



Civil Aviation Authority

GUIDANCE MATERIAL FOR WILDLIFE HAZARD MANAGEMENT

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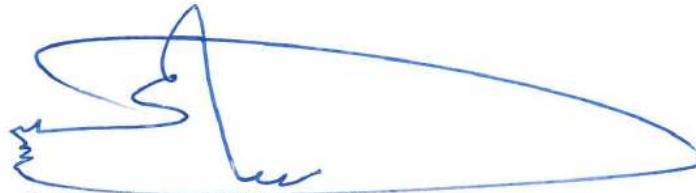
FOREWORD

This guidance focuses on wildlife strike hazard reduction as required by CAR-139 (Part 1-Chapter-9). It includes the bird and wildlife control for the purpose of reducing the hazard of bird/wildlife strikes to aircraft. Aerodrome operator shall include both birds and wildlife in their airport bird/wildlife control programme. In fact, CAR-139 requires that action be taken to decrease the risk to aircraft operations by adopting measures to minimize the likelihood of collisions between wildlife and aircraft.

This document was written on the assumption that birds and wildlife are a serious hazard to aircraft, and it attempts to outline what can and should be done to overcome this hazard. It is not the purpose of this document to discuss the relative importance of various hazards but to stress the importance of good organization and planning in the creation of a successful bird/wildlife control programme.

The manual includes material dealing with the reasons why birds/wildlife occur at an aerodrome, the organization and composition of a committee to combat potential bird/wildlife hazards to aircraft operations, and the modifications to be carried out at an aerodrome to remove the features which attract birds/wildlife.

This manual is effective from 14 February 2021.



Salim Hamed Al Husaini

Acting Director General of Civil Aviation Regulation



1 Purpose of this guidance document

The main purpose of this manual is to provide airport personnel with the information necessary to develop and implement an effective bird/wildlife control organization for their aerodrome. Because the risk of bird/wildlife strikes is different at each site, the management will also be different. The seriousness of a bird/wildlife hazard problem is affected by geographic location, attractiveness of the site to birds/wildlife, and air traffic density.

This document Provides also a guidance to evaluate the Ecological Study (Wildlife Hazard Assessment) and Wildlife Hazard Management Plan (WHMP) submitted by Aerodrome Operators. These materials are developed by the Aerodrome Operator and may be evaluated as part of Aerodrome Certification, during periodic surveillance audits or during the change management process. The evaluation shall be conducted by the Aerodrome Operator.

2 Roles and responsibilities within a bird/wildlife strike control programme

2.1 General

CAR-139-Part 1, requires that The Civil Aviation Authority (CAA) shall certify all aerodromes used for international or national operations, in accordance with the specifications contained within the CAR-139. As part of this certification process, aerodrome operators are required to develop an aerodrome manual which includes information on the aerodrome site, facilities, services, equipment, operating procedures and management, including a safety management system.

The aerodrome certification process requires that the Aerodrome Operator shall evaluate the wildlife hazard in the vicinity of the aerodrome and adopt measures to minimize the likelihood of collisions between wildlife and aircraft. The aerodrome operator shall develop and implement a procedure for recording and reporting wildlife strikes to aircraft as well as wildlife hazard assessment and control measures, which are included in the Aerodrome Manual.

2.2 Roles & Responsibilities of the Civil Aviation Authority (CAA)

- 2.2.1 CAA shall ensure that any procedures in the aerodrome manual relating to bird/wildlife control are developed and implemented as part of the aerodrome safety management system (SMS).
- 2.2.2 CAA is responsible for the development and issuance of the regulatory and guidance material applicable to aerodromes design and operations.
- 2.2.3 CAA shall evaluate the Aerodrome Manual submitted by an Aerodrome Operator including the wildlife hazard assessment and the wildlife control measures to determine whether it complies with National Regulation and indicate whether the applicant will be able to operate and maintain the aerodrome properly (See Appendix D - Wildlife Hazard Management Assessment checklist).
- 2.2.4 CAA collects, through its reporting systems, information from aircraft operators, airport personnel, and other sources, on the presence of wildlife on or around the aerodrome constituting a potential hazard to aircraft operations.
- 2.2.5 CAA adopts, if required, the mutual coordination and communication among aerodrome operator and any other Omani departments regarding land-use planning and development in

the vicinity of aerodrome as long as this development affects the likelihood of wildlife existence.

- 2.2.6 Finally, at the end of each year and after receiving the annual report from the aerodrome operators, CAA shall submit Wildlife Strike Reports to the ICAO Bird Strike Information System (IBIS) database.

2.3 Roles & Responsibilities of Aerodrome Operator

- 2.3.1 The Aerodrome Operator is responsible for the conduct of a wildlife hazard assessment in the vicinity of the airport.
- 2.3.2 The Aerodrome Operator is also required to include in the aerodrome manual, the wildlife hazard assessment and the measures adopted to control the identified hazards and minimize the likelihood of collisions between wildlife and aircraft.
- 2.3.3 The Aerodrome Operator, in cooperation with CAA, approaches and communicates with the different Omani-related departments in the aerodrome vicinity to be notified with any development or land-use planning which may affect the likelihood of wildlife existence. In order that the aerodrome operator may evaluate the expected impact behind that development or land-use planning.
- 2.3.4 Wildlife hazard management on an airport often requires communication, cooperation, and coordination among various groups on the aerodrome. This is especially true when identifying hazardous wildlife situations, executing large-scale habitat management actions, or developing management strategies for hazardous wildlife that are endangered or threatened. For that The Aerodrome Operator shall establish of an Airport wildlife committee in order to facilitate this communication, cooperation and coordination.
- 2.3.5 Members of the Airport Wildlife Committee should include the following:
- Senior Manager
 - Wildlife Control Coordinator
 - Wildlife Control Operator representative
 - Aircraft Operator representative
 - Airport Planning Manager
 - Aerodrome maintenance and operation Manager
 - ATC representative
 - Local runway safety team representative
 - Local authorities
 - Depending on the organizational structure of the airport, other representatives can also be included, such as the Fire and Rescue services
- 2.3.6 The Airport Wildlife Committee shall review strike data collected and observations of birds/wildlife, assess bird/wildlife risks and summarize trends in order to evaluate and determine what effective control measures should be implemented in order to manage the issues arising.
- 2.3.7 The airport bird/wildlife strike control coordinator (or equivalent) shall coordinate the activities of the wildlife control programme with air traffic control (ATC) and other stakeholders. The coordinator's responsibilities shall allow for the time required to be involved with

observations, control and reporting all confirmed, unconfirmed wildlife strikes. The wildlife coordinator at the site should also review strike reports, monitor daily activity records and maintenance reports to determine the requirements for short- and long-term management programmes, and this information should be passed to managers accountable for safety on a regular basis (at least monthly).

- 2.3.8 The Aerodrome operator shall also identify which stake-holders will be responsible for providing input and consultation. Stakeholders can include transportation officials (including government), aerodrome staff, airline representatives (including pilots), conservation organizations (government and non-government), local municipalities/cities, and organizations that are responsible for land management in the area surrounding the aerodrome.

3 Risk Assessment of Wildlife Hazard

3.1 Initial Assessment

- 3.1.1 An Aerodrome Operator shall conduct for each aerodrome an initial assessment of the existence and level of hazard posed or likely to be posed by wildlife in the vicinity of the aerodrome.
- 3.1.2 The initial Wildlife Hazard Assessment shall be conducted by wildlife specialists, with proven knowledge of the types and behaviours of the wildlife species present or likely to be present in the area where the aerodrome is located.
- 3.1.3 The initial Wildlife Hazard Assessment should:
- a) identify the wildlife species that have access to the airport, in accordance with 3.1.5 cross;
 - b) describe the features that may attract wildlife, in accordance with 3.1.6;
 - c) assess the wildlife hazards or potential hazards to aircraft operating to or from the aerodrome, in terms of:
 - i. the likelihood of occurrence of a wildlife strike; and
 - ii. its impact on the flight; and
 - d) recommend actions for reducing identified wildlife hazards to aircraft operating to or from the aerodrome, using one or more of the control measures.
- 3.1.4 The methodology used for the identification of wildlife species must be documented in a standardized procedure. As a minimum, it should include the number and location of the survey points established, the duration of the observation, and how the selected duration allows for adequate assessment of the wildlife species and seasonal patterns.
- 3.1.5 For each type of wildlife species, the following information must be provided:
- a) methodology used for observation;
 - b) its scientific and local name;
 - c) estimated numbers and locations; and
 - d) local movements, daily and seasonal occurrences.

3.1.6 Potential wildlife attractants may include:

- a) waste disposal;
- b) water management facilities;
- c) wetlands;
- d) confined disposal facilities;
- e) agricultural activities (livestock, aquaculture, farming ...etc.);
- f) landscaping; or
- g) any other specific land-use activities that may attract wildlife.

3.1.7 The description of the potential wildlife attractants should include:

- a) name;
- b) distance from the aerodrome reference point;
- c) direction from nearest approach / take-off path;
- d) dimensions;
- e) type of activities;
- f) seasonality (if applicable); and
- g) wildlife species that may be attracted to it.

3.1.8 The wildlife hazards or potential hazards can be categorized on the basis of their probability and severity.

3.1.9 An example of a Risk Assessment Matrix is provided in Table 1. The level of Risk for each species of bird, bat and terrestrial animal is determined as a combination of the Probability of a Strike and the Severity of the Outcome. In the example the Risk is also rated on a scale of 3 – Acceptable, tolerable and Unacceptable. A colour coding may be used to indicate what is intolerable (Red – unacceptable under the existing circumstances), tolerable (Yellow – acceptable based on mitigation measures to control wildlife) or acceptable (Green – acceptable).

			Severity of Strikes				
Probability of Strikes			Catastrophic A	Hazardous B	Major C	Minor D	Negligible E
Definition		Meaning	A/C Crash & Severe	A/C Crash & Light casualty	A/C Severe Damage & No Crash	A/C light Damage	near miss
Frequent	5	5/10,000 mvts	5A	5B	5C	5D	5E
Occasional	4	4/10,000 mvts	4A	4B	4C	4D	4E
Remote	3	3/10,000 mvts	3A	3B	3C	3D	3E
Improbable	2	2/10,000 mvts	2A	2B	2C	2D	2E
Extremely improbable	1	1/10,000 mvts	1A	1B	1C	1D	1E

Table 1- Example of Risk Assessment Matrix for Wildlife

3.1.10 The Risk Assessment will rank the risk of each species and highlight those species that should be prioritized for risk mitigation in the **Wildlife Hazard Management Plan (WHMP)**.

3.1.11 The final stage of the Risk Assessment of Wildlife Hazard is to identify the root cause of each wildlife hazard. Here, it is critical to understand the behaviour and basic requirements of each hazardous species of wildlife. Remember, each animal has a basic requirement for energy and nutrients, including water. They must maintain their bodies core temperature, they must breed and reproduce, and they must avoid being predated by another animal. When identifying root causes of wildlife hazards, consider each species and its basic requirements. Then, observe the aerodrome and surrounding areas to determine how the different habitats may aid the species in fulfilling its requirements.

3.1.12 This stage of the Risk Assessment shall involve a trained wildlife biologist who is familiar with ecology and animal behaviour. Ideal habitats for hazardous wildlife may not be readily apparent, and the attractiveness of aerodrome habitats may vary seasonally. Consider all stages of an animal's requirements throughout the annual cycle. Breeding seasons, annual migrations, seasonal weather patterns, and food availability are all factors that can contribute to temporal changed in wildlife hazard.

3.1.13 **Example of ESTIMATING THE PROBABILITY OF A STRIKE**

The probability of a wildlife strike should be calculated using wildlife incident data and current data on the presence, location and behaviour of wildlife in the aerodrome and its vicinity. Strike records also allow the determination of daily and seasonal trends to determine the likelihood of future strike events.

Using wildlife strikes to calculate probability depends on the number of strikes and the reporting culture. Aerodromes with fewer operations may generate fewer collisions; therefore, the limited data may not allow accurate or useful predictability on strike probability.

