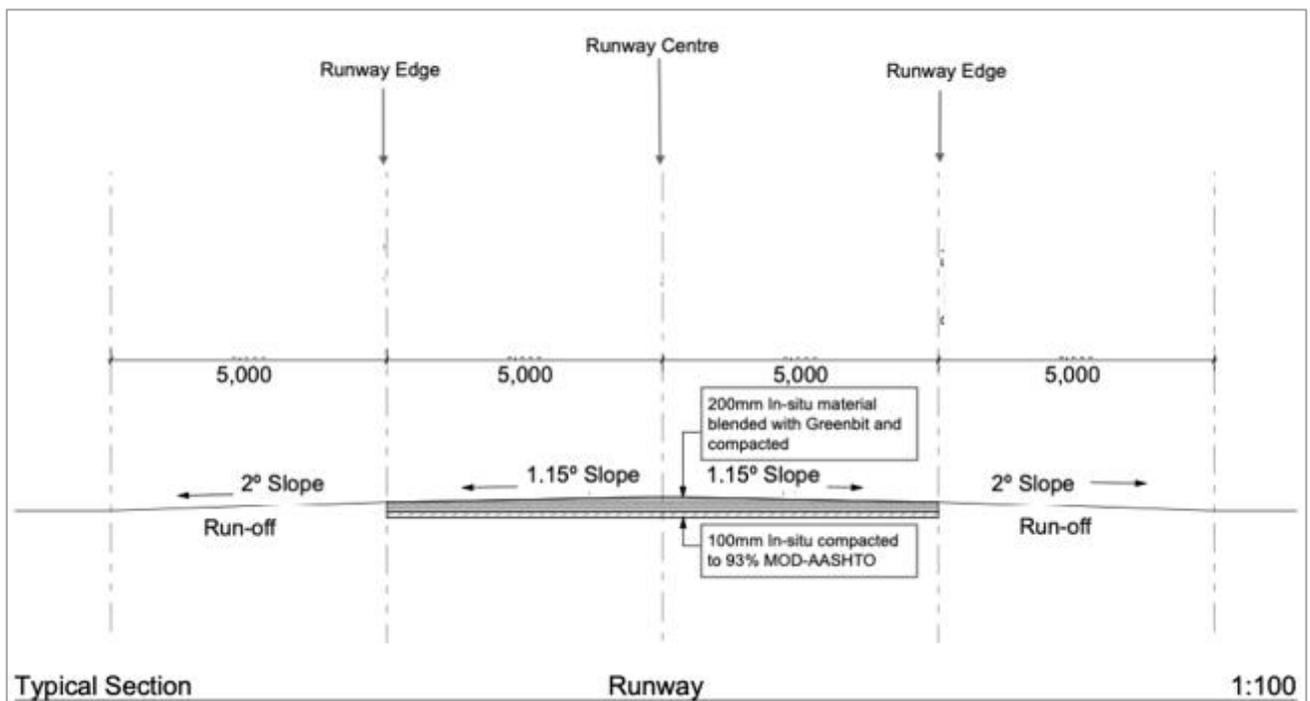


Figure 3. Section view showing the slope gradients.

2.3 Construction

A contractor will be appointed for the project. They will have approximately 10 employees living on site during construction. Contractor staff will stay in tents in the existing staff village and use the existing staff ablution facilities. Their meals will be cooked on a gas stove by a staff chef and no firewood will be collected.

Calcrete clay will be obtained from shallow borrow pits near the runway and existing tracks in a manner that causes the least environmental impact. A borrow pit design protocol is given in Section 4.2.5 with stipulations that are intended to minimise animal mortality and topographical impacts. Calcrete will be spread uniformly over a graded substructure, compacted, and the top layer will be bound with a lignin-based product called GreenBit.

Graders, compacter rollers and tractors will be used by the contractor. Water will be collected from the staff village and the lodge and transported to the site with a water bowser. All construction vehicles will use the existing track from the NRNP entrance via the staff village to the airstrip (orange lines in Figure 1 and **Error! Reference source not found.**) and the contractor and their staff will be made aware of strict road use rules, e.g. speed limit, no off-road driving, no making new tracks. The NRNP road building guidelines will be used and borrow pits and laydown areas will be chosen with the input of NP management.

The site perimeter will be clearly demarcated, and no construction or human activity will be allowed outside the site boundaries. No mature trees or shrubs will be removed or damaged, and contractors and their employees will be trained to actively preserve naturally occurring vegetation.

The airstrip site was chosen to avoid trees and mature shrubs. There may be no deviation from this path without written permission from the Natural Selection Operations Director.

2.4 Operational phase

It is foreseen that an average of one airplane per day will use the airstrip for Nkasa Linyanti Camp.

3 IMPLEMENTATION

Natural Selection Safaris is responsible for the day-to-day implementation of this EMP. All contractors, subcontractors, visitors and staff must be made aware of the contents of the EMP and their roles in following it.

The objectives of the (EMP) include:

1. Assuring MEFT (the Environmental Commissioner) that suitable and sufficient mitigation and monitoring measures are in place
2. Identifying potential impacts associated with the project
3. Proposing measures to prevent or mitigate negative impacts and enhance positive impacts
4. Providing a monitoring tool for MEFT and the JMC
5. Providing a management tool to ensure a consistent approach to airstrip construction and management
6. Compliance with environmental legislation
7. Informing staff, contractors, MEFT and communities how to implement sustainable environmental practices
8. Implementation actions aim to minimise negative impacts and enhance positive impacts that originate from both the construction and the operational phases.

This EMP illustrates the commitment of Natural Selection Safaris to follow sustainable tourism best practices. It is a legally binding document and constitutes an environmental contract between Natural Selection Safaris (Pty) Ltd and the Government of the Republic of Namibia: MEFT.

The EMP is a living document that will be updated as new information, policies, authority guidelines and technologies are developed and become available.

3.1 Training

Appropriate training, education and experience for the tasks that are expected of employees will result in competence of the workforce. All employees will receive induction training upon arrival on site, and the manager on site will keep a register of completed training.

A site induction should contain at least the following components:

- Definitions of “environment”, “social”, “impact”, etc. in language that is understandable by the trainees
- The risks and potential impacts associated with the project
- How can risks and impacts be minimised
- Environmental rules of the project
- The roles and responsibilities of the trainee in relation to the environment and this EMP
- Procedures to follow in the event of an environmental incident

- The consequences of non-compliance, including the possibility that the ECC may be withdrawn, and the project forced to close.

3.2 Compliance

- Natural Selection Safaris will avoid or minimise potential impacts on the by complying with the guidelines in this EMP.
- Immediate action will be taken if EMP measures are not followed.
- All required environmental authorisations, permits and licences have been obtained; their stipulations are implemented; and renewal will be done before expiry.
- Contractors and new employees will be informed of the high value placed on the environment and will be aware of the measures in the EMP and their responsibility in carrying out those measures.

3.3 Consequences of non-compliance

This EMP is a legally binding document. The consequences of non-compliance will be stipulated in every employment contract as well as in contracts with contractors and subcontractors and will include but are not limited to:

- Fines and penalties to the contractor
- Legal action
- Cancellation of contract
- Suspension of work
- Disciplinary action if the perpetrator is an employee of the proponent
- Withdrawal of ECC

3.4 Environmental Awareness Training

Construction Phase

The proponent will ensure that all contractors and their personnel are aware of the contents of the EMP and their need to follow the provisions of the Management tables (Section 4).

Operational Phase

The lodge employees who maintain the airstrip, are responsible for safety at the airstrip and those picking up or dropping off passengers will receive training regarding the requirements of this EMP and it will become part of the standard operating procedure of the project.

3.5 Environmental incident reports

Construction phase: Environmental incidents will be reported to the construction supervisor, Lodge Manager and Operations Manager.

Operational phase: Environmental incidents will be reported to the Lodge Manager and Operations Manager.

3.6 Contractual obligations

The proposed project is regulated by two contracts, the HCC and COC. The HCC takes precedence in the event of discrepancies. The JMC, consisting of a representative of the WBD conservancies, Natural Selection Safaris and MEFT each and meeting quarterly, will monitor compliance with these contracts and the EMP.

3.7 Environmental Control Officer

According to section 7.12 of the COC the proponent is obliged to appoint an independent environmental control officer (ECO) with the following responsibilities:

- Ensure compliance with relevant environmental regulations
- Ensure compliance with this EMP
- Monitor the effectiveness of mitigation measures set out in this EMP
- Ensure that impacts are prevented and/or managed.
- Regular inspections of the construction site and operational areas
- Promote environmental awareness among the contractors and their staff, and project employees
- Request the removal of people and/or machinery that do not comply with the EMP

If the ECO is not an independent consultant but is employed by the proponent, their appointment should be approved by the Concessions Unit of MEFT.

3.8 Reporting

The proponent should deliver reports to MEFT: Concessions Unit during the construction phase as stipulated in the HCC and COC, and thereafter biannually. An annual EMP audit report shall be prepared by an independent environmental consultant.

4 IMPACT MANAGEMENT

4.1 Potential impacts

Potential impacts were identified during the scoping phase, and they are summarised in Table 1. The level of significance is given for with and without mitigation. A minus (-) sign indicates a negative impact and a plus (+) is for positive impacts. Significance can be Very Low (VL), Low (L), High (H) or Very High (VH).

