Drayton Farms Ltd and
R G Carter Farms Ltd
Proposed Residential-led Development at
Reepham Road, Hellesdon, Norwich

Bird Hazard Risk Assessment and Management Plan

July 2019

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AIRFIELD WILDLIFE MANAGEMENT LTD

Contents

1. Executive Summary

This bird hazard risk assessment and management plan is partly desk-based (based on historical local knowledge of the area and involvement in risk assessments and consequent design inputs to several local developments by this report's author), but is supplemented by site visits on 28th June, 9th July (to include the missed section immediately east of Manor Farm and south of Holly Lane) and 21st July 2019, when harvesting was beginning. This report examines any likely or possible changes in bird numbers, distribution and movements that could result from the proposed development and how these changes could affect the birdstrike hazard to aircraft operating at Norwich Airport. The second half of the report – the Bird Hazard Management Plan – describes the design features and additional mitigation measures that will be implemented to reduce any identified additional birdstrike risk to levels that are as low as is reasonably practicable. This report takes a cautious approach throughout and the aim is to deliver a scheme where Norwich International Airport (NIA) can be confident that *there will be no measurable increase in the local birdstrike risk as a result of the proposed development*.

The proposed development involves the creation of a residential housing development, commercial units and associated landscaping on a plot of land straddling Reepham Road, immediately north of Hellesdon and south of Holly Lane (fig 1). The site occupies what are presently arable fields under cultivation, that lie immediately adjacent to the eastern boundary of Norwich International Airport (NIA). NIA has requested that the developer produces a Bird Hazard Risk Assessment (BHRA) and a Bird Hazard Management/mitigation Plan (BHMP) to address concerns that the proposed development may have the potential to attract hazardous birds into a sensitive location or may generate local movements of birds that may be hazardous to local air traffic. AWM (Airfield Wildlife Management Ltd) has been engaged by Code Development Planners Ltd to carry out this work.

The BHMP addresses the identified potential risks associated with the development that are identified in the BHRA and proposes design, maintenance and monitoring systems to ensure that the development will have no adverse impact on the birdstrike risk to aircraft operating at and in the vicinity of Norwich Airport.

It is the opinion of Airfield Wildlife Management Ltd that, provided that the landscape and drainage features are delivered as proposed the development represents a very low birdstrike risk to NIA due to the lack of feeding opportunities (and loss of feeding opportunities for some hazardous flocking farmland birds), a lack of security (and high casual disturbance by residents and their pets) and the lack of any suitable nesting opportunities. The green landscaping of the development has been designed and refined from the outset with mitigation of birdstrike risks in mind. Compared to the environmental *status quo* of the site the post-development landscape represents a clear improvement in the local birdstrike hazard at Norwich International Airport.

Any bird or bat boxes to be erected on the site will be designed only to be used by small birds (smaller than starling) or bats. Most small birds that use nest boxes are not involved in birdstrikes, but it is acknowledged that some species are occasionally struck by aircraft – but the risk of damage is negligible due to their small size and low weight.

On this basis we conclude that the proposed development can constructed, maintained and managed with no increase, and some significant reductions, in the local birdstrike hazard provided that the full range of measures described below are implemented and sustained.

2. Airfield Wildlife Management Ltd (AWM)

AWM was established in 1985 to offer wildlife management services to the aviation industry, including military aerodromes, civil airports, airlines and aircraft manufacturers in the UK and overseas. Since the company's creation we have been engaged as contractors and consultants by the Royal Air Force, many UK airports (including the UK's largest airport operating companies) and to regulators such as the UK Civil Aviation Authority (including the creation and amendment of policy documents). Planning and safeguarding advice to minimise birdstrike hazards is one of the core services that we provide, formerly under contract to the CAA and latterly as consultants to airports and planning applicants. The author of this report has an unmatched length and breadth of experience in this specialised field.

3. Background

A birdstrike is a collision between one or more birds and an aircraft, and an average of just over 2,600 incidents were reported involving civil aircraft each year in the UK over the period 2012-2016, with a continued trend for increasing numbers of incidents each year[1]. Although most of these incidents cause little or no damage to the aircraft involved, birdstrikes can on occasion cause serious damage and the cost to the aviation industry in the UK runs into the tens of millions of pounds annually. On rare occasions birdstrikes have caused serious accidents and more than 200 civilian lives have been lost as a result of birdstrikes[i]. Only three birdstrike related civil aircraft accidents that have occurred in the UK but one was at Norwich Airport (in 1973) when a Dassault Falcon business jet lost power to both engines after striking a flock of gulls on take-off. The crew were forced to make a crash landing in a field, but fortunately although the three crew of the aircraft were injured the passengers were unhurt.

There is particular concern about birdstrikes involving large water birds such as geese (and this concern pre-dates the Airbus A320 accident at New York La Guardia Airport in January 2009 where the aircraft crash landed in the Hudson River). Feral greylag and Canada geese (in particular) are increasing in the UK and are heavier than current aircraft and engine birdstrike certification standards. As a result of their behaviour, numbers and weight they carry a much higher risk of causing serious damage to aircraft than the majority of bird species that are commonly seen in the UK.

Considerable effort is devoted to combating the birdstrike hazard on UK aerodromes, with well-developed habitat modification techniques and the provision of manpower and equipment to detecting and dispersing hazardous birds from the aerodrome and its immediate environs. However, existing bird habitats or new developments beyond the aerodrome boundary may cause concentrations and/or movements of birds in the local airspace that are hazardous to aircraft but cannot be influenced by actions taken at the aerodrome.

The European Aviation Safety Agency (EASA) and the UK Civil Aviation Authority (CAA) require all airports to take appropriate measures to deter birds on and around airfields, as birdstrike is one of the main controllable hazards to aviation. Most birdstrikes occur on or near aerodromes, but as birds are highly mobile, bird-attractive features beyond an aerodrome boundary have the potential to increase the local birdstrike risk depending on how the local bird populations move through the local airspace.