Where good quality strike data is not available, it is important to consider the potential risk of collision determined by the existence of wildlife and their movements on and in the vicinity of the aerodrome.

Based on the above, the probability of a wildlife strike is defined for diverse variables which are not exclusive. The more knowledge about the presence and behaviour of wildlife on, and in the vicinity of, the aerodrome, the stronger the estimation of wildlife strike probability and the final safety risk assessment for each relevant species.

The aerodrome should have records of wildlife incidents, as well as information about observed wildlife, its habits, preferred areas, etc. This information can provide an input for wildlife probability calculation.

Due to the differences in resources available depending on the aerodrome, the data to be used in the safety risk assessment can be quantitative and qualitative. Best practice is to use quantitative data. Both quantitative and qualitative measurements of abundances of wildlife and number of strikes are used to rank probabilities of a species being involved in a strike at a particular aerodrome since aerodromes differ in the quality and quantity of information that they hold. This is useful to take into account different levels of knowledge and available statistics for different aerodromes.

An example is shown in Table 2 regarding the values of some descriptive variables of a specific species, in order to be categorized (quantitatively and qualitatively) for probability of impact:

	Probability category				
	Very high	High	Moderate	Low	Very low
QUANTITATIVE APPROACH Presence of wildlife (<i>number of days per year a species is observed on the aerodrome and its surroundings</i>)	> 200	100-200	50-100	50	10
QUALITATIVE APPROACH Presence of wildlife (<i>subjective evaluation</i>)	Permanent	Most	Some	Few	Occasional
QUANTITATIVE APPROACH Average number of strikes per year (5 years)	>10	3-10	1 - 2.9	0.3 - 0.9	0 - 0.2
QUALITATIVE APPROACH Strikes per year (<i>subjective evaluation</i>)	Very often	Often	Some	Occasional	Rare/None

Table 2. Example of impact probability categorization

Different biological and behavioural characteristics of wildlife species can help classify them in specific risk levels. For instance:

- species that shy away from aircraft noise or that learn to avoid aircraft could be rated as low probability;
- birds that flock in large numbers to certain habitats in the flight path could be rated a high or very high probability;
- solitary animals might be rated as moderate probability;
- species with low or erratic flights could be rated as high or very high probability; and
- species with nocturnal activity on aerodromes with nocturnal flights should have a higher probability of impact.

Other behavioural factors should also be considered. The probability might also vary with the season, age or gender of the creatures, or other conditions such as grass length or rain and other weather conditions.

Other variables to assess the risk more accurately include:

- flight activity on the aerodrome (the higher number of air operations,
- the higher the probability of wildlife strike), the type of aircraft using the aerodrome (larger, faster aircraft are likely to increase the risk of wildlife strike).
- Relating the number of impacts with the number of flight operations may help better understand if an increasing frequency of impacts can be related to a greater number of operations, to a greater wildlife presence, or both.

3.1.14 ESTIMATING THE SEVERITY OF A STRIKE

The next step is to rank the expected severity of the impact or damage resulting from a strike event. A scale similar to the strike probability scale can be used.

Wildlife strikes have a directly associated severity, defined by the damage that the animal has caused to the aircraft after the impact. For observed wildlife, the severity scale will depend essentially on the size of the animal and its tendency to flock or congregate. Generally, heavier

wildlife and greater flock size increases the probability of damaging an aircraft and impacting its flight performance. Flocking behaviour could include multiple impacts or increase the probability of a strike.

Severity can be rated, among other approaches, in terms of aircraft damage and human casualty, wildlife strikes with a consequence of damage to the aircraft, and number of events with an adverse effect on flights (for example missed approach or aborted take-off).

Table 3 describes how to categorize, in two different approaches, the severity related to a determined species according to the damage this species has caused in the strikes recorded by an airport. In this example, the severity of the common kestrel to aviation in a theoretical airport is analysed:

	<i>Severity category</i>				
	<i>Very High</i>	<i>High</i>	<i>Moderate</i>	<i>Low</i>	<i>Very Low</i>
Percentage of strikes with common kestrel causing damage (compared with the total amount of wildlife strikes at the airport)	>20%	10-20%	6-10%	2-6%	0-2%
Type of aircraft damage and/or human casualty (in strikes with common kestrel)	Catastrophic	Hazardous	Major	Minor	Negligible

Table 3- Example of severity categorization (common kestrel)

In case of species for which no data about the severity of the damage they can cause is available, the severity could be calculated by the mass multiplied by the type of flock (flock size).

To perform this calculation, previous categories of weights or sizes of wildlife, and flock sizes should be established by the aerodrome operator to fit each species within a category.

Below is an example of how to establish these categories:

<i>Body Mass</i>	<i>Examples</i>	<i>Body Mass Value</i>
< 50 g	Sparrows	2
51-200 g	Starlings	4
201-1 000 g	Pigeons	8
1-5 kg	Large gulls	16
>5 kg	Big birds of prey	32

Table 4. Example of wildlife categorization based on body mass

<i>Flock size</i>	<i>Examples</i>	<i>Flock value</i>
Usually solitary or widely spaced	Big birds of prey, Sparrows	1
Often in loose flocks	Pigeons, Large gulls	2
Often in tight flocks	Starlings	4

Table 5. Example of wildlife categorization based on flock size

Flock size may depend on specific aerodrome location and species involved.

it is possible to locate the analysed species in one of the severity ranges that could cause a collision with an aircraft.

	<i>Severity category</i>				
	<i>Very high</i>	<i>High</i>	<i>Moderate</i>	<i>Low</i>	<i>Very low</i>
Severity value (mass category value x flock category value)	32-128	16	8	4	2

Table 6. Example of severity categorization based on severity value

Regarding the severity categories to be established, each aerodrome should determine its own scale. Since the severity of collision also depends on the type of aircraft, the range of aircraft sizes or types of aircrafts operating at an aerodrome would also need to be taken into consideration; clearly the views of the aircraft operators should be considered

3.1.15 ESTIMATING THE SAFETY RISK OF WILDLIFE SPECIES

A safety risk assessment matrix is completed by combining the probability and severity of each species to determine whether further action is required. A safety risk assessment should be reviewed at least annually or following a significant wildlife strike event and existing wildlife control measures adjusted to see if further action is required. An example of a risk assessment matrix is shown in Table 7:

		PROBABILITY				
		Very High	High	Moderate	Low	Very Low
SEVERITY	Very High					
	High					
	Moderate					
	Low					
	Very Low					

Table 7. Example of risk assessment matrix

Example of a case study. In an aerodrome, the following data of three wildlife species were collected throughout the year:

- A common resident species at the aerodrome, the common kestrel, produced nine impacts, causing minor damage to aircraft in two of them.
- The migratory barn swallow produced many impacts in spring and summer, although it was not possible to calculate the exact number of impacts. Due to the bird's size, it has never caused any damage.
- This year, griffon vultures appeared for the first time in the area for several days throughout the year. There are no historical records about the presence of vultures in the aerodrome, but due to the bird's size and possible formation of flocks, their possible hazard for operations must be taken into account. According to the tables previously shown as examples of ways to categorize the probability and severity of impacts:
 - For the common kestrel, its impact probability is HIGH. Its severity, taking into account the percentage of impacts that have caused damage, is VERY HIGH. However, knowing that the common kestrel is typically solitary, and weighs less than 300 g, its severity could be reduced to some degree, to MODERATE. This reduction would also depend on the type of damage or caused effect on flight, the type of aircraft affected, etc. As it is known from aerodrome records that the aircraft damage has always been minor, the reduction to the degree of severity is confirmed.
 - For the barn swallow, which has produced several impacts, the probability is HIGH. However, it should be taken into account that its occurrence is seasonal, which concentrates its probability of impact to a few months per year. This could allow for reduction to some degree of the probability of impact. Its severity, according to the absence of damage, and with its small size (20 g), is VERY LOW.
 - For griffon vultures, although there have been no impacts yet, their new and persistent presence at the aerodrome should be taken into account. Its probability would be HIGH. Its severity, considering its size (more than 7 kg) and flight form, would be VERY HIGH. Therefore, the final risk assessment matrix in this example, after categorizing the analysed species, would be the following:

		PROBABILITY				
		Very high	High	Moderate	Low	Very low
SEVERITY	Very High		Griffon vulture			
	High					
	Moderate		Common kestrel			
	Low					
	Very Low		Barn swallow			

Table 8. Example of risk assessment matrix categorizing analysed species

Note— Generic data. This could be interpreted as:

- It is necessary to apply more mitigation measures, or improve existing ones, to control the presence of the common kestrel at the aerodrome, thus decreasing the probability of impact.
- The presence of barn swallows is acceptable, although mitigation measures that are already being applied should continue to be applied in order to minimize their presence at the aerodrome as much as possible.
- Mitigation measures must be applied on the griffon vulture to minimize or eliminate its presence at the aerodrome, before impacts occur.

3.2 Continuous Assessment

3.2.1 The Aerodrome Operator shall establish a procedure for continuous assessment of the wildlife hazard.

3.2.2 The Wildlife Hazard Assessment should be reviewed:

- a) at least once a year; or
- b) after a wildlife occurrence.

3.2.3 The review of the wildlife hazard assessment shall identify any changes in:

- a) wildlife species;
- b) the features that may attract wildlife on, or in the vicinity of the aerodrome; or
- c) the assessment of the wildlife hazards or potential hazards to aircraft operating to or from the aerodrome.

3.2.4 The review of the wildlife hazard assessment shall identify:

- a) new wildlife control measures that may be required of address newly identified hazards; and
- b) existing wildlife control measures that may need to be reinforced, and/or wildlife control measures to be discontinued because they are no longer required or are ineffective.

4 Wildlife Control and Reporting Wildlife Strikes

4.1 Description of the Control Measures

4.1.1 The aerodrome operator shall demonstrate that the proposed wildlife control measures are adequate to reduce the risk posed by wildlife to aircraft operating to or from the aerodrome as identified in the wildlife hazard assessment or its subsequent review.

4.1.2 The description of the selected control measures should include:

- a) type of control measures selected;
- b) wildlife species;
- c) potential wildlife attractants;
- d) actions to be implemented;
- e) periodicity, or season(s) where applicable;
- f) equipment to be used, where applicable; and
- g) personnel involved and the training requirements where applicable.

4.1.3 Habitat Modification and Exclusion: Habitat modification means changing the environment to make it less attractive or inaccessible to the problem wildlife identified during the wildlife hazard assessment. It can be achieved through the reduction, elimination, or exclusion of one or more of the elements that attract wildlife such as:

- a) Food;
- b) Water; or
- c) shelter.

4.1.4 Wildlife Removal: if legally allowed for the species being considered, wildlife removal may include:

- a) Capturing;
- b) destroying eggs and nests;
- c) shooting;
- d) oral or contact toxicants;
- e) fumigants; or
- f) lethal traps.

4.1.5 Repellent and Harassment Techniques: Repellent and harassment techniques may be used to keep hazardous wildlife away from specific areas on or near an airport by affecting the animal's senses through chemical, auditory or visual means. Repellent and harassment techniques may include:

- a) patrols of airside areas to disperse birds and other hazardous wildlife;
- b) audio repellents appropriate to the type of bird or mammal; or
- c) visual repellents appropriate to the type of bird or mammal.

4.1.6 Aircraft Schedule Modification: The flight schedules of some aircraft may be adjusted to minimize the chance of a strike with a wildlife species that has a predictable pattern of movement.

4.2 Recording and Reporting Wildlife Strikes

4.2.1 **Recording:** An Aerodrome operator shall maintain a database of wildlife strikes containing at least the date, types and numbers of birds or animals, and aircraft involved. The procedure for recording the wildlife strikes must be documented in the Aerodrome Manual.

