AIRPORTS NPS - HABITATS REGULATIONS ASSESSMENT APPENDIX B

APPROPRIATE ASSESSMENT OF SHORT LIST ALTERNATIVES

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Department for Transport

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1 BACKGROUND

1.1 INTRODUCTION

1.1.1 The Airports Commission's (AC) Interim Report reported on the end of Phase 1[1], and identified two existing airports as credible locations for additional runway capacity: Gatwick and Heathrow. At Gatwick, the AC committed to further consideration of a new runway to the south of the existing runway, London Gatwick Second Runway (LGW-2R). At Heathrow, two alternative expansion proposals were carried forward: a new runway to the north west of the existing runways, London Heathrow Northwest Runway (LHR-NWR) (the preferred option); and the extension of the current northern runway to create a runway of double length, London Heathrow Extended Northern Runway (LHR-ENR).

1.1.2 This document presents an appropriate assessment (AA) of LGW-2R and LHR-ENR. This assessment is carried out to enable a comparison of the effects of the other shortlisted schemes with LHR-NWR.

1.2 HABITATS REGULATIONS ASSESSMENT (HRA) SCREENING

1.2.1 The options for the proposed policy were screened to assess the potential for likely significant effects (LSE)[2]. This involved considering whether there were any clear cause-effect pathways between the options for delivering the proposed policy and European sites.

1.2.2 The screening assessment undertaken identified an initial zone of influence (ZoI) within which possible impact pathways could potentially allow significant effects to arise as a result of the proposed policy, either alone or in-combination with other policies, plans and projects. Within this ZoI, 13 European sites were identified.

1.2.3 Having identified the European sites within the ZoI, a range of impacts that could arise from the policy were identified including:

- Direct habitat loss / fragmentation;
- Disturbance (noise / vibration / visual / recreational);
- Hydrological changes (quality / flow);
- Air quality changes; and
- Operation/management and mitigation (species mortality, including bird strike).

1.2.4 These impacts were assessed as likely to arise as a result of the proposed policy, either alone or in-combination with other policies plans and projects. The following European sites were considered to require further assessment either as a result of LSE or due to a lack of certainty as to the absence of such effects:

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[1] The first phase of works completed by the Airports Commission included an assessment of options available for delivering extra capacity in the long-term. This first phase of works cumulated in the identification of two credible locations for extra capacity.

[2] A possible significant effect; one whose occurrence cannot be excluded on the basis of objective information (C-127/02).

LGW-2R

- Mole Gap to Reigate Escarpment Special Area of Conservation (SAC);
- Ashdown Forest SAC; and
- Ashdown Forest Special Protection Area (SPA).

LHR-ENR

- South West London Waterbodies SPA;
- South West London Waterbodies Ramsar;
- Richmond Park SAC;
- Windsor Forest and Great Park SAC;
- Burnham Beeches SAC;
- Thursley, Ash, Pirbright and Chobham SAC;
- Thames Basin Heaths SPA; and
- Wimbledon Common SAC.

1.2.5 It was determined that these European sites required further consideration through Stage 2 of the HRA process (AA), to establish if adverse effects on the integrity of these sites from the proposed policy could be ruled out. The outcomes of the AA would then be considered in the formation of the proposed policy.

1.3 APPROPRIATE ASSESSMENT (AA)

1.3.1 This AA considers the potential effects identified during the Habitats Regulations Screening Assessment (HRSA) in more detail in terms of the nature and extent of such potential effects. The objective of the AA is to establish whether adverse effects on the integrity of European sites can be ruled out, taking into account mitigation measures and the potential for further in-combination effects that may arise from other plans or projects.

1.3.2 The following steps have been incorporated into the AA:

- Gathering additional information on, and exploring the reasons for, the relevant European site designations;
- Determining the nature of the environmental conditions required to maintain the integrity of the European sites and the trends in associated environmental processes;
- Identifying whether the proposed policy could lead to an impact on any identified processes that support the European sites;
- Determining whether the identified impact could result in an adverse effect on the integrity of European sites;
- Identifying other plans and projects that might affect these European sites in combination with the proposed policy and establishing whether there are any adverse in-combination effects; and
- Developing mechanisms to enable the delivery of measures to avoid or mitigate for any identified potential effects.

1.3.3 The following sections of this AA will consider each of the impacts identified in Section 1.2.3 in more detail. It should be noted however that this AA is being undertaken at a strategic level where there are uncertainties regarding the nature, scale and final footprint of the LGW-2R, and LHR-ENR schemes. These uncertainties limit the capacity of the AA to reasonably predict the effects on relevant European sites.

1.3.4 However, all information that can be reasonably gathered at this stage is being used to inform this high level HRA. In addition, the AA can provide recommendations for further studies, avoidance and mitigation measures to inform the overall development of the proposed policy and to provide guidance to the Department for Transport (DfT) to ensure that the findings of this strategic level AA are incorporated into, and explored at the appropriate level of detail at the project-level HRA.

1.4 IN-COMBINATION EFFECTS ON NATURA 2000 AND RAMSAR SITES

1.4.1 It is a requirement of the Habitats Regulations that the impacts and effects of a plan or project are not considered in isolation. Where potential effects could become significant in combination with other plans and projects, these potential effects are also considered within the HRA.

1.4.2 The Appraisal of Sustainability (AoS) identifies a number of policies, plans and projects to be considered for in-combination assessment. It is possible to outline at a strategic level the broad types of effects that may arise from the implementation of these policies, plans and projects, notwithstanding the fact that further potential effects may be identified at project-level HRA. Initial consideration of the potential for these effects to act in-combination with the schemes and result in adverse effects on the integrity of European sites is provided where appropriate, in Table 1.1 below. At the project level, further scrutiny of plans and projects, including projects coming forward or gaining permission at the time, will need to be undertaken to inform the in-combination assessment.

Table 1.1: Initial Screening of Other Policies, Plan and Projects for In-Combination Effects

TYPE	NAME	SUMMARY DESCRIPTION
Policy	National Policy Statement (NPS) for National Networks (2014)[3]	The NPS sets out the need for (and Government's policies to deliver), development of nationally significant infrastructure projects (NSIPs) on the national road and rail networks in England.[4] Potential for in-combination effects relating to transport, in particular surface access.
Policy	NPS for Waste Water (2012)[5]	The NPS sets out Government policy for the provision of major waste water infrastructure. It also provides information on two potential NSIPs. These are: a sewage treatment works option at Deephams in North East London and a waste water collection, storage and transfer tunnel (the Thames Tunnel).[6]
Project	High Speed Rail (London - West Midlands) Act 2017	HS2 is being delivered to provide Britain's railways with new capacity, better connectivity and quicker journeys. Phase One of HS2, between London and the West Midlands, is consented. Phase Two will connect Birmingham to Leeds and Manchester. Potential for in-combination effects relating to transport, in particular surface

[3] Department for Transport, 2014. *National Policy Statement for National Network*. [online] Accessed 04/01/2016.
[4] Department for Transport, 2014. *National Policy Statement for National Networks*, Section 1.1. [online] Accessed 04/01/2016.
[5] Defra, 2012. *National Policy Statement for Waste Water*. [online] Accessed 04/01/2016.
[6] Defra, 2012, *National Policy Statement for Waste Water: A framework document for planning decisions on nationally significant waste water infrastructure*, Section 1. [online] Accessed 27/01/2017.