[1] https://www.caa.co.uk/Data-and-analysis/Safety-and-security/Datasets/Birdstrikes/

4. Aerodrome Safeguarding Requirements

In response to this significant safety risk the International Civil Aviation Organization (ICAO) provides standards and recommended practices to member states. The UK, as a signatory to the Convention on International Civil Aviation, Chicago 1944, has adopted many of the provisions specified in Annex 14 to the Convention. Annex 14, published by ICAO, includes standards and recommended practices (SARPs) that address the risk of a birdstrike and a potential increase of the birdstrike risk due to the presence or development of bird-attractant features on, or in the vicinity of, an aerodrome (the term "in the vicinity" is taken to be land or water within 13km of the aerodrome). The following text is directly extracted from the current edition of ICAO Annex 14. In ICAO terminology, the use of the word “shall” indicates that the subsequent procedures are standards rather than advisory or recommended practices. Paragraph 9.4.4 is the key statement underpinning aerodrome policy with respect to potential wildlife (bird) hazards.

> *9.4.3 Action shall be taken to decrease the risk to aircraft operations by adopting measures to minimize the likelihood of collisions between wildlife and aircraft.*
>
> *9.4.4 The appropriate authority shall take action to eliminate or to prevent the establishment of garbage disposal dumps or any other source which may attract wildlife to the aerodrome, or its vicinity, unless an appropriate wildlife assessment indicates that they are unlikely to create conditions conducive to a wildlife hazard problem. Where the elimination of existing sites is not possible, the appropriate authority shall ensure that any risk to aircraft posed by these sites is assessed and reduced to as low as reasonably practicable.*

As a signatory to the Convention on International Civil Aviation, 1944 (the Chicago Convention) the UK Civil Aviation Authority (CAA) is obliged to enforce this Standard. Because of this requirement Norwich Airport must carefully consider any application with the potential to attract hazardous birds and take all reasonable action to prevent their implementation unless it (and the CAA) is satisfied that there will be no net increase in the local birdstrike hazard to aircraft as a result of the development.

To comply with the international standards, in the UK a safeguarding consultation process exists as part of the planning process to address proposed developments with the potential to affect the safety of aircraft operations at certain civil and military aerodromes, designated by the Government as “officially safeguarded aerodromes.” The consultation process includes a means to address potential bird attractant developments within a 13km radius circle of the aerodrome. Safeguarding maps are used to define the 13km radius circle and are lodged with local planning authorities. The 13km circle is based on a statistic[ii] that 99% of birdstrikes occur below a height of 2,000ft above ground level, and that an aircraft on a normal approach would descend into this circle at approximately this distance from the runway.

Norwich Airport is required to ensure that any development within a circle of 13km radius drawn from the Aerodrome Reference Point (ARP) does not increase the risk of a birdstrike to aircraft using the aerodrome. The underlying regulatory framework for this requirement is described in: -

i. International Civil Aviation Organization ICAO Annex 14, Volume 1, to the Convention on International Civil Aviation (see above).

ii. European Commission Regulation (EU) No 139/2014 of 12 February 2014. Article 9 (e).

iii. The European Commission Implementing Rules ADR.OPS.B.020.

iv. Detailed Regulatory guidance regarding wildlife hazards to aviation in the UK is provided by the UK Civil Aviation Authority as an Acceptable Means of Compliance (AMC) with the EC regulations in their

publication CAP 772 - *Wildlife Management at Aerodromes*[iii] (October 2017) and Chapter 5 of CAP 168 *Licensing of Aerodromes.*[ii]

v. The necessary mechanisms for aerodrome (including bird hazard) safeguarding are codified in UK planning regulations by ODPM/DfT Circular 1/2003 *"Safeguarding aerodromes, technical sites and military explosives storage areas."*

Although virtually all land types and land uses (including natural habitats) attract birds in some way, safeguarding is intended to address developments that, whether individually or as part of a cumulative process, could become bird attractants with the potential to increase the birdstrike risk at an aerodrome.

5. Outline

The proposed development is within the 13km radius Bird Hazard Safeguarding Zone for Norwich Airport and accordingly the Airport has a statutory requirement to ensure that new developments within its vicinity do not lead to any increase in the birdstrike risk for aircraft operating at and around the airport. The applicant has, therefore, commissioned AWM to conduct an independent Bird Hazard Risk Assessment to enable Norwich Airport and the council's planning department to fully assess any potential that the proposed development may have to increase the birdstrike risk at and in the vicinity of the airport.

The following factors are taken into consideration when assessing the potential change in birdstrike risk:

1. the numbers, including seasonal variations, and types of birds that may be attracted to the development, both in the construction phase and the post completion environment;
2. any proposed landscaping or habitat designs;
3. the distance from the aerodrome;
4. the location of the development relative to aircraft arrival and departure flightpaths and within the visual circuit;
5. bird movements in relation to the aerodrome; for example, waterfowl move primarily between wetlands and along watercourses.

In terms of potential risk to aircraft, the primary concerns are the size (weight), numbers and flocking behaviour of birds that could be attracted into airspace around Norwich Airport at heights and in locations that would be likely to cause conflict with aircraft movements. Although small birds (in this context, birds of less than 100g) cause many birdstrikes, at inland UK airports they are not considered hazardous to aircraft with the notable exception of starlings (which often form, and be struck as, very dense flocks).

Norwich airport has valid concerns over the potential short-term effect of the earthworks during the construction phase and the post-completion landscape of the development on local bird populations and, in accordance with current regulation and best practice, has sought assurances from the developer that the local birdstrike hazard will not be adversely affected by any aspect of the development. This document is designed to provide that assurance.

6. Site Location

The proposed development involves the creation of a residential housing development, commercial units and associated landscaping on a plot of land straddling Reepham Road, immediately north of Hellesdon and south of Holly Lane (fig 1). The site occupies what are presently arable fields under cultivation, that lie immediately adjacent to the eastern boundary of Norwich International Airport (NIA). NIA has requested that the developer produces a Bird Hazard Risk Assessment (BHRA) and a Bird Hazard Management/mitigation Plan (BHMP) to address concerns that the proposed development may have the potential to attract hazardous birds into a sensitive location or may generate local movements of birds that may be hazardous to local air traffic. AWM (Airfield Wildlife Management Ltd) has been engaged by Code Development Planners Ltd to carry out this work.

Due to the very close proximity to the airport boundary and the extended runway centreline, the site is in a particularly sensitive location because aircraft are most vulnerable to birdstrikes in the final phases of landing

Figure 1. Site Location (Yellow Outline) With Respect to Norwich International Airport (Boundary in Orange). Crops indicated are those in cultivation during summer 2019

and during take-off (more than 90% of UK birdstrikes occur below 2,000ft above ground level).