Table 1. Key impacts identified during the scoping process

Description of Impact	Source of impact	Description of significance	Mitigation	Significance
1. Destruction of organisms and their habitats. Loss of terrestrial flora. Mortality of birds.	Construction phase: land clearing and compacting; access routes; digging borrow pits; movement of vehicles and heavy equipment; human presence. Alien invasive plants.	Death of organisms and destruction of habitat represent permanent loss and degradation at the level of individual animals and small locations. No species is expected to be affected to any meaningful level. Birds are particularly vulnerable to aircraft collisions. The extent of the impact is limited to the project site. The spread of alien invasive plants threaten ecosystem functions.	without	-L
	Operational phase: airplane noise; risk of collisions.		with	-VL
2. Disturbance of animals and interference with their behaviour.	Construction phase: land clearing and compacting; access routes; digging borrow pits; movement of vehicles and heavy equipment; loud noises; human presence.	The disturbance of animals in their daily foraging and movements may increase the risk of mortality. The impact is at the level of individual animals and the loss of a population is highly unlikely. The small size of the project footprint limits the extent of the impact, and management measures in the EMP are intended to limit the severity.	without	-L
	Changes in vegetation and topography cause habitat fragmentation.		with	-VL
	Operational phase: Airstrip and unrehabilitated borrow pits create obstacles to the directional movement of animals, especially mammals. Loud noises caused by airplanes landing and taking off disturb animals, specifically bird and mammals.	Operational activities have a low potential of causing this impact and it can be largely avoided by following the management measures in the EMP.		

Description of Impact	Source of impact	Description of significance	Mitigation	Significance
3. Alteration of topography.	Construction phase. Earthmoving equipment levels the site. Borrow pits are deep, open cavities with steep sides and water collects there in the rainy season.	May affect ecosystems on a limited scale. Direct destruction of animals and habitats (see impact 1). Fragmentation of habitat, leading to the loss of migration corridors for various taxa (mammals, amphibians and reptiles), in turn resulting in the loss of individual organisms (see impact 2.)	without	-H
			with	-L
4. Contamination of groundwater, surface water and soil.	Construction: Spillage of hydrocarbons from vehicles and machinery. Operations: Spillage of hydrocarbons from airplanes during routine checks and from vehicles. Accumulation of rainwater is expected in the borrow pits and runoff zones either side of the landing strip. It could infiltrate underground and contaminate groundwater and soil, or it could contaminate surface flow.	Potential cumulative impact: Groundwater contamination from waste or polluted surface runoff is difficult to clean. Contamination can occur repeatedly during the rainy season and accumulate if the source is not removed. May be a continuous source of contamination that can accumulate, but can be minimised by the management measures recommended in the EMP.	without	-H
			with	-VL
5. Damage to or destruction of sites with cultural value.	Earthmoving machinery and vehicles expose sites or items of cultural value during construction.	It is a brownfield site, but the chance find protocol given in the EMP will be followed and heritage finds will be protected.	without	-L
			with	-VL
6. Anti-poaching.	Incoming aircraft spot poaching activities in areas of the Park that are inaccessible to vehicles.	An extra layer of security against poaching.		L+
7. Medical evacuation	In case of a medical emergency NRNP staff and nearby community members could be evacuated quickly.	Lives could be saved and life-altering injuries prevented.		H+

4.2 Management measures

Table 3, Table 4, Table 5 and Table 6 contain a register of potential impacts and management measures for each impact. The table headings are discussed here.

Nature of impact

Description of potential risk sources (impacting activities) and the mechanisms through which an impact may occur are described.

Management

Management measures are proposed for each identified impact. These measures take the form of specific management actions that aim to avoid, minimise or remedy negative impacts, together with adjustments to respond to unforeseen impacts.

Responsibility

Successful implementation of an EMP relies on defined roles and responsibilities. Natural Selection Safaris has allocated duties to individuals and teams (Table 2), and they are responsible for carrying out the management actions listed in the column *Mitigation*.

Table 2. Responsible individuals and teams.

Person/Team	Responsibilities
Operations Manager (Ops)	Overall responsibility for implementation of this EMP. Support to construction and lodge staff for the implementation of environmental management measures. Provide financial and technical resources for the project and implementation of the EMP.
Environmental Control Officer (ECO)	Ensure compliance with this EMP. Keep a register of employees and contractor staff who completed site induction. Notify the relevant authorities in the event of a serious environmental incident. Ensure employees and contractors understand and comply with this EMP. Keep a record of environmental complaints and responses from the community, public and authorities.
Maintenance team (Maint)	Maintenance of airstrip. Monitor airstrip for damage. Report damage to the Lodge Manager.
Guides	Transport of guests to and from airstrip. Safety of guests, staff and other passengers at the airstrip. Ensure adherence to the Guiding Protocol and the NS airstrip safety protocol.
Contractor	Ensure all their staff are familiar with the provisions in this EMP and how they pertain to each employee's tasks. Implement the measures in this EMP. Adhere to any relevant statutory and legal requirements. Report environmental incidents to the Operations Manager and the Lodge Manager. Identify potential risks and report them to the Operations Manager.
Joint Management Committee (JMC)	Representatives of the WBD conservancies, MEFT and Natural Selection Safaris form the JMC. Required to meet quarterly. Oversee the implementation of and adherence to this EMP.

Tools/monitoring

This column refers to actions, equipment, procedures, protocols and/or guidelines that enable the implementation and monitoring of the management actions.

The Natural Selection group has two airstrip protocols that will be implemented:

- NS Airstrip construction guidelines and
- NS Airstrip safety protocol

4.2.1 Planning and construction phase

Once construction starts, Natural Selection Safaris will inspect the site daily to ensure compliance by the contractor, sub-contractors and their employees. A final inspection will be done upon completion of construction and before signing off on the project to ensure that the contractor has satisfied all the requirements in this EMP.

The key impacts summarised in Table 1 were further broken down into detailed impacts and they are arranged in Table 3 according to the environmental aspects they affect.

Table 3. Management actions for the construction phase.

NATURE OF IMPACT	MANAGEMENT	RESPONSIBILITY	TOOLS/MONITORING
Aspect 1. Biodiversity			
Destruction of organisms and their habitat. Mortality of amphibians, reptiles, birds, mammals. Snakes are particularly vulnerable because they are usually killed on sight. Loss of terrestrial flora.	Avoid any nests, burrows, dens and roosting sites.	ECO	Identify sites with nests, burrows, dens. Demarcation of sensitive sites.
	Educate contractor and staff to avoid sensitive sites.		
	Venomous snakes should be removed by a specialist, and other snakes should be avoided.	Contractor	Induction. Construction contract.
	Educate staff in the ecological value of snakes and how to avoid them.		
Speed limit for heavy vehicles is 20 km/h. Other vehicles keep to the NRNP speed limit at all times.		Speed limit	
Disturbance of animals and interference with their behaviour, daily foraging and movements.	Construction activities takes place only during daylight hours. Vehicles and machinery are fitted with noise minimising implements where possible. Confine all construction, driving and human movement activities to defined development and accommodation areas.	ECO. Contractor	Induction. Construction contract.
<u>Borrow pits</u> : Fauna is trapped in the pits	Use multiple small, shallow borrow pits only. Excavation limited to minimum material requirement. No vertical faces permitted. Irregular shapes rather than rectangular.	Contractor	ECO Visual inspections

NATURE OF IMPACT	MANAGEMENT	RESPONSIBILITY	TOOLS/MONITORING
<u>Borrow pits</u> : Mortality of tortoises, terrapins, reptiles and small mammals	Final pit slopes $\leq 1V:3H$ (target $1V:4H$). Install fauna escape ramps ($\leq 1V:3H$) during excavation. Avoid existing pans. Roughen the sides during digging to provide footholds.	Contractor	Daily pit inspections. ECO verification.
<u>Borrow pits</u> : Drowning and secondary attraction of scavengers	Prevent permanent water retention in borrow pits. Provide drainage outlets or shallow spillways. Shape wet margins to $\leq 1V:4H$ where pooling occurs.	Contractor	Visual inspection after rainfall
<u>Borrow pits</u> : Prolonged disturbance due to open pits	Progressive rehabilitation of each pit immediately after extraction ceases. No pits left open unnecessarily.	Contractor	ECO sign-off per pit
<u>Borrow pits</u> : Failure of rehabilitation	Strip, stockpile and replace topsoil (150–300 mm). Roughen surfaces and sides, and blend landform with surroundings.	Contractor	Post-rehabilitation inspections by ECO
Poaching of wildlife. Tortoises and small mammals are particularly vulnerable.	The greater area around building sites should be searched for snares during the construction phase and after construction is complete.	ECO. Contractor	Visual inspections by ECO
	Restriction of contractor staff movement	Contractor	
	Inspection of contractor staff housing to check for animal parts and/or products	Contractor	
Damage to vegetation, leading to a loss of habitat integrity and disruption of ecosystem functions. Poaching of plants for trade.	Motorised access is limited to existing tracks and defined development areas.	ECO. Contractor	Visual inspections by ECO
	No off-road driving is allowed under any circumstances.	Contractor	
	Only existing, permitted access roads and paths are used by construction workers and vehicles at all times.	Contractor	
	No firewood may be collected.	Contractor	
	Carry out regular inspections of the staff village and staff transport, looking for poached plants or animal parts.	ECO. Contractor	
	Rehabilitate laydown areas, temporary construction facilities and construction tracks	ECO. Contractor	

Aspect 2. Topography

NATURE OF IMPACT	MANAGEMENT	RESPONSIBILITY	TOOLS/MONITORING
Alteration of the shape of the landscape from earthmoving equipment and borrow pits. Fragmentation of habitat leading to increase in mortality of specifically mammals.	The use of earthmoving equipment is restricted to the airstrip site. Heavy vehicles move only in designated supply corridors.	Contractor	Demarcation of construction area and supply corridors
	Construction site office and facilities to be dismantled and removed once construction is completed	Contractor	Site inspection
	Borrow pits: see Aspect 1 and Section 4.2.5		
Aspect 3. Soil and water			
Erosion, compaction of and damage to soils. Off-road driving damages the structure of the soil surface and causes soil compaction, which results in less water infiltration and availability, limited root penetration and less vegetation cover. Damaged soil crust makes the fine underlayer of soil vulnerable to wind erosion, the resulting dust settles on plants, interferes with photosynthesis, and causes a decline in habitat quality.	Motorised access will be limited to existing tracks and defined development areas. No new roads or tracks will be made.	ECO. Contractor	Visual inspections
	No off-road driving is allowed. Regular road maintenance, erosion control and good drainage will prevent the need for off-road driving.	ECO. Contractor	Road building and maintenance plan
	No construction activities may take place outside the defined infrastructure footprint areas.	Contractor	Site plans to clearly define construction areas.
	Movements of the construction crew must remain within the demarcated site boundaries at all times.	ECO. Contractor	Site boundary demarcation.
	An area for mixing and stockpiling construction material must be demarcated. It must be located in an area that is already disturbed, or where development will take place.	ECO. Contractor	Selection of laydown area. Demarcate area.
	Access routes between the stockpiling area and the airstrip site are demarcated on existing roads and their use enforced.	ECO. Contractor	Demarcated roads.
	Once construction work is completed, all building material and rubbish must be removed from NRNP and the construction sites must be rehabilitated to a state as close as possible to its pre-construction condition.	Contractor	Visual inspections. Sign-off by ECO.
Damage to roads and tracks	The contractor shall ensure that all vehicles remain on designated roads at all times. No off road driving under any circumstances.	Contractor	All contractors are made aware of this requirement.
	All vehicles used in the area must be operated with low tyre-pressure to minimise negative impacts on tracks and roads.	Contractor	All contractors are made aware of this requirement.