TYPE	NAME	SUMMARY DESCRIPTION
		access.
Policy	Crossrail Act 2008[7]	Crossrail is a set of improvements to cross London rail infrastructure which are designed to support London's economic growth. Crossrail was adopted by the government as an Act of Parliament, the Crossrail Act 2008. It is intended that Crossrail will increase London's rail transport capacity by 10%, make journey times shorter and bring an extra 1.5 million people within 45 minutes of London's business centres. Crossrail connects Heathrow and Reading west of London, with Shenfield and Abbey Wood, east of London. Potential for in-combination effects relating to transport, in particular surface access.
Plans	Local Development Plans	Local planning authorities must prepare a local plan which sets planning policies in a local authority area. The plans also provide the framework for future development of land. For the schemes, plans for the following local authority areas apply: Crawley District, Horsham District, Reigate and Banstead District, Surrey County; Mole Valley District, Tandridge District, West Sussex County; Runnymede District, Slough Borough, South Bucks District, Spelthorne Borough, The London Borough of Ealing, The London Borough of Hammersmith and Fulham, The London Borough of Hounslow, The London Borough of Hillingdon, The London Borough of Richmond upon Thames; and The Royal Borough of Windsor and Maidenhead.
Plans	Local Mineral and Waste Plans	All Planning Authorities are required, by law, to develop plans for mineral and waste provision. The plans also provide the framework for mineral extraction and waste management. For the schemes, plans for the following local authorities apply: West Sussex County Council, Surrey County Council, London boroughs (as listed above), Buckinghamshire County Council, Slough Borough Council, Windsor and Maidenhead Borough Council.
Plans	London Plan[8]	The London Plan is the statutory spatial development strategy for the Greater London Area, and provides a strategic plan for the borough's within this area. The Plan identifies various schemes which support the delivery of strategic housing, infrastructure, economic and open space. Much of the area around Heathrow Airport is located within the Greater London boundary. Gatwick is located outside of this boundary.
Plans	River Thames Flood Relief Scheme	Work being led by Environment Agency on plans to reduce flood risk between Datchet and Teddington, the largest area of undefended floodplain in England. Much of this section of the Thames is located to the south of Heathrow and passes through South West London Waterbodies complex.

[7] UK Government, 2008. *Cross Rail Act 2008*. [online] Accessed 04/01/2016.
[8] Greater London Authority, 2011. *The London Plan – Spatial Development Strategy For Greater London*. [online] Accessed 04/01/2016.

1.4.3 The following sections summarise the AA findings:

- Effects of disturbance (noise/vibration/visual/recreation);
- Effects of operation/management and mitigation (species mortality, including bird strike);
- Effects of direct habitat loss/fragmentation;
- Effects of changes to air quality; and
- Effects of hydrological changes (quality/flow).

1.5 CONSULTATION

1.5.1 Consultation with Natural England is a statutory requirement for an AA. Natural England will be formally consulted on the findings of this AA and due regard will be given to their representations.

2 EFFECTS OF DISTURBANCE

2.1 INTRODUCTION

2.1.1 Disturbance to the qualifying features of European sites can result from a number of sources including sound, light, visual and vibration and can be influenced by a range of factors such as source (type) of disturbance, timing of disturbance and frequency of disturbance. Furthermore, different species will respond to disturbance in different ways, with some species considered to be of greater sensitivity (i.e. more prone to react) than others. These factors, whilst not exhaustive, highlight some of the complexities in assessing disturbance impacts.

2.1.2 Recreational use of a European site in the context of airport expansion may arise during the construction phase due to the influx of a temporary work force, which may result in increased visits to vulnerable European sites. Recreational disturbance has the potential to disturb sensitive species (for example, ground-nesting birds and wintering wildfowl). It also may prevent appropriate management or exacerbate existing management difficulties, damage sites through erosion and fragmentation (for example through trampling); and result in nutrient enrichment (for example eutrophication, as a result of dog fouling). European sites are subject to different types of recreational pressures and have different vulnerabilities. Studies across a range of species have shown that the effects from recreation can be complex.

2.2 RELEVANT EUROPEAN SITES

2.2.1 The European sites identified in the HRSA as sensitive to disturbance and the potential impact pathways are provided in Table 2.1.

Table 2.1: Relevant European Sites and Disturbance Pathway

EUROPEAN SITE	LOCATION IN RELATION TO OPTION	EUROPEAN SITE VULNERABILITY / IMPACT PATHWAY
South West London Waterbodies SPA / Ramsar	Adjacent to LHR–ENR	Disturbance is recognised as a key issue for the site. The site is located immediately adjacent to the proposed option sites. Whilst some existing baseline habituation is likely it cannot be assumed that additional levels of disturbance would not result in an effect alone or cumulatively with the existing airport operations. Public Access/Disturbance is recognised as a key issue for the site. Most of the component sites have some level of formal or informal public access, including water-based activities (angling, sailing, water-skiing). During periods when the interest features are present these activities could lead to disturbance and displacement. These impacts could occur both alone and cumulatively as a result of increased levels of recreational activity arising through increased numbers of residents within the area.

2.3 APPROPRIATE ASSESSMENT

CURRENT BASELINE – SOUTH WEST LONDON WATERBODIES SPA

2.3.1 The SPA designation comprises a large series of waterbodies that have been historically created in the south west London area as a result of the development of water-supply reservoirs and the gravel extraction industry. Seven of these waterbodies were designated in 2000 as the South West (SW) London Waterbodies SPA (refer to Table 2.2).

Table 2.2: South West London Waterbodies SPA Components

SPA COMPONENT	SUB-SITE	DISTANCE FROM HEATHROW AIRPORT
Staines Moor	King George VI Reservoir	850 m southwest
	Staines Reservoir	650 m southwest
Wraysbury and Hythe End Gravel Pits	Wraysbury Gravel Pit – North	3700 m southwest
	Wraysbury Gravel Pit - South	4100 m southwest
Kempton Park Reservoirs	Kempton Reservoir East	5100 m southeast
	Redhouse	4700 m southeast
Knight and Bessborough Reservoirs	-	7300 m southeast
Sunnymeads Gravel Pits	Wraysbury Gravel Pit – North	4400 m west
	Wraysbury Gravel Pit - South	4100 m west
Thorpe Park Gravel Pit (Pit 1)	-	9400 m southwest
Wraysbury Reservoir	-	1900 m west

2.3.2 The SPA designation implies that the Site of Special Scientific Interest (SSSI) component sites are biologically integrated. However, there are a large number of other non-designated waterbodies including five water supply reservoirs, six active gravel workings, three water-treatment works, one natural lake, and around 45 former gravel pits. It is the combination of both designated and non-designated waterbodies within the area that contribute to the region's waterfowl interest and some of which are thought to be used by the SPA populations of the above species.

2.3.3 The most recent five years of WeBS data for Gadwall and Shoveler both within the SPA and surrounding waterbodies is summarised in Tables 2.3 and 2.4 below.

Table 2.3: Shoveler Peak counts 2010/11 – 2014/15 at the South West London Waterbodies complex and surrounding sites

WATER BODY	2010/11	2011/12	2012/13	2013/14	2014/15	PEAK MONTH	5YR AVG
Staines Reservoirs	153	197	106	312	581	Oct	270
King George VI Reservoir	290	38	59	29	43	Sep	92
Knight and Bessborough Reservoirs	93	91	35	13	21	Oct	58
Wraysbury Gravel Pits	19	29	49	77	19	Dec	44
Thorpe Water Park	9	27	23	17	20	Mar	19
Queen Mary Gravel Pit	26	0	11	23	11	Oct	14
Wraysbury Reservoir	0	6	44	0	9	Oct	12

WATER BODY	2010/11	2011/12	2012/13	2013/14	2014/15	PEAK MONTH	5YR AVG
Longside Lake				8	12	Feb	10
Island Barn Reservoir	3	4	2	19	1	Apr	6
Halliford Mere	2	0	4	7	8	Jan	4
Egham Hythe Lake		3	6	2	0		3
Queen Elizabeth II Reservoir	2	6	0	2	1	Sep	2
Queen Mary Reservoir	7	1	0	0	0		2
Ferry Lane Gravel Pit	0				0		0
Hersham Gravel Pit		0					0
Molesey Gravel Pit		0		0	0		0

Table 2.4: Gadwall Peak Counts 2010/11 – 2014/15 at the South West London Waterbodies Complex and Surrounding Sites

WATER BODY	2010/11	2011/12	2012/13	2013/14	2014/15	PEAK MONTH	5YR AVG	
Wraysbury Gravel Pits	1,005	173	352	268	511	Feb	462	
Thorpe Water Park	187	163	165	146	86	Dec	149	
Staines Reservoirs	78	94	87	83	83	Jan	85	
King George VI Reservoir	231	73	26	36	52	Feb	84	
Queen Mary Reservoir	63	147	29	11	22	Sep	54	
Island Barn Reservoir	52	51	20	24	41	Feb	38	
Queen Elizabeth II Reservoir	22	61	39	15	24	Mar	32	
Knight and Bessborough Reservoirs	14	38	23	20	16	Apr	22	
Wraysbury Reservoir	18	15	22	12	22	Oct	18	
Halliford Mere	4	0	4	4	11	Jan	5	
Molesey Gravel Pit		8		0	0		4	
Egham Hythe Lake		0	0	3	10	Dec	3	
Queen Mary Gravel Pit	0	1	2	1	4	Feb	2	
Ferry Lane Gravel Pit	0				0		0	
Hersham Gravel Pit		0					0	

2.3.4 All the waterbodies that comprise the SPA are man-made. Some are old gravel-extraction sites, which are used for recreational activities such as dog walking, fishing, sailing, and water-skiing. The others are impounded reservoirs that are likely to require decommissioning and re-development.