7. Pre and Post-Development Bird Populations Within and Around the Development Site Boundary

Any assessment of the birdstrike hazard associated with a development should consider the pre-development bird populations of the site, the anticipated post-development bird populations of the site and the likely net changes in the populations and movements of hazardous birds through the critical airspace over and around the airport. This evaluation should include consideration of likely or possible interactions with known "bird sites" in the local area. If a development has the potential to create an *increased* local birdstrike hazard as a result of increased local populations of hazardous species (or the creation of hazardous bird traffic between the development site and other local sites) then the potential hazards should be identified, quantified where possible and mitigated to a level that is as low as is reasonably practicable and no higher than the pre-development situation.

7.1 Farmland Birds

The land within the development boundary has historically been under continuous arable rotation, growing a mixture of root crops (including potatoes and carrots) and cereals (including maize, barley and rye in 2019) in the sandy soils. The distribution of crops during the 2019 season is illustrated in fig 1.

The field to the west of Reepham Road was under maize in 2019 (fig 2), with two fields under potatoes (fig 3) including one adjacent to the airport boundary, three under barley (again, one on the airport boundary (fig 4) and one under rye (which had just been harvested on the last visit). Most of the fields have strong hedgerow features, with many of these hedgerows containing occasional mature trees distributed along their length. The edges of the plot that fringe Reepham Road, particularly along the eastern roadside, form a linear copse or woodland including oak *Quercus robur*, ash, hawthorn and blackthorn (fig 5).

Figure 2. Maize Field West of Reepham Road

Figure 3. Potatoes in Field Immediately East of Reepham Road (Roadside on Left).

Figure 4. Barley Field Extending toward Airport Boundary.

Figure 5, Field Boundary on the Western Edge of Reepham Road

During the site visits the visible bird populations (of species of concern to aviation i.e. larger and/or flocking species) were completely dominated by woodpigeons *Columba palumbus* and gulls (the latter a mixture of lesser black-backed gulls *Larus fuscus* and herring gulls *Larus argentatus*, joined during harvesting by smaller numbers of black-headed gulls *Larus ridibundus*. Woodpigeons were impossible to count with any accuracy, as there was so much overhead traffic of birds across the site, but during each visit the numbers seen within the plot boundaries were in the hundreds of birds. A local resident that I met on one of the footpaths through the site showed me a photograph of around 300 woodpigeons that he had shot on this land in a single day just before my last visit. Gull numbers were lower during the first two visits, with overhead traffic only due to the absence of feeding opportunities on the site, but during the last visit when harvesting had begun there were more than 200 gulls on and overhead the rye stubble immediately west of Horford Cricket Club. Other notable birds seen were a typical mixture of carrion crows (at least three pairs), magpies (two family parties) and buzzards (one pair with young, mainly seen on the west side of Reepham Road). A handful of waterfowl were seen flying overhead the site, specifically several groups of 3-6 mallard and two individual grey herons. It is inevitable, however, that normal arable farming activity later in the season will attract large flocks (numbering hundreds, possibly thousands) of potentially hazardous birds to this location during cultivation operations such as ploughing (which attracts gulls, corvids and starlings) and to the crops themselves (the species, numbers and timing of the bird attraction would depend on the type of crop being grown, but this may include geese being attracted to the debris left by harvesting carrots, potatoes and maize). As a result, by removing these activities from this critical location the post-development environment would constitute **a significant and permanent reduction in (potentially hazardous) farmland bird populations at the site**.

7.2 Woodland and Hedgerow Birds

Most bird species typical of woodland and hedgerow are insignificant in terms of birdstrike risk, but populations of woodpigeons, corvids and starlings, which are a potential hazard to aircraft, can all be affected by the size (area), height, species mix and location of woodland and hedgerow. As was noted above, there are a number of well-defined hedgerows within the site and along its borders with significant tree lines along Reepham Road, around the cricket club and around Manor Farm and scattered mature trees in some of the managed field hedges. The primary impact of these features within the area under consideration is to provide nesting, resting and roosting sites for corvids, pigeons and buzzards. It is notable that although these hedgerows contain a variety of berry-producing species, including *Rosa* spp. and hawthorn, the latter is less dominant in the established hedgerows than is typical of the area.

Post development, depending on the management of the hedgerows and any new planting there may be some changes in the populations of some hedgerow and woodland species and more typical "garden birds" such as blackbird, robin, goldfinch, greenfinch, house sparrow and collared dove are likely to increase in numbers. These typical garden birds do not, however, represent a birdstrike risk

Most of the existing trees and hedgerows on the site will be retained, and where new planting is proposed it will either be consistent with the local native hedgerows in species mix (but with the proportions of the most attractive berry producing species reduced wherever possible) or will incorporate shrubs and trees that are not attractive to hazardous birds (see BHMP for details). As a result, there will be **little or no significant change to the existing woodland and hedgerow bird populations and no increase in populations or movements of hazardous woodland and hedgerow birds at the site.**

7.3 Water Birds

This grouping includes ducks, geese and swans, but also moorhen, coot, grey herons and cormorants.

There is no permanent or persistent open water on the site, and nearest bodies of open water are the lagoons associated with the Northern Distributor Road (NDR), most significantly lagoons 8 and 8a on the A140 interchange on the northern boundary of the site. During my visits these lagoons occasionally held small numbers of mallard, but on 21st July there were over 100 gulls in and around lagoon 8a, drinking and bathing. The most significant waterfowl populations in the local area are 3+ km to the west of the site at the lakes in the former mineral quarrying sites at Costessey and Taverham. It should be noted that the birdstrike hazard associated with water birds such as swans, geese and ducks is generated by their movements between water bodies or between water bodies and terrestrial feeding sites such as arable stubbles, winter oilseed rape, etc., rather than by their presence on the water. At this location waterfowl movements between any flooded SuDS basin on this site and the lakes immediately to the west would be at low altitude due to the short distances to be travelled. Because of the location of these lakes in relation to the airport and the development site under discussion here, any local movement of water birds between the Costessey and Taverham lakes and this site would not be across the airport, but would still be taking place in a critical area where aircraft are at low altitude. As a result, the airport requires that the site will have no standing open water that could be colonised or utilised by hazardous water birds.

In summary, there are no waterfowl populations either resident on, or regularly visiting, the pre-development site due to the lack of suitable wetland habitats. Provided that the design and undertakings for the site's drainage proposals are delivered and monitored then this situation will not change. As a result, **the proposed drainage designs for this site, which will create no permanent or persistent open water, will lead to no increase in the local waterfowl birdstrike hazard**.

