Taking account of aviation hazards in the development of a Wetland Vision for England

Wetland Vision Technical Document: Overview and reporting of project philosophy and approach

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Mickle Fell across the blanket bogs, Stainmore Common, North Yorkshire © Derek Ratcliffe / Natural England

Taking Account Of Aviation Hazards In The Development Of A Wetland Vision For England

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1 Introduction

The development of a wetland vision for England over the next 50 years has the potential to produce major benefits in terms of biodiversity gains, flood management and carbon sequestration. Wetland developments also have the potential to lead to conflicts with the aviation industry and its regulators because some of the birds attracted to wetlands proposed near airports may increase the birdstrike risk to aircraft. The case for wetland development is set out in detail elsewhere in the Wetland Vision documentation, but it is important that those involved in wetland creation, both at the strategic and site specific stages, understand the constraints under which the aviation industry operates. Aerodromes are specifically protected from increases in the birdstrike hazard by planning legislation and problems frequently occur late in the planning process because wetland developers underestimate, or are unaware of, the importance of birdstrike risk to flight safety. These problems can often be avoided by early consultation because identification of proposals that may increase birdstrike risk at an early stage provides an opportunity to avoid developments that are totally unacceptable and to design others so that they can proceed without the need for airports to object.

This document seeks to

- summarise the significance of birdstrikes to the aviation industry
- examine the processes by which airports are protected against developments that might increase the birdstrike risk
- suggest ways in which consideration of birdstrike risk can be incorporated into decisions about wetland development at both strategic and local level to achieve conservation objectives and maintain air safety

2 Birdstrikes as a hazard to aircraft

2.1 The risk posed by birdstrikes

Between 1912 and 2004, birdstrikes caused the loss of at least 88 aircraft and 243 lives in civil aviation worldwide (Thorpe 2005). Western military air forces suffered 286 aircraft losses and 141 deaths due to birdstrike between 1950 and 1999 (Richardson & West, 2000). The costs of damage to civil aircraft, and delays and cancellations to flights due to birdstrikes, have been estimated to be between US$ 1.2 and 1.5 billion per year for the world civil aviation fleet (Allan 2002).

Because of these risks, the International Civil Aviation Authority (ICAO) (the body that regulates world civil aviation on behalf of the United Nations) has imposed a series of Standards And Recommended Practices (SARPS) that relate to birdstrike prevention. Countries that are signatories to the Chicago Protocol on Civil Aviation (which includes the UK) are required to enact legislation or otherwise to ensure that the standards are complied with. The standards state *inter alia that*

'When a bird strike hazard is identified at an aerodrome, the appropriate authority shall take action to decrease the number of birds constituting a potential hazard to

aircraft operations by adopting measures to discourage their presence on, or in the vicinity of, an aerodrome.'

and

'*Garbage disposal dumps or any such other source attracting bird activity on, or in the vicinity of, an aerodrome shall be eliminated or their establishment prevented, unless an appropriate study indicates that they are unlikely to create conditions conducive to a bird hazard problem.'*

Reference to the ICAO standard above shows that it is not just wetlands that are subject to safeguarding controls. Landfills, sewage works, nature reserves large flat roofs and amenity planting are typically causes for concern and all require an assessment of their likely impact on the birdstrike risk if they are proposed within the safeguarding circle of an aerodrome.

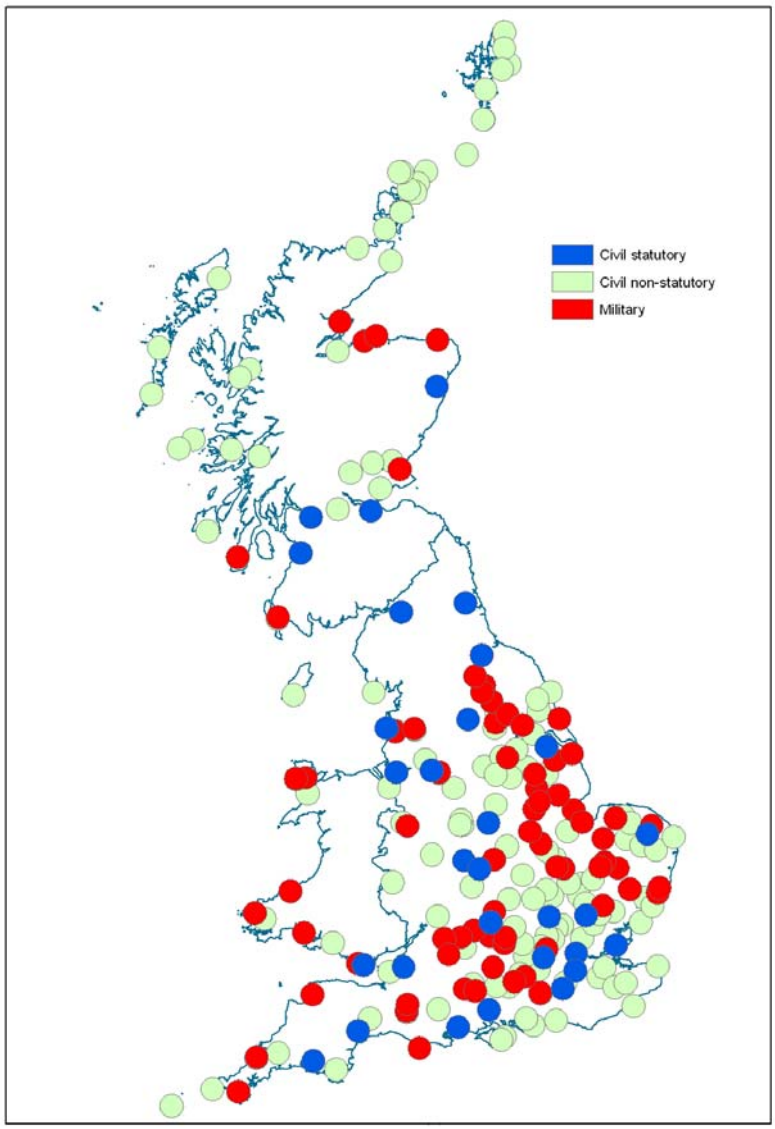
In order to comply with the ICAO standards, the UK government has established 8 nautical mile (13km) radius safeguarded zones around major civil and all military aerodromes (ODPM 2003). Within this zone any planning application which has the potential to increase the birdstrike risk to aircraft must be referred by the Local Planning Authority to either the MOD (Defence Estates Safeguarding) for military airfields or to the aerodrome manager for civil airfields. Approximately 30 of the largest civil airports are specifically named as requiring a safeguarding process to be in place. The establishment and effective running of a safeguarding process is required as part of the aerodrome licensing procedure for these airports and is audited by the Civil Aviation Authority. Other, smaller airports can establish a safeguarding arrangement by lodging a safeguarding plan with their Local Planning Authority if they wish. Military aerodromes are safeguarded by the Ministry Of Defence, but the process is conducted centrally by Defence Estates. Assuming that every licensed civil aerodrome were to safeguard itself, the total area of the UK covered by the safeguarding process is shown in fig 1.