NATURE OF IMPACT	MANAGEMENT	RESPONSIBILITY	TOOLS/MONITORING
Soil is contaminated by hydrocarbons and other chemicals used in the construction process	The mixing and use of concrete and cement must takes placed in defined, designated areas only.	Contractor	Designated mixing areas.
	All hydrocarbons and chemicals must be stored, handled and dispensed on and over an impermeable surface.	Contractor	Lined and banded storage areas.
	Any spillage must be contained and cleaned up with 24hrs of occurrence. The resulting waste must be sealed in an appropriate container and taken off site for disposal.	Contractor	Spill kits. Drums with sealable lids.
Surface water (to a lesser extent groundwater) is contaminated by hydrocarbons and other chemicals used in the construction process.	The mixing and use of chemicals, concrete and hydrocarbons only take place in designated and demarcated areas.	ECO, Contractor	Identify, prepare and demarcate areas. Visual instpections
	Hydrocarbons and chemicals are stored, handled and dispensed in a manner that prevents spillage and contamination.	Contractor	Identify storage and dispensing protocols.
Aspect 4. Heritage/archaeology			
Construction activities damage and/or destroy sites of cultural significance.	Report any find that may be of cultural or archaeological value to the National Heritage Council.	ECO, Contractor	Chance find procedure (Section 4.2.4)
Aspect 5. Bush fires			
Bush fires destroy habitats and animals, and present a risk to the life and health of humans.	Fire extinguishers and other firefighting equipment are strategically located throughout construction area. Staff are trained in their usage.	Contractor	Firefighting equipment
	Adequate firebreaks must be made around all infrastructure after consultation and agreement with NRNP management.	ECO, Contractor	Grader
	Gas canisters to be housed in Bureau of Standards approved structures.	Contractor	Gas enclosures
	Staff are aware of the fire prevention measures, and know what to do should a fire break out.	ECO, Contractor	Induction
NRNP fire management plan	The HCC requires that wildfires be left alone by the project staff unless life or property is under direct threat. Agree with NRNP management on a fire protocol that includes clear	ECO	HCC, COC. Induction.

NATURE OF IMPACT	MANAGEMENT	RESPONSIBILITY	TOOLS/MONITORING
	communication channels. All staff are aware of the NP fire protocol.		

4.2.2 Operational phase

The key impacts summarised in Table 1 were further broken down into detailed impacts and they are arranged in Table 4 according to the environmental aspects they affect.

Table 4. Management actions for the operational phase.

NATURE OF IMPACT	MANAGEMENT	RESPONSIBILITY	TOOLS/MONITORING
Aspect 1. Biodiversity			
Birds collide with flying aircraft.	There is a low probability of this impact occurring due to the low frequency of flights. No roosting or breeding colony of large birds has been identified directly in the flight path.		
The noise of aircraft landing and taking off disturbs animals and interfere with their behaviour. The runway is an obstacle to the directional movement of animals, especially small mammals and reptiles.	Other airstrips in protected areas with big populations of large mammals (e.g. Chobe and King's Pool in Botswana) have proven that large mammals adapt to noise disturbance and the intensity and probability of the impact occurring decrease quickly. There is a low probability of this impact occurring due to the low frequency of flights.		
Mortality of mammals on the runway due to collision with airplane.	A lodge vehicle is required to be on the airstrip 30 minutes before arrivals and departures, checking the runway.	LM, Guides, Maint	Airstrip Safety Protocol
Aspect 2. Soil and water			
Erosion, compaction of and damage to soils. Off-road driving damages the structure of the soil surface and causes soil compaction, which results in less water infiltration and availability, limited root penetration and less vegetation cover. Damaged soil crust makes the fine underlayer of soil vulnerable to wind erosion, the resulting dust settles on plants, interferes with photosynthesis, and causes a decline in habitat quality.	Motorised access will be limited to existing tracks and defined development areas. No new roads or tracks will be made.	LM, Guides, Maint	Guiding protocol, standard operational procedures, Induction and annual training
	No off-road driving is allowed. Regular road maintenance, erosion control and good drainage will prevent the need for off-road driving.	LM, Guides, Maint	

Damage to roads and tracks	All lodge staff who drive to and from the airstrip will remain on designated roads at all times. No off road driving under any circumstances.	LM, Guides, Maint	
	All vehicles will be operated with low tyre-pressure to minimise negative impacts on tracks and roads.	LM, Guides, Maint	
Water run-off causes pooling and erosion around airstrip and further downstream.	During rainy season, the run-off and dispersal channels are inspected and repaired after every rainfall event.	ECO, LM, Maint	
Aspect 3. Heritage/archaeology			
Should items or sites of cultural significance be discovered during the lifetime of the project, the proponent will follow the heritage chance find procedure.	Report any find that may be of cultural or archaeological value to the National Heritage Council.	ECO, LM	Chance find procedure (Section 4.2.4)
Aspect 4. Bush fires			
Bush fires destroy habitats and animals, and present a risk to the life and health of humans.	Fire extinguishers, all legally required firefighting equipment and any other safety measures required by international best practice are stationed in an appropriate locations.	LM	Firefighting equipment
	Staff are aware of the fire prevention measures, and know what to do should a fire break out.	ECO, LM	Induction. Fire training
NRNP fire management plan	The HCC requires that wildfires be left alone by the project staff unless life or property is under direct threat. Agree with NRNP management on a fire protocol that includes clear communication channels. All staff are aware of the NP fire protocol.	ECO, LM	HCC, COC. Induction.
Aspect 5. Airstrip safety			
This aspect is regulated by the Namibia Civil Aviation Authority. The proponent will follow all policies, regulations and guidelines regarding airstrip and airplane safety.		Ops. LM	NCAA regulations. NS Airstrip Safety Protocol

4.2.3 Closure and decommissioning

Tourism is a non-consumptive activity with an indefinite projected lifespan and after 25 years the business and immovable assets will become the property of the WBD conservancies, as stipulated in the HCC and the COC. The airstrip remains the property of MEFT.

However, should closure and decommissioning be required, an extensive decommissioning plan will be drawn up and meticulously followed according to the highest standards of environmental management best practices. The priority for closure will be to return the land as closely as possible to the pre-construction condition. Measures will be taken to prevent soil erosion and provide protection for colonising vegetation. A site assessment will be carried out after closure to ensure that no structures remain, and that site rehabilitation has been fully achieved.

There would be four primary closure objectives.

1. Protect public health and safety, as well as health and safety of fauna and flora.
2. Alleviate or eliminate environmental damage.
3. Return the site to its original, pre-development condition.
4. Ensure that social and economic benefits are sustainable after closure.

Table 5. Decommissioning plan at concept level.

NATURE OF IMPACT	MITIGATION
Infrastructure	
Buildings and support infrastructure	All structures will be completely removed to the satisfaction of MET.
Roads and tracks	As required by MEFT, roads and tracks will be rehabilitated to a state as close as possible to the original condition of the area.
Pathways	All pathways will be rehabilitated to a state as close as possible to the pre-construction condition.
Vegetation: destruction of & damage to plants; disturbance of soil	
Soil erosion	The site will be suitably re-vegetated. If this is not appropriate, then it will be covered with scrub to prevent soil erosion and to provide protection for colonising vegetation.
Alien plant invasion	Follow-ups will be done to ensure that alien or invasive plants and weeds have not flourished.
Damage to vegetation	Construction guidelines will apply to ensure limited impact.
Soil	
Compaction of and damage to soils, contamination	Construction guidelines will apply to ensure limited impact.
Hydrology	
Contamination of ground and surface water, erosion of river banks	Construction guidelines will apply to ensure limited impact.
Animals: habitat disturbance; death of animals	
Death of animals, poaching, habitat or behaviour disturbance	Construction guidelines will apply to ensure limited impact.
Negative visual impact	

NATURE OF IMPACT	MITIGATION
Sewerage system	Septic tanks will be drained and removed. The area (including soak-away) will be filled with rubble or with fill from an environmentally acceptable source.
Water pipes	All pipe lines will be removed from the concession.
Electricity lines	All electricity infrastructure will be removed from the concession.
Foundations, concrete slabs, holes in ground	All structures in or on the ground will be removed. All holes, pits and depressions will be filled.
Ground surface retains signs of development	Ground surface will be raked, swept and levelled as appropriate. Rocks, stones and vegetable matter will be scattered as appropriate to return the ground to a state as close as possible to its original condition.
Construction structures and facilities	Construction site office, facilities and structures to be dismantled and removed once decommissioning is completed
Solid waste, sewage and waste water discharge	
Large volumes of rubble, materials and equipment	Everything will be removed from the concession.
	Nothing will be burnt or buried on the concession.
Ecological damage	Construction guidelines will apply to ensure limited impact.
Machinery & vehicles: noise, contamination of soil and water by liquids, erosion of roads	
Noise, contamination of soil and water, erosion	Construction guidelines will apply to ensure limited impact.
Construction staff damage local environment	
Disruption of ecological processes through physical acts and/or pollution	Construction guidelines will apply to ensure limited impact.
Bush fires: destruction of habitat and death of animals	
Outbreak of fire	Construction guidelines will apply to ensure limited impact.
Health and Safety of staff	
Injury to persons	Construction guidelines will apply to ensure limited impact.