2.3.5 A comprehensive study of the SW London Waterbodies by Briggs was published in 2007[9]. The background to this study stemmed from the considerable direct pressure that SW London Waterbodies were exposed to from mineral extraction, decommissioning and redevelopment, and recreation. Furthermore at the time, infrastructure development including airport expansion and widening of the M25 were identified as having potential for further indirect effects. The aims of Briggs' study were:

→ To investigate the use made by Gadwall and Shoveler of waterbodies within and around the SW London Waterbodies SPA;

[9] Briggs, B., 2007. *The use of waterbodies in South-West London by Gadwall and Shoveler; implications for nature conservation*. University of Oxford Department of Zoology: Oxford.

- To provide information on the state of the SPA and trends in the populations of the citation species;
- To establish a strategic basis for the long-term management of the sites for nature conservation; and
- To document new findings on wildfowl behaviour, habitat choice, and population ecology.

2.3.6 Briggs' research is of particular relevance to this assessment by providing an improved understanding of waterbird use both within the designated waterbodies and those that perform an integral function to maintaining the conservation interests of the citation species. A number of the key findings from Briggs' study are summarised below.

2.3.7 Wintering Gadwall numbers in the SW London area generally peak in mid-winter. Shoveler numbers peak in autumn, when large numbers of birds move through the area on migration.

2.3.8 The SW London area appears to hold a largely self-contained population of Shoveler each winter. On a more local scale, sub-populations of Shoveler also use a number of smaller waterbody complexes in the Wraysbury and Walton-on-Thames area. The area is considered to be particularly important for Shoveler, which may have a migration strategy that in most winters ensures it is rarely present on wetlands which are vulnerable to freezing at critical times of the winter cycle.

2.3.9 The SW London area does not appear to hold a self-contained population of wintering Gadwall; there is more exchange of Gadwall with sites outside the study area than there is between sites within the area. On a local scale, Gadwall do not often use complexes of waterbodies.

2.3.10 The SW London Waterbodies SPA, when considered independently of the surrounding non-designated waterbodies, does not appear to be used as a complex by either species.

2.3.11 One of the most important general findings of the Briggs study was the extensive variability of the waterbodies in the SW London area, both temporally and physically. From year to year bird numbers varied significantly both on individual sites and in the study area as a whole; food and disturbance levels change, and behaviour and patterns of site use change.

2.3.12 The large fluctuations in Gadwall numbers observed over the last 20+ years is considered likely to have occurred in part as a result of increasing levels of human disturbance, either directly through water-based activities, or indirectly through ecological changes resulting from activities such as carp fishing. The stability of Gadwall numbers in the wider Thames region over the same period suggests that the local declines are the result of redistribution rather than density-dependent impacts at the population level.

2.3.13 The long-term foraging strategy used by Shoveler over the Briggs study period likely reflected the unpredictability of their food resource, and that density-dependent mortality (or onward migration leading to increased risk of starvation) may occur when zooplankton is scarce and bird numbers are high. The wintering population is considered to be more or less entirely dependent on the SW London Waterbodies. Accordingly Shoveler is considered to be more vulnerable than Gadwall to the effects of human disturbance and environmental change in the area.

2.3.14 The maintenance of internationally important numbers of Shoveler in the SW London area is considered to rely on the protection and management of complexes of sites, the individual components of which may each hold particular value for birds at different times of the day or winter, or even in different years.

2.3.15 It was identified that to enhance and support the Gadwall in the SW London area provision of large numbers of macrophyte-rich habitats with little disturbance or disturbance-free zones was required. The potential value of some of the SW London Waterbodies for wildfowl is significantly underexploited, and with appropriate action it was considered possible to improve the existing habitats significantly.

2.3.16 The findings of the Briggs study presented a reasoned argument for the inclusion of additional waterbodies in the SPA. It was identified that by including three additional sites the percentage of overwintering Shoveler protected by the designation could be increased from 58% to 81%, and of Gadwall from 34% to 56%, (based on data from 2004/5-2006/7). On this evidence it was considered that all of the key sites which make up the complexes used by populations of Shoveler in the Stain Hill reservoirs, Colne Mere & Hythe Lagoon SSSI, and Princes & Bedfont Lakes. Wraysbury and Walton areas would significantly benefit from inclusion in the designation, thus the SPA could reasonably be considered in terms of its 'coherence of ecological structure and function', i.e. its integrity.

2.3.17 A further recommendation was for the development of a 'London Basin Waterfowl Strategy'. This strategy would have the aim of protecting waterfowl on all waterbodies in the SW London area. It would identify high and low priority sites and 'consultation zones' for waterfowl conservation, and site-specific management statements for waterbody managers. Provided the owners of private waterbodies would sign- up to the strategy, it was considered to be an effective way to protect and maintain Gadwall numbers in the area, since this species uses a large number of non-designated sites.

2.3.18 Given the intrinsically variable nature of waterbodies in SW London, the Waterfowl Strategy was also considered to be of value to wintering Shoveler, which relies to some extent on waterbodies outside the SPA boundary. A number of the current SIP[10] measures directly relate to taking forward the work completed by Briggs.

POTENTIAL EFFECTS OF CHANGES TO BASELINE AT SOUTH WEST LONDON WATERBODIES AS A RESULT OF LHR–ENR

2.3.19 Noise disturbance to birds during construction has been the subject of considerable monitoring work and research. Much of this work has been in relation to development at coastal and estuary sites and the associated bird assemblages. This is relevant in the context of SW London Waterbodies on the basis that the interest features share commonality in terms of being migratory waterbirds.

2.3.20 Disturbance events from construction activities can cause an interruption to the feeding, roosting or breeding behaviour of birds[11.] Disturbance can result in birds flying away or ceasing to feed which may cause an increase in their energy requirements or result in them relocating to alternative, less suitable feeding or roosting sites. This may result in possible long-term effects where there is a repetition of such activities and can lead to consequences such as: prolonged displacement from a habitat, effects on energy budgets and food intake, loss of weight, condition and a reduction in reproductive success and potentially survival[12] [13].

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[10] Natural England, 2016. *Site Improvement Plans*. [online] Accessed 04/01/2016.

[11] Including Peters, K. A. and Otis, D. L., 2006. Shorebird Roost Site Selection at Two Tempiral Scales: is Human Disturbance a Factor? *iJournal of Applied Ecology*. *44, 196-209*

[12] Kaiser, M. J., 2002. *Predicting the displacement of the common scoter Melanitta nigra from benthic feeding areas due to offshore windfarms*, p. 77. Centre for Applied Marine Sciences (COWRIE): Bangor,

[13] Stillman, R. A., West, A. D., Clarke, R. T. and Liley, D. 2012. *Solent Disturbance and Mitigation Project Phase II: Predicting the impact of human disturbance on overwintering birds in the Solent*. Solent Forum: Winchester

2.3.21 Research indicates that some bird species will often habituate to repeated disturbance events, with irregular or unknown visual and noise stimuli often causing the greatest behavioural responses. However the factors surrounding habituation are not well understood and are typically very situation-specific and the uncertainty surrounding habituation is an important consideration in this AA. With respect to piling specifically, it has been concluded that although piling has the potential to create most noise during construction; it often consists of rhythmic "bangs", which birds are likely to become accustomed to after a short period[14].