Even a brief examination of fig.1 will show that, for the majority of southern and eastern England, those considering the development of wetlands that involve a planning consent are highly likely to become involved in a safeguarding process of some sort. Even if one disregards the majority of the smaller civil aerodromes, which may not choose to adopt a safeguarding policy, there is clearly considerable overlap between safeguarded areas and potential wetland creation and enhancement. This is further exacerbated by the fact that aerodromes were frequently located on flat open areas, often river floodplains or coastal marshes, or on areas of low agricultural value, such as bogs or mosses, with the result than many areas of potential wetland development are also close to aerodromes.

Given that there is a high chance that any wetland creation or enhancement will fall within a safeguarded area, it is clearly important that those considering such developments check to determine whether they are within 13km of a licensed civil or military aerodrome. This can be done by reference to the LPA who should hold a safeguarding map for the aerodrome concerned. If the development does lie in a safeguarded area, then early consultation with the aerodrome manager or the MOD is vital if future conflicts are to be avoided. In many cases, especially for smaller civil

aerodromes, the response will be that the aerodrome has no objection to the proposed development and that the development can proceed. In other cases, design modifications or management plans may be required to control particular species of hazardous bird before the aerodrome is satisfied that no additional birdstrike risk will result. Only in a very limited number of cases will an aerodrome find itself compelled to object outright to a development.

Fig 1 The maximum possible total area of land safeguarded against increases in birdstrike risk to aircraft in the UK.



It is important for the wetland developer to understand that airports have relatively little scope for compromise in safeguarding negotiations. The airport cannot be moved and approach and departure corridors for aircraft are defined by air traffic control regulations and other issues such as noise abatement requirements. If it is not possible to agree a set of design modifications to the wetland proposal, the aerodrome manager is left with only two choices, object or not object. Once an airport has allowed a

development to proceed without objection there is no other action that it can take to control a birdstrike risk if it develops at a site. Thus, unless an acceptable compromise can be found (see section 4 below) airports are left with little option other than to object if they are to remain compliant with their regulatory framework. In the event that an LPA approves an application despite an objection from an aerodrome, the CAA or MOD have the power to have a planning application 'called in' for determination by ministers.

2.2 Identifying hazardous birds

Different bird species pose different risks to aircraft. Understanding these risks may allow wetland designers and planners to avoid creating habitat that will attract the most hazardous birds when developing wetlands within the 13km safeguarding circle. In general, larger bird species are more likely to cause damage to an aircraft simply because of the greater mass involved in the collision. Birds that weigh below 100g (smaller than a Starling) damage aircraft on only 2.5% of all strike incidents, whereas birds over 1kg in weight (larger than a Herring Gull) cause damage in 22% of incidents (Milsom & Horton 1995). Table 1, below, provides a breakdown of the species struck in the UK in 2005 (the most recent year for which data are available). These data are taken from the CAA birdstrike database to which pilots are required to report all birdstrikes in the UK. As can be seen from the number of 'unknown' species, pilots are often unable to determine the bird species involved in an incident, and some of the reports may refer to 'near miss' events where the pilot thought a birdstrike had occurred but in fact it had not. Notwithstanding these problems with the data, it can be seen that gulls constitute 23.5% of the 956 identified birdstrikes that occurred in 2005, with hirundines and Swift (13%), pigeons (12.5%), larks pipits and wagtails (9.1%), Kestrel (5.4%), corvids (5.1%), Starling 2.5%) and Lapwing (1.9%) the most frequently struck groups. All of these are species that feed on or over grassland and often frequent airfields. Only gulls and Lapwings, which may breed or roost on wetlands, and Starlings and hirundines, which may roost in reedbeds, are specifically related to wetland development.

Table 1 Species involved in birdstrikes in the UK in 2005 (source UK CAA birdstrike database)

Bird Species	No. incidents
Not kown	691
Gull sp.	127
Not known - small	67
Woodpigeon	66
Swallow	59
Skylark	54
Kestrel	52
Black-headed Gull	51
Pigeon sp.	47
Swift	40
Herring Gull	38
House Martin	25
Starling	24
Not known - large	23
Rook	23

Crow	19
Lapwing	19
Meadow Pipit	17
Golden Plover	13
Ringed Plover	12
Buzzard	11
Barn Owl	10
Pheasant	8
Oystercatcher	8
Sparrow	8
Pied Wagtail	8
Wagtail	8
Racing Pigeon	7
Lesser Black-backed Gull	6
Snipe	5
Sandmartin	5
Curlew	4
Rock Dove/Feral/Racing Pigeon	4
Linnet	4
Goose	4
Plover	4
Thrush	4
Swan	3
Great Black-backed Gull	3
Carrion and Hooded Crow	3
Grey Partridge	3
Arctic Tern	3
Redwing	3
House Sparrow	3
Owl	3
Short-eared Owl	2
White-fronted Goose	2
Mallard	2
Stock Dove	2
Magpie	2
Little Owl	2
Corvid	2
Duck	2
Great Black-backed Gull	2
Tern	2
Mute Swan	1
Canada Goose	1
Gannet	1
Pink-footed Goose	1
Black-throated Diver	1
Grey Heron	1
Peregrine	1
Tawny Owl	1
Partridge	1
Woodcock	1
Collared Dove	1
Sparrowhawk	1