4.2.4 Heritage chance find procedure

When a heritage site or item of cultural significance is discovered during any phase of the development, it has to be reported to the National Heritage Council to ensure compliance with the National Heritage Act (27 of 2004), section 55: “a person who discovers any archaeological object must as soon as practicable report the discovery to the Council”.

There is a specific process to follow when a potential heritage item is found, whether by a contractor, guest or lodge staff member.

Table 6. Heritage chance find procedure

1. Responsibilities	
Finder	The person who discovers archaeological or heritage items
Supervisor	Secure site and advise management
Senior manager	Report finding to NHC. Determine safe working boundaries
Archaeologist	Inspect, identify, advise management, and recover the items
2. Actions	
Person	Actions
Finder	If operating machinery or equipment, stop work
	Demarcate the site
	Take GPS coordinates if possible
	Report findings to supervisor
Supervisor	Report findings, site location and actions taken to superintendent.
	Cease any works in immediate vicinity
Senior manager	Visit site and determine whether work can proceed without damage to findings
	Determine and mark exclusion boundary
	Site location and details to be added to Archaeological Heritage Geographical Information System (GIS) for field confirmation by archaeologist
Archaeologist	Inspect site and confirm addition to GIS
	Advise NHC and request written permission to remove findings from work area
	Recovery, packaging, and labelling of findings for transfer to National Museum
3. Discovery of human remains	
	Actions as above
	Advise and liaise with NHC and Police
	Recovery of remains and removal to National Museum or National Forensic Laboratory, as directed by the police and NHC

4.2.5 Borrow pit design parameters

Material for the construction of the Nkasa Linyanti airstrip will be obtained from several small, shallow borrow pits located close to the runway and along existing tracks, rather than from a single large excavation. Each borrow pit will be excavated only to the minimum viable volume required for construction.

This approach is made possible by sealing the airstrip surface with the lignin-based product GreenBit, which significantly reduces aggregate demand.

Borrow pits shall be planned, excavated, operated and rehabilitated in a manner that prevents wildlife entrapment, avoids the formation of long-term hazards, and allows rapid reintegration with the surrounding environment, with particular consideration given to tortoises, terrapins, small mammals, reptiles and ground-foraging birds. Tortoises and terrapins are highly sensitive to the impacts of borrow pits on this site.

Key design and operational requirements are as follows:

- Borrow pits shall be small in footprint and shallow in depth, and shall not be expanded beyond the minimum material requirement.

- Final side slopes shall have a target gradient of 1V:4H ($\approx 14^\circ$) and shall not exceed 1V:3H ($\approx 18-20^\circ$) under any circumstances.
- Vertical or near-vertical faces are prohibited.
- Where temporary excavation faces steeper than 1V:3H are unavoidable during construction, fauna escape ramps shall be installed along pit edges. Ramps shall have a gradient of $\leq 1V:3H$, and a roughened or stepped surface.
- Borrow pits shall not be designed to retain permanent water. Drainage outlets or shallow spillways shall be provided to prevent standing water. Where temporary pooling occurs after rainfall, at least two margins shall be reshaped to $\leq 1V:4H$ to allow safe fauna egress.
- Topsoil shall be stripped separately, stockpiled outside drainage lines, and replaced evenly to a depth of 150–300 mm immediately after completion of extraction at each pit.
- Progressive rehabilitation is mandatory. Each borrow pit shall be fully reshaped and rehabilitated as soon as material extraction ceases, and shall not remain open until the end of the construction phase.
- Final surfaces shall be lightly ripped or roughened and blended into the surrounding topography. Tree trunks, rocks and natural debris may be scattered to promote microhabitat formation and erosion control. These materials to be from indigenous vegetation, and sourced sustainably from outside NRNP.

Compliance with these requirements is mandatory and will be verified by the Environmental Control Officer prior to construction sign-off.

Sign-off criteria

Each pit may be signed off only when:

1. Final slopes are $\leq 1V:3H$, with a target of **1V:4H**.
2. No vertical or near-vertical faces remain.
3. Topsoil has been replaced and surfaces roughened.
4. The pit blends visually and geomorphologically with the surrounding landscape.
5. No evidence of fauna entrapment is observed.

5 MONITORING

This EMP can only provide value in preventing and managing potential impacts if the proponent implements it. Compliance with the EMP must be monitored regularly, and adaptive management applied based on the results of monitoring.

The proponent has to deliver monthly reports to MEFT during the construction phase, and annually thereafter. An annual EMP audit report must be prepared by an independent environmental consultant, as stipulated in the HCC and COC.

5.1 Water monitoring

1. Visual inspection of borrow pits for any waste or groundwater seepage and immediate removal of contaminants.
2. Inspection of wastewater treatment facility, sampling and analysis of effluent.
3. Ensure minimal leakage from evaporation ponds.
4. Monitor abstraction rates.
5. Assessment of abstraction rate yearly and adjustment as required for sustainable utilisation.
6. Groundwater level monitoring in all boreholes – production and monitoring borehole (weekly)
7. Considering the shallow water table, it is essential to prevent groundwater contamination by ensuring that septic tanks are sealed and all pipes leak-free.
8. Drinkwater quality is monitored annually (at least) at a point of use (tap in the kitchen or bathroom) to analyse for fitness for human consumption.
9. Effluent should be tested twice a year for the values in the Effluent Discharge Permit.

6 CONCLUSIONS AND RECOMMENDATIONS

This Environmental Management Plan describes the management measures that can prevent or mitigate negative environmental impacts and enhance positive impacts that may result from the construction and operation of the lodge. It is a legally binding document that compels Natural Selection Safaris (Pty) Ltd to comply with the management measures, monitoring programmes and other plans presented in this document. The EMP will be implemented throughout the lifetime of the lodge, including closure and decommissioning should that become necessary.

No fatal flaw was identified, and all potential impacts can be either prevented or mitigated to a low or very low significance by implementing the measures in this EMP.

It is recommended that an Environmental Clearance Certificate be issued to the proponent.

APPENDIX I. Natural Selection Airstrip Safety Protocol

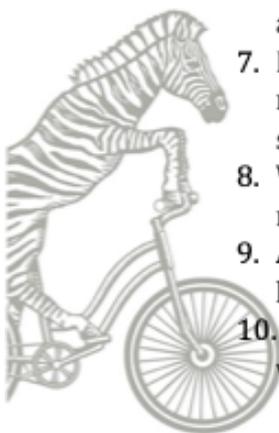
NATURAL SELECTION

safaris of character

Airstrip Safety Procedures and Protocol

The Airstrip is where you meet and greet most of your guests and will be the first and last impression you leave with the guests of Natural Selection Safaris. It is therefore extremely important that all safety regulations are followed and adhered to for the safety of your guest, yourself, and the pilot. Therefore, it will be expected of you to always adhere to the following safety regulations and protocols.

1. Be at the airstrip 30 minutes before take-off or landing (arrival/departure).
2. Report your arrival on the radio to the camp.
3. Assess the runway for any debris and remove it, this includes rocks, branches, any foreign objects, holes created by animals.
4. Ensure the windsock is fully functional.
5. Check if emergency equipment is present and ready for use in case of an emergency.
6. Ensure all animals have been removed from the runway and surrounding edges. If necessary, position the vehicle between animals and the runway otherwise,
7. Position the vehicle halfway down the airstrip, (not on the runway) facing the oncoming airplane. Flash your lights to signal if it is not safe to land.
8. Wait until the aircraft has passed you on the runway and then make your way to the apron.
9. Always park behind and to the side of the parked aircraft to load and off load passengers.
10. Assist the pilot with luggage and escort the guests to the vehicle.



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11. Welcome the guest warmly and explain to the guest that you will be waiting for the aircraft to take off safely before you depart to camp.
12. Make sure the airstrip is still clear of any animals and park halfway down the airstrip facing the oncoming aircraft. If departing guest, get out of the vehicle, standing next to your vehicle and wave friendly as they take off.
13. If welcoming new guest, offer them water/cold drink and explain you will be heading to the camp and the estimated time it will take.
14. Never ever drive on the runway or cross the runway with your vehicle, it will damage the surface.
15. Report any damage to the runway markers, runway surface, airstrip name, emergency station, windsock to the camp immediately for it to be repaired.
16. Ensure that the pilot fills in the landing book.
17. Report to the camp that you are leaving the airstrip.

APPENDIX II. Natural Selection Airstrip Construction Guidelines



Airstrip Construction Guidelines

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CHAPTER 1: AIRSTRIP LOCATION AND LAYOUT

1. SITE CONSIDERATIONS

- 1.1. General. Airstrip orientation limiting factors (refer Paragraph 2 “Airstrip Direction” below), and flexibility to accommodate any future expansion of the airstrip infrastructure is fundamental to the planning and design of an airstrip.
- 1.2. Weather and Visibility. We are a VFR operation, therefore and in particular the airstrip “usability” factor, as determined by wind distribution, and the occurrence of localized fog is of concern. A study should be made of the wind conditions occurring with poor visibility and/or low cloud base at the airstrip, including the frequency of occurrence and the accompanying wind direction and speed.