2.3.22 Other research has also indicated that in general, birds appear to habituate to continual noises as long as there is no large amplitude 'startling' component[15.] For example, as part of the construction work for ABB Power Generation Ltd (Pyewipe), winter bird monitoring showed that there was no large-scale disturbance due to construction work on the site. Although some localised disturbance was recorded in response to two sudden events, this was not considered to have a major effect on surrounding bird populations and was found to be no greater than the effect arising from third party disturbance, including walkers and stopped cyclists, which were unrelated to the work carried out by ABB. Observations suggested that it was the initial sudden bang during piling activities, which caused the disturbance, and that subsequent bangs typically resulted in reduced disturbance, demonstrating habituation[16].

2.3.23 For this reason, noise from construction and regular vehicle or vessel movements are often tolerated more by birds than sporadic visits to a feeding or roosting area. Overall, responses to construction noise appear to initiate similar or less disturbance than that of recreational activities[17].

Disturbance from Airport Activities

2.3.24 Noise associated with general airport operations and aircraft movements has the potential to disturb birds and to interrupt key behaviours, leading to impacts on health and breeding, as well as on survival of individual birds and of populations.

2.3.25 Komenda-Zehnder *et al.* (2003)[18] performed experimental overflights on waterbirds in Swiss lowlands and found the disturbance effects of helicopters to be greater than that of aeroplanes. Birds disturbed by aircraft returned to a relaxed behaviour within five minutes of the overflight and the minimum flight level that did not disturb birds was 450 m for helicopters and 300 m for aeroplanes.

2.3.26 Smit and Visser[19] reviewed existing data and showed comparable reactions in birds in the Dutch Wadden Sea and Delta Area. Oystercatchers generally were most tolerant to aircraft noise and Curlew were least tolerant. One study showed a negative impact on foraging behaviour in Knot, with large numbers of birds absent on days in which aircraft activity was high.

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[14] ABP Research. 2001. *ABP Grimsby & Immingham, Immingham Outer Harbour Environmental Statement. ABP Research & Consultancy Ltd,* Research Report No. R.903

[15] Hockin, D., Ounsted, M., Gorman, M., Keller, V., and Barker, M.A. 1992. Examination of the effects of disturbance of birds with reference to its importance in ecological assessments. *Journal of Environmental Management*, 36, 253-286

[16] ERM. 1996. South Humber Power Station, Pyewipe, Bird Monitoring Study.

[17] Cutts, N., Phelps, A. and Burdon, D., 2009. *Construction and Waterfowl: Defining, Sensitivity, Response, Impacts and Guidance - Report to Humber INCA.* Institute of Estuarine and Coastal Studies: Hull.

[18] Komenda-Zehnder, S., Cevallos, M. and Bruderer, B. 2003. *Effects of Disturbance by Aircraft Overflight on Waterbirds – An Experimental Approach*. International Bird Strike Committee. IBSC26/WP-LE2.

[19] Smit, C.J. and Visser, J.M. 1993. *Effects of disturbance on shorebirds: a summary of existing knowledge from the Dutch Wadden Sea and Delta area*, In: *Disturbance to Waterfowl on Estuaries*, August 1993.

2.3.27 Reactions to aircraft noise were more severe in Knot when visibility was reduced and light aircraft caused strong disturbance even when flying above 100 m[20] .

2.3.28 A review of WeBS survey data in relation to disturbance by Robinson and Pollit[21] showed that aircraft noise, particularly from low flying military aircraft, was one of the most common causes of disturbance to waterbirds, although it is recognised that general airport movements will be more regular with increased chances of habituation occurring.

2.3.29 Komenda-Zehnder *et al.* found no evidence of habituation of waterbirds during 326 experimental flights, although other studies have shown that habituation to regular noise disturbance can occur. In particular, flocks of waterfowl on the Humber Estuary appeared to habituate to regular approaches of planes towards Humberside Airport, although the same birds appeared to be disturbed by the 'shadow' of an approaching plane in some instances[17]. Furthermore, a report by Brisbane Airport Corporation states that surveys in 2005/06 found no visible reaction from roosting or feeding shorebirds to overhead air traffic[22].

Visual and Recreational Disturbance

2.3.30 Visual disturbance can also interrupt feeding, roosting and breeding behaviour of coastal birds, with similar effects to those caused by noise disturbance. Repeated disturbance can cause habitat displacement, effects on energy budgets and food intake resulting in loss of weight, condition and reduction in reproductive success and potentially survival. Birds will typically disperse when disturbed, with prolonged and repeated disturbance potentially causing more significant displacement. The magnitude of the effects of such disturbance is linked to the number of occurrences and the status of the conditions that are prevalent [23] [24] [25].

2.3.31 The body of research looking at disturbance to waterbirds strongly indicates that one of the more significant sources of disturbance is caused by the human form, visual disturbance through undertaking recreational activities (e.g. people walking, fishing, kayaking)[17]. It is assumed that waterbirds associate the human form as a predatory threat and as such the presence of the human figure is most likely to disturb birds.

2.3.32 Gill (2001)[26] reviewed the approaches to measuring human disturbance. Gill noted that behavioural responses are always context-dependent, and individual responses will therefore depend on the trade-offs experienced by those individuals. For example, the decision of birds to stay or leave an area in response to disturbance will be influenced by the quality of the area, the availability and relative quality of other areas, relative predation risks etc. Birds may remain in disturbed areas because the cost of moving to a new location is too great, the food resources are more abundant, or predation risk is lower than in alternative sites. Animals that move readily may do so because the costs of moving are small.

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[20] Koolhaas, A. Dekinga, A. and Piersma, T. 1993. Disturbance of foraging Knots by aircraft in the Dutch Wadden Sea in August–October 1992. *Wader Study Group Bulletin*, 68, 20–22.
[21] Robinson, J. A. and Pollitt, M. S. 2002. Sources and extent of human disturbance to waterbirds in the UK: an analysis of Wetland Bird Survey data, 1996/96 to 1998/99. *Bird Study 49*, 205-211.
[22] Brisbane Airport Corporation, 2007. *New Parallel Runway Environmental Impact Statement. Volume D: Airspace*. Hazards and Risks of Airport Operations.
[23] Liley, D. and Fearnley, H. 2011. *Bird Disturbance Study, North Kent 2010/11*. Footprint Ecology.
[24] Coleman, R. A., Salmon, N. A and Hawkins, S. J., 2003. Sub-dispersive human disturbance of foraging oystercatchers Haematopus ostralegus. *Ardea 91*, 263-268.
[25] Ruddock, M. and Whitfield, D. P., 2007. *A Review of Disturbance Distances in Selected Bird Species*. A report from Natural Research (Projects) Ltd to Scottish Natural Heritage.
[26] Gill, J. E. *et al*., 2001. The effects of disturbance on habitat use by black-tailed godwits Limosa. *Journal of Applied Ecology*, 38, 846-856.

2.3.33 Visual disturbance during construction is generally temporary and only short term. The level of impact will however be dependent on the distance of visual disturbance sources from key foraging, roosting and breeding areas for birds.

2.3.34 It typically appears that birds will often habituate to regular and repeated activities, with irregular or unknown visual stimuli causing the greatest behavioural responses[27] [17]. A study of the Forth Estuary found that Redshank, Curlew, Oystercatcher and Shelduck in areas subject to higher levels of disturbance allowed a closer approach by humans than individuals of the same species in less disturbed areas, before becoming alert and moving away[28].