Greeshank	1
Redshank	1
Dunlin	1
Greenfinch	1
Goldfinch	1
Stonechat	1
Bunting	1
Ducklings	1
Golden Plover/Curlew	1
Heron	1
House Sparrow/Skylark	1
Lark	1
Not known - medium	1
Ring-necked Parakeet	1
Song Thrush/Meadow Pipit	1
Swift/Swallow	1

Total strikes in 2005 1647

Birds that habitually live in flocks also pose a greater risk than solitary species, because impacts with several individuals simultaneously (a multiple birdstrike) increase the chance that a bird will hit a vulnerable part of the aircraft. When single birds are hit, damage results from 8% of strikes, whereas when flocks of over 10 birds are struck there was damage is reported in 40% of incidents (Milsom & Horton 1995).

Birdstrikes involving flocks also raise the possibility of multiple engine failures following the ingestion of birds into more than one engine, the most likely cause of a catastrophic incident (Thorpe 2005). The development of 'big twin' airliners, such as the Boeing 777 and the Airbus 320 series, means that the possibility of birds being ingested into all engines of an aircraft has increased as 3 and 4-engined aircraft are becoming less common in the world fleet.

Aircraft engines and other components are designed to withstand birdstrike impacts as far as is possible. Engines are required to pass a bird impact test before being allowed into service. The standard for the engines to be supplied to the new Airbus A308 and other 'super jumbo' aircraft has recently been increased to the ability to tolerate a single 5.5lb (2.45kg) bird and continue to operate for 20 minutes. All other engines currently in service are only required to tolerate a single 4lb (1.78kg) bird and shut down safely. Many of the species that are attracted to wetlands are larger than 1.78 kg and it is the prospect of multiple impacts with these birds that give aerodromes particular cause for concern. Reference to table 1 shows that there are relatively few incidents of this type recorded each year, but table 2 shows that of the 9 species weighing more than 1.5kg struck in the UK in 2005, 8 are ecologically associated with wetlands.

Aerodrome safeguarders are thus likely to be most concerned by wetland developments that may attract large numbers of those species most frequently struck on aerodromes (grassland feeders) or relatively small numbers of those likely to cause the most damage to aircraft (birds of high weight). Developments designed to avoid these birds (e.g. wet woodland that will attract small birds that do not exploit grassland) are most likely to find favour with aerodrome managers.

Table 2 The weight and resultant probability of damaging an aircraft of the bird species struck in the UK in 2005. Damage probability is calculated based on the equations in Allan (2006). Unidentified strikes or those not identified to a level to which a weight could be assigned are omitted.

Bird Species	Weight (g)	% of strikes resulting in damage
Mute Swan	10000	140.0
Swan	10000	140.0
Canada goose	3600	50.4
Gannet	2900	40.6
Pink-footed goose	2450	34.3
White fronted goose	2350	32.9
Black-throated Diver	2340	32.8
Great black-backed gull	1690	23.7
Grey Heron	1500	21.0
Pheasant	1100	15.4
Mallard	1080	15.1
Herring Gull	1020	14.3
Lesser black-backed gull	820	11.5
Buzzard	800	11.2
Peregrine	790	11.1
Curlew	770	10.8
Carrion and hooded crow	530	7.4
Crow	530	7.4
Oystercatcher	500	7.0
Tawny owl	480	6.7
Woodpigeon	465	6.5
Partridge	450	6.3
Rook	430	6.0
Grey partridge	400	5.6
Racing pigeon	393	5.5
Rock dove/feral/racing pigeon	393	5.5
Short-eared owl	355	5.0
Stock Dove	345	4.8
Barn owl	315	4.4
Woodcock	304	4.3
Black-headed gull	275	3.9
Magpie	220	3.1
Lapwing	215	3.0
Kestrel	204	2.9
Collared dove	194	2.7
Sparrowhawk	190	2.7
Golden plover	185	2.6
Little owl	164	2.3
Greeshank	159	2.2
Redshank	148	2.1
Common snipe	125	1.8
Snipe	125	1.8
Arctic tern	105	1.5
Starling	80	1.1
Starlings	80	1.1
Redwing	67.2	0.9
Ringed Plover	54	0.8

Dunlin	50	0.7
Swift	41	0.6
Skylark	38.6	0.5
Greenfinch	28.6	0.4
House sparrow	28.2	0.4
sparrow	28.2	0.4
Pied/white wagtail	22.6	0.3
Wagtail	22.6	0.3
Linnet	18.6	0.3
Swallow	18.6	0.3
Meadow pipit	18.2	0.3
House Martin	17	0.2
Goldfinch	16.4	0.2
Stonechat	14.4	0.2
Sandmartin	13.4	0.2

2.3 The management of birdstrikes

More than 80% of birdstrikes to civil aircraft occur on or close to airports, where aircraft are operating at low altitude (Milsom & Horton 1995, Transport Canada 2001).

UK aerodromes are required by the CAA to develop a bird hazard mitigation plan as part of their safety management systems. These are audited periodically by the CAA as part of their Aerodrome Licensing system. The CAA provides guidance in the form of CAP 772 Birdstrike Risk Management for Aerodromes (CAA 2007). This document provides guidance on how Civil Airports should manage their birdstrike risk. Military aerodromes, although not regulated by ICAO, seek to operate to the same standards. The nature, scope and intensity of the aerodrome bird hazard control will depend on the size of the airport and the nature of the air traffic that uses it. Bigger airports will have continuous patrolling by trained bird controllers equipped with deterrent devices such as bird distress calls, pyrotechnics and firearms, and will manage the airport habitat to make it as unattractive to birds as possible by culverting or netting ditches and filling-in or netting ponds to exclude hazardous birds. Aerodromes also manage the grass between the runways to be as unattractive to birds as possible by cultivating dense, weed free swards 15-20 cm tall, which are known to reduce numbers of grassland birds by up to 85% compared to short grass (Mead & Carter 1973, Brough & Bridgman 1980). Military aerodromes operate similar practices to large civil airports, but have the same levels of bird control irrespective of the size or type of air traffic across the majority of their airfields.