1.3. Surface Type

- 1.3.1. Sand, gravel, black cotton soil, depth of bedrock i.e. potential of the proposed site to withstand aircraft operating characteristics e.g. landings, prop-wash, high load distribution over small tyre area etc. must be taken into consideration.
- 1.3.2. Surface Type in turn affects construction costs, plus subsequent repair and maintenance costs.
- 1.3.3. Consideration must extend to taxiways and parking areas over and above the strip itself, and be capable of supporting the heaviest aircraft likely to use the strip and should be free of any features (e.g. holes, ditches, rocks, furrows, loose stones, gravel or other obstacle likely to cause damage to aircraft).

1.4. Slopes

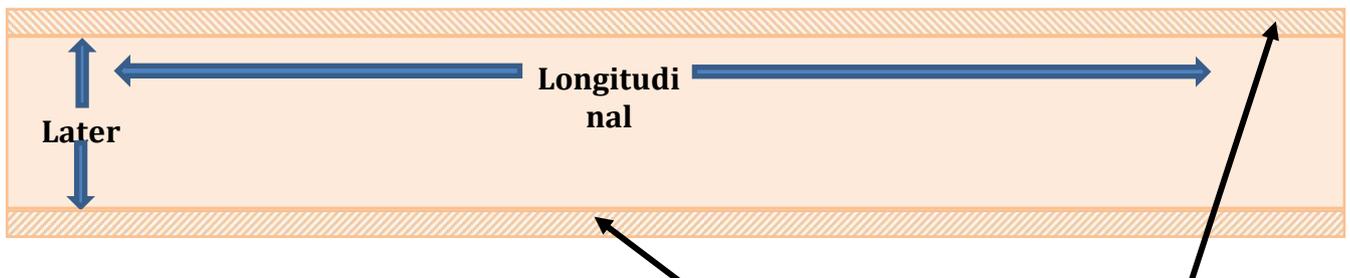
1.4.1. Airstrip slopes – the maximum surface slopes should not exceed:

- a) Longitudinal 2% (1:50); and
- b) Lateral 3% (1:33).

1.4.2. The first 3 meters out from the airstrip shoulder edge, however, may be as great as 5% (1:20) “laterally” to facilitate drainage.

1.4.3. Camber is good to facilitate drainage on the strip itself. However the camber should also not be excessive as to influence the directional control of the aircraft

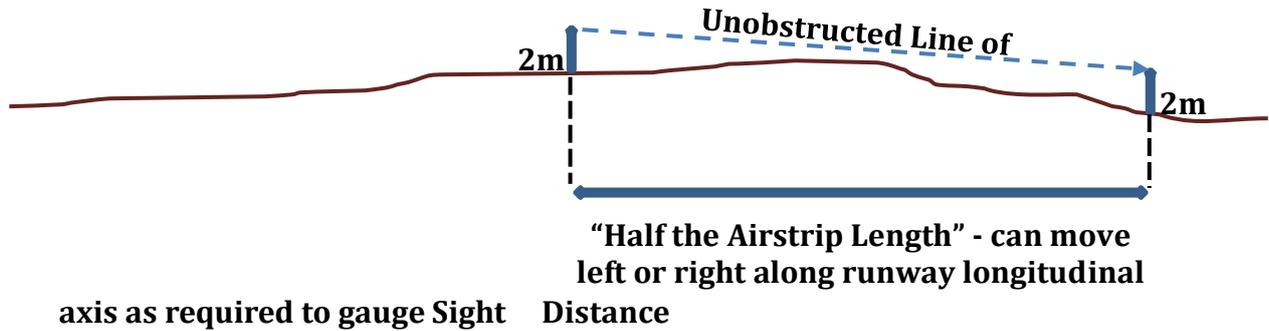
a) **STRIP SLOPE ORIENTATION (PLAN VIEW STRIP FROM ABOVE)**



**3m either side of Airstrip
Shoulder Edges**

1.5. Sight Distance. An unobstructed line of sight must be available from any point 2 meters above the airstrip to all other points 2 meters above the airstrip within a sight distance of at least half the airstrip length.

b) **SIGHT DISTANCE (CROSS SECTION ALONG LENGTH OF STRIP)**



1.6. Topography. The topographical features of the airstrip site and surroundings (including approach and take-off considerations) should be examined. In particular the following should be reviewed:

- a) Compliance with the obstacle limitation surfaces (refer Chapter 1, Paragraph 6 “Obstacle Clearance” below) and missed approach procedures;
- b) Current and future land use;
- c) The orientation and layout should be selected so as to protect as far as possible the particularly sensitive areas such as conservation areas, environmental impact, residential, school and hospital zones from the discomfort caused by aircraft noise;
- d) Current and future airstrip lengths to be provided for;
- e) Construction costs; and
- f) The possibility of installing suitable visual aids for approach-to-land (VFR operation).

1.7. Air Traffic. When considering the siting of airstrips the following should be taken into account with respect to air traffic in the vicinity:

Proximity of other airstrips or ATS routes etc.; and

Traffic density in the area

1.8. Aircraft Performance Considerations. (Refer Chapter 1, Paragraph 3 “Airstrip Length”; Paragraph 3 “Stopway and Clearway”; and Paragraph 6 “Obstacle Clearance” below)

1.9. Environmental Considerations. The effect of a particular airstrip alignment on wild life, the general ecology of the area, and noise sensitive areas of communities should be considered. The noise level produced by aircraft operations at and around the airstrip is generally considered a primary environmental cost associated with the facility. Most noise exposure lies within the land area immediately beneath and adjacent to the aircraft approach and departure paths.

2. AIRSTRIP DIRECTION AND DIRECTION INDICATION

2.1. Direction

- 2.1.1. It is not entirely necessary to physically indicate the direction of an airstrip of the general class and category of our airstrips.
- 2.1.2. However, should the law dictate or we choose for whatever reason to indicate the direction of the airstrip, then the direction is with reference to magnetic north.
- 2.1.3. The direction should be depicted by 2 numbers at the beginning of the airstrip at either end. These two numbers are the first 2 digits of the three digits of a 360° compass rounded off to the nearest 10° e.g. on a strip whose direction lies in an easterly direction of 090°, then the 2 numbers will be 09.

c) **STRIP DIRECTION INDICATION (PLAN VIEW OF STRIP FROM ABOVE)**



- 2.2. Directional Course. It is preferable that the airstrip be straight so as to avoid any directional change required to maintain centre line. Any directional change of 3° or more is to be avoided.
- 2.3. Orientation. Orientation of the airstrip should preferably be no more than 30 degrees deviation from the prevailing surface winds for the area (data for any given area can be retrieved from the met services or from a published atlas to determine airstrip directions).

3. AIRSTRIP LENGTH

- 3.1. Airstrip Length in General. Factors which have a bearing on the airstrip length to be provided are:
 - a) Performance characteristics and operating masses of the aeroplanes to be served;
 - b) Weather, particularly surface wind and temperature;
 - c) Airstrip characteristics such as slope and surface condition;
 - d) Airstrip location factors, for example, airstrip elevation which affects the barometric pressure; and

- e) Topographical constraints.

3.2. Factors Affecting Desired Airstrip Length

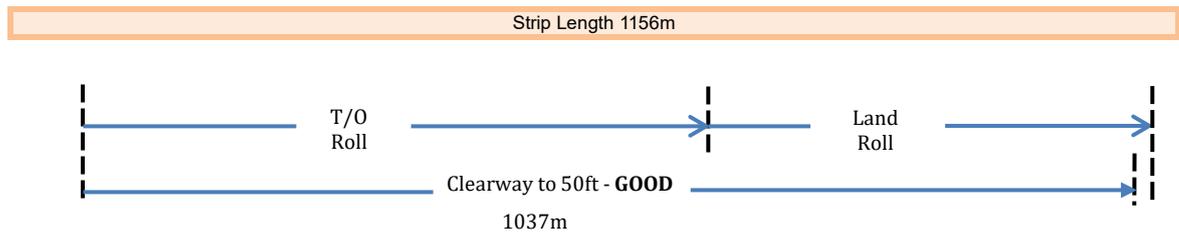
- 3.2.1. It is pointless to build a general airstrip and then “declare” distances for operator’s to work out their limitations when we are the main operator of that airstrip. The airstrip needs to consider the limitations of the aircraft we operate and therefore the required length of the airstrip is dependent on the aircraft type and the aircraft manufacturer’s recommendations to be applied.
- 3.2.2. Ideally the longer the airstrip the safer the airstrip, however a lengthy strip has a huge cost factor.
- 3.2.3. Although each aircraft type (with aircraft manufacturer’s recommendations) combined with the elevation, temperature and weight of the aircraft landing or taking off will determine actual length required and decision of go or no-go on the day in question, our desired minimum airstrip length should consider:
 - a) The length of the take-off roll of the heaviest aircraft intended to take-off at that airstrip (consider POH recommendations wet / grass strip); plus
 - b) the length of the landing roll of the heaviest aircraft intended to land at that airstrip (consider POH recommendations wet / grass strip); at
 - c) MAUW of the heaviest aircraft intended on the respective airstrip; calculated at d) 40°C; for
 - e) the actual elevation of the airstrip.
- 3.2.4. Should the heaviest aircraft intended have superior STOL characteristics than other intended aircraft, then the weakest performing aircraft should have consideration.

DETERMINATION OF REQUIRED MINIMUM AIRSTRIP LENGTH: EXAMPLE

CESSNA GRAND CARAVAN 208B (example only – POH takes precedence)

Field Elevation:	2000ft	-	610m
Ambient Temperature:	40°C	-	104°F
Flaps @ 20°			
Maximum Take-off Weight:	8750lbs	-	3969kg
Take-Off Roll:	1818ft	-	699m
Clear Way to 50ft	2870ft	-	1037m
Maximum Landing Weight:	8500lbs	-	3856kg
Landing Roll:	1095ft	-	457m

REQUIRED MINIMUM AIRSTRIP LENGTH (PLANVIEW OF STRIP FROM ABOVE)



3.3. Stopway and Clearway

3.3.1. Where an actual airstrip length is less than that resulting from the above application as appropriate, and/or take-off and approach surfaces are hindered by terrain, manmade or vegetation obstacles, a stopway and/or clearway consideration might be necessary, but in such a case any combination of airstrip, stop way and/or clearway provided should permit compliance with the operational requirements for take-off and landing of the aeroplanes the airstrip is intended to serve, and the required corrections should be obtained by means of a specific study.