4.2.2 The following events shall be recorded and used for assessing and mitigating the risk of wildlife hazards:

- a) any reported collision between wildlife and an aircraft for which evidence in the form of a carcass, feathers, any other remains, or damage to the aircraft is found;
- b) any reported collision between wildlife and an aircraft for which no physical evidence is found, but an indication of a collision exists (e.g. visual observation of the collision or acoustic perception of the impact);
- c) any wildlife found dead on an aerodrome without any other obvious cause of death; and
- d) incidents or observations where the presence of wildlife on or in the vicinity of the aerodrome could have an effect on a flight (e.g. missed approach, aborted take-off, etc.).

4.2.3 **Reporting:** A Wildlife Strike Reporting Form is made available to aircraft operators, airport personnel and air traffic controllers to report wildlife strikes confirmed and unconfirmed wildlife strikes.

- ❖ **Confirmed wildlife strikes:** collision between a bird/wildlife and an aircraft for which evidence, in the form of a carcass, or other remains, is found on the ground; or damage and/or other evidence is found on the aircraft.
- ❖ **Unconfirmed wildlife strikes:** collision between a bird/wildlife and an aircraft for which no physical evidence is found (i.e. no damage to the aircraft is evident upon inspection, and no bird remains, carcass or blood smears are evident on the airframe).

4.2.4 **Submission of Wildlife Strike reports to ICAO:** At the end of each year CAA shall forward all bird/wildlife strikes received for the aerodrome operator to the International Civil Aviation Organization (ICAO) for incorporation into ICAO's Bird Strike Information System (IBIS) Database (*Note: **Appendix A** provides a guide for the bird strike reporting form*).

5 Wildlife Hazard Management Plan (WHMP)

The Wildlife Hazard Management Plan (WHMP) is a document created to provide the strategy for reducing the risk that wildlife poses to safe airport operations. The plan is based on the Risk Assessment of Wildlife Hazards. An effective WHMP shall:

- a) Identify the wildlife species that are a priority for risk reduction;
- b) Prescribe the actions necessary to reduce the risk associated with the individual species;
- c) Clearly identify of the roles and responsibilities personnel are required to fulfill; and
- d) Describe a Communication Strategy for ensuring that the information necessary for managing wildlife risk is shared effectively;
- e) Outline a Training Programme for the personnel involved in Wildlife Hazard Management;
- f) Describe a monitoring and evaluation strategy for the entire WHMP;
- g) Prioritize the specific research needed to advance the efficacy of wildlife hazard management on the aerodrome.

A model guidance for development of Wildlife Hazard Management Programs at airports is described in the Appendix B

5.1 Roles and Responsibilities

The WHMP should explicitly identify the personnel who will be involved in the Wildlife Management Programme, including the roles and responsibilities they will fulfill. The paragraph 2 outlines the specific roles and responsibilities associated with wildlife management at aerodrome.

Appendix C - Key Roles & Responsibilities provides the roles and responsibilities for all key person.

5.2 Communication Strategy

5.2.1 Aerodrome operators shall create communication procedures for managing and reacting to wildlife hazards and for acting when a strike does occur.

5.2.2 It is critical for safety that key personnel are notified when there is an elevated risk of a wildlife strike. The communication strategy shall summarize which personnel are responsible for recognizing and alerting of an increased wildlife hazard, and which personnel shall be notified. The communication strategy shall be inclusive of wildlife management technicians, pilots, and air traffic control.

5.2.3 A communication strategy is also necessary for when a strike does occur. This allows the effective collection of data pertaining to the strike, including the airline and type of aircraft involved, the stage of flight, the damage to the aircraft and whether there was an effect on flight, and the species of wildlife involved. The wildlife strike data can then be used as an evaluation tool.

5.3 Taking Action to Reduce Risk

Once the risk presented by various wildlife species is prioritized, a series of actions for reducing that risk is outlined. The actions needed to reduce the risk can take several forms and include managing aerodrome habitats so that they are less attractive (fulfill fewer of the animal's basic requirements); dispersing wildlife with behavioural stimulants; physically excluding wildlife from the aerodrome; physically removing wildlife from the aerodrome; and strategies for managing habitats that are within

the vicinity of the aerodrome but outside its boundaries. The actions shall also include a system for communicating the risk of bird strikes to critical personnel, including pilots, air traffic controllers, and wildlife management personnel.

5.4 Training Programme

A Training Programme must be established through the WHMP. Effective training ensures that actions taken to reduce wildlife hazards are consistent across all personnel. A basic Training Programme is provided in the paragraph 6.

5.5 Monitoring and Evaluation

Once action is taken to reduce risk, it is important to establish monitoring procedures to collect the information needed to evaluate the efficacy of the action. The WHMP must define this strategy. the paragraph 7 outlines the general requirements of monitoring and evaluation.

5.6 Research Priorities

The final component of the WHMP is a list of research priorities. Research projects shall be designed to assess the efficacy of novel management practices and control actions on reducing wildlife hazards. Proper experimental design is critical to the successful evaluation of novel practices, and aerodrome operators should consult with local biologists when considering their research priorities.

6 Training

6.1 Objectives of the Training programme

It is important for aerodromes to outline the objectives of a bespoke wildlife and habitat management plan. It is not sufficient for staff to undertake any role within the aerodrome wildlife team without appropriate wildlife and habitat training. The plan objectives are:

- Ensure training plan meets best international, national & local standard
- To deliver appropriate wildlife/habitat management training to staff that are tasked with managing and implementing the plan
- Ensure local aerodrome conditions and effective control measure are included in training plan
- Ensure that staff have a full understanding of procedures and practices required to deliver on objectives of the WHMP;
- Provide practical training programme that ensure full competency on wildlife control practices.

6.2 Content the Training programme

6.2.1 Effective wildlife management is critically dependant on staff with the tools, knowledge and motivation to complete the task. The program will address the following:

- Nature and Extent of the Wildlife Management Problem;
- Regulations, Standards and Guidance;
- Wildlife Control Procedures Manual;

- Species of Conservation Concern;
- Liability;
- Habitat Management;
- Issues Outside of the Airport Boundary;
- Active Management;
- Removal Techniques;
- Wildlife Management Planning;
- Development and Implementation of Awareness Programs;
- Monitoring; and,
- Training Record and Schedule.

6.2.2 In addition to training directly associated with wildlife behaviour and the application of management techniques as part of the AWMP, it is essential that safety requirements are fully reviewed and addressed. This should include at a minimum:

- Safe use and storage of pyrotechnics;
- Safe use, storage and maintenance of pyrotechnic launchers; and
- Identification and mandatory use of safety equipment.

The following table details the staff who have attended the training program or are proposed to do so:

6.2.3 The aerodrome operator shall define for each level of management (Wildlife Management Officer, Wildlife specialist, Wildlife Control Coordinator, Wildlife Agent) the type of the programme of training to be conducted.

6.2.4 It is not sufficient to provide theoretical training for this role as much knowledge will be gained from carrying out the task under a proficient and competent person. The programme should be sufficiently enough to ensure effective delivery and should have a sign off process on the proficiency of the person across all the practical, procedural and skills required to manage and implement the plan. It is critical that each aspect of the procedures required for wildlife habitat and management are well practiced and understood by the wildlife team.

6.2.5 Due to the nature of the role and the requirement to operate close to runways (never inside the flight strip unless with ATC permission) staff must have completed runway incursion prevention training.

6.2.6 Where a wildlife management person is involved and found to have failed to follow procedures, the option to re-train may exist. It is important that the area of weakness is identified and remedial action taken. All incidents on the airfield are investigated by aerodrome operator, sometimes in cooperation with ATC.

6.2.7 Each aerodrome operator shall have an effective refresher training programme that the wildlife team will complete on a regular basis. The training must include a dedicated wildlife management and habitat module which will reflect on statistical information, procedural reviews, staff feedback and a central piece by a subject matter expert at the aerodrome (internal or external) and by a senior manager responsible for the aerodrome management and habitat plan.

7 Evaluation of WHMP

7.1 Purpose

Aerodromes shall have a process to review and evaluate the wildlife management plan to provide safety assurance that the plan is fully effective and correctly implemented. The review shall be completed on an annual basis but also must include an on-going review process to ensure that the plans are always current and fully functional at all times.

Procedures to monitor and evaluate the effectiveness of bird or wildlife control strategies might include:

- Airport's WHMP include wildlife control performance monitoring, measurement and improvement systems;
- Personnel training, competence assessment and appraisal.

Evaluation of the Aerodrome Wildlife & Habitat Management Plan

- Are roles clearly defined and understood by all?
- Do aerodrome personnel understand their roles and responsibilities?
- Do programmes meet required standards in ALL respects?
- Is the programme effectively resourced & managed?
- Are procedures efficient and effective?
- Are programmes current with all regulations and best practices?
- Is there an effective review process in place?

7.2 Evaluation Process

Administrative Level

- i. **Evaluation the Authorities and responsibilities:** to ensure that all roles clearly defined and understood by all and the aerodrome personnel understand their roles and responsibilities.
- ii. **Evaluation the Training of employees:** to ensure the computability with the training program.

Operational Level: Assessment should include at least the following:

- i. **Evaluation The Hazardous Wildlife Identification and Mitigation Procedures:** include assessment the records of any habitat modifications and adjacent land use management, which will consequently affect the presence of wildlife (time, locations, dates, migratory flyways, numbers, etc....).
- ii. **Wildlife Survey Feedback:** is a valuable tool for aerodromes to ensure their wildlife management and habitat plans are effective, meet all regulations and standards required (ATC, Airlines andetc.).
- iii. **Evaluation the WHMP Process Performance Indicator:** Performance indicators are critical to determine the need for enhancement or modification. It is also very necessary because actions to reduce one wildlife hazard will inevitably result in improved conditions for some other wildlife species.
 - a) The number of wildlife strikes;
 - b) Strike rate;
 - c) Damage associated with strikes;
 - d) Individual species' hazard assessments;
 - e) Risk rankings for airport; and
 - f) The status of action items that have been recommended in the plan.

Evaluation of the Keeping Records:

- a) **Records of wildlife activity,** wildlife strikes, and wildlife management actions.
- b) **Maintenance activities** and any other corrective and preventative actions: keep records of any corrective and preventative actions serving wildlife hazard management and control concept, such actions might be installing or repairing fencing, thinning trees, clearing construction debris, applying pesticides or repellents, conducting grass-height management, installing netting in hangers or wires over ponds or oxidation tanks, and regarding pavement or grass areas to eliminate standing water.
- c) **Recorded Information Analysis:** the information recorded will be most useful if it is summarized into monthly and annual statistics. The use of computerized database systems customized to provide summaries of wildlife control activities is recommended.

Note: Furthermore, without accurate records and proper evaluation, it might be difficult to justify and defend certain management actions such as wildlife removal.

- d) **Evaluation of Resources for Employees: Periodic analyses of daily wildlife reports, will reveal:**
- The effectiveness of applied control techniques for various wildlife species;
 - The effectiveness of different dispersal techniques at different times of the day and under different weather conditions; and
 - The amount of time wildlife remains dispersed.