Aerodromes thus invest substantial amounts of time and money in controlling the birdstrike risk on their property (Allan 2002). They have, however, little or no control over risks that arise from outside the aerodrome. Birds attracted to features off the aerodrome such as landfills, wetlands, parks, sports fields, gardens etc. may transit the airfield or its approaches and create a birdstrike risk over which the aerodrome manager has absolutely no control. Neither the regulators nor the airport itself can act to control an existing birdstrike risk outside the aerodrome without the agreement of the landowner concerned.

2.4 Assessing risk

One of the most difficult problems encountered when assessing whether a wetland will result in an additional flight safety hazard from birds is how to measure or estimate the actual risk from birdstrikes at an aerodrome and to determine how that risk will change if a wetland is developed.

The current risk can be measured quite accurately by referring to the birdstrikes reported at the aerodrome. The number of strikes, the size of the birds, and the number of encounters with flocks can all be calculated and the probability of a strike that damages an aircraft can be determined. This can be expressed as a simple statistic or it can be weighted based on the number of flights at the aerodrome if a risk per flight is required (Allan 2006). For civil airports in the UK it has been mandatory for pilots to report all birdstrikes since late 2003. A good dataset is therefore beginning to be built for those aerodromes that have previously lacked good reporting, but the necessary information will take time to accumulate.

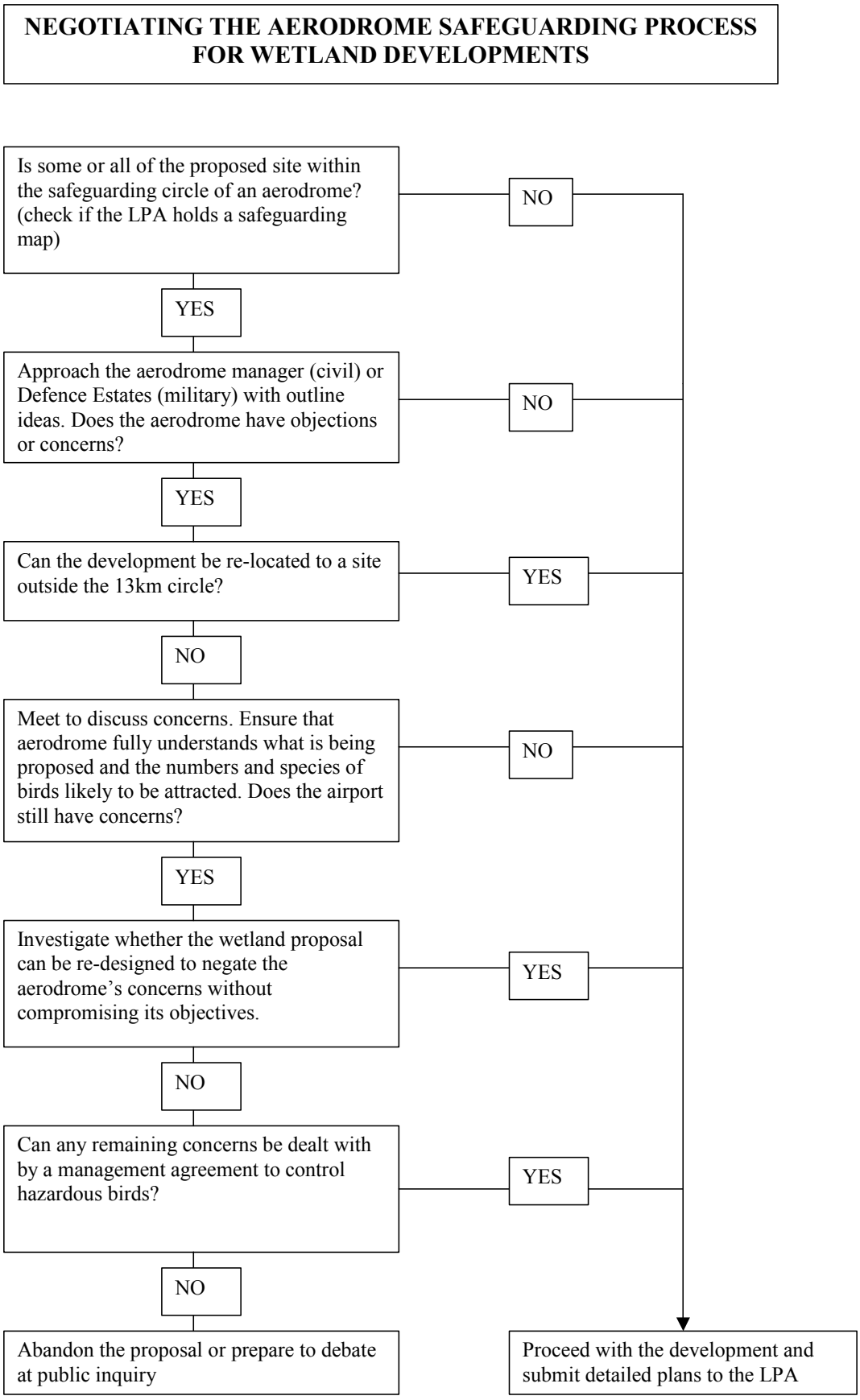
When it comes to assessing the impact of a new or enhanced wetland the situation is more complex. It is not simply a case of estimating the numbers and species of birds likely to be attracted, but also of assessing their likely behaviour. A bird sitting on a wetland poses no risk to an aircraft, only when the birds move onto an airfield or move across the approaches is there a risk of collision. Estimating the frequency with which birds will move to and from a wetland depends on the ecology of the species involved and the distance and resource value of other exploitable sites in the local area. A wetland that could support a gull roost, developed 3 miles from an existing landfill, would be almost certain to cause gull movements between the two sites, but would probably not result in movements of waterfowl in the same direction. Conversely, the same wetland, 2 miles from a series of water meadows, would probably result in the movement of grazing waterfowl such as swans geese and some duck species. Such movements would not necessarily cause a birdstrike risk unless they resulted in birds crossing an airfield or its approaches at an altitude that would bring birds into conflict with aircraft. Predicting, the numbers, frequency and altitude of movements of birds to and from wetlands is impossible to do with precision, and resulting estimates of changes in risk levels arising from a development tend to rely on an ‘educated guess’ based on imperfect information about the habits of particular species. The UK CAA guidance on the subject recognises this fact and suggests an approach based on an assessment of habitat type, numbers of birds likely to be attracted, their likely behaviour, other sites in the area to and from which they might move, and the proximity of these movements to the aerodrome or its approaches (CAA 2007). There is considerable uncertainty surrounding the estimation of most of these parameters, and this inevitably leads to disagreements and a ‘battle of experts’ with developers minimising likely bird numbers and movements and a aerodromes assuming a worst case scenario. Other techniques, involving numerical models of bird movements, have been employed in a limited number of cases, but these are still based on untested assumptions about the frequency of movement between particular sites for particular species and are equally open to challenge. Whatever the actual increase in risk, the key test that an aerodrome manager applies is one that asks the question ‘if there was an accident involving loss of life at my aerodrome could I defend allowing this development to proceed without objection when I believed that it would cause an increase in the birdstrike risk, however small?’ A planning inspector