8. Construction Phase Bird Hazards

There are several potential sources of attraction to hazardous (in this context, large and/or flocking species) birds associated with the construction phases of this project: - potentially increased access to soil invertebrates (earthworms, insect larvae, etc.) during the "earthworks" and bare earth phases, ponding attracting waterbirds and terrestrial species seeking drinking and bathing water, exposed grit (primarily woodpigeons) and access to an abundance of weed species that inevitably germinate after the soil is disturbed (woodpigeons and stock doves). The species likely to be influenced, the biological basis of these influences and suggested mitigation measures are outlined below.

The potential birdstrike risks associated with the construction phase of this project can be summarised as follows: -

Works Phase	Potential Bird Attraction	Species Likely to be Attracted	Likely Severity
Earth moving, re-grading, consolidation, cultivation and re-seeding.	Opportunity for feeding, resting and roosting for flocking open-country species. Refuge from airfield bird control measures.	Lapwings, golden plovers, gulls.	May be severe (see below.
	Exposure of insects, earthworms, etc. to feeding birds.	Corvids, gulls, possibly starlings.	Local and short-term (hours after excavation). Daylight hours only.
	Food discards by contractors.	Corvids, gulls.	Typically, a low-level nuisance, but may escalate to moderately severe if site housekeeping is lax.
	Ponding.	Mallard, terrestrial birds – particularly woodpigeons.	Dependent on area and duration of ponding.
Re-seeding.	Availability of grass seed to birds.	Stock doves and feral pigeons, possibly woodpigeon and collared dove. Linnet, house sparrows and other small seed feeders.	Short-term (a few days) but may be widespread.
Initial stages of grass growth or weed growth on exposed soil.	Opportunity for feeding, resting and roosting for flocking open-country species normally deterred by long grass. Refuge from airfield bird control measures.	Lapwings, golden plovers, gulls.	May be very severe (see below) but at this site can be discounted (open areas of grassland are small, open areas of bare earth will be short-term).
Subsequent to above.	Establishment of undesirable weed species, including germination of weed seeds contained in	Woodpigeon, stock dove, partridge, finches.	Potentially widespread and persistent, but can be completely mitigated by prompt implementation of the landscaping proposals.

	topsoil, providing food to herbivorous species. Persistent ponding.	 Mallard and terrestrial species – see above.	 See comments re ponding above.

9. Risk Assessment by Bird Species/Family.

9.1 Corvids – rook and jackdaw.

Although rooks are numerous on and around UK aerodromes, they are involved in fewer birdstrikes than their numbers would suggest. This is certainly because rooks and other members of the *corvidae* have a significant ability to learn how to deal with high-speed traffic, including cars at motorway speeds and aircraft. However, even a single bird of this size (460-520g) can cause substantial damage to airframes or, particularly, engines and there have been at least two military aircraft losses ascribed to this species. Juvenile rooks are at significantly higher risk of involvement in birdstrikes and reported strikes with this species in the UK are heavily concentrated in the period late May to early August. Jackdaws are also numerous in the local area and often occur in mixed flocks with rooks. This species is smaller (c.220g), and its involvement in UK birdstrikes is very low, with just a few incidents reported annually. The seasonal timing of works is important in considering bird attraction of a construction site. For example, spring is a time of considerable food stress for rooks, particularly in dry weather, as adult birds will be trying to find sufficient food for themselves and their dependent young at a time when invertebrates are moving deeper into the soil, becoming less accessible. Any accessible food source can be a significant attraction to these birds, particularly in spring, and if the reward balances any costs (such as disturbance) these birds can be very persistent indeed. The main food sources for these birds are soil invertebrates, particularly insect larvae and earthworms.

Corvids are also significantly attracted to discarded food and are frequently noted entering waste bins and skips to extract discarded food, often along with its associated packaging.

9.2 Pigeons

In the local area, the likely problem species are feral pigeon *Columba livia*, stock dove (aka stock pigeon) *Columba oenas,* woodpigeon *Columba palumbus* and, to a lesser extent, collared dove *Streptopelia decaocto*. The first three species are a significant birdstrike risk due to their weight, body density and their extremely poor skills at aircraft avoidance. Additionally, although easily disturbed they tend to be very persistent when food is available, and the main risk is during their flights to and from food sources. These birds will be attracted by open water (even small pools), exposed grit, germinating and seeding weeds and seed laid for re-grassing of the site. It is possible that there may be some short-term increased level of pigeon activity at the site and an associated increase in pigeon traffic through the local airspace unless mitigation measures are implemented.

9.3 Gulls

Exposed soil is attractive to gulls, which feed mainly on earthworms in this setting. With the recent colonisation of the area by roof-nesting herring gulls and lesser black-backed gulls, these birds are now present locally year-round. Gull problems associated with earthworks are always short-term (during earthworks and for a few hours after the ground is broken) but may be acute and are typically worst in the winter months and particularly in wet conditions. Gulls are also strongly attracted to discarded food and will quickly take any food discarded in the open (or in some cases snatch it from the hands of people eating in the open) but are less inclined than corvids to enter skips or bins in search of food – although they may steal it from corvids that have accessed such sources.

9.4 Lapwing and golden plover

The activity levels at a housing construction site are always sufficient to deter lapwing and golden plovers unless there is a significant period of suspended activity. Given the expected rate of work progress and the amount of human and plant activity that will occur at the site these two species can be discounted from consideration.

9.5 Waterfowl

Even small temporary pools crated by ponding on a construction site will often attract mallard, but at this site the likelihood is reduced due to the soil types. Any significant ponding on the site during the construction phase will, however, need to be managed promptly.

10.Bird Hazard Risk Assessment - Summary

The bird hazard risk assessment for the development (excluding short-term construction phase hazards) is summarised in the table below.