Note: see figure 1 -Evaluation Process

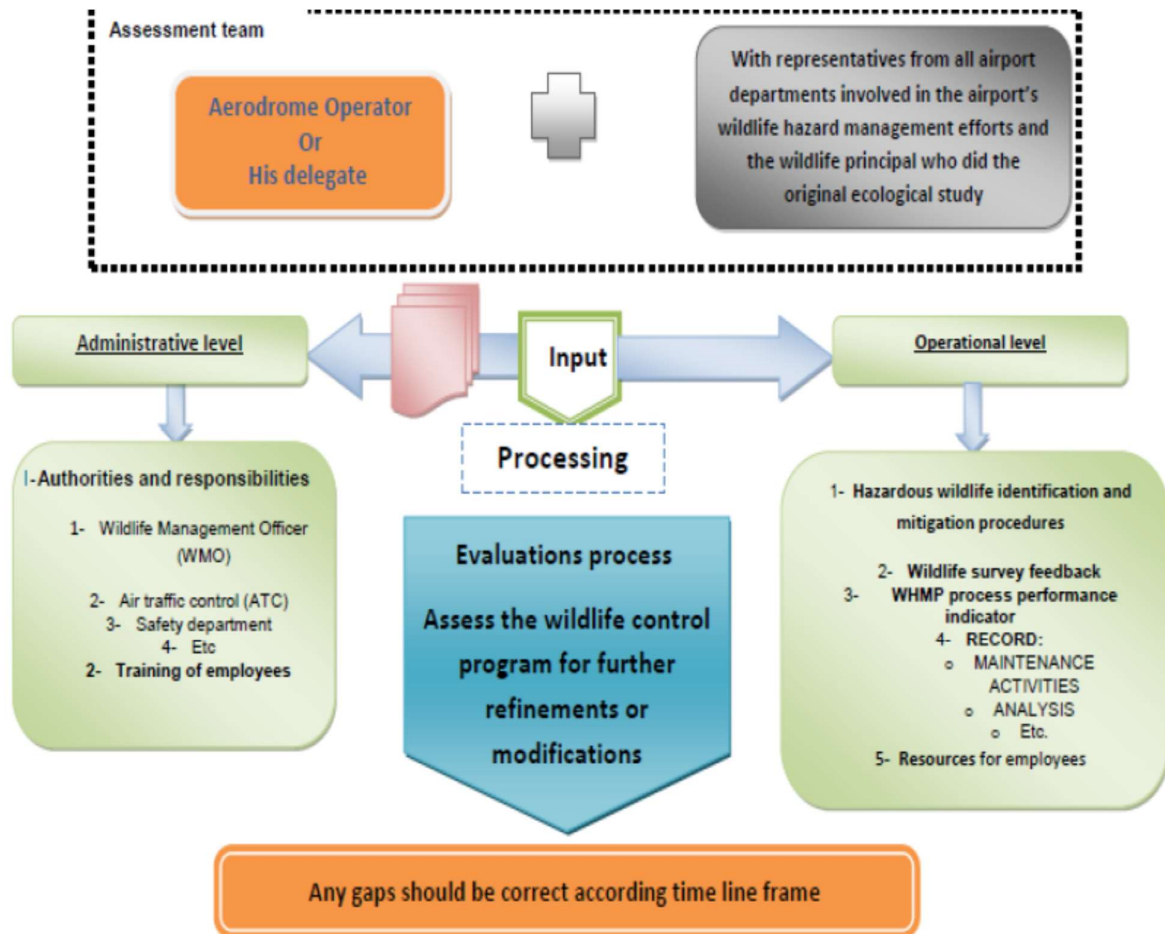


Figure 1 - Evaluation Process

8 Habitat management and site modification

8.1 Introduction

Habitat management is probably the most important method of preventing or reducing wildlife strikes on and around an airport. The airfield habitat should be less attractive to the animals than the surrounding areas. If there are off-airport sites that attract birds these may need dealing with - also these can create flight line of flight paths of birds moving from one area to another (e.g. from an overnight roost to a feeding location) then the airport should, in conjunction with local regulators seek to reduce the attractiveness of these off airport sites also.

Once the attraction has been identified, a management plan shall be developed either to remove it entirely, reduce it in quantity, or to deny access to it. It is not possible to define precisely what types of habitat management will be effective at a particular site because airfields around the world are all different and because the bird/wildlife species that frequent them vary from region to region. Typical examples include manipulating the species and/ or height of vegetation cover on the airport, removal of trees and bushes fencing off the aerodrome, netting of water bodies, excluding birds from buildings by netting or other means, selection of non-attractive amenity planting around terminals. Regardless of the techniques used, all airports should be able to show that they have assessed the bird attractions on their property and developed and implemented a habitat management plan to reduce these attractions as far as is practicable.

8.2 On Airport Habitat Management

Wildlife can be attracted to particular sites for feeding, breeding, roosting, resting or access to water. Efforts put into reducing the attractiveness of the airfield can be the most productive way to reduce the risk of wildlife strikes.

The large expanse of grass, low vegetation or even the lack of vegetation present at airports is attractive to wildlife that prefer open country habitats partly because they rely on being able to observe predators at long distances. When combined with food resources, airports can be very attractive habitats for open-country wildlife. The presence of numerous buildings and hangars along with trees and bushes adjacent to the airfield can also provide suitable habitat for many species.

Therefore, it is necessary to identify and evaluate the attractants present on the airport so that they can be reduced, eliminated, or effectively managed, thereby achieving a long-term solution to the problem of wildlife strikes.

If the aerodrome environment is made less attractive to the wildlife species present, they will seek their needs elsewhere and the resident wildlife population will decline significantly, along with the number of wildlife strikes. By modifying the habitat, it is possible to modify both the quantity and the type of wildlife species active on the airfield.

There are a number of habitats on an airfield to which wildlife may be attracted. These are listed below with an explanation of what features can be attractive and what steps can be taken to counter this.

- **Buildings** – provide sites for nesting, roosting and perching;
- **Open water** – access to water, breeding and roosting sites;
- **Trees, shrubs, berries** – perching, nesting and feeding;
- **Grass** – see details below on how to manage airfield grass.

Controlling the attractiveness of an airport to birds and other wildlife is fundamental to good control. Indeed, it is probably more important than bird dispersal in terms of controlling the overall risk. If an airport provides easily accessible resources to birds/wildlife in terms of food, water, shelter or breeding sites, then they will continue to try and return despite any dispersal tactics that are used to dissuade them. Habitat management to deter birds/wildlife involves two processes, identifying the attractive features and implementing changes to either remove the attraction or to deny access.

An airport should undertake a review of the features on its property that attract hazardous birds/wildlife. The precise nature of the resource to which birds are attracted should be identified and a management plan developed to eliminate or reduce the quantity of that resource, or to deny birds access as far as is practicable. Documentary evidence of this process, its implementation and outcomes should be kept.

1. Food

An aerodrome has the potential to offer a great variety of food sources to wildlife. The main sources of food for wildlife are:

- i. Grass used by grazing animals such as geese, rabbits, deer, etc.
- ii. Other vegetation, such as fruit bushes and trees, seed-producing plants and grasses, green weeds, aquatic vegetation;
- iii. Dense populations of small mammals (e.g. mice), birds or amphibians, as well as invertebrates (e.g., insects, earthworms); and
- iv. Rubbish/garbage/waste, especially food waste.

The production of seeds by herbaceous plants, particularly the many species of graminaceous plants which provide a favourable source of food for some bird species.

If the presence of birds is to be decreased substantially, it is necessary to take action mainly at the source by reducing their food supply. The use of pesticides and herbicides may be a solution in some cases.

2. Water

Insofar as possible, very wet land and stagnant water on aerodromes should be drained. The presence of water is a major factor in attracting wildlife, particularly birds, aquatic mammals and amphibians and creates habitat for aquatic invertebrates that often hatch synchronously in large numbers thereby attracting large numbers of insect predators (e.g. birds, bats).

It is often difficult and costly to eliminate all wet areas from an aerodrome. Where construction measures, such as drainage, cannot be undertaken, airport operators should identify water bodies that are used by significant numbers of hazardous wildlife and undertake action to limit the access of wildlife to these bodies. Placing floating balls, netting or overhead wires, can be excellent solutions, depending on the species present.



3. Shelter

Buildings can provide numerous opportunities for roosting and or nesting by birds and are often inhabited by small mammals. For certain species of birds and mammals that are well adapted to the human environment, aerodromes are attractive sites.

Analysis of buildings can identify places that can be used by wildlife. The elimination of these potential shelters will decrease the numbers of animals present. All dilapidated or ruined buildings, on or in the direct vicinity of the aerodrome, should either be repaired or demolished. Those structures are often colonized by wildlife that uses them as shelters and for breeding purposes.

Signs and lights along runways and taxiways are ideal perches for birds, and particularly raptors, which use them as observation posts when hunting. Limiting their use as perches can be an excellent solution to reduce the presence of birds. The installation of metal spikes, preferably the 'rotating 3-spike version', prevents birds from landing on them.

4. Grass

Aerodrome operators may need to obtain advice from specialists working in conjunction with local agronomists on the seed mixes to be used for planting on the airfield. The mix should permit development of slow-growing plants producing a minimum of seeds, to avoid providing food for birds, yet with sufficient regeneration to maintain good soil coverage. Consideration should be given to using high entophyte type plants to minimize wildlife use of the vegetation.

Most evidence shows that short grass (5-10 cm) attracts more birds than longer grass (15-20 cm). In some cases, very long grass (1 m) is necessary to deter the major hazardous species of birds. Predators, including raptors and certain terrestrial grassland bird species, do not like to hunt for their prey, particularly small mammals, in long grass. When birds are not hunting, they like to have clear all-round vision to avoid danger. Longer grass creates an insecurity factor and discourages them from landing, resting or nesting in this type of grassland habitat.

Therefore, the larger and most hazardous species, because they are usually much taller than 20 cm, require grass heights well in excess of the typical “tall” grass range. Grass management has to be adapted for each aerodrome. No general principles can be adopted on this subject at the international level.

Aerodromes which do not have vegetation covering the soil do not offer much food to birds, but may attract certain species to nest or roost directly on the soil. At airports where sparse or no vegetation attracts hazardous species, studies could be conducted to determine possibilities for plant coverage that prevents nesting and roosting without increasing food sources. It is not automatically the best choice to provide a grass covered airfield. If the surrounding areas are arid desert, then the green grass may well attract birds.

Depending on the type of grass used and the local climate, grass coverage needs to be maintained. Depending on the type of grass, the machinery used to mow will have to be adapted to pick up maximum amounts of grass after mowing, and must not create ruts, which may offer wildlife a favourable environment. For example, if they become filled with water. The continual collection of grass may also lead to reduced soil fertility and may require periodic added fertilization, preferably in the form of low-nutrient organic fertilizer.

The period during which grass is cut is a determining factor in wildlife hazard management. It is essential to be able to carry out this work under dry weather conditions and be sure that it can be completed as rapidly as possible. Consideration should also be given to conducting grass cutting at night time. Night cutting eliminates the risk of attracting birds to the mowers to feed. The period after mowing should allow for grass to grow to its optimal height before the next mowing is carried out.

The grass that is cut must be sufficiently mulched, or preferably collected and removed from the aerodrome. The presence on the ground of decomposing grass creates a thatch layer that favours an increase in invertebrate numbers which will in turn attract birds. Clumps of grass also provide ideal nesting habitat for field rodents and can contribute to high rodent populations which can attract raptors.

This may mean an airfield should have grass cut to a particular length such that local bird species cannot find food and cannot rest because their sight is interrupted by the grass. At other locations it may be more important to not provide perching opportunities on structures or, in dry areas not to provide access to surface water. A study of the airport environment should lead to the implementation of a Habitat Management Plan that describes the management needed for the different areas and habitats of the airport perimeter.

Where grass does grow naturally in the environment it can be managed as described elsewhere. In terms of operational procedures this will mean a plan to achieve the following:

- Soil sampling to ensure there are no insects and larvae that will attract birds to feed;
- Weed-killer to reduce weeds upon which birds may feed;
- Insecticide to remove insects upon which birds may feed;
- Fertiliser application to ensure the grass can grow to the required length;
- Bottoming out – cutting the grass very short in spring;

- to ensure fresh vigorous growth and to remove grass cuttings or thatch that can build up and harbour insects and attract birds;
- Regular topping cuts to maintain upright grass of the required height. In warm wet periods the grass may grow more quickly and in hot dry periods it may cease to grow – these variations in the weather will need to be taken into account so as not to strictly follow a time based plan for cutting.

However, general guidelines are difficult to establish for all climates and locations. According to the type of vegetation, growing conditions and wildlife at the location, an appropriate mowing regime must be determined.

8.3 Off Airport Habitat Management in the Aerodrome's Surroundings

Generally, the airport does not have the opportunity to directly manage habitats outside of the airport. Therefore, the aerodrome operator shall develop good relationships with the adjacent landowners and the local government to be able to influence land uses that affect hazardous wildlife distribution, movements and abundance.