is likely to ask him/herself the same question. The planning process has, so far, put public safety ahead of conservation interests when considering such cases, and the onus remains on the wetland developer to produce a scheme that does not increase the birdstrike risk at a nearby aerodrome. This raises interesting questions when the use of natural wetlands is proposed for flood control near airports. In these cases one aspect of preserving public safety will need to be offset against another and this debate is yet to be resolved.

3 Options for conflict resolution

Figure 2 summarises the process that wetland developers should go through in dealing with possible birdstrike risks. Initial reference to the LPA will determine whether their proposal lies within a safeguarded area, and this is frequently the only check that is required. If the proposal is in a safeguarding zone, then early consultation at the design concept stage may either provide assurance that there is no problem or will help to identify those parts of the proposal that give the airport greatest cause for concern and provide the opportunity for them to be relocated designed out, mitigated or managed (see below).

Figure 2


NEGOTIATING THE AERODROME SAFEGUARDING PROCESS FOR WETLAND DEVELOPMENTS
Is some or all of the proposed site within the safeguarding circle of an aerodrome? (check if the LPA holds a safeguarding map)
NO
YES
Approach the aerodrome manager (civil) or Defence Estates (military) with outline ideas. Does the aerodrome have objections or concerns?
NO
YES
Can the development be re-located to a site outside the 13km circle?
YES
NO
Meet to discuss concerns. Ensure that aerodrome fully understands what is being proposed and the numbers and species of birds likely to be attracted. Does the airport still have concerns?
NO
YES
Investigate whether the wetland proposal can be re-designed to negate the aerodrome's concerns without compromising its objectives.
YES
NO
Can any remaining concerns be dealt with by a management agreement to control hazardous birds?
YES
NO
Abandon the proposal or prepare to debate at public inquiry
Proceed with the development and submit detailed plans to the LPA