2.4 SUMMARY OF POTENTIAL EFFECTS ON INTEGRITY AS A RESULT OF CONSTRUCTION AND OPERATION OF THE SCHEMES

LHR-ENR

2.4.1 There is no research or evidence to indicate that the existing airport operations at Heathrow result in adverse disturbance effects to the SW London Waterbodies SPA. The Promoter's information assumes that the interest features are tolerant or habituated to these effects. However there is no supporting evidence or studies to substantiate this assumption. Further, regardless of any existing perceived tolerance or habituation, it cannot be assumed that this would also negate additional disturbance impacts occurring cumulatively from increased airport operations and the associated disturbance arising from LHR-ENR.

2.4.2 In addition, as outlined above, there are existing disturbance factors occurring which could be considered significant for the SPA such as those set out by Briggs[9,] including recreation, and this baseline must be considered against any further disturbance effects from LHR-ENR cumulatively. In addition, there are disturbance pressures relating to gravel extraction, and operation of the waterbodies as reservoirs.

2.4.3 Cumulatively these effects are difficult to differentiate. Based on the evidence available at this time it is reasonable to assume that the existing levels of disturbance at the SW London Waterbodies SPA represent a limiting factor to the site. Effects on integrity will be effects that cause deterioration below this limited level.

2.4.4 Given the uncertainty surrounding flight paths and flight heights at this time, and perhaps even more so, a general lack of broader scientific understanding of the effects of aviation disturbance to waterbirds, the precautionary principle requires the assumption that any further disturbance effects would be likely to result in cumulative disturbance to the interest features of the site. As such an adverse effect on the sites integrity cannot be ruled out.

[27] ABP Marine Environmental Research Ltd. 2013. *Hub for London Ecology Desk Study – Part B: Marine and Coastal Baseline*. Report No. R2130.

[28] Dwyer, R.G., 2010. *Ecological and anthropogenic constraints on waterbirds of the Forth Estuary: population and behavioural responses to disturbance*. Thesis submitted as candidature for the degree of Doctor of Philosophy Centre for Ecology and Conservation.

Table 2.5: Potential Effects at South West London Waterbodies

SITE	INTEREST FEATURE	POTENTIAL EFFECT OF DISTURBANCE	POTENTIAL ADVERSE EFFECT ON CONSERVATION OBJECTIVE
South West London Waterbodies SPA/Ramsar	Northern shoveler and Gadwall	The effects of disturbance could lead to species displacement both within the SPA and areas beyond the SPA, fragmentation, increased competition within the SPA and areas beyond the SPA, increased pressure on habitats within the SPA and areas beyond the SPA, increased energetic use leading to reduced breeding success and potentially mortality.	Potential to compromise; The extent and distribution of the habitats of the qualifying features The structure and function of the habitats of the qualifying features The supporting processes on which the habitats of qualifying features rely The population of each of the qualifying features The distribution of the qualifying features within the site

2.5 AVOIDANCE AND MITIGATION MEASURES

LHR-ENR

2.5.1 During construction of the Humber International Terminal ("HIT"), long-term changes in trends were not observed in wintering bird activity. It was noted that the construction area became an increasingly important roosting site for some waders, indicating that some wading birds habituated to construction related works (of which, irregular disturbance was a factor). In this study it was noted that irregular disturbance emitting noise levels over 70dB LAeq was much more likely to cause disturbance than regular disturbance under 50dB LAeq[17]

2.5.2 Extrapolating the results of the HIT observations, it is considered reasonably likely that there would be some habituation with the restriction of regular construction noise to below 70dB LAeq and with the avoidance of, sudden irregular noise above 50dB LAeq.

2.5.3 In addition, mitigation should consider the timing of flights, flight paths, and flight heights over the waterbodies. Where feasible this measure could effectively remove operational disturbance. Whilst it is recognised that it may not be operationally viable to implement this measure should be explored fully at the detailed design stage.

2.5.4 Briggs identified a number of measures that would result in benefits to the SPA. This included the development of a ‘London Basin Waterfowl Strategy’. This strategy would have the aim of protecting waterfowl on all waterbodies in the SW London area. It would identify high and low priority sites and ‘consultation zones’ for waterfowl conservation, and site-specific management statements for waterbody managers. A key focus of this strategy would be mitigation through the management of the existing recreational disturbance pressures through relocation and appropriate zonation of water recreation activities. The strategy would seek to reduce site vulnerabilities and contribute towards the achievement of the site’s conservation objectives.

2.6 EFFICACY OF MITIGATION PROPOSALS AND RESIDUAL EFFECTS

2.6.1 It is considered likely that a number of potential adverse effects described above will be able to be mitigated through detailed design. However, at this plan stage it is not possible to exclude the likelihood of adverse effects given that more detailed project design information, and detailed proposals for mitigation, are not presently available. Such project detail would need to be reviewed against a baseline disturbance assessment at the SPA/Ramsar.

2.7 EFFECTS IN COMBINATION WITH OTHER PLANS AND PROJECTS

In the context of known disturbance factors and interest feature vulnerabilities, it is also not possible at this strategic plan-level to rule out the likelihood that LHR-ENR could act in-combination with other plans being brought forward (those described in Table 1.1 above), which may alone result in disturbance effects. These potential effects are summarised in Table 2.6.

Table 2.6: Potential Disturbance Effects In Combination With Other Plans And Projects

OTHER PLAN / POLICY	SOUTH WEST LONDON WATERBODIES SPA/RAMSAR
NPS for National Networks	Other projects in proximity creating disturbance could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality.
NPS for Waste Water	Other projects in proximity creating disturbance could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality.
High Speed Rail (London - West Midlands) Act 2017	Highly unlikely that effects would occur within a ZoI that would result in effects in combination
Crossrail Act 2008	Highly unlikely that effects would occur within a ZoI that would result in effects in combination
Local Development Plans	Other projects in proximity creating disturbance could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality.
Local Mineral and Waste Plans	Mineral extraction issues are identified as a cumulative disturbance effect. Other projects in proximity creating disturbance could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality.
London Plan	Other projects in proximity creating disturbance could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality.
River Thames Flood Relief Scheme	Thames flood relief scheme occurs in close proximity creating disturbance could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality. Thames flood relief scheme also offers potential for positive effects through indirect habitat creation.

2.8 CONCLUSION

2.8.1 It is considered likely that a number of potential adverse effects described above will be able to be ruled out through detailed design. However, at this plan stage it is not possible to exclude the possibility of adverse effects given that more detailed project design information, and detailed proposals for mitigation, is not presently available.

3 EFFECTS OF OPERATIONAL MANAGEMENT

3.1 INTRODUCTION

3.1.1 Birdstrikes have been responsible for the loss of at least 108 aircraft and 276 lives in civil aviation[29]. As well as being a threat to life, less severe birdstrike incidents result in significant operational costs to the industry, either directly, in terms of the costs of damage to aircraft, or as a result of delays and cancellations arising from the need for precautionary checks or emergency return to an airport after a strike has occurred.

3.1.2 The aviation industry has adopted measures to reduce the levels of risk. Fundamentally these measures seek to reduce the presence of birds in areas where they could collide with aeroplanes. Such measures already occur at the operational airport locations; however increased levels of bird scaring/control as part of birdstrike risk management measures could cause effects to other non-target waterbird species including the SPA interest features. Further, any compensation habitat provided in areas subject to birdstrike risk management could limit the potential benefits and ultimately compromise the effects of the compensation.

3.2 RELEVANT EUROPEAN SITES

3.2.1 The European sites identified in the HRSA as sensitive to operation and the potential impact pathways are provided in Table 3.1.

Table 3.1: Relevant European Sites and Potential Operational Management Impact Pathway

EUROPEAN SITE	LOCATION IN RELATION TO OPTION	EUROPEAN SITE VULNERABILITY / IMPACT PATHWAY
South West London Waterbodies SPA / Ramsar	LHR-ENR	Increased levels of bird scaring/control as part of birdstrike risk management measures could result in significant effects to other non-target waterbird species including the SPA interest features. Further any compensation habitat provided in areas subject to birdstrike risk management could limit the potential biodiversity benefits and ultimately compromise the effects of the compensation.