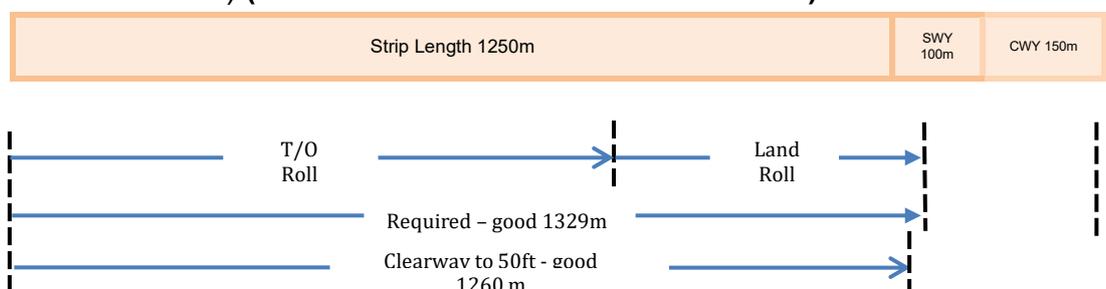
DETERMINATION OF REQUIRED MINIMUM AIRSTRIP LENGTH INCLUSIVE

d) CONSIDERATION OF STOPWAY / CLEARWAY: EXAMPLE CESSNA GRAND CARAVAN 208B (example only – POH takes precedence)

Field Elevation:	4000ft	-	1219m
Ambient Temperature:	40°C	-	104°F
Flaps @ 20°			
Maximum Take-off Weight:	8750lbs	-	3969kg
Take-Off Roll:	2548ft	-	838m
Clear Way to 50ft	3743ft	-	1260m
Maximum Landing Weight:	8500lbs	-	3856kg
Landing Roll:	1195ft	-	491m

REQUIRED MINIMUM AIRSTRIP LENGTH INCLUSIVE STOPWAY / CLEARWAY

e) (PLANVIEW OF STRIP FROM ABOVE)



3.3.2. Transition from the airstrip onto the stopway must have a minimal intermediary impact, and be clear of any obstacle capable of causing damage to aircraft

4. AIRSTRIP WIDTH

4.1. Airstrip Width

- 4.1.1. Factors affecting the airstrip width include immediate surrounding topography, trees and scrub vegetation.
- 4.1.2. Ideally the wider the airstrip the safer the airstrip, however a wide strip has a huge cost factor.
- 4.1.3. The desired minimum width should be 23 metres for the current aircraft types, specifically if the obstacles mentioned in paragraph 4.1.1 above are a real hazard.
- 4.1.4. On airstrips susceptible to contamination (stones, mud, standing water) and crosswind conditions, then a wider strip is encouraged by approximately 50%.

4.2. Airstrip Shoulder Edge Stopway

- 4.2.1. It is desirable to have an airstrip shoulder edge stopway to prevent damage to aircraft and persons should the aircraft inadvertently depart the strip left or right.
- 4.2.2. This stopway should if possible be 15 metres wide either side of the strip.
- 4.2.3. The transition from the airstrip to the stopway should have minimal intermediary impact, and be clear of any obstacle capable of causing damage to aircraft

5. THRESHOLDS AND TURNING CIRCLES

5.1. Thresholds and Turning Circles

- 5.1.1. To avoid unnecessary damage to the airstrip surface, SOP's dictate that aircraft turn at either threshold as opposed to midway on an airstrip. It is therefore advantageous to have a well compacted and stone-free threshold / turning circle.
- 5.1.2. On particularly bad surface strips, motivation to pave or concrete the thresholds is to be considered, with the dimensions of a "Lolly-drop" (**not an ICAO Annexure 14 requirement**) being considered the most effective. Recommended dimensions are:

"LOLLY-DROP" DIMENSIONS (PLANVIEW OF STRIP FROM ABOVE)



20m to

5.1.3. The “Lolly-Drop” paving ensures that propeller damage incurred whilst the aircraft is turning around will be largely reduced, and that airstrip threshold erosion caused by propeller wash over time is also mitigated.

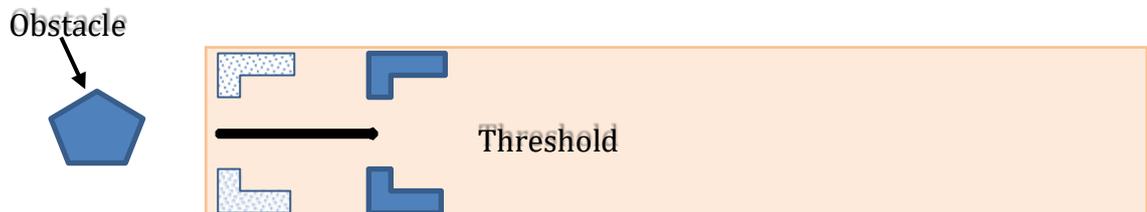
5.1.4. On narrower strips the threshold (or turning circle) should be able to accommodate the turning radius of the largest aircraft intended to serve the strip.

5.2. Location of Threshold and Displaced Threshold

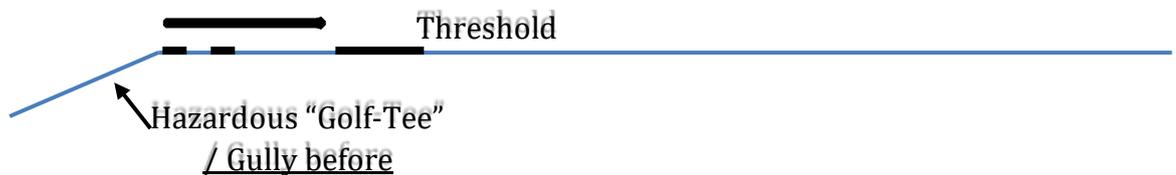
5.2.1. The thresholds are normally located at the extremities of an airstrip’s ends. That is, if there are no obstacles penetrating above the approach surface, and/or there are no other extreme hazards that pose a threat to aircraft landing e.g. deep gullies or “golftee” type threshold etc.

5.2.2. In some cases, however, due to these local conditions as mentioned above, it may be desirable to displace the threshold permanently. If an object extends above the approach surface and the object cannot be removed, consideration should be given to displacing the threshold permanently. When studying the location of a threshold, consideration should also be given to the height of obstacle clearance limits.

DISPLACED THRESHOLD DUE OBSTACLE (PLANVIEW OF STRIP FROM ABOVE)

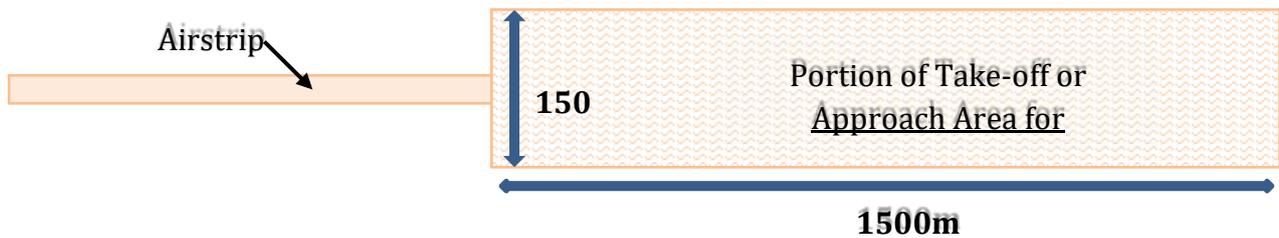


DISPLACED THRESHOLD DUE “GOLF-TEE” / GULLY (CROSS SECTION OF STRIP)



5.2.3. In determining that no obstacle penetrates above the approach surface, account should be taken of mobile objects (vehicles on roads, trains, etc.) at least within that portion of the approach area within 1,200 m longitudinally from the threshold and of an overall width of not less than 150 m.

OBSTACLE CLEARANCE MOVING OBJECT CONSIDERATION (PLANVIEW OF STRIP FROM ABOVE)



5.2.4. To meet the obstacle limitation objectives, the threshold should ideally be displaced down the airstrip for the distance necessary to ensure that the approach surface is clear of obstacles.

5.2.5. However, displacement of the threshold from the airstrip extremity will inevitably cause reduction of the landing distance available, and this may be of greater operational significance than penetration of the approach surface by marked obstacles.

5.2.6. A decision to displace the threshold, and the extent of such displacement, should therefore have regard to an optimum balance between the considerations of clear approach surfaces and adequate landing distance. In deciding this question, account will need to be taken of the types of aeroplanes which the airstrip is intended to serve,

the limiting visibility and cloud base conditions under which the airstrip will be used and the position of the obstacles in relation to the threshold.

5.2.7. Notwithstanding the consideration of landing distance available, the selected position for the threshold should not be such that the obstacle-free surface to the threshold is steeper than the Obstacle Clearance as per below.

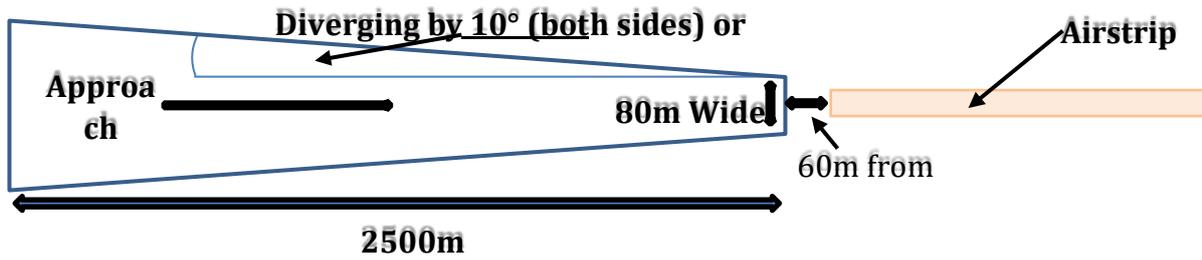
6. OBSTACLE CLEARANCES

6.1. Airstrip Orientation. All airstrips should be oriented so that approach and departure areas are free of obstacles and, preferably, so that aircraft are not directed over populated areas. However this is not to say that wind direction must be forgotten. If a good compromise cannot be reached between obstacle clearance orientation and wind orientation, it would be prudent to search for a new site.