3.1 Site selection

3.1.1 Distance from the aerodrome

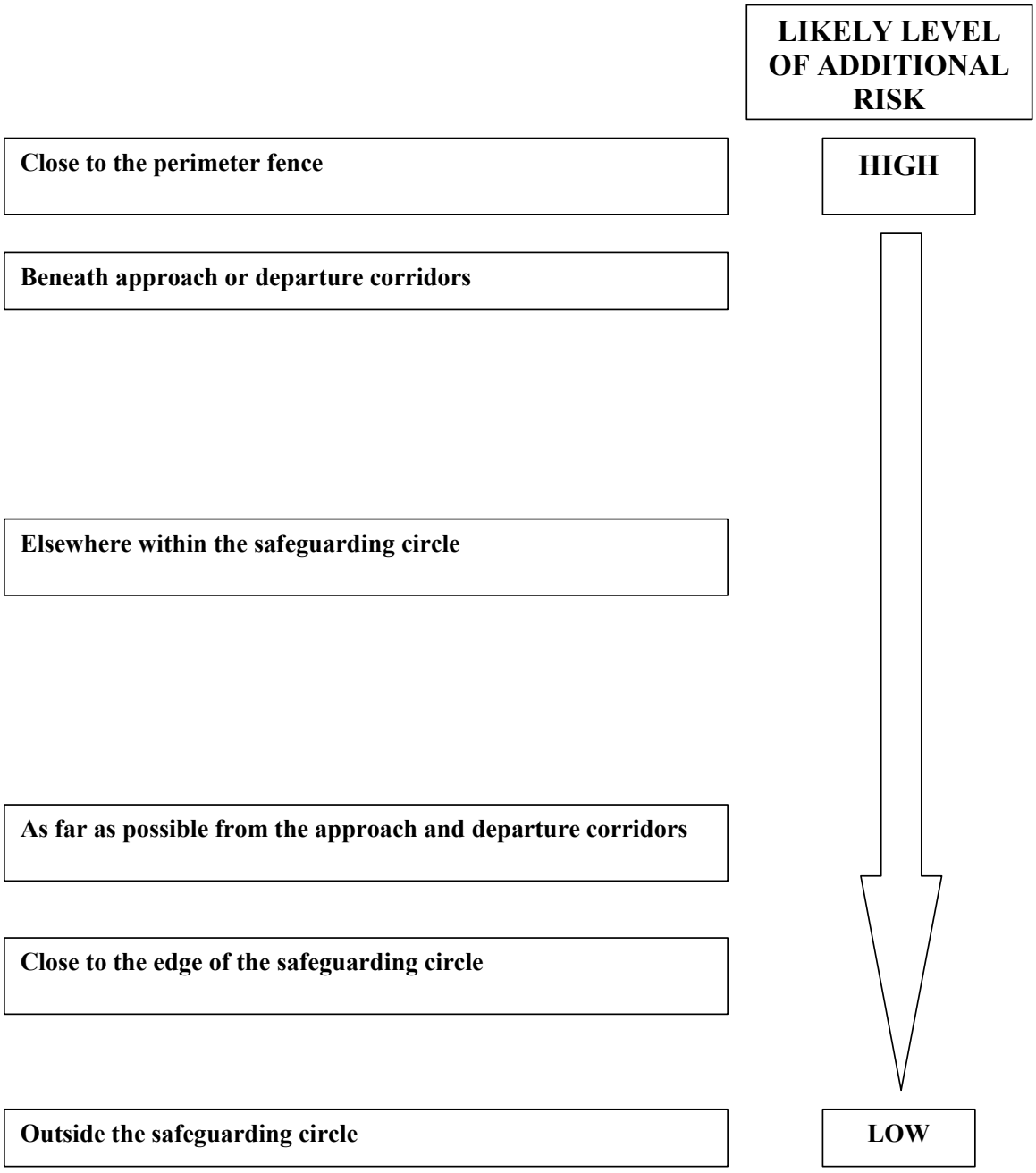
The most obvious solution to possible problems is to select wetland development sites that are sufficiently distant from aerodromes not to pose any problems. In general any site more than 13km form an aerodrome will not attract an objection from aerodrome mangers. This is not to say that all wetland developments more than 13km from an airfield pose no risk. Very large wetlands, or complexes of wetlands that support large numbers of hazardous birds, particularly gulls, may pose risks to aircraft if the birds involved move long distances to feed, nest or roost on a regular basis. It is known that gulls may commute 50km to a reliable source of food such as a landfill, returning each day to roost on large open water bodies. The creation of such sites could, therefore, result in additional risk to aerodromes more than 13km distant, but only in exceptional cases are aerodrome managers likely to lodge objections, as the increasing distance of the airfield from the wetland makes increased risk harder to prove and an objection harder to sustain. The simplest solution to birdstrike issues is for those involved in either the strategic development of wetlands or more detailed local selection of sites to develop to ensure that they are not within 13km of a safeguarded aerodrome. Providing that this is the case then the development should proceed without aviation hazards being an issue. This is, of course, not always possible. In the event that a wetland development has to be within a safeguarded area, choosing the location with care may help to control birdstrike risks that may arise. Figure 3 summarises the main issues that need to be considered in relation to the positioning of wetlands near airports.

In general, the further away from the airfield itself or the approach and departure corridors the less risk will result. This is somewhat dependent on the numbers and species of birds likely to be attracted to the wetland. For example, a site likely to support a gull roost (thousands of birds of a species that moves long distances and is often struck on airfields) is unlikely to be acceptable anywhere in a safeguarding circle. A site that is likely to attract a small number of geese might be acceptable close to the edge of the circle well away from the approaches, but would not be acceptable close to the perimeter fence. A site only likely to attract small passerines such as warblers and finches might be acceptable anywhere.

Figure 3

PROXIMITY TO THE AERODROME

Disregarding all other factors, the distance of a proposed wetland development from a safeguarded aerodrome can be used as one factor that will influence the risk that will be generated.