[29] J. Thorpe, 2010 Update On Fatalities & Destroyed Civil Aircraft due to Bird Strikes with Appendix for 2008 & 2009

3.3 APPROPRIATE ASSESSMENT

CURRENT BASELINE

3.3.1 As part of their work for the Airport's Commission Jacobs commissioned a Birdstrike Report:[30] *The Birdstrike Risk, Needs for Management, and Associated Biodiversity Impacts for Proposed Additional Runways at London Heathrow and London Gatwick Airports.* The key elements of the report which are of particular relevance to this section of the assessment are presented below.

3.3.2 To control the birdstrike risk, the International Civil Aviation Organisation (ICAO) has implemented a series of standards and recommended practices that require airports under their control to manage birdstrike risk effectively. In the UK, the Civil Aviation Authority (CAA) implements these measures by requiring airport license holders to manage the birdstrike risk as part of their licensing procedures. The CAA provides guidance on how this should be carried out in their publication CAP 772 Bird Control on Aerodromes (CAA 2008) which is currently undergoing revision.

3.3.3 The actions needed to control the birdstrike risk at UK aerodromes are well understood (e.g. Allan 2006[31]), and these can be extrapolated to airport expansions, providing sufficient information about the numbers of hazardous birds, existing birdstrike rate, current birds control practices etc. is available.

3.3.4 The movements of birds from place to place are most significant because it is when birds cross the active airspace that they pose the greatest risk to aircraft. It is also obviously the case that most birdstrikes are caused by common species that are most abundant around the airfield. These are often species which may not typically be included in ecological baseline surveys due to commonality (e.g. flocks of gulls and pigeons).

3.3.5 All licensed civil airports in the UK are required to have an effective plan in place to monitor and manage the birdstrike risk at the airport. This plan is periodically audited by the CAA as part of their routine safety audit procedures. It is important to note however that risks arising from outside the airport property may be impossible for the airport to control. Nearby landowners are not obliged to allow the airport access to their property to disperse hazardous birds, nor are they required to manage their property to deter hazardous birds from frequenting the area. This means that once features that attract hazardous birds are developed near an airport it can be very difficult to have them removed or otherwise managed in order to control the risk.

3.3.6 It is therefore important that any airport development does not introduce features that will either attract more hazardous birds or include features that will change the behaviour of the existing hazardous birds in a way that increases the risk (e.g. by making it more likely that they will fly across the active airspace). It is also important that the airport development does not change the behaviour of aircraft in a way that makes it more likely that they will encounter birds (e.g. by moving a runway closer to known bird concentrations).

[30] Jacobs, 2014. 7. *Biodiversity: Assessment*. [online] Accessed 04/01/2016.
[31] Allan, J. R., 2006. A heuristic risk assessment technique for birdstrike management at airports. *Risk Anal*, 26, 723–729.

POTENTIAL EFFECTS OF CHANGES TO BASELINE AS A RESULT OF LHR–ENR

3.3.7 The western approach to the existing northern runway at Heathrow passes over the R.Thames, Queen Mother Reservoir and the R.Colne, whilst the western approach to the southern runway crosses the R.Thames, the complex of flooded gravel pits between Horton and Wraysbury, Wraysbury Reservoir itself and the R.Colne. The normal composition of bird species that would be expected at a UK airport is therefore augmented by very large numbers of gulls that roost on the open waterbodies and by large numbers of waterfowl that occupy these reservoirs and gravel pits all year round.

3.3.8 These areas also attract smaller numbers of other hazardous species such as cormorant and grey heron. The larger than normal numbers of wetland bird species in the area means that any development that influences the number or behaviour of these birds, or brings the aircraft into closer proximity to them, has the potential to increase the birdstrike risk, unless appropriate mitigating action is taken.

3.3.9 The Birdstrike Risk Report suggests that the overall strike rate at Heathrow per 10,000 aircraft movements is low compared to other airports in the UK and to other large international airports around the world.

3.3.10 The LHR-ENR option involves extending the existing northern runway to the west, and operating in dual- mode with landings and departures on the same runway at the same time. This will mean that the western threshold of the extended runway will be significantly closer to the complex of reservoirs and gravel pits to the west of the airport.

3.3.11 The main risk to aircraft that arises from these waterbodies comes from the very large winter gull roosts that occur there. On clear, still winter days, gulls may commute into their roosting sites at altitudes in excess of those quoted for aircraft by the promoter, and may also soar above roost sites at similar heights. Gulls also routinely move between the larger reservoirs when arriving at roost or during the night and there are regular movements of many hundreds of gulls between Queen Mother reservoir and Wraysbury reservoir.

3.3.12 It is highly likely that the LHR-ENR option will result in a significantly elevated birdstrike risk from gulls. This risk would need to be addressed by ensuring the dispersal of the roost from the waterbodies concerned and/or from feeding sites that result in flightlines of birds that cross the active airspace at a height which results in an increased risk.

3.3.13 It is therefore likely that mitigation of birdstrike will be required. Any such measure that involves large scale bird dispersal from the reservoir has the potential to adversely impact on non-hazardous birds of conservation concern (including the SPA interest features) that currently use the site.

3.3.14 This could result in adverse effects through species displacement both within the site and areas beyond the site. It may also result in fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially, also mortality. Further it could also compromise the efficacy of any mitigation and compensation measures.

3.4 SUMMARY OF POTENTIAL EFFECTS ON INTEGRITY

Table 3.2: Potential Effects of Operational Management at LHR-ENR

SITE	INTEREST FEATURE	POTENTIAL EFFECT OF OPERATIONAL MANAGEMENT	POTENTIAL ADVERSE EFFECT ON CONSERVATION OBJECTIVE
South West London Waterbodies SPA	Northern shoveler and Gadwall.	The effects of operational management could lead to: → Species displacement both within the site and areas beyond the site; → Fragmentation; → Increased competition within the site and areas beyond the site; → Increased pressure on habitats within the site and areas beyond the site; → Increased energetic use leading to reduced breeding success; and potentially mortality. It could also compromise the efficacy of mitigation and compensation measures	Potential to compromise: The extent and distribution of the habitats of the qualifying features The structure and function of the habitats of the qualifying features The supporting processes on which habitats of qualifying features rely The population of each of the qualifying features; The distribution of the qualifying features within the site

3.5 AVOIDANCE AND MITIGATION MEASURES

3.5.1 The LHR-ENR option contains a commitment to compensation along with a number of sites where such compensation could be carried out. This includes 26 ha of lakes and ponds, the location of which could have a significant impact on the birdstrike risk at the airport.

3.5.2 In the case of both schemes, removal of the proximity issue amounts to moving the compensation habitats far enough away from the airport so that the impact on birdstrike risk becomes negligible. However this approach conflicts with typically adopted best practice where compensation is carried out as close to the original site as possible. Conversely locating compensation further away with no design constraints does offer greater opportunity to maximise the biodiversity benefits.

3.5.3 Given the uncertainty surrounding flight paths of birds and flight heights of aeroplanes, the precautionary principle requires that the compensation proposals proposed by the promoters would conflict with birdstrike management. The corresponding need for increased bird management has the potential to disturb non-target species including the interest features of the SPA. Such additional disturbance effects would be likely to result in cumulative disturbance to the interest features of the site and as such an adverse effect to the site's integrity.

3.6 EFFICACY OF MITIGATION PROPOSALS AND RESIDUAL EFFECTS

3.6.1 It is considered likely that a number of potential adverse effects described above will be able to be mitigated through detailed design. However, at this plan stage it is not possible to exclude the likelihood of adverse effects given that more detailed project design information, and detailed proposals for mitigation, is not presently available. Such project detail would need to be reviewed against a baseline assessment at the SPA/Ramsar.

3.6.2 Given the information currently available, there is uncertainty that the potential adverse effects identified could be avoided via mitigation.