The first stage consists of gathering specific data on wildlife outside the physical boundaries of the aerodrome. While it is critical to know the seasonal abundance of each hazardous species on and near the airport, it is also important to know how those species interact with the airport. For example, knowledge of movement routes makes it possible to provide pilots with reliable information on potential hazards within approach and departure paths. Knowing where species nest/den etc. can be very important in determining control strategies for young animals that are frequently most at risk of causing a strike.

The areas surrounding the aerodrome have a direct impact on the presence of wildlife on the aerodrome. Their physical location may also result in animals crossing the aerodrome regularly. It may be necessary to gain an understanding of wildlife behaviour outside the aerodrome.

The types of environments in the vicinity of an aerodrome, have a direct impact on the presence of wildlife are described below. The list is not exhaustive:

Local Agricultural Practices

In general, experts advise against growing agricultural crops on the aerodrome. Outside the aerodrome site, it is difficult to influence the choice of crops, unless national legislation has been adopted on this subject. Whatever the situation, it may be necessary to engage with local farmers in the vicinity of the aerodrome to influence their activities.

Landfill/Garbage Disposal Sites

Landfills and garbage dumps are a significant source of food for birds. Certain species will travel several kilometres to reach a dump. Birds flying to and from these sites may cross over an aerodrome or aircraft flight paths. It is not uncommon to observe birds, in particular gulls, soaring over dump sites in the thermals created by composting garbage. The greater presence of birds may give rise to problems for approaching aircraft. The presence of garbage dumps on aerodromes must be totally prohibited. In accordance with various national recommendations for the prevention of bird hazards, regulations call for the elimination of garbage dumps within a radius of up to 13

kilometres of the aerodrome. Even this regulation may be inadequate to prevent hazards if the airport is located between the landfill and the roosting site of the birds using the landfill.

Reservoirs, Lakes, Ponds, Rivers and Salt Marshes

Wetlands are often used by significant numbers of waterbirds, which tend to be among the higher hazard species due to their size and flocking behaviour. If possible changes to these waterbodies should be undertaken to reduce their attractiveness to birds if the birds are known to present a flight safety risk.

The existence of several bodies of water may result in bird movements from one to another, thereby increasing the risk of bird strikes especially if the airport lies between those waterbodies. Particular attention has to be paid to the risk of bird strikes at aerodromes situated in coastal areas or near estuaries.

Nature Reserves

The establishment of nature reserves in the vicinity of aerodromes can attract wildlife, especially if hunting exists outside of the reserve. In general, nature reserves are formed where unique, diverse or remnant habitats exist. They may or may not harbour hazardous species. Airports should develop a solid relationship with reserve management, so that if habitat enhancement is conducted on the reserves' wildlife hazards to aircraft are a primary consideration.

Possible Future Hazards in the Vicinity of the Aerodrome - Safeguarding

Airport operators should take steps to prevent new or increased hazards caused by developments in the vicinity of the aerodrome and should also encourage developments that reduce wildlife hazards. ICAO quotes a distance of 13km from the airport. However, developments beyond 13km can still create a hazard if animals move past the airport or runway ends, to and from the newly developed land use. Information needs to be collected by the appropriate State authority and/or the airport operator about the local wildlife species, their abundance and their movements to and from feeding and roosting areas at different times of the year.

Where such developments are likely to increase the hazard, the airport operator should communicate those concerns to the developer, municipal planners and the national aviation authority.

Landscaping of Aerodromes

In many projects for the revitalization, extension or construction of new aerodromes, external landscaping is given importance in the project in order to welcome aerodrome users in an agreeable manner. The planting of trees, bushes and other plants has the undesired effect of attracting wildlife, and particularly birds. The management of the wildlife hazard should be considered part of the project planning from the very beginning. Care should be taken with the selection of sites for planting and the varieties used which can have a significant impact on the presence of wildlife. In all cases, plants which produce food such as berries and fruit should be avoided. Also, continuous stands of vegetation should be avoided. Preferably, trees should be spaced so that they do not form a continuous canopy and shrubs should not be planted under the canopy of trees and should also be spaced so as to not touch each other. Open form trees and shrubs should be selected, avoiding coniferous trees and shrubs which provide year-round shelter.

Airports should conduct an inventory of bird attracting sites within the ICAO defined 13km bird circle, paying particular attention to sites close to the airfield and the approach and departure corridors. A basic risk assessment should be carried out to determine whether the movement patterns of birds/wildlife attracted to these sites means that they cause, or may cause, a risk to air traffic. If this is the case, options for bird management at the site(s) concerned should be developed and a more detailed risk assessment performed to determine if it is possible and/ or cost effective to implement management processes at the site(s) concerned. This process should be repeated annually to identify new sites or changes in the risk levels produced by existing sites.

Once sites that support birds/wildlife that are, or might, cause a flight safety problem are identified, management options can be developed. These can range from minor habitat modification, changing cropping or other agricultural practices, major drainage operations or large scale removal of bird/wildlife populations. Again the choice of technique will depend on the particular situation encountered and expert advice should be sought if necessary. Larger scale off-airport bird/wildlife management may also involve liaising with local conservation interests, especially if the sites that need to be managed are nature reserves. In some cases, it may be impossible to resolve the conflicting interests of flight safety and conservation, but in trying to do so the airport will be in a better position to show due diligence in the event of an accident or legal claim in the future.

9 Repellent and Intervention techniques

9.1 General

Repellent and harassment techniques should be used to keep hazardous wildlife away from specific areas on or near an airport. The long-term cost-effectiveness of repelling hazardous wildlife does not compare favourably with habitat modification or exclusion techniques. Wildlife will return as long as the attractant is accessible. However, habitat modification and exclusion techniques will never rid an airport of all hazardous wildlife. Repellent techniques are a key ingredient of any wildlife hazard management plan.

Repellents work by affecting the animal's senses through chemical, auditory or visual means. Habituation or acclimation of birds and mammals to most mechanical repellent techniques are a major problem. When used repeatedly, without added reinforcement, wildlife soon learn that the repellents or techniques are harmless and the repellents or techniques are ignored.

When using repellents, four critical factors shall be remembered:

- a) there is no single solution to all problems;
- b) there is no standard protocol or set of procedures that is best for all situations. Repelling wildlife is an art and a science. Motivated, trained and suitably equipped personnel who understand the wildlife on the airport are critical for the successful use of repellents;
- c) each wildlife species is unique and will often respond differently to various repellent techniques. Even within a group of closely related species, such as gulls, the various species will often respond differently to various repellent techniques; and
- d) to lessen habituation to repellent techniques:
 - (1) use each technique sparingly and appropriately when the target wildlife is present;
 - (2) use various repellent techniques in an integrated fashion; and
 - (3) reinforce repellents with occasional lethal control (only when necessary depredation permits are in place) directed at abundant problem species.

Advances in electronics, remote sensing and computers have resulted in “intelligent” systems that can automatically dispense repellents (for example, noisemakers, chemical sprays) when targeted wildlife enter selected areas. These devices are used to reduce habituation and increase the effectiveness of other repellent techniques. It should be remembered that automated repellents are not a substitute for trained people on the ground, who can respond appropriately to incursions by various wildlife species, and should be considered only when more traditional methods of control and dispersal have proved ineffective.

9.2 Wildlife patrols and runway sweeps in vehicles

Patrols of airside areas to disperse birds and other hazardous wildlife are a critical part of an integrated programme of wildlife hazard management on airports. Driving a vehicle toward the wildlife may be enough to cause the wildlife to disperse. This is especially true if the driver has been using repellent and removal techniques as outlined below. Regular and continuous patrols and sweeps help wildlife control personnel to learn the behaviour, daily movement patterns and habitat preferences of wildlife on the airport. This information helps identify hazardous wildlife attractants on the airport (for example, low areas that gather standing water after rains) and hence future problems. All wildlife carcasses found during runway sweeps should be collected, identified as to species and documented in a wildlife strike log of carcass remains.

9.3 The use of trained falcons and dogs to repel birds

9.3.1 Since the late 1940s trained falcons and other birds of prey have been used intermittently on various airports in Europe and North America to disperse birds. The advantage of falconry is that the birds on the airport are exposed to a natural predator of which they have an innate fear. The disadvantage is that a falconry programme is often expensive, needing many birds that must be kept and cared for by a crew of trained, motivated personnel. The effectiveness of falconry programmes in reducing bird strikes, in comparison with more conventional techniques, has been difficult to evaluate and, as important, wildlife management by these techniques requires a dedicated team of motivated, trained and competent personnel.

9.3.2 The following is considered to be a comprehensive summary of good operating practices for falconry use on airports:

- a) properly trained birds of prey of the right species for the job, used regularly and persistently by skilled and conscientious personnel, are effective in clearing birds from airfields during daylight and good weather;
- b) for good results, year-round, daily operations are usually needed;
- c) several falcons are needed to have at least one bird always ready to fly;
- d) a staff of at least two full-time, well-trained personnel are needed to capture, train, work and care for falcons. It should be noted that this practice may not be permitted in many parts of the world, where only captive-bred birds may be used, and indeed falconry is banned in some States; and
- e) access to a full range of other techniques is also required.

9.3.3 The use of trained dogs, especially border collies, to chase geese and other birds from golf courses, airports and other sites is a recent development. The successful use of border collies to repel birds requires a high degree of dedication and commitment by the handlers. As with falcons, the advantage is exposure to a natural predator. The disadvantages are:

- a) a trained person must always be in full control of the dog;
- b) most dogs respond well only to a single handler;
- c) the dog needs care and exercise every day; and

- d) a dog will have little influence on birds that are flying over the airport.



Figure 2 - Trained dogs/ Falconry deployed

9.4 Wildlife patrols and runway sweeps in vehicles

9.4.1 Cartridges and shell crackers are the most common means used throughout the world to scare birds. The visual and auditory effect of cartridges and crackers vary but is a direct and variable method that can be taken to wherever birds are situated. Certain types produce an explosion

9.4.2 when they are fired or when they have traversed a certain distance while others only detonate at the end of their trajectory. Some leave smoke trails or flares and others produce a whistling sound. Pyrotechnics are fired using revolvers, pistols or shotguns.

9.4.3 The scaring effect of cartridges or crackers fired from firearms is well known. Cartridges and shell crackers should be used carefully. They shall not be fired from within a vehicle. They shall always be fired between the risk area and the birds so they will be scared away from the area where they pose a risk to the airport operation.

9.4.4 Pyrotechnics shall not be launched into flocks of birds. This typically causes uncontrolled dispersal in all directions. Typically, pyrotechnics should be directed to one side of the flock opposite to the desired direction the controller wishes the birds to flush.

9.4.4 Pyrotechnics shall not be used only after CAA and ROP approval.



Figure 3 - Pyrotechnic pistol with an assortment of flares

9.5 Distress/Alarm Calls

9.5.1 Birds emit distress calls when captured by a predator. The use of distress calls is therefore effective as long as the birds are correctly identified to species and the right distress calls are then used. This involves recording and emitting distress calls through high-quality loud speakers which emit the full range of call frequencies and are then mounted on the bird hazard prevention vehicle.

9.5.2 Depending on the geographical situation of the aerodrome and the species present, the use of distress calls can be an excellent solution. Their effectiveness is well proven in the case of gulls, for example.

9.5.3 Birds normally react to distress calls in the following manner:

- They are alerted and take flight;
- They approach the source of the sound and circle overhead;
- Certain birds dive to assess the source of the threat.

9.5.4 When the calls cease, the birds very often leave the area. It can be effective to combine audio methods with visual methods such as the use of cracker shells or models or effigies. When calls are associated with a dead or distressed bird, the reaction of most birds is to leave the area. According to expert opinion, when distress calls alone are used, birds cannot precisely identify the threat or the predator and the safest action for them is to disperse. In view of this, the dispersal of birds through the use of distress calls may take time.

9.5.5 It is important to mount loudspeakers on the wildlife hazard prevention vehicle. They should be mounted facing the front of the vehicle. In this way, the driver always has the birds being dispersed in sight and can monitor their response and take any necessary follow-up measures.