Summary of Likely Bird Population Changes Pre and Post Development				
Bird Populations	**Status Quo**	**Post Development**	**Forecast Change** (Without Mitigation)	**Comments**
Farmland	Arable farmland with the typical bird populations of gulls, corvids, pigeons etc.	Housing and commercial development with associated landscaping.	**Permanent and marked reduction in populations of birds that are potentially hazardous to aircraft.**	
Woodland and Hedgerow	Extensive hedgerows, tree lines and copses.	Some reduction in extent of hedgerows, some new planting of native and ornamental species.	**Negligible, probably no significant change.**	
Lakes and Ponds	No open water on the site. A pond on the immediately adjacent property to the north, SUDS lagoons associated with the NDR and extensive lakes c.4.5km west of the airport.	There is potential to bring some additional waterfowl (only mallard are likely) closer to Norwich Airport and to generate new flight paths between local water bodies if any SuDS features were to hold persistent open water.	If the proposed designs for the site's drainage systems are delivered there will be no associated waterfowl populations or additional local movements.	**The desired outcome is contingent on the delivery of a drainage system that rarely holds open water, has a minimal footprint and drains quickly.**

In conclusion, the only identified bird hazards that *could* be increased as a result of the development should be potential short-term problems during the construction phase. In the worst-case scenarios, earthworks and/or poor site housekeeping during the construction phase could lead to a temporary short-term increase in gull and/or corvids numbers at the site (although this would still be less acute than has historically occurred during agricultural activity). The thorough mitigation of the potential risks identified above is the focus of the Bird Hazard Management Plan (BHMP) that follows.

Bird Hazard Management Plan

1. Basis

Norwich Airport is required to ensure that any development within a circle of 13km radius drawn from the Aerodrome Reference Point (ARP) does not lead to any increase in the birdstrike hazard to aircraft operating at the airport or within its critical local airspace. The underlying regulatory framework for this requirement is described in: -

a) International Civil Aviation Organization ICAO Annex 14, Volume 1, to the Convention on International Civil Aviation ("the Chicago Convention").

b) European Commission Regulation (EU) No 139/2014 of 12 February 2014. Article 9 (e).

c) The European Commission Implementing Rules ADR.OPS.B.020.

d) Detailed Regulatory guidance regarding wildlife hazards to aviation in the UK is provided by the UK Civil Aviation Authority as an Acceptable Means of Compliance (AMC) with the EC regulations in their publication CAP 772 - Wildlife Management at Aerodromes (2013) and Chapter 5 of CAP 168 Licensing of Aerodromes.

2. Definition

The following Bird Hazard Management Plan (BHMP) is proposed as a scheme agreed between ***** and Norwich International Airport dated TBA 2018 and designed to minimise populations of potentially hazardous birds at the site.

3. Objectives

The purpose of this document is to ensure compliance with the current International, European and UK regulatory framework by ensuring that no increase in bird hazards to aircraft operating at and in the vicinity of Norwich Airport is permitted as a result of this development. In the context of this specific planning application the priority species identified as representing the highest potential risk are gulls, pigeons (particularly woodpigeon *Columba palumbus*), rooks and mallard. These birds are prioritised "highest risk" because: -

a) They are species typically found visiting the sites of construction projects of this type.

b) They are susceptible to involvement in birdstrikes.

c) They are already resident in the local area.

d) They are large enough to cause damage to aircraft, particularly when encountered in flocks.

4. Proposed Mitigation and Monitoring Measures

Having identified the primary species of concern, a comprehensive range of measures is proposed below to minimise the potential attraction of the development to hazardous birds, to monitor the performance of these mitigation measures and to communicate with Norwich Airport.

4.1 Mitigation Measures – Construction Phase

The following narrative describes the mitigation measures required to mitigate the potential bird hazards identified in the Bird Hazard Risk Assessment above.

4.1.1 Procedural

i. The timing of all significant earthworks, particularly topsoil spreading and grading, shall be notified to the airport (Airfield Operations, 07872 376275 or email: airops@norwichairport.co.uk) in advance and scheduled, where possible, at times of lower flying activity.

ii. Any grass seeding will be done in phased sections (if the area to be seeded is larger than 150m^2) rather than all at once. Intervals between discrete blocks should ideally be in the order of 3 days. This will produce staggered germination, reducing the amount of seed available to pigeons, reducing the area affected at any one time and allowing better deployment of passive deterrent measures.

iii. Broadcast spreading of grass seed will be avoided, instead harrowing and rolling, hydroseeding or turfing, all of which reduce the exposure of the seed to feeding birds.

iv. Blocks of ground where construction work has been completed shall be reinstated or covered and re-seeded (where applicable) at the earliest opportunity.

4.1.2 Passive Deterrents

There are many passive (i.e. not directly man-operated) bird deterrents available, but the propane gas cannon (or any device that startles birds into flight) must be avoided, as they may well *increase* the birdstrike hazard by scaring birds onto the airport and/or into the path of aircraft. Many of the commercially available devices, including all "ultrasonic" devices, are completely ineffective and advice should be taken before acquiring and deploying any passive system. Rotating devices, humming lines, flags, etc. are all practicable but their effect is short-lived (a few days at best), and the most effective passive deterrent is likely to be the deployment of line of sight obstacles, of which the most practical and cost effective is the ubiquitous orange plastic safety barrier fencing as a line of sight (LOS) interference deterrent.

Since our original trials in 1998-2000, artificial LOS systems using plastic fencing have been used on large construction sites on and near major UK airports, smaller works sites on other aerodromes and airports and at very large car parking compounds used by a UK car import/export centres (to prevent loafing and roosting by gulls). In all settings it has proven effective, and when operational and cost considerations allow proper design, deployment and maintenance they have proven capable of providing an effective passive deterrent.

Ethos

Many birds that feed on the ground in flocks have a strong, sometimes overriding, preference for open ground with uninterrupted lines of sight and unobstructed take-off and landing areas. This is understandable, as there are many avian and mammalian predators that take birds, and flocks on the ground are an attractive target. Therefore, these birds find security in being able to detect predators by sight at long distances, by

being able to pick up on visual cues of danger from other birds in the flock and by being able to take flight quickly when required. By introducing barriers to these lines of sight and obstructions to flight, this open aspect (to the birds' perspective) can be destroyed, which compromises the birds' security. These line of sight (LOS) deterrents can completely exclude some species, such as lapwings and golden plovers from covered areas, and dramatically reduce the attraction of a site to others, including pigeons, corvids and gulls. This effect is the underpinning principle of aerodrome "Long Grass Policies."

The fencing described below should be deployed over any significant seeded areas as soon as seeding and rolling is complete and should be removed when active construction begins or, in landscaped areas, once germination is well established (area uniformly green, seedlings average at least 4-5cm). It may also be used as a temporary measure around and across temporary ponding where it a significant deterrent to birds, particularly gulls and mallard. The shorter the time that LOS fencing is in place, the lower the risk that birds will become habituated and defeat the system, and this is typical of any non-lethal visual deterrent.

On other open ground areas deployment of this system can be held in reserve to be installed only if gulls, etc., become a persistent nuisance on the site.