3.7 EFFECTS IN COMBINATION WITH OTHER PLANS AND PROJECTS

3.7.1 In the context of known disturbance factors and interest feature vulnerabilities, and the possibility of cumulative effects as a result of the implementation of the Heathrow schemes, the precautionary approach at this strategic level requires that adverse effects are assumed. It is therefore also assumed that the schemes could act in-combination with other plans and projects being brought forward which may alone result in disturbance effects.

3.7.2 These potential effects are summarised in Table 3.3.

Table 3.3: Potential Operational Effects In Combination with Other Plans and Projects

OTHER PLAN / POLICY	SOUTH WEST LONDON WATERBODIES SPA
NPS for National Networks	Other projects in proximity creating disturbance could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality.
NPS for Waste Water	Other projects in proximity creating disturbance could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality.
High Speed Rail (London - West Midlands) Act 2017	Highly unlikely that effects would occur within a ZoI that would result in effects in combination
Crossrail Act 2008	Highly unlikely that effects would occur within a ZoI that would result in effects in combination
Local Development Plans	Other projects in proximity creating disturbance could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality.
Local Mineral and Waste Plans	Mineral extraction issues are identified as a cumulative disturbance effect. Other projects in proximity creating disturbance could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality.
London Plan	Other projects in proximity creating disturbance could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality.
River Thames Flood Relief Scheme	Thames flood relief scheme occurs in close proximity creating disturbance could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality. Thames flood relief scheme also offers potential for positive effects through indirect habitat creation.

3.8 CONCLUSION

3.8.1 It is considered likely that a number of potential adverse effects described above will be able to be ruled out through detailed design. However, at this plan stage it is not possible to exclude the possibility of adverse effects given that more detailed project design information, and detailed proposals for mitigation, is not presently available.

4 EFFECTS OF DIRECT AND INDIRECT LOSS AND FRAGMENTATION ON HABITATS AND FUNCTIONALLY LINKED HABITAT

4.1 INTRODUCTION

4.1.1 The AA requires the assessment to test whether or not a plan or project will give rise to an adverse effect on the integrity of the site. For the purpose of this assessment the integrity of a site is defined as 'the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex and/or the levels of populations of the species for which it was classified[32] [33].

4.1.2 Accordingly, areas of habitat outside of the designation boundary can be fundamental to the integrity of the site and as such require consideration in the same context as the site itself. These areas are termed 'functionally linked habitat' in this report[34].

4.1.3 Taking this into account and in consideration of the likely ZoI of the proposed schemes, the HRSA concluded that LSE would potentially occur as a result of direct and indirect loss and fragmentation on habitats and functionally linked habitats.

4.2 RELEVANT EUROPEAN SITES

4.2.1 The European sites identified in the HRSA as sensitive to direct and indirect loss and fragmentation and the potential impact pathways are provided in Table 4.1.

Table 4.1: Relevant European Sites and Potential Direct and Indirect Loss and Fragmentation Impact Pathway

European Site	Location in Relation to Option	European Site Vulnerability / Impact Pathway
South West London Waterbodies SPA / Ramsar	Adjacent to LHR–ENR	LSE was identified in HRSA as the option would result in a direct impact due to land take from the Staines Moor SSSI. Based on scenarios presented in the option there is potential for indirect impacts on Unit 12 of Staines Moor SSSI from works affecting the River Colne, this could lead to the loss of 40ha of the SSSI and/or other areas of functionally linked habitat, which are

[32] Managing Natura 2000 Sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC

[33] Paragraph. 39 of the judgment of the Court of Justice of the EU in Case C-258/11 ***Sweetman v An Bord Pleanála***: '*in order for the integrity of a site as a natural habitat not to be adversely affected, the site needs to be preserved at a favourable conservation status. This entails the lasting preservation of the constitutive characteristics of the site that are connected to the presence of a natural habitat type whose preservation was the objective justifying the designation of the site'.*

[34] Terminology is in accordance with Natural England Commissioned Report NEC207 (February 2016) 'Functional Linkage: How Areas that are Functionally Linked to European Sites have been Considered when they may be Affected by Plans and Projects – A Review of Authoritative Decisions'.

		identified under an updated baseline.

4.3 APPROPRIATE ASSESSMENT

CURRENT BASELINE

South West London Waterbodies SPA and Ramsar

4.3.1 A large series of waterbodies have been historically created in the south west London area as a result of the development of water-supply reservoirs and the gravel extraction industry. Seven of these waterbodies were designated in 2000 as the SW London Waterbodies SPA. Hundreds of migratory wintering Gadwall and Shoveler birds spend the winter on and around these waterbodies and their numbers are significant at a European level.

4.3.2 Some sites appear to be favoured by one species more than the other whilst some are used by both, and individual birds move from one waterbody to another. The waterbodies are also of national importance to a number of other species of wintering wildfowl, namely cormorant (*Phalcrocorax carbo*), great crested grebe (*Podiceps cristatus*), tufted duck (*Aythya fuligula*), pochard (*Aythya farina*), and coot (*Fulica atra)*.

4.3.3 As described by Briggs[35] the SPA classification implies that component sites are biologically connected. However, there are more than 50 other waterbodies within the area that contribute to the region's waterfowl interest. Twenty of these were originally included in the pre-selection stage, but were subsequently omitted from the classification.

4.3.4 In accordance with Article 6(3) of the Habitats Directive, for the purpose of this AA the complex of SPA and SSSI components (and additional components forming potential functionally linked habitat, not yet identified under the current baseline) are considered in the assessment.

POTENTIAL EFFECTS OF CHANGES TO BASELINE AS A RESULT OF LHR–ENR

4.3.5 The LHR-ENR option would result in a direct impact due to land take from the Staines Moor SSSI, comprising the loss of Unit 1 (Poyle Meadow, 8.74 ha) of the SSSI. The predicted impact is 5.7 ha of the total 8 ha of the management unit. It is likely that the whole of the unit would be adversely impacted given that modifications to the transport corridors would take place on either side of the site as well. Therefore, it is likely the whole of this site would be lost.

4.3.6 Based on scenarios presented in the LHR-ENR option there is potential for indirect impacts on Unit 12 of Staines Moor SSSI from works affecting the River Colne, this could lead to the loss of 40ha of the SSSI (and therefore the SW London Waterbodies SPA).

4.3.7 Any reduction to the size of the SSSI components would effectively reduce the areas of designated habitat available to the interest features of the SPA. The SW London Waterbodies SPA operates as a network and the pattern of use of the network is varied and influenced by a broad range of factors. Reduction in the areas of component sites could result in that component being of reduced benefit to the interest features, for example as a result of inadequate size or functional change. On a precautionary basis such changes could reasonably be predicted to result in displacement of the interest features to other waterbodies either within the SPA, which could place pressures on unaffected habitats, or displace birds outside of the designated site to areas in the local or wider area that are not afforded the same level of protection.

[35] Natural England, 2016. *Site Improvement Plans*. [online] Accessed 04/01/2016.

4.3.8 Further this impact is predicted to be cumulative with other impacts identified in this assessment including air quality, hydrology, disturbance and recreation.

4.3.9 Accordingly any removal of such habitat could reasonably be expected to result in an adverse effect to the integrity of the waterbird populations and as such the integrity of the SPA.

4.4 SUMMARY OF POTENTIAL EFFECTS ON INTEGRITY

Table 4.2: Potential Effects of Functionally Linked Habitat Loss at LHR-ENR

SITE	INTEREST FEATURE	POTENTIAL EFFECT OF HABITAT LOSS	POTENTIAL ADVERSE EFFECT ON CONSERVATION OBJECTIVE
South West London Waterbodies SPA / Ramsar	Northern shoveler and Gadwall	There is potential for surface access routes to overlap with the boundaries of sites that include SSSI components of the SPA and potentially other functionally linked habitat.	Potential to compromise; The extent and distribution of the habitats of the qualifying features The structure and function of the habitats of the qualifying features The supporting processes on which the habitats of the qualifying features rely The population of each of the qualifying features The distribution of the qualifying features within the site

4.5 AVOIDANCE AND MITIGATION MEASURES

4.5.1 Indirect impacts to Unit 12 of Staines Moor SSSI from works affecting the River Colne as part of LHR-ENR could be avoided through the design of channel diversions and minimising culverting requirements. Through maintaining water quality, volume and flow rate (or not adversely affecting these), then impacts to the SSSI, Management Unit 12, downstream should be avoided. These measures are considered to be viable and robust to prevent adverse effects to integrity of the site.