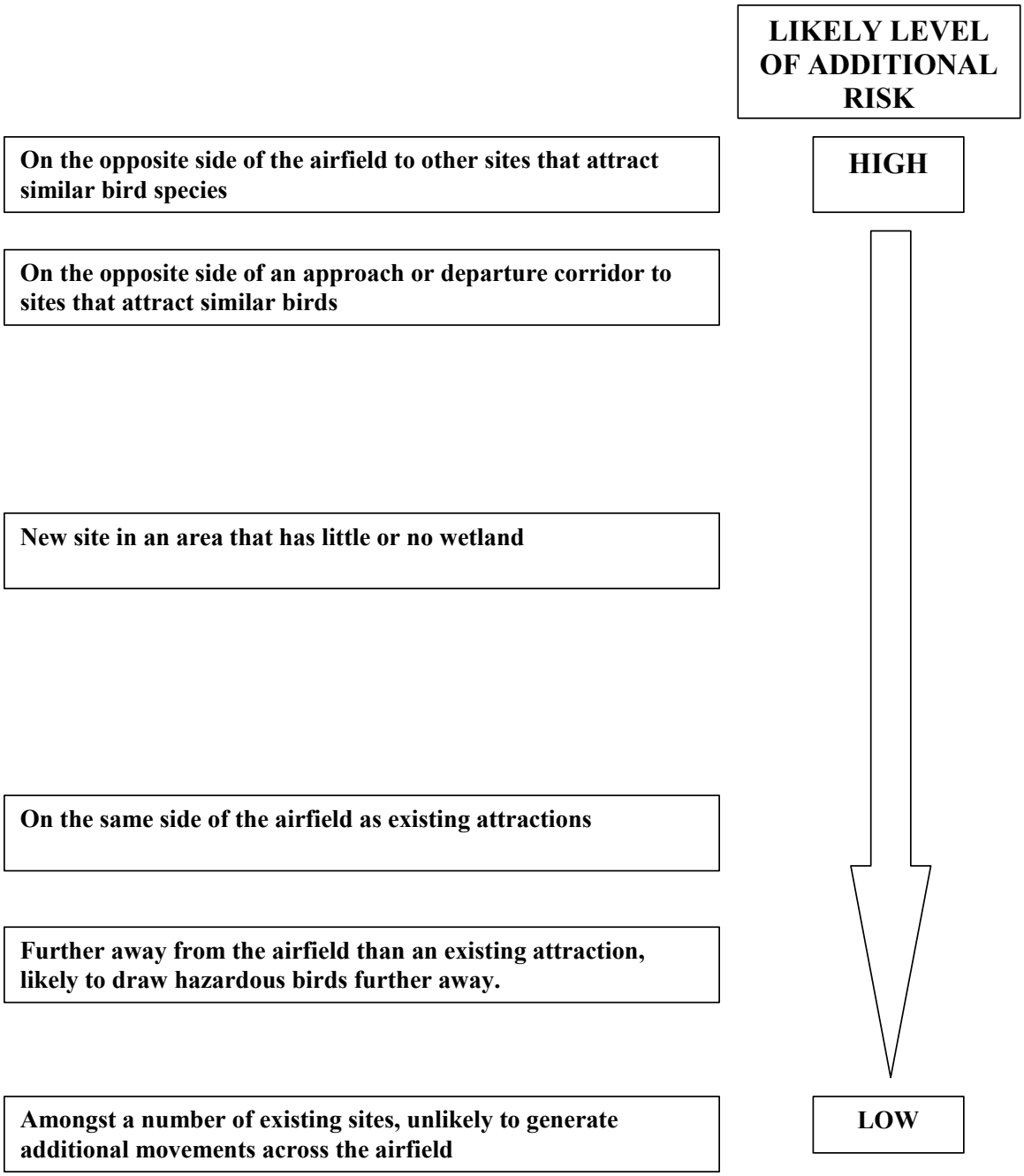
3.1.2 Relationship to other sites

Key to the assessment of likely additional risk from a new or enhanced wetland is the relationship of the new site to existing bird attractions in the local area. No bird resting on a wetland has ever been struck by an aircraft, and it is only when birds move into the operational airspace that a risk results. Estimating the frequency of these movements, the numbers of birds involved, the probability of encountering an aircraft the probability that the birds will fail to avoid it and the severity of damage that will result is, in essence, how the safeguarding process works. Figure 4 summarises how the relationship between a new wetland and existing bird attractions can act to influence the birdstrike risk. Even if a site is close to the edge of the safeguarding circle and as far as possible from the approach and departure corridors, it could still be unacceptable if it lies on the opposite side of the airfield from a known attraction for birds of the species that the new site is likely to harbour. Thus a wetland with a design likely to attract Grey Heron, if located well away from an airfield and not near the approaches, might be acceptable if the local heronry was on the same side of the airfield and birds could move between the two sites without encountering aircraft. The same wetland would be completely unacceptable if the local heronry was on the opposite side of the airfield and re-location, design changes or active bird management would need to be considered.

Figure 4

RELATIONSHIP TO OTHER SITES

The location of a new wetland in relation to other sites that provide attractions for the same birds that the wetland may attract, and the location of these in relation to the airfield and the approaches will influence the number of birds that will move into the operational airspace and hence influence birdstrike risk



3.2 Design modification

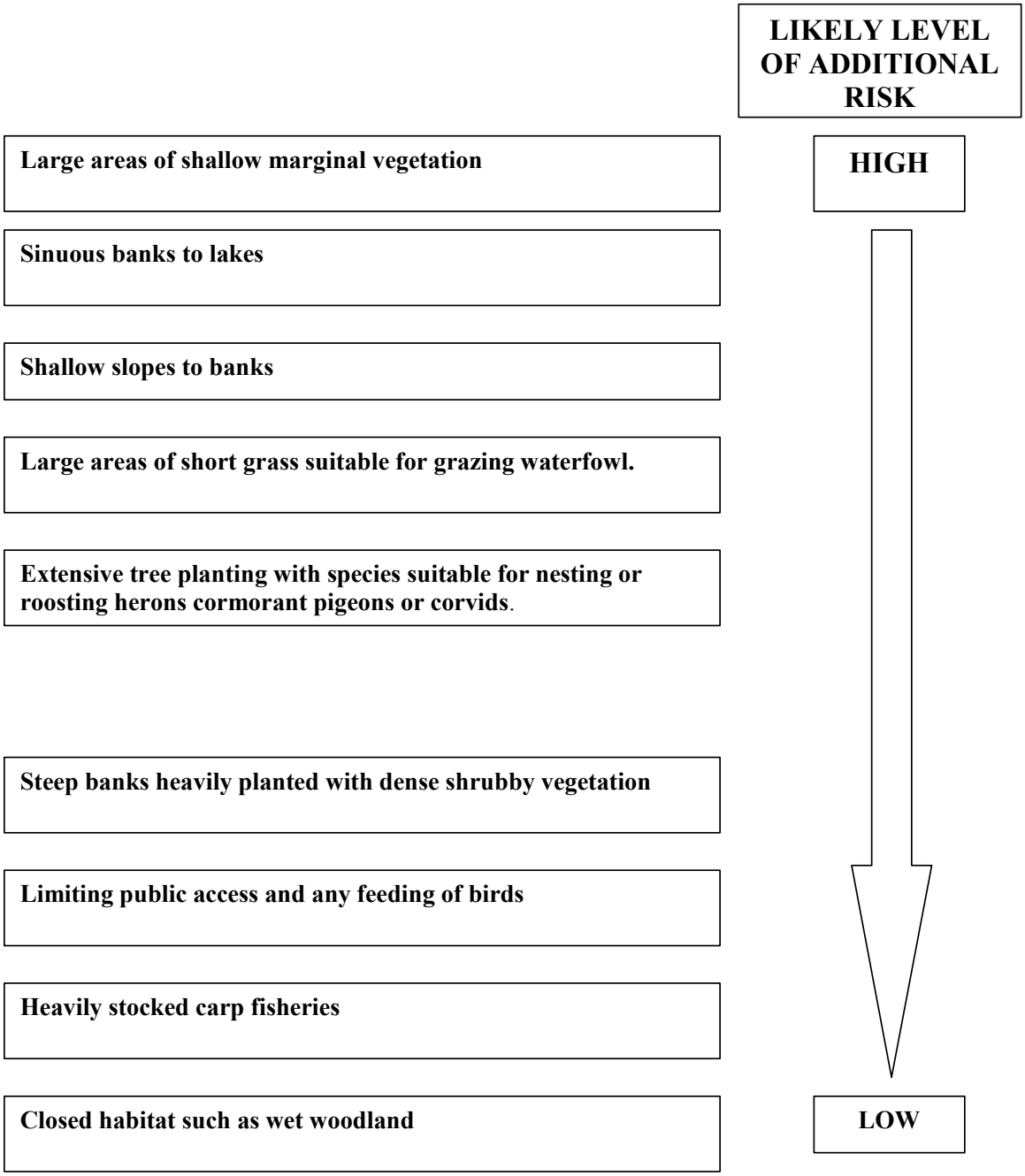
Where the location of a wetland development is such that concerns about flight safety have been expressed, it is sometimes possible to modify wetland designs so that they do not attract hazardous birds but still fulfil other functions such as flood alleviation, recreation or non-avian biodiversity. Unfortunately, birds are an obvious and well-liked part of the environment, and they are frequently high on the list of priorities for wetland designers. Their popularity with the public also means that statutory conservation bodies and NGOs have a powerful lobbying position when trying to influence LPAs tasked with deciding whether to approve wetland developments and the authorities themselves will have local biodiversity targets to meet. Wetlands developed to benefit plants, invertebrates or amphibians, all equally valuable in a biological sense, may be considered incomplete if they do not include benefits for birds. It is, however, possible to design wetlands that are less attractive to particular types of hazardous bird that are of concern to aerodrome managers. Proposal that are marginal in terms of distance from the airfield and location relative to other attractions, may be made acceptable by suitable design modification. It is in this area that wetland designers have the opportunity to be imaginative and proactive in addressing birdstrike issues and offering solutions that meet both their requirements and those of the aerodrome. Again it is important to emphasise that early consultation is vital if ideas for wetland creation are not to become fixed in a way that leads to expensive conflict at a later date.