Materials Used

The main material used successfully has been plastic mesh works safety fencing. UV stabilised, mid or heavyweight, oval pattern mesh. Heavy-duty snow fencing is available in similar designs but is more expensive. This material is widely available in 1.5 x100m rolls, and in various colours. Alternative materials trialled have been black plastic mesh snow fencing and rigid plastic grid modular fencing units (for flexible deployment on car parking compounds). The black lightweight snow fencing showed poor results compared to the other materials used, as the mesh was finer and more transparent, and the black colour enhances this effect by absorbing light rather than reflecting it back to the eye of the viewer. It is likely that colour is unimportant, other than that light colours (better reflectors) can be expected to give a more obtrusive LOS barrier than darker, light-absorbing colours.

Fixing

There are several support options. The standard fixing is wooden stakes, spaced at appropriate intervals along the length of the fence. Glass fibre and steel fixing stakes are also available. In consideration of the possible risk of fencing breaking loose and being carried onto the airport by high winds it is suggested that the fixing system is modified in "near-airside" environments by fixing especially securely at one point along each run of fencing material. If this is done properly, a detached fencing section will break away in a controlled manner but remain fixed at one end or a central point and although it may blow like a streamer in the wind, it will not break free. This safety feature can be further enhanced by limiting the lengths of individual "runs" of fencing used (see below). Where wooden stakes have been used as fixtures to reduce costs, durability is poorer, and repair is both more frequent and more time-consuming, but in the environment under consideration, long-term durability is less important – the fencing is only required to be *in situ* for a few weeks. Given the need to promote seed germination in landscaped areas and maximum coverage, it may be prudent to mount fencing so that the lower edge is not in contact with the soil, as wind action would lead to damage to germinating grasses where there is abrasive contact. A clearance of 3-6 cm should suffice, while retaining its deterrent effect.

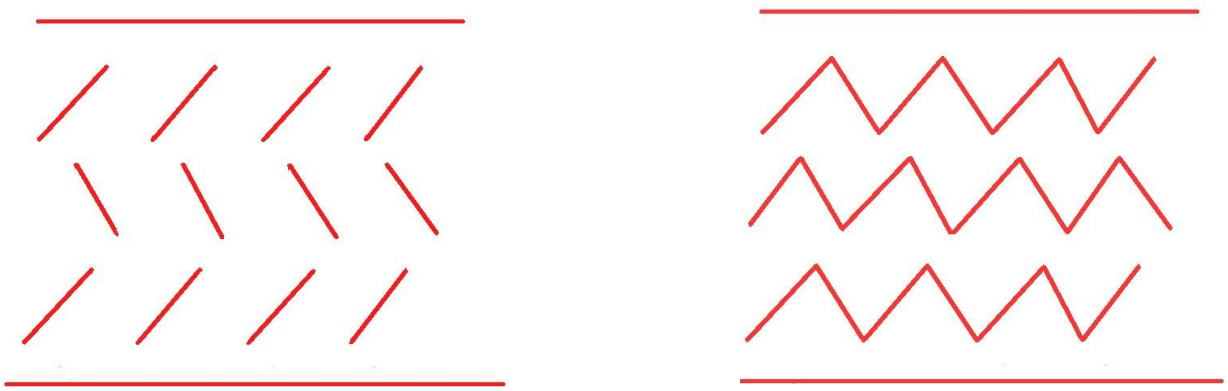
Installation and Layout Design

It is tempting, and may be labour-saving, to use the full length of the fencing roll (50 or 100m in most cases) in single runs. However, if a section of fence breaks away from its supports in high winds, the longer the section of fencing that tears free, the more force is exerted on the remaining supports – the detached fence

acts like a sail. A “runaway” detachment is possible, and this can be hazardous in an airfield environment. This can be prevented by cutting the fence sections into shorter lengths, so that the “sail” effect can be controlled. We make no specific recommendations on this, as there is insufficient data or experience available for installations in areas of differing climate, exposure, etc.

Installing fences at, or near, perpendicular to prevailing wind directions will increase the risk of a breakaway or flattening by the bending or breaking of supporting stakes. This risk can be minimised by angling fence runs against the prevailing winds – the smaller the angle, the least wind resistance, but this also reduces effectiveness as a bird deterrent (as it produces into-wind “lanes” for take-off and landing) and a balance must be struck.

The best layout pattern is one that gives maximum coverage of the area to be treated, effective LOS effect on birds, convenience for inspection and maintenance, for minimum materials use (cost). Again, we do not recommend any specific pattern other than to state that runs of fence should be arranged to minimise LOS corridors or gaps. There are two simple patterns for achieving this – zigzags or “chevron” patterns, both combined with interspersed straight runs of fencing. LOS bird deterrent fence installations can be completed by a perimeter fence, but access routes for inspection and maintenance should be designed into the installation. Precise spacing between runs of fencing does not appear to be critical. At the moment, the maximum spacing that will be effective is not known, but spacings of 5-10m (varied within a single installation) appear to be very effective in the UK, and spacings of up to 20m with full height fencing have been effective in deterring loafing gulls. More experience is required before firm recommendations can be made for all species, but a starting point of <20m seems prudent, with the option to increase density if required.



Suggested layout patterns

Maintenance

Open corridors should be built in to the layout to allow easy inspection. Fencing may sag, begin to lean, or be flattened by wind, vehicles or human intervention. Damaged areas are likely to deteriorate further, and as a sufficient area is compromised it may become ineffective as a LOS deterrent. Regular inspections and running repairs are necessary to maintain effectiveness.

Further Enhancements

If required, the addition of streamers of, for example, barrier tape to introduce movement to the installation is a simple, low-cost measure. Other enhancements including “humming line” etc. may also be used, but these should only be introduced if there are indications that birds are beginning to penetrate the system.

4.1.3 Control of Ponding

Ponding on a constructions site in close proximity to an airport unequivocally increases the birdstrike risk, even when it is limited in extent and short-term. Larger, and more persistent, areas of ponding increase the hazard. Works at the site shall be designed to minimise the risk of ponding (it is acknowledged that some small-scale temporary ponding is probably inevitable in particularly wet weather) and that any ponding that does occur is rectified in a very short timescale. Small areas of ponding can be mitigated in the short term by fencing or covering but infilling and/or regrading will be carried out if ponding becomes persistent or if birds are seen using any areas of ponding. Ponding mitigation will require careful monitoring, particularly after rainfall and records will be kept of ponding (location and approximate dimensions) and any rectification/mitigation measures.