Some guidelines for the use of bird distress calls are as follows:

- The vehicle should be stationary;
- The vehicle should be upwind of the flock of birds;
- The vehicle (and loudspeakers) should face the flock of birds;
- The ideal distance between the vehicle and the birds is less than 100 meters;
- The broadcasting of distress calls should last for around 90 seconds.

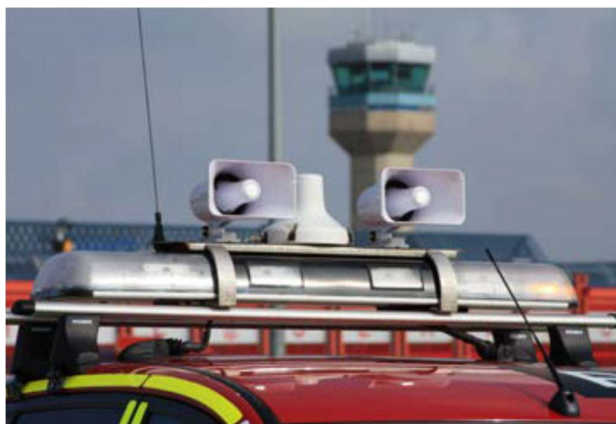


Figure 4 - Loudspeaker mounted on a vehicle

9.5.6 The use of distress and alarm calls are one of the most challenging control methods to use. Not only is their effect somewhat subtle, the proper application of the method is challenging. As a result, few controllers use the method appropriately and effectively and as a result tend to abandon using the method all together. Repeated training by individuals who have successfully mastered the use of alarm and distress calls and the effective use of models should be used to provide controllers with expertise in the use of this method.

9.5.7 Fixed and mobile noise makers, such as propane canons, can also be a potential means of dispersal for certain species. If properly equipped with remote control, the advantage of this method is that staff in the control tower can operate them when necessary. If the wildlife hazard prevention patrol is on the other side of the airfield, this method can allow them to extend their range by activating a device remotely. However, the effectiveness of each device is limited to a set range and when positioned at a fixed location, only birds within this range are exposed. Even then, without a significant negative experience associated with the noise birds very rapidly habituate and the effectiveness rapidly declines.

9.6 Trapping/Killing/Culling

Constructive measures should be taken to limit the presence of mammals. If removal is desired or required, experienced hunters or trappers shall be called upon to assist in the trapping or removal of wildlife. If they persist despite these measures, it is likely that more permanent measures shall be taken such as habitat modification or exclusion methods. The destruction of animals through the killing of individuals and removal of nests or eggs shall be carried out in accordance with Omani legislation. In no case should the destruction of animals be used as the primary and /or sole method of wildlife management on an aerodrome. The use of limited, targeted, lethal control by trained staff may be necessary either to reinforce non-lethal control measures or to remove individual problem wildlife that cannot be controlled through any other method. Where wildlife is shot or captured, operatives shall be trained in wildlife identification to insure that the correct species is targeted, and trained in proper removal methods and handling of live and dead animals. Trapping and handling of live animals takes considerable training to be successful and guarantee the safety of both the animals and the trapper and likely requires additional permitting by the government.



Figure 6 - Living trapping for immigration**9.7 Visual Repellents**

Predator models can exist in the form of kites, balloons, scarecrows and even small models. Experience throughout the world shows very rapid habituation by birds. The more mobile the model, the longer it will be effective. These methods should only be used for brief periods of time, generally no more than 3-4 hours and if they can be used with other more effective methods their effectiveness can potentially be increased. Scarecrows are also only effective for very short periods of time and then only when there is action or other methods in use. The “Scary Man” scarecrow has been used in some locations, but the effectiveness is very limited both spatially and temporally.

--- End ---

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Appendix B-model guidance for development of wildlife hazard management program

The extent of a wildlife hazard at particular airport locations is widely variable. Many solutions are available but none are likely to be useful at any one airport, the most important action, upon which any risk management strategy must be founded, is knowing the nature of the hazard; this may vary by time of day and seasonally and must be related to the likely pattern of aircraft movements. For that, Aerodrome Operators are required to establish all the documents needed to demonstrate the level of risk posed by the existing hazards of the wildlife hazard to enable them to establish the effective criteria for mitigate the hazard of the wildlife.

2- Phase I: Wildlife Hazard Assessment /Ecological Study

Starting with a Wildlife Hazard Assessment Study is highly recommended which is starting with collecting data (information, records, etc...) (INPUTS), then analyses all these data to identify the hazard, which will affect to aircraft operation.

Step 1: Data Collection

1. All the previous events and bird strikes records and statistics.

- (1) Analysis of the event, which prompted the study.
- (2) All the records of damaging collisions with wildlife other than birds.
- (3) Observed wildlife species.
- (4) Observed wildlife numbers and sizes.
- (5) Observed wildlife locations and local movements.
- (6) Observed wildlife daily and seasonal occurrences.
- (7) Identification and location of wildlife attractants on and near the airport.

Step 2: Data Analysis

Analysis all collected data of the wildlife hazard to air carrier operations.

Step 3-4: Document Preparation:

The study describe in above paragraph shall be introduced to CAA taking into consideration some important parameters refer to (paragraph 3 in this manual).

3- Phase II: Establish Wildlife Hazard Management Plan (WHMP)

The goal of this Wildlife Hazard Management Plan (WHMP) is to promote aviation safety for passengers and flight crews by reducing wildlife hazards and associated risks to aircraft and airport operations caused by wildlife activities on and in the airport vicinity. A wildlife management plan is a document used by airport operator to outline and implement steps for preserving, altering, or exploiting wildlife on/off airport, a management plan usually contains maps, descriptive documents.

The WHMP should be establish based on the ecological study (Wildlife Hazard Assessment) and shall contain at least the following:

- (1) Definitions
- (2) Objective
- (3) Duties & Responsibilities
- (4) Wildlife Hazard identification and Assessment
 - (a) All the previous events and bird strikes records and statistics.
 - i. The most significant wildlife hazard that induces events.
 - ii. The potential time and date of events occurrences.
 - (b) All the records of damaging collisions with wildlife other than birds.
 - (c) Observed wildlife species.
 - i. Basic information about the wildlife at the airport region.
 - ii. The airport region relevant biodiversity.
 - iii. The most significant wildlife species behaviour.
 - iv. The main reasons for such wildlife species existence or flying over.
 - v. Migratory flyway (If it is migratory bird species).
 - vi. Flyway altitude.
 - vii. Determination of the altitudes and geographical sites of interference between aircrafts pathway and the migratory birds' flyway.
 - (d) Observed wildlife numbers and sizes.
 - (e) Observed wildlife locations and local movements.
 - i. The most significant bird flocks gathering points and geographical distribution at the airport region (on or within the airport vicinity).
 - ii. The local movement of bird flocks determination.
 - (f) Observed wildlife daily and seasonal occurrences.
 - (g) Identification and location of wildlife attractants on/in the vicinity of aerodromes.
- (5) Description of the wildlife hazard to air carrier operations
- (6) Wildlife Control
 - (a) Monitoring
 - i. Daily Wildlife Management Log
 - ii. Monthly Summary
- (7) Establishment of Performance Indicators and Self-Assessment
- (8) Recording and Reporting Wildlife Strikes.

4- WHMP Implementation Phases

4.1 The purpose of this Section is to establish criteria for implement the WHMP by the following components:

1. Phase I: Planning Phase
 - (a) Conduct Gap Analyses
 - (b) Resource Allocation
 - (c) Responsibility Identification
 - (d) Hazard Identification

2. Phase II: implementation phase
- (a) WHMP Implementation Procedures
 - (b) Periodic Evaluating

Note: see Figure 6 – WHMP implementation phases

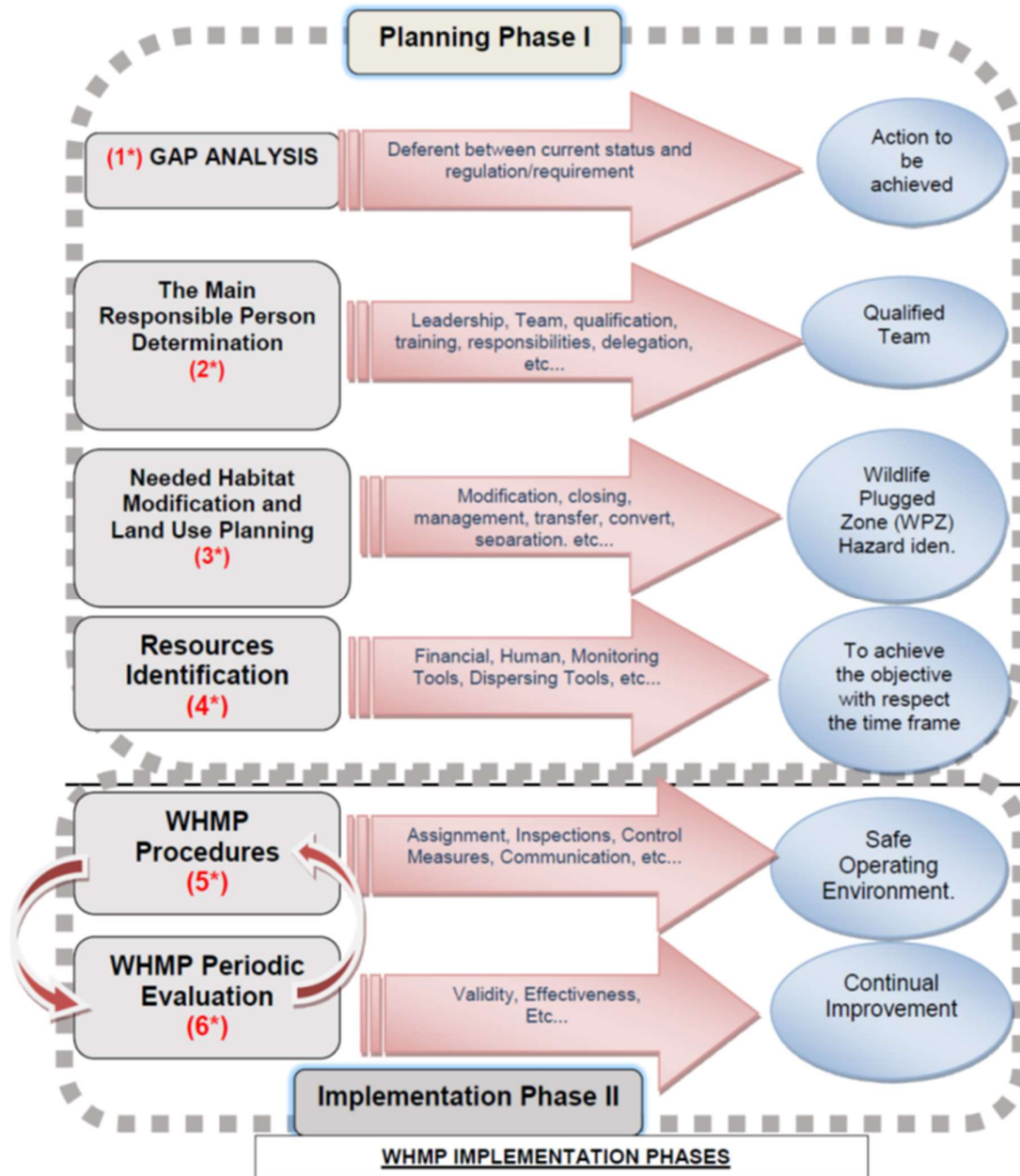


Figure 6 – WHMP implementation phases

Process #	Task Title	Process	Deliverable
<u>Phase I: Planning Phase</u>			
1*	Gap Analysis	Current situation vs objectives	Requirements needed to be fulfilled
2*	Resource Identification	Human, financial, tools, etc...	Allocated all needed resource for Suitable work environment
3*	Responsible Person Determination	Team assignment and training	Qualified team
4*	Habitat Modification	Management, closing, transfer, etc...	Passively created considerable safe operating environment
<u>Phase II: Implementation Phase</u>			
5*	WHMP Implementation Procedures	Inspection, wildlife dispersing, recording, analysis, etc...	Actively created considerable safe operating environment
6*	Periodic Evaluating	WHMP Validity and effectiveness verification	Verified and audited plan which includes continual improvement

4.2 Phase I: Planning Phase

Step 1*: Gap Analysis (Where Are You? And What Should You Be?)