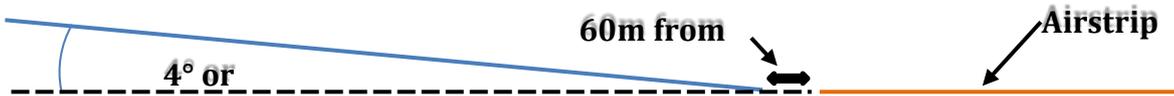
6.2. Take-Off and Approach Surfaces

6.2.1. The take-off and approach obstacle clearance limits are similar, and if the airstrip is useable in both directions for take-off and landing, then the **approach limitations being more restrictive** should be applied to both thresholds.

APPROACH SURFACE OBSTACLE CLEARANCE (PLANVIEW OF STRIP FROM ABOVE)

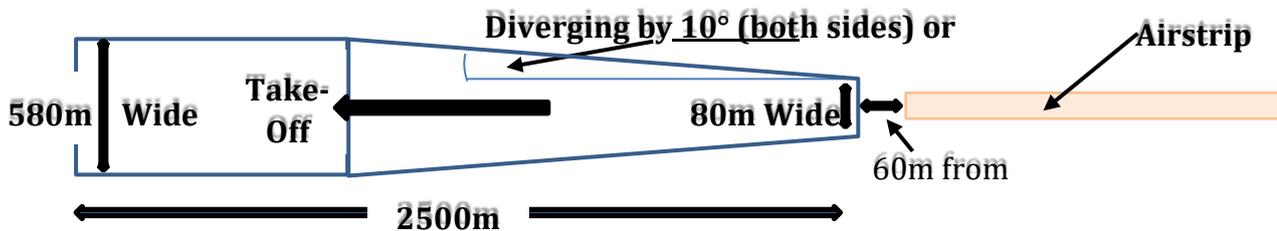


APPROACH SURFACE OBSTACLE CLEARANCE (CROSS SECTION ALONG STRIP LENGTH)



6.2.2. If the air strip is limited to approach in one direction and take-off in the opposite direction, then the less restrictive limitation for take-off can be used for the take-off obstacle clearance.

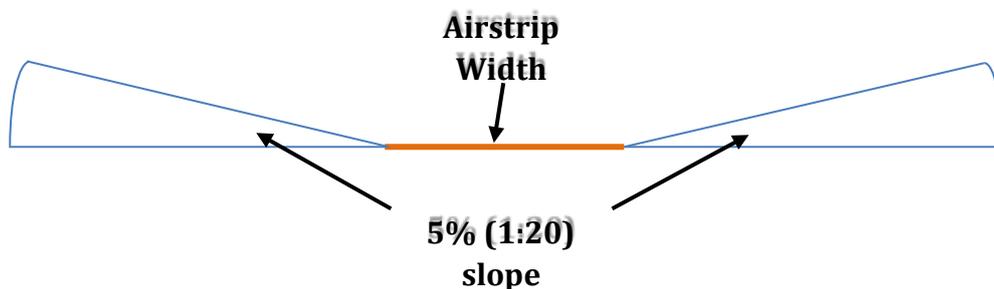
TAKE-OFF SURFACE OBSTACLE CLEARANCE (PLANVIEW OF STRIP FROM ABOVE)



6.3. Airstrip Edge Shoulder Obstacle Clearance

6.3.1. A clear 5% (1:20) slope should be available for the airstrip edge shoulder obstacle clearance. The slope should originate from the edge of the airstrip edge shoulder or from the edge of the edge stopway at 90° or perpendicular to the strip edge.

f) **EDGE SHOULDER OBSTACLE CLEARANCE (CROSS SECTION ACROSS STRIP WIDTH)**



CHAPTER 2: AIRSTRIP FACILITIES

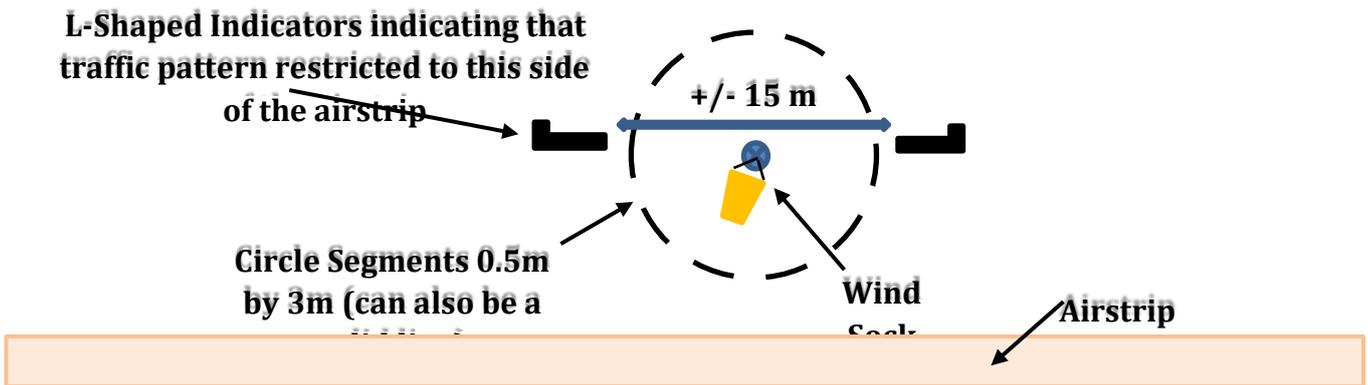
1. WIND SOCK

1.1. Visibility of Sock. At least one standard windsock is considered necessary. The windsock should be visible from a height of 2000ft and the colour best suited for this is Day-Glo or Red.

1.2. Demarcation of Sock. A white segmented or solid circle with a diameter of +/- 10m around the windsock (segment or circle line width of 0.5 metre by 3 metres) to make the windsock clearly visible from the air is beneficial.

1.3. Traffic Pattern. If the traffic pattern is restricted to one side of the airstrip, then traffic pattern "L" shape indicators should be inserted either side of the windsock circle (+/- 2m beyond the circle) parallel to the airstrip at 1 metre wide and 4 metres long.

WIND SOCK (PLANVIEW OF STRIP FROM ABOVE)



2. AIRSTRIP MARKERS

2.1. Airstrip Direction Numbers. Refer Chapter 1, Paragraph 2 "Airstrip Direction" above. Airstrip direction numbers (if applied) need to be visible from at least the airstrip circuit boundary at 1000ft height or a one mile final approach, otherwise the direction markers would be pointless. It is recommended that the dimensions of these numbers be at least 3m in length and 1m wide, and white in colour (or a colour that allows a clear contrast between marker and surrounding ground surface).

2.2. Airstrip Markers

2.2.1. Over and above airstrip direction numbers, airstrip markers, where possible, should be provided if applicable and specifically if the airstrip surface does not allow for a clear contrast between the airstrip and the surrounding area.

2.2.2. The two probable markers that might have an impact on aiding pilot judgement would be the:

- a) Threshold markers, which could be piano-bar type or simple "L" shape. These markers should be about 4 m long and at least 1 metre wide, and white in colour (or a colour that allows a clear contrast between marker and surrounding ground surface).
- b) Airstrip edge markers, which should be about 2 to 3 m long and at least 1 metre wide, and white in colour (or a colour that allows a clear contrast between marker and surrounding ground surface). Edge markers should be at or slightly inside the edge of the airstrip itself (not outside of the strip edge).

AIRSTRIP MARKERS (PLAN VIEW OF STRIP FROM ABOVE)



2.3. Airstrip Marker Profile. Airstrip markers should not be an obstacle (island) and should be level with the surrounding surface so as not to cause undue damage to aircraft

3. AIRCRAFT PARKING

3.1. Parking Area. An area should be provided off the actual airstrip and be of sufficient size to park the anticipated maximum number of aircraft to be parked at any one time.

3.2. Parking Demarcation. The parking area should be clearly demarcated with perimeter markings of any suitable type. If nature of the surface does not allow for a clear contrast between the surface and the surrounding area and the demarcation has a vertical profile, then such demarcation shall be at a distance to prevent inadvertent wingtip strikes.

3.3. Parking Bay Concrete Slabs (***not an ICAO Annexure 14 requirement***). A concrete slab (if possible) needs to be positioned at each parking bay (especially for turbine aircraft). This is to reduce sand ingestion and propeller wear during start-ups and shut downs and engine warm ups. These slabs need to be +/- 4m x 4m with a thickness of +/- 150 mm, and need to be level with the surrounding ground i.e. minimal vertical profile.