The precise nature of design modifications required will depend on the species that need to be deterred, those that can be safely attracted, and the conservation, flood alleviation or other objectives of the wetland creation proposal. For example, for a site where only gulls are an issue, the presence of islands in a water body may be advantageous as they will deter a gull roost (providing that they are densely planted to prevent colonies of nesting gulls becoming established) shallow water and convoluted bank profiles would not be a concern as they are not especially attractive to gulls. Conversely, at a site where waterfowl were considered a significant problem, shallow water, bank sinuosity and island nesting sites would all need to be eliminated from a design before it might be acceptable. Other factors such as recreational use or establishment of fisheries (that might attract piscivorous birds) may also be unacceptable, depending on the location of the proposed development. In general, smaller water bodies with steep densely planted banks, deep water and less bank sinuosity are less attractive to the majority of hazardous birds. Other types of wetland, such as wet woodland or closed reed bed, offer relatively little attraction to hazardous birds, but even these would not be acceptable very close to the airfield or the approaches as they may still attract corvids, pigeons or a Starling roost. Figure 5 summarises some of the options available to change designs of wetlands to reduce the attraction to hazardous birds.

Figure 5

DESIGN MODIFICATIONS

For some wetlands, especially those with public access or recreational uses, it may be possible to reduce the attraction to particular hazardous species groups by removing particular habitat features from a design.



3.3 Active bird management

The final option for wetland developers who cannot relocate or redesign their proposals is to offer a bird management plan for a site specifically designed to deter hazardous birds. For sites that are primarily for recreational or flood defence purposes this may appear a desirable option, and it may also be possible for sites with a limited number of non-hazardous species of conservation interest where the dispersal of other hazardous birds can be achieved without detriment to the protected species. Such bird management agreements may seem initially appealing, but they should be carefully considered. They will need to be adopted in perpetuity, or at least as long as both the wetland and the aerodrome continue to exist. They may be expensive and difficult to carry out, especially on large sites where large investments in manpower and equipment may be needed to achieve effective dispersal. They also need to be policed, so that the aerodrome can be satisfied that it is being adequately protected from birdstrike risk.

Agreements to undertake some bird management techniques, such as physical exclusion by netting, or the prevention of nesting by hazardous birds, are likely to give aerodrome managers more confidence than others that rely on site managers taking action to disperse birds for the indefinite future. Aggressive bird dispersal actions, that may involve an element of reinforcement by lethal control, are often counter-intuitive to staff whose primary role is to protect and encourage the presence of wildlife and it may prove difficult to persuade staff to carry our these actions diligently, or at all. Aerodrome managers are likely to be reluctant to enter into management agreements at sites where, were the agreement to fail to be effective, or fail to be implemented correctly, a serious hazard would result. Bird management plans should thus be regarded as an additional measure to give aerodrome managers confidence that no additional risk will result after location and design modification measures have already been used to minimise any additional risk from a wetland development. They are not a means by which otherwise unacceptably hazardous developments can be transformed into acceptable ones.

Figure 6

MANAGEMENT AGREEMENTS

Where wetlands are created for purposes other than bird conservation, e.g. for flood management or for conservation of botanical or other interests, it may be possible to enter into a management agreement to deter or control certain hazardous species.

LIKELY LEVEL OF ADDITIONAL RISK

Management of a single species on a site that offers attraction to other hazardous birds

HIGH

Management actions at the site owner's discretion

No independent monitoring of effectiveness

Management of an agreed suite of hazardous species

Management actions triggered by agreed numbers of hazardous birds

Free access for inspection (subject to health and safety constraints)

Adequate record keeping and reporting of success/failure with mechanism to review the plan as required

LOW

4 Conclusion

Wetland creation is one of the most problematic development types in terms of birdstrike prevention at aerodromes. Wherever possible developers should seek to keep proposals as far from aerodromes as possible and outside the 13km safeguarded zone of major civil and all military aerodromes. Where this is not possible, careful site selection, design modification and, as a last resort, bird management plans may be sufficient to control any additional risk and avoid an objection from the aerodrome manager or the regulator. Whatever the strategy adopted by a wetland developer, the earliest possible consultation with aviation interests is vital in order to ensure the best chance of achieving a mutually acceptable compromise.

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