4.1.4 Site Rules (Housekeeping – Waste Management)

The consumption of food on the site and the disposal of waste that could contain food will need to be controlled to prevent any attraction to scavenging birds. This will include measures such as ensuring that all food is consumed inside the designated site cabins, provision of self-closing bins or skips, ensuring that bins or skips do not become over-full and the prohibition of storing of any waste that could contain putrescible material (food) in the open in plastic bags (which are broken open by corvids and gulls and scavenging foxes, cats, etc.). In addition, the workforce will be instructed via toolbox talks not to feed birds or other animals on the site, whether deliberately or inadvertently – and the reasons for this explained.

All site personnel will be responsible for monitoring the condition of the site and collecting and properly disposing of any litter (whether food packaging that might attract birds or paper/plastic that might create a foreign object hazard if blown onto the airport) that they observe.

Waste collection will be scheduled weekly (or more frequently if indicated by the rate of filling of waste bins and skips).

4.1.5 Active Bird Monitoring and Dispersal

It was learned at both Stansted and Manchester Airports that the control of birds at a major construction site adjacent to an active airport required bird monitoring and control measures to be active on both the construction site and the airport simultaneously, and the efforts co-ordinated. Failure to do so led to an uncontained bird hazard, and uncoordinated/independent bird control efforts within the construction site has the potential to make the hazard worse by displacing birds onto the airport or into the vulnerable airspace at times when the risk of conflict with aircraft was high, and/or when the airside bird control vehicle was not in the area adjacent to the construction site. The hazard at construction sites is primarily in the period dawn to dusk, provided that control of birds is achieved in the daylight hours and ponding is strictly managed. If, however, bird numbers remain elevated throughout the day then the site may be used for roosting, particularly by lapwings and golden plovers and these birds may be randomly displaced onto the airport by the movements of people, vehicles or animals such as foxes through the site.

The required bird control effort (resources, frequency and duration) on the site cannot be predicted or dictated in advance with any certainty, as the hazard is highly dependent on seasonality, weather conditions and how the work is carried out. Also, any passive deterrents deployed on the site tend to be effective when first installed but this effect fades and requires increased reinforcement with time (increased exposure time leads to increased risks of habituation). In any case, close monitoring coupled with the ability to react swiftly to arising hazards will be paramount.

One or more key staff assigned to the construction project will monitor numbers of the target species (gulls, rooks, pigeons and any ducks) on the site and check the effectiveness of any passive bird deterrents deployed. Records should be kept of any occurrence of ten or more of any of the target species, whether individually or combined. The primary "active" bird deterrent measure on this site will be the near-constant disturbance on the site caused by project staff and vehicle movements, and the times at which birds are most likely to build up on the site will be periods of reduced activity. As spring approaches and days grow longer, the early morning period before the main site work commences is likely to be the most vulnerable period. Given that the use of pyrotechnics and firearms cannot be permitted at such a site and wide scale disturbance of birds so close to an airport is a potential hazard, unobtrusive and short-range systems such as human presence and arm waving are recommended for removing birds from the site. This should always be done from the part of the site nearest the airport boundary and moving birds away from the airport. **If target bird numbers on the site exceed the 10+ figure, then the airport should be notified and clearance to proceed obtained before any attempt is made to disperse them.** The airport may request a short delay in order to deploy the bird control vehicle to the adjacent part of the airport to monitor bird movements.

4.1.6 Summary.

It is possible that the construction phase of the project could temporarily increase the birdstrike hazard at Norwich Airport unless the risks are anticipated and the necessary means to minimise these risks are put in place. No single strategy is appropriate, and a combination of close monitoring, passive deterrence, control of ponding, site rules and active detection and dispersal of birds from the site (the latter closely coordinated with the team working on the airport) will be necessary. Some birds are susceptible to passive deterrents in the short term, but these need to be varied and reinforced, and their effectiveness should be monitored closely. No viable passive deterrent that can be safely deployed near an airport, other than properly deployed Line of Sight interference system, is likely to be effective for more than a few days.

4.2 Mitigation Measures – Design and Post- Construction Management of the Development

4.2.1 Site Landscaping and Planting

Green landscaping of this site incorporates the creation of areas of wildflower meadow, some tree planting, native hedgerows and areas of ornamental shrubs and herbaceous planting. Existing specimen trees and boundary hedgerows will be retained to the maximum extent possible. Proposed sports fields are also incorporated in the design masterplan, but it should be noted at the outset that the potential hazard of gulls feeding on turf sports pitches adjacent to the airport has been considered and mitigated at the outset with a commitment to all-weather surfaces that are no attractive to gulls.

The grassed areas within the site boundary post-completion will be too small (and too close to buildings) to constitute any attraction to gulls, lapwings, etc., and the grassland areas designated as wildflower meadow will be too long to be attractive to these species in any case. Tree and shrub planting will be consistent with the local vegetation and the planting scheme will be designed, and refined, at the detailed proposals stage to avoid the use of any species that are particularly attractive to nesting and roosting birds (such as Scots pine *Pinus sylvestris* and *Cupressocyparis leylandii*) and shrubs that produce large volumes of attractive berries that may attract flock feeding species such as starlings (for example, elder *Sambucus nigra)*.

4.2.2 Drainage – Sustainable Drainage Systems

Wildfowl (ducks, geese and swans) and other waterfowl (e.g. cormorants, grebes) use water bodies to provide a range of key requirements. The components and relative importance of these requirements vary between species, but the common factors can be summarised as: -

- Feeding Opportunities (aquatic and marginal vegetation in the case of the main target species)
- Nesting opportunities (islands or dense bankside vegetation)
- Security

For the target species “security” is provided by: -

- Long lines of sight
- Water deep enough to deter predators from wading
- Sufficient area of water to provide a “safe distance” from the shore (protection from predators, shooting, etc.,)

The proposals for the site include a number of features to meet the statutory requirement for Sustainable Drainage Systems (SuDS) to be part of the development. Designed from the outset to avoid the creation of any new permanent or persistent areas of open water, the proposed drainage systems for the site include a mixture of permeable paving, stone-filled filter drains along the spine roads, shallow linear swales along the estate roads (grass lined and with a maximum water depth of less than 0.4m after storm rainfall) and underground storage crates. No ponds, basins or lagoons are proposed.