A gap analysis is a method of assessing the differences in performance between a current situation (present state) and standard situation (the target state) to determine whether requirements are being met and, if not, what steps should be taken to ensure they are met successfully. Gap refers to the space

between "where we are" (the present state) and "where we want to be".

- **The first step** in conducting a gap analysis is to establish specific target objectives by looking at the strategic goals and improvement objectives, which are stated in WHMP.
- **The next step** is to analyse current state processes by collecting relevant data on performance levels and how resources are presently allocated to these processes. This data can be collected from a variety of sources depending on what is being analysed, such as by looking at documentation and observing current activities. Lastly, after an airport compares its target goals against its current state, it can then draw up a comprehensive implementation plan to fulfil the gap between its current and future states, and reach its objectives level.

Note: *C - Risk Analysis may be used to conduct gap analysis*

Step 2*: Resources Allocation:

aerodrome Operator responsible for allocate the resources to implement the appropriate wildlife hazard management techniques these resource is defining as:

- **Human Resources Identification:** assign key person from the following department (the Wildlife Hazards Control Team) and other contributing airport personnel for implementing each phase of the plan
 - a) Environmental Department
 - b) Safety Department
 - c) Operations Department
 - d) Maintenance Department
 - e) Security Department
 - f) Air Traffic Control (ATC)
 - g) Planning Department
 - h) Financing Department
 - i) Wildlife Controller (Coordinator): (To oversee the daily activities and analyse the collected data and carry out risk assessments in order to develop and implement the WHMP).
- **Financial Resources Identification:** In coordinating with Planning and Financing Departments, the Aerodrome Operator shall determine the most appropriate wildlife monitoring and dispersing tools to be purchased and the training to be provided.

Step3*: Responsibility Determination

- The Aerodrome Operators responsibilities shall be borne by the senior manager role and this shall be specified in the aerodrome Safety Management System (SMS). The Wildlife Control Coordinator is in charge of the implementation of the WHMP. The Wildlife Control Operators carry out the required tasks and field work. A Wildlife Committee will ensure that all stakeholders are engaged in the WHMP.
- The assignment of actual roles, titles and tasks will vary from airport to airport. At smaller airports, the roles might be divided or merged to just 1 or 2 levels. Larger airports will require larger, possibly dedicated teams. Some tasks or roles may be contracted to an external company or organization.

Note: see Figure 7 – Sample of Organization Chart ((this organization chart may be differing from one airport to another).

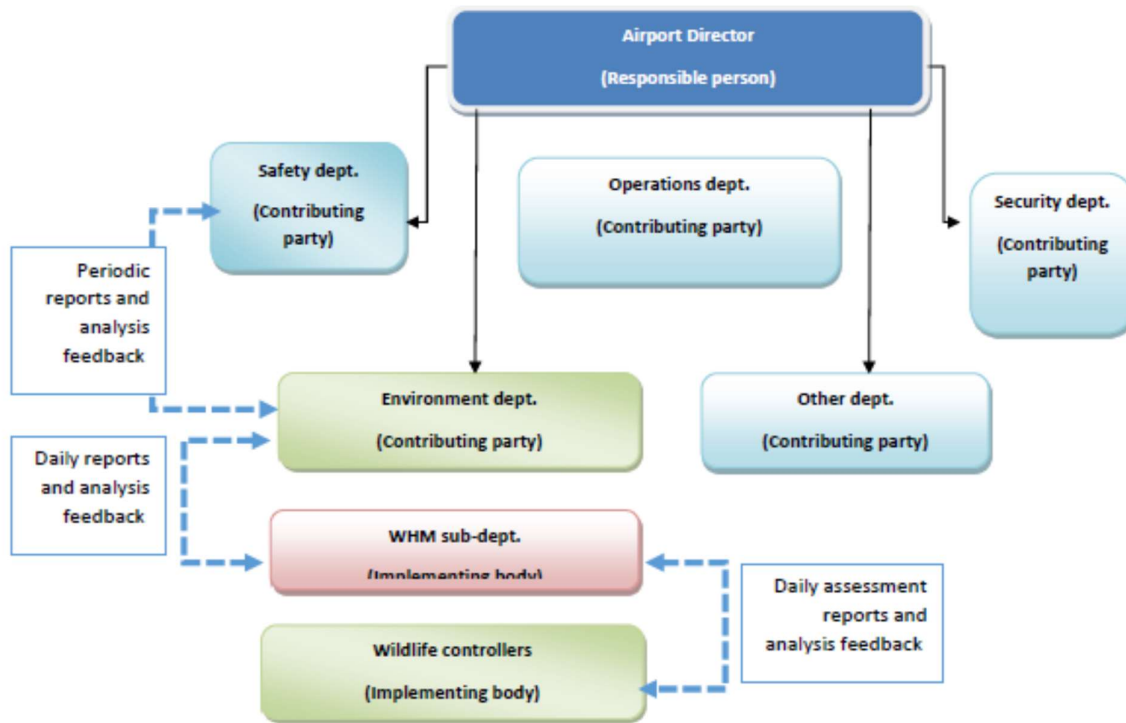


Figure 7: Organisational Chart

Roles & Responsibilities of Wildlife Hazard Management (Coordinator) and Relevant Team (Front-Line Personnel (Wildlife Controllers)):

- (1) Monitoring bird's local movements area on/in the airport vicinity using one of the monitoring tools from the highest point at airport (as much as possible) especially the airport movement area with the aim of quick intervention in case of presence of such wildlife hazards to prevent the likelihood of bird strikes or any other damaging collisions.
- (2) Daily inspections and patrolling of the airport movement area to verify wildlife hazard and/or wildlife hazard attractants absence.
- (3) Periodical inspection of the wildlife hazards attractants on/in the aerodrome vicinity.
- (4) Wildlife hazard management and control relevant records, checklist filling out, and keeping.
- (5) Raising up weekly and monthly reports conveying the current situation of his activities, performance, and any other relevant duties.
- (6) Keeping in contact with quick reaction with the ATC department in case of any emergency notifications regarding wildlife existence.
- (7) Coordinate the activities of the WHMP with air traffic control (ATC) and other stakeholders and contributors (as mentioned in the following flowchart).
- (8) Bird/wildlife observations, control and reporting.
- (9) Review strike reports, monitor daily activity records and maintenance reports to determine the requirements for short- and long-term management plans, and this information should be passed to managers accountable for safety on a regular basis at least on monthly basis (Ref: ICAO Service manual part 3).
- (10) Regular coordinating with WHMP other contributing parties and informing them with their roles and responsibilities in WHMP implementation.

Note: Appendix D, Key Roles and Responsibilities provides a guide for the key roles and responsibility, for further information can be found: ICAO Airport Service Manual, Part 3, Wildlife Control and Reduction, paras 3.3 Role of the Airport Operator and 3.4 Role of Bird/Wildlife Strike Control Coordinator and ACI Wildlife Hazard Management Handbook Section 2.

Step 4*: Needed for Habitat Modification and Land Use Planning:

Hazards attractants recognizing (description of wildlife habitats and resources): Habitat management is

the heart of airport's Bird/Wildlife Hazard Management Program because it offers ecologically based, long-term measures for reducing the number of hazardous birds/wildlife at the airport. Before undertaking activities to manage the environment, it is important to first carry out an Ecological Survey of the airport and surrounding area to identify sources of food, water and shelter attractive to wildlife on and in the vicinity of the airport.

Categorized the hazard as the following:

- **1st Landscape Category**, which is the airport itself, where habitats and the wildlife using them will be described in detail. This will rely on site-specific field work and standard techniques for describing vegetation communities (e.g., Ecological Land Classification) and wildlife communities, their use patterns and seasonal variations that have been observed or that might be expected.
- **2nd Landscape Category**, which is the nearby lands, those are not under direct control of the airport. The physical area included in this category generally includes lands up to 8 km from the airport reference point, which should include an area of sufficient size to provide an adequate picture of wildlife movements through the airspace identified later in this document. This assessment is largely based on existing information and remotely sensed habitat analysis rather than site-specific field work. It will describe the location of moderately hazardous land use practices such as wastewater discharge plants and sewage lagoons, crop production, recreational sites and managed or created wildlife habitats. There is no requirement under the regulation to manage these lands however, it is important to be aware of potentially hazardous off airport land uses.
- **3rd Landscape Category**, which is the determination of the presence of extremely hazardous land, use practices that may be many kilometres from the airport. At a minimum, food waste disposal sites, outdoor composting and commercial fish plants will be mapped when they occur within 13 km of the airport reference point. Such features may be mapped at greater distances where wildlife associated with them may become a hazard to aircraft using the airport.

4.3 Phase II: Implementation Phase

Step 5*: WHMP Operational Process:

The Wildlife Hazard Implementation Process should have formal mechanism to ensure that the Wildlife Hazard Management Plan will be implemented effectively for that is the following procedures should be followed (Figure 8):

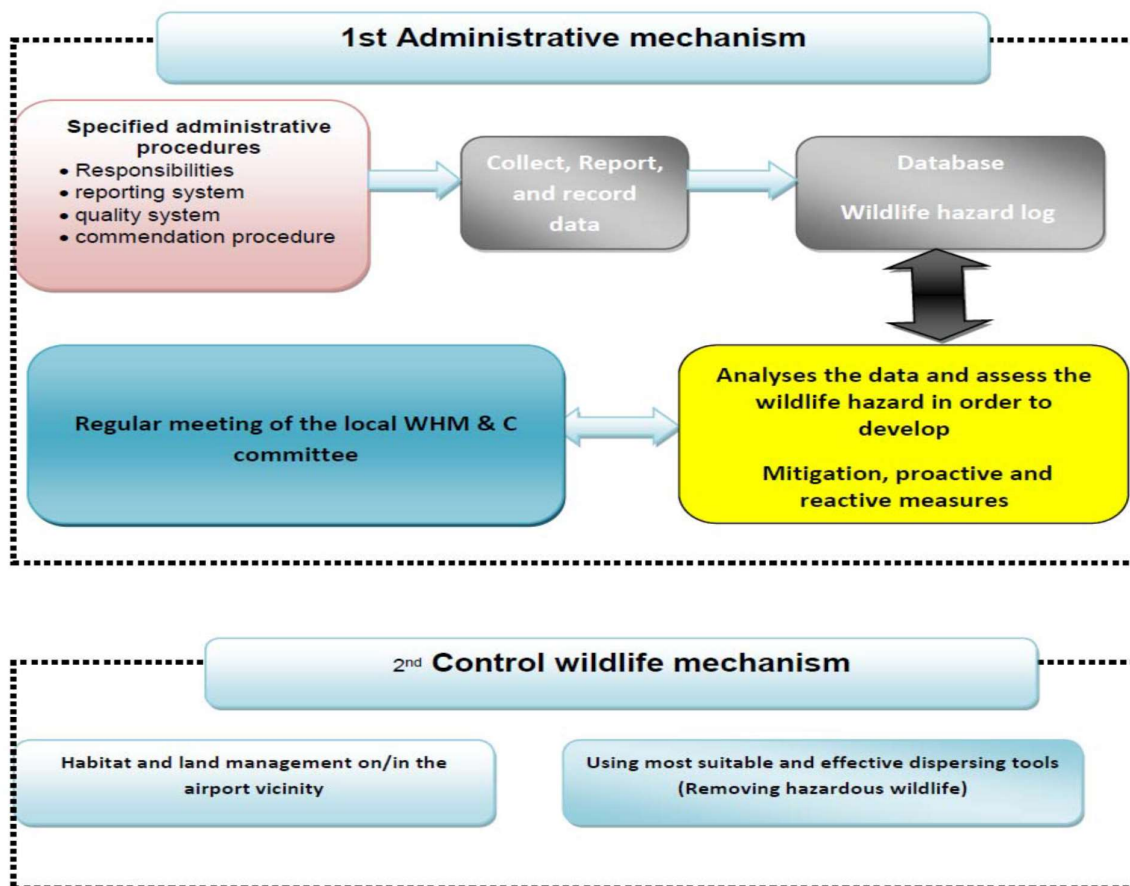


Figure 8

1st Administrative Mechanism

- For effective implementation the Airport Operator shall have specified administrative procedures whether to activate the key person responsibilities, writing reports and quality system include documents control system.
- Senior airport staff will be responsible for the implementation of this WHMP. This includes the acquisition of the various permits, the provision of training and awareness programs and the review and submission of the annual strike reports and two-year updates.
- Senior management, or their designate, will be responsible for coordinating, supervising and the overall management of the WHMP on a long-term and a daily basis at the site-specific level. This will include the nomination of the key Wildlife Management Officer, coordination of training, safety assurance and ensuring that the necessary equipment is available.