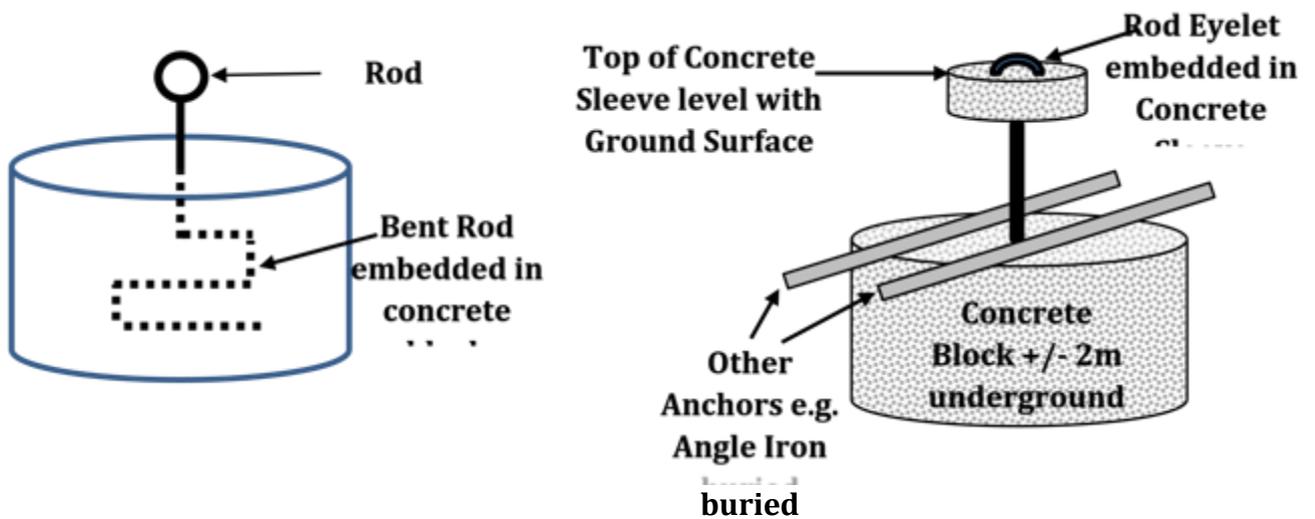
3.4. Parking Tie-Down Points (***not an ICAO Annexure 14 requirement***).

3.4.1. A tie-down system to secure aircraft in windy conditions must be available and sufficient to accommodate the anticipated maximum number of aircraft at any one time.

3.4.2. The system can be stand alone for each singular tie-down point, or linked with a steel cable (minimum 15mm diameter) if the parking bays are aligned and serve as a line along which the tie-down is not restricted to a singular point.

3.4.3. The tie-down points need to be properly anchored into the ground i.e. a simple straight rod into the ground, or concrete blocks on top of the surface WILL NOT SUFFICE – the aircraft will get airborne. A rudimentary acceptable method would be a 4 to 6 metre steel rod (minimum 15mm diameter) with eyelet, bent through 90° several times encased in a concrete block, and the concrete block buried at least 2m deep into the ground with other forms of anchoring.

TIE-DOWN CONSTRUCTION



- 3.4.4. Tie-down points can be incorporated into the concrete slabs as mentioned above bearing in mind the tie-down points (mid-wing) on the aircraft relative to the concrete slab.
- 3.4.5. Tie-down points need to be clearly marked and level with the ground so as to avoid a prop strike or any other damage to the aircraft – consider eyelet height in the construction.

SINGULAR TIE-DOWN POINT VISIBILITY



3.5. Non-Shutdown Turnaround Concrete Slabs (*not an ICAO Annexure 14 requirement*).

3.5.1. In the event that the parking area requires to have a C208B Caravan Non-Shutdown Turnaround facility, the concrete slab needs an increase in dimensions to 6m x 6m and should be painted (colour-coded) as below.

NON-SHUTDOWN TURNAROUND CONCRETE SLAB

3.5.2. The **RED** area is the danger area over which the propeller should be positioned during the off-loading and loading during the non-shutdown turnaround and if at all possible should be positioned upwind of the prevailing wind.

3.5.3. The **GREEN** area is the off-loading and loading area and would be adjacent to the cargo door of the aircraft

3.5.4. The **WHITE** area is a neutral area and would be adjacent to the passenger door of the aircraft, but is an 'unused' area during non-shutdown turnaround operations.

3.5.5. The non-shutdown wheeled steps are of the "solid surface box type" to prevent inadvertent "slip through" like a ladder type rung and are wheeled into position at the cargo door once the cargo door has been opened and upon appropriate signal from the pilot. The guests can then disembark and embark the aircraft under control by the loadmaster.

3.5.6. Both of these wheeled apparatus should be of a light aluminium alloy so as to be easily manoeuvrable on the strip surface.

g) **4. AIRSTRIP NAME CIRCLE**

4.1. Airstrip Name Circle Visibility. The size of the letters of the airstrip name to be such that they are easily readable at a height of 2000 feet above the airstrip level, and white in colour (or a colour that allows a clear contrast between marker and surrounding ground surface)

4.2. Demarcation of Name Circle. A white segmented or solid circle with a diameter of +/- 20m around the name (segment or circle line width of 0.5 metre by 3 metres) to make the name visible from the air is beneficial.

4. 3.Airstrip Name Circle Dimensions. All lettering should be 1 meter wide and 3 meters long.

5. **AIRSTRIP PASSENGER BARRIERS** (*not an ICAO Annexure 14 requirement*)

- 5.1. Airstrip Passenger Barriers. It is highly recommended that barriers are erected to keep passengers away and off the aircraft parking area until such time the pilots are ready to load guests.
- 5.2. Barrier Visibility. Barrier should be made visible (red and white in example below) so as to not be a hazard to guests.
- 5.3. Barrier Positioning. Barriers need to be positioned between the area that the vehicles park and the aircraft parking bay.

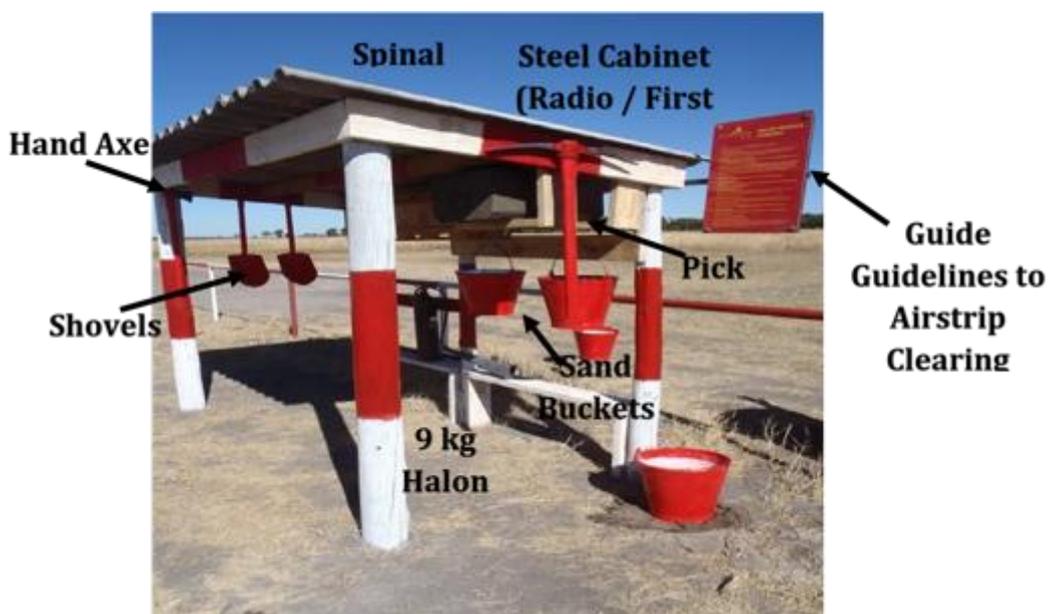
h) AIRSTRIP PASSENGER BARRIERS



- i) **6. FIRE STATION / FIRST AID KIT / RADIO STATION (*not an ICAO Annexure 14 requirement*)**
 - 6.1. Fire-Fighting Equipment. As a minimum: 2 x 9 kg halon fire extinguishers; two buckets of sand; two shovels; one pick, one small hand axe, one large axe, one set of cutting tools, one crow bar and a medium size knife should be provided.
 - 6.2. First Aid Kit. A suitable first aid kit together with a spinal board shall be provided for the intended operations. An example of the first aid contents is included in the Airstrip Maintenance and Inspection Manual (DOC-AMI)
 - 6.3. Radio Station. The air-to-air band radio/s and respective charger/s (solar powered) should be provided.
- j) **6.4. Housing Shelter**
 - 6.4.1. It is natural that all the above equipment (fire-fighting equipment; first aid kit; spinal board; and radio station) be housed together in a suitable shelter.
 - 6.4.2. The shelter provides a means of protection from the elements e.g. keeping the sand in the buckets dry.

- 6.4.3. The shelter should contain a lockable steel cabinet to house the radio/s; radio charger/s; and the first aid kit. The lock itself should be of the “combination” type with the code known to all guides, air crew and other personnel deemed necessary
- 6.4.4. The position of the shelter should be at least 20 metres off the airstrip edge, in the vicinity of the middle of the strip length, in such a position from which both thresholds can be seen
- 6.4.5. The shelter shall at all times, during the aerodromes hours of operation, be available, clearly visible and accessible to the guides, air crew and other personnel deemed necessary who may have to make use of the equipment.

k) FIRE STATION / FIRST AID KIT / RADIO STATION



l) 7. CLOSED AIRSTRIP MARKINGS

- 7.1. Closed Airstrip. If an airstrip is closed and is intended to remain closed for some time, white crosses (or a colour that allows a clear contrast between marker and surrounding ground surface) must be placed at each threshold thus indicating the strip is closed.
- 7.2. Cross Dimensions. The crosses should be large to avoid any confusion and should be a minimum of 3 metres wide and 15 metres long and MUST be clearly visible from a height of 2000 feet above the ground

m) 8. GENERAL AIRSTRIP SURFACE CONDITION

- 8.1. Airstrip Surface. It should be possible to drive a vehicle at 80km/h without undue shock to the vehicle over the airstrip surface at any point on the strip itself. However, this is for assessment only and as a general rule, vehicles should not be driven on the airstrip surface at all.
- 8.2. Airstrip Stopway / Shoulder Edge. . It should be possible to drive a vehicle at 50 km/hour off the airstrip and onto the stopway / shoulder edge without undue shock to the vehicle.

However, this is for assessment only and as a general rule, vehicles should not be driven on the airstrip surface at all.