The only features of the drainage scheme that would generate new open water on the site are the estate road swales. The proposed design would render these swales useless to waterfowl because they would not permit the establishment of aquatic flora and fauna and open water would not persist for long enough for these birds to locate and occupy the temporary area of open water (indeed, after any significant rainfall there will be much more attractive open water areas in the local area). In addition, any water birds visiting the site would be confronted by very high levels of casual human disturbance in narrow, shallow depressions that would not offer the security of a large water area, water depth nor any dense emergent or waterside vegetation that would offer cover at times where there would be extensive and more suitable open water in the local countryside.

The final details of the drainage proposals will need to be refined at the application stage, but the concept design offers a high degree of confidence that any potential waterfowl hazard can be eliminated by the creative use of proven drainage systems.

Summary

Provided that the concept design proposals are delivered, the drainage features of this development will provide no nesting sites, no feeding opportunities and no security for waterfowl. However, a fall-back position (additional mitigation measures) is strongly recommended to assure NIA that if the site is found to attract hazardous birds then the applicant or future site managers will take all necessary measures to correct the situation. This fall-back position will include a commitment by the developer to undertake engineering works to improve discharge rates and/or install effective waterfowl exclusion measures.

There will be no new permanent or persistent open water created. on the site.

4.2.3 Nest Boxes

Any nest boxes to be installed on the site will have hole sizes of 35mm or smaller (thereby excluding starlings) or be small open fronted types designed for robin, wagtails and spotted flycatcher. Large nest boxes intended for owls, etc., will not be installed on the site as the likely occupants (owls, kestrel, jackdaw and stock dove) are prone to involvement in birdstrikes. The bird species that nest in boxes of the prescribed types are harmless to aircraft. There are no limitations on the installation of bat boxes of current designs.

4.2.4 Roof-Nesting or Roosting Gulls

In the local area (and in all areas of the UK apart from coastal towns) most gulls nest on large industrial buildings rather than "low-rise" residential properties. Given the design of the properties to be constructed as part of this development there is, therefore, low likelihood that roof-nesting gulls will colonise the residential site and no mitigation measures for this part of the development are proposed. However, given the widespread colonization of industrial and commercial rooftops in the local area by nesting gulls, the proposed commercial development will require design input and monitoring to minimize and manage any potential gull problems. This is addressed in the gull management plan attached at appendix 1. This describes a framework for gull monitoring and management by the owners or occupiers of any commercial/industrial buildings constructed on the site.

5. Means of Compliance

Delivery of the drainage design and site landscaping as described on the drawings/plans accompanying the application for planning permission, and the mitigation measures described in this Bird Hazard Management Plan will be secured by a Planning Condition to be approved by the local planning authority in liaison with Norwich International Airport (NIA).

Targets: The site owner commits to a target number of zero resident or persistent roof-nesting or roosting gulls, ducks, geese swans or grey herons on the site. Resident birds would comprise those that are either regularly feeding or nesting on the site and "persistent birds" are birds present on two consecutive visits. Birds that are seen flying over the site are beyond the control of the management of the site itself and are therefore not considered as part of the target figures. If these stated targets are exceeded, the necessary additional monitoring and mitigation measures will be discussed and agreed with NIA, initiated and sustained until the targets are achieved.

Monitoring: NIA will monitor the site at their own discretion. The inspection frequency may be varied if the records collected over an extended period show that the initial frequency is either unnecessarily high or too low to ensure that the target species are not present on the site. An appointed member of the construction contractor's staff will be responsible for the ongoing monitoring of birds on the site during the construction phase and will be the point of contact for the airport. He/she will be responsible for ensuring that the reporting of bird numbers on site is shared with the airport at regular (weekly) intervals.

Oversight: Spot checks (which may be either pre-arranged or unannounced) by NIA during the construction phase will be permitted and facilitated by the *(nominated point of contact TBD)*, to verify that standards and obligations are being maintained. The *(nominated point of contact)* will be notified of the name(s) of those personnel authorised to conduct these spot checks and appropriate photographic identification will be carried during site inspections.

Dispute and Conflict Resolution: In the event of any dispute between the site operator and Norwich Airport regarding the implementation of any aspect of the Bird Management Plan, site landscaping and maintenance, monitoring and reporting or site access then any grievance should be raised by the aggrieved part at the earliest opportunity with a view to achieving a mutually acceptable resolution. If a resolution to a dispute cannot be achieved by direct discussion between the site operator and Norwich Airport, then a suitably qualified and experienced (and recognised as such by both parties to the dispute) third party shall be appointed by the site operator to offer an independent view.

6. Conclusion

It is the opinion of Airfield Wildlife Management Ltd that, provided that the construction phase bird management plan and the outline landscape and drainage proposals are delivered, this development represents a very low birdstrike risk due to the lack of feeding opportunities, lack of security (and high casual disturbance) and the lack of any new suitable nesting opportunities for hazardous bird species.

The green landscaping of the development has been designed and refined with mitigation of birdstrike risks in mind, and species that induce flock feeding (by producing large volumes of berries), encourage breeding of hazardous birds (particularly tall coniferous species) or may hold roosting starlings (e.g. tall thickets of thorny shrubs or tall *Leylandii* cypress hedges) will be excluded from the final detailed planting scheme. Where berry producing species are included, they will be in low concentrations, consistent with the constitution of the local hedgerows and berry production will be limited by regular clipping of hedgerows.

Any bird or bat boxes to be erected on the site will be designed only to be used by small birds (smaller than starling) or bats. Most nest box using small birds are not involved in birdstrikes, but it is acknowledged that some species (such as swift and house martin) are struck by aircraft – but the risk of damage is negligible due to their small size and low weight.

A commitment to monitor and manage gulls on any commercial buildings will be imposed on the final owners/residents of these buildings as described in appendix 1.

On this basis we conclude that the proposed development can constructed, maintained and managed with no increase in the local birdstrike hazard provided that the full range of measures described above are implemented and sustained.

7. Appendices

Appendix 1. The Monitoring and Management of Gulls on Commercial and Industrial Buildings in the Vicinity of Norwich International Airport.

8. References

[i] Federal Aviation Administration. 2005. *Wildlife Hazard Management at Airports*. 2nd Edition. FAA Washington DC.

[ii] Civil Aviation Authority. 2006. *CAP 738 Safeguarding of Aerodromes.* 2nd Edition. CAA London.

[iii] Civil Aviation Authority. 2017. CAP 772 - *Wildlife Management at Aerodromes.* http://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=2726