- Regular meeting of the Local Wildlife Hazard Management and Control Committee.
- Wildlife Hazard Management on an airport often requires communication, cooperation, and coordination among various groups on the aerodrome. Establishment of the Airport Wildlife Committee is required to facilitate this communication, cooperation and coordination. This committee might be included within the Safety Management Committee.

Members:

- a) Airport Operator.
- b) Bird/Wildlife Department Team.
- c) Maintenance Department Representative/s.
- d) Planning Department Representative/s.
- e) Financing Department Representative/s.
- f) Operations Department Representative/s.
- g) ATC Representative/s.
- h) Security Department Representative/s.
- i) Environment Department Representative/s.
- j) Agriculture Department Representative/s.
- k) Airport Using Airlines Representative/s.
- l) Local Runway Safety Team Representative.

Roles and Responsibilities:

- a) Review strike data collected.
- b) Assess bird/wildlife risks.
- c) Summarize trends in order to evaluate and determine what effective and most suitable control measures should be implemented in order to manage the bird/wildlife hazards.

Committee Meeting Intervals:

- a) Based on the airport complexity and the level of bird/wildlife existence (recommended monthly).
- An integrated approach is needed to coordinate throw the airport organizations. It is important to have effective communication between those involved in bird/wildlife dispersal and air traffic control. Upon receipt of notice of a specific wildlife threat, air traffic control shall issue appropriate warnings to aircraft on and in the vicinity of the airport. (Aircraft operators also are part of such an integrated approach by implement their roles upon receipt of the warning of a specific threat.)

Example of communication procedures should be stated in Wildlife Management Plan (*see figure 9*):

1. Information will be provided directly from the wildlife observer on duty to Air Traffic Services (ATS) via radio contact.
2. Wildlife observer responsible for ensuring that updated wildlife information is provided to ATS immediately if an urgent situation arises and on a regular basis depending on the current conditions, or when requested by ATS.
3. ATS deployment any information received from aircraft operator concern wildlife observations to wildlife observer in a timely manner.

-
- Communication Significance**
- PILOT**
- ATC**
- WILDLIFE CONTROLLERS + OPERATION DEPT.**
- Siren Sound Production**

2nd Wildlife Control Mechanism (*Operational Mechanism*)

- ### ***1- Habitat (Wildlife Hazard Attractants) Management Mechanism on/in the Airport Vicinity***

- The airport's WHMP should provide details on the actions and procedures necessary to manage both habitat and wildlife given the specific local conditions and considerations. Actions to deal with wildlife on a daily basis starts with patrols and inspections, observation of wildlife and other conditions, making interventions and assessing the response to interventions. It is also crucial to record all actions and observations in order to be able to review the effectiveness of the WHMP and development improvements.
- After working hazard identification and analysis (item 3-1-1) airport operator should have mechanisms to control of wildlife attractants through the following:
 - a) Avoid establishment of such kind of wildlife attractants anymore in the airport new projects or expanding.
 - b) Reduce the wildlife attractants from its original source as much as possible.
 - c) Destroying the food chain of such wildlife species at airports by using a series of insecticides, herbicides and rodenticides applications.
 - d) Management of airport's airside ground cover as appropriate with its relevant wildlife species and its behaviours.

- e) Choosing the optimum way of habitat modification based on the existing and expected wildlife.
- f) Definitely short grass cover is more convenient for visual and physical access of wildlife control team.
- g) Eliminate all standing water on an airport to the greatest extent possible.
- h) Modify waste water oxidation ponds whether by monitoring and dispersing birds regularly to form a wildlife plugged zone (WPZ) or covering it using nets or any other relevant suitable techniques (exclusions techniques).
- i) Proper fencing installation.
- j) Others.

2- Using Most Suitable and Effective Dispersing Tools

1. Repellent and harassment techniques should be used to keep hazardous wildlife away from specific areas on or near an airport. The long-term cost-effectiveness of repelling hazardous wildlife does not compare favourably with habitat modification or exclusion techniques. Wildlife will return as long as the attractant is accessible. However, habitat modification and exclusion techniques will never rid an airport of all hazardous wildlife. Repellent techniques are a key ingredient of any wildlife hazard management plan.
2. Repellents work by affecting the animal's senses through chemical, auditory or visual means. Habituation or acclimation of birds and mammals to most mechanical repellent techniques are a major problem. When used repeatedly, without added reinforcement, wildlife soon learns that the repellents or techniques are harmless and the repellents or techniques are ignored.

3- When Using Repellents, Four Critical Factors should be remembered:

1. there is no single solution to all problems;
 2. there is no standard protocol or set of procedures that is best for all situations. Repelling wildlife is an art and a science. Motivated, trained and suitably equipped personnel who understand the wildlife on the airport are critical for the successful use of repellents;
 3. each wildlife species is unique and will often respond differently to various repellent techniques. Even within a group of closely related species, such as gulls, the various species will often respond differently to various repellent techniques; and
 4. to lessen habituation to repellent techniques:
 - i. use each technique sparingly and appropriately when the target wildlife is present;
 - ii. use various repellent techniques in an integrated fashion; and
 - iii. Reinforce repellents with occasional lethal control (only when necessary depredation permits are in place) directed at abundant problem species.
- Advances in electronics, remote sensing and computers have resulted in "intelligent" systems that can automatically dispense repellents (for example, noisemakers, chemical sprays) when targeted wildlife enter selected areas. These devices are used to reduce habituation and increase the effectiveness of other repellent techniques. It should be remembered that automated repellents are not a substitute for trained people on the ground, who can respond appropriately to incursions by various wildlife species, and should be considered only when more traditional methods of control and dispersal have proved ineffective.

Appendix C- Key roles and responsibilities

Title	Key WHMP Responsibilities
Airport Manager	<ul style="list-style-type: none"> • Implementation of this WHMP; • Acquisition of the various permits; • Provision of training and awareness programs; • Review and submission of the annual strike reports and two year updates.
Assistant Manager	<ul style="list-style-type: none"> • Coordinating, supervising and the overall management of the WHMP; • Nomination of the key Wildlife Management Officer (WMO); • Co-ordination of training, safety assurance; • Ensuring that the necessary equipment is available.
Wildlife Management Officer (WMO)	<ul style="list-style-type: none"> • Maintenance of the Wildlife Management Log (e.g., including strike data, details on wildlife numbers and activity; • WHMP measures undertaken, firearm use details; • details on the use of lethal reinforcement and monthly summaries); • Co-ordination of the monitoring program; • Preparation of the annual strike report; • Ensuring that Airport operations are consistent with the requirements of the WHMP; • Ensuring that the appropriate permits are current and present on-site; • Undertaking deterrent activities; • Ensuring all activities are undertaken following standard practices and safety protocols; and identification of equipment, resource and training needs.
Back-up to WMO	<ul style="list-style-type: none"> • Filling in for WMO during vacations, lunch, sick time etc.
Air traffic Control (ATC)	<ul style="list-style-type: none"> • Informing wildlife hazards controllers, environmental dept. and operations dept. in case of observing any of these birds and/or wildlife gathering on/in airport vicinity or when receiving any relevant notification from pilot. • Warning pilots in case of wildlife observations (risky operating environment) and hazards expectation. • Report any unsafe conditions including hazardous wildlife on or in airport vicinity to the appropriate airport personnel anytime they are observed. • Actively attend the local wildlife hazard control committee meetings and any other relevant meetings.
Safety Department	<ul style="list-style-type: none"> • Receiving all wildlife strikes and events with the aim of risk assessment formation to ease the future forecasting based on accurate database and risk assessment strategy. • Actively attend the local wildlife hazard control committee meetings and any other relevant meetings
Maintenance Department	<ul style="list-style-type: none"> • Periodical inspection of the wildlife attractants (such as ponds, transfer stations and water treatment facilities) or airport infrastructure (such as fence) which ease the wildlife invasion. • Corrective maintenance actions and preventative maintenance actions to be taken for wildlife hazards management and control verification.

Title	Key WHMP Responsibilities
Environmental Department	<ul style="list-style-type: none">• Receiving wildlife strike reports from the wildlife hazard coordinator or wildlife hazards controllers.• Wildlife existence notification receiving from ATC and then verification of wildlife hazards controllers moving to the place of wildlife existence.• Database formation including wildlife species, numbers, sizes, date and time of existence, local movements, behaviours, the most suitable way of dispersing, etc...• Wildlife hazards management plan evaluating for effectiveness and verification of its compliance with the original wildlife hazard assessment (Ecological study).• Preparing under direct supervision of aerodrome operator for the local wildlife hazards control and management committee and other relevant meetings.• Follow-up decisions and recommendations taken by the mentioned above committee.
Other government municipalities (such as) agriculture offices, state or national environmental offices etc.	<ul style="list-style-type: none">• Advance cooperation and coordination with airport management regarding land use planning for those located in airport vicinity.• Exchange information on research and development in airport wildlife control.• Providing and updating much relevant information for those in the aviation community.

The aerodrome operator can assign the key responsibilities to a different department if it has a different organization.

Appendix D - Wildlife Hazard Management Assessment Checklist

Name of Aerodrome:		Inspection Date:			
Name of Operator:		Inspector(s) Name (s):			
	Item	Yes	No	N/A	Remark
1	Has the Bird/Wildlife Control Officer(s) at the site been appointed and responsibilities assigned?				
2	Has a training programme been developed to train those involved in Bird/Wildlife Control Programme?				
3	Have the control officer(s) being trained accordingly?				
4	Has the Bird/Wildlife Control Co-ordinating Committee been established with well-defined responsibilities?				
5	Has the Bird/Wildlife Control Programme (Management Plan) been developed?				
6.	Is level of implementation of measures in control programme (including those below) satisfactory?				
7	Does the Aerodrome Operator maintain an observation log? Does the content of the log give an indication of the actual status during inspection				
8	Does the aerodrome operator on a regular basis remove the attraction to birds particularly water, food, nesting sites and resting places?				
9	Does the operator maintain a wildlife/bird dispersal log? Does the content of the log give an indication of the actual status during inspection?				
10	Does the CAA/Aerodrome Operator regulate the creation of refuse dumps that would attract birds in the vicinity of the aerodrome where the safety of aircraft operations is affected?				
11	Has a reporting procedure been documented covering all aspects of the Bird/Wildlife Control Programme?				
12	Does the Aerodrome Operator keep records of timely reports on bird strike incidents or accidents occurring at the aerodrome?				
13	Does the Aerodrome Operator submit reports to the CAA for onward submission to ICAO on a regular basis, bird strike reports to facilitate effective use of the IBIS programme?				
14	Does the operator make available information on the presence of birds and associated hazards to ATC for advising arriving and departing aircrafts?				
15	Has a list of all bird/wildlife attractants at the aerodrome been completed?				
16	Has a list of all birds/wildlife surrounding the aerodrome been completed?				
17	Has a Land Use Plan been established with regard to effective land use on and off the aerodrome as it pertains to the bird/wildlife control programme?				