4.5.2 However where loss cannot be avoided, such as with Unit 1 of Staines Moor SSSI as a result of LHR-ENR, it is considered unlikely that viable mitigation can be provided to reduce the impact.

4.6 EFFICACY OF MITIGATION PROPOSALS AND RESIDUAL EFFECTS

4.6.1 There is uncertainty that the potential adverse effects at LHR-ENR could be avoided via mitigation. At this plan stage it is not possible to exclude the likelihood of adverse effects given that more detailed project design information, and detailed proposals for mitigation, is not presently available. Such project detail would need to be reviewed against a baseline assessment at the SPA/Ramsar.

4.7 EFFECTS IN COMBINATION WITH OTHER PLANS AND PROJECTS

4.7.1 In the context of known site conditions and interest feature vulnerabilities, and the possibility of cumulative effects as a result of the implementation of the schemes, the precautionary approach at this strategic level requires that adverse effects are assumed. It is therefore also assumed that the schemes could act in-combination with other plans and projects being brought forward, which may alone result in additional pressures. These potential effects are summarised in Table 4.4.

Table 4.3: Potential Habitat Loss and Fragmentation Effects In Combination with Other Plans and Projects

OTHER PLAN / POLICY	SOUTH WEST LONDON WATERBODIES SPA/RAMSAR
NPS for National Networks	Other projects in proximity resulting in habitat loss and/or fragmentation could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality.
NPS for Waste Water	Other projects in proximity resulting in habitat loss and/or fragmentation creating disturbance could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality.
High Speed Rail (London - West Midlands) Act 2017	Highly unlikely that effects would occur within a ZoI that would result in effects in combination.
Crossrail Act 2008	Highly unlikely that effects would occur within a ZoI that would result in effects in combination.
Local Development Plans	Other projects in proximity resulting in habitat loss and/or fragmentation could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality.
Local Mineral and Waste Plans	Mineral extraction issues are identified as a cumulative disturbance effect. Other projects in proximity resulting in habitat loss and/or fragmentation could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality.
London Plan	Other projects in proximity resulting in habitat loss and/or fragmentation could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality.
River Thames Flood Relief Scheme	Thames flood relief scheme occurs in close proximity creating disturbance could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality. Thames flood relief scheme also offers potential for positive effects through indirect habitat creation.

4.8 CONCLUSION

4.8.1 It is considered likely that a number of the potential adverse effects described above will be able to be ruled out through detailed design. However, at this plan stage it is not possible to exclude the possibility of adverse effects given that more detailed project design information, and detailed proposals for mitigation, is not presently available.

5 EFFECTS OF CHANGES TO AIR QUALITY

5.1 INTRODUCTION

5.1.1 The threshold for effects of atmospheric nitrogen ('Critical Loads' and 'Critical Levels') has been exceeded for many European sites in the UK[36]. Potential outcomes of exceedance include changes in species composition, especially in nutrient-poor ecosystems with a shift towards species associated with higher nitrogen availability and a reduction in species richness.

5.1.2 The air quality assessment module for the proposed LGW-2R and LHR-ENR schemes[37] considers the total mass emissions of key pollutants associated with airport activity. The assessment considers the following main categories of sources as a result of the proposed schemes:

- Airport related road transport 'Surface Access' (vehicle access including car parking);
- Airport activities (such as aircraft movements, heat & power generation);
- Non-Airport related road transport 'Surface Access' (vehicles on the surrounding roads); and
- Other emissions (such as industry and energy production).

5.1.3 Taking account of the above described emission sources and in consideration of the likely initial ZoI of the proposed schemes set in the HRSA (both a 2 km 'local study area' for airport emissions and within the 15 km buffer applied around the scheme for surface access impacts where increases in traffic on roads within 200 m of European sites may be expected), the HRSA concluded that LSE could occur as a result of changes in air quality.

5.2 RELEVANT EUROPEAN SITES

The European sites identified in the HRSA as vulnerable to nitrogen deposition and the potential impact pathways from the LGW-2R and LHR-ENR schemes are provided in Table 5.1.

[36] Carnell, E. J. and Dragosits, U., 2015. *Assessing and Addressing Atmospheric Nitrogen Impacts on Natura 2000 Sites in Wales*. Project Report, Centre of Ecology and Hydrology, Edinburgh.

[37] Jacobs, 2015. *Module 6: Air Quality Local Assessment. Detailed Emissions Inventory and Dispersion Modelling*. [online] Accessed 20/01/2017.

Table 5.1: Relevant European Sites and Potential Air Quality Impact Pathway

European Site	Location In Relation To Option	European Site Vulnerability / Impact Pathway
Mole Gap to Reigate Escarpment SAC	9.5 km north of LGW-2R	LSE could not be discounted in the HRSA as a result of the option's non-airport related road transport (part of the option's surface access considerations). Sections of the SAC are located within approximately 200 m[38] of the M25 and A24 and potentially other (including minor roads), which may experience greater traffic flows as a result of the option. The SAC is identified as vulnerable to nitrogen deposition in the SAC's SIP with levels currently exceeding the site-relevant critical load.
Ashdown Forest SAC	11.8 km southeast of LGW-2R	LSE could not be discounted in the HRSA as a result of the option's surface access. Sections of the SAC are located within approximately 200 m of the A22 and potentially other (including minor) roads, which may experience greater traffic flows as a result of the option. The SAC is identified as vulnerable to nitrogen deposition in the SIP with levels currently exceeding the site-relevant critical load.
Ashdown Forest SPA	11.8 km southeast of LGW-2R	
South West London Waterbodies SPA	Adjacent to LHR-ENR	LSE identified in HRSA as a result of the immediate proximity of the site to the option. Air quality impacts from the option (airport-related activities) as well as a result of surface access may occur.
South West London Waterbodies Ramsar	Adjacent to LHR-ENR	
Richmond Park SAC	10 km east of LHR-ENR	LSE could not be discounted in the HRSA as a result of the option's surface access. Sections of the SAC are located within approximately 200 m of the A3, which may experience greater traffic flows as a result of the option. The SAC is not currently identified as vulnerable to nitrogen deposition in the SIP; however, it is currently in exceedance of the site-relevant critical load.
Windsor Forest and Great Park SAC	6.2 km west of LHR-ENR	LSE could not be discounted in the HRSA as a result of the option's surface access. Sections of the SAC are located within approximately 200 m of the A332 and A329, which may experience greater traffic flows as a result of the option. The SAC is identified as vulnerable to nitrogen deposition with levels currently exceeding the site-relevant critical load.
Burnham Beeches SAC	10.2km north-west of LHR-ENR	LSE could not be discounted in the HRSA as a result of the option's surface access. Sections of the SAC are located within approximately 200 m of the A355, which may experience greater traffic flows as a result of the option. The SAC is identified as vulnerable to nitrogen deposition with levels currently exceeding the site-relevant critical load.
Thursley, Ash, Pirbright and Chobham SAC (and Thames	Closest component 10.8km south west of LHR-ENR	LSE could not be discounted in the HRSA as a result of the option's surface access. Sections are located within approximately 200 m of the M25 (SPA only), M3 and A322 (SAC and SPA), which may experience greater traffic flows as a result of the option. The SAC is identified as vulnerable to nitrogen deposition with levels currently exceeding the site-relevant critical load.

[38] Screened in for further assessment in accordance with the ZoI prescribed in the HRSA (any major road within 200 m of a European site which may potentially increase in traffic as a result of the Scheme within a 15 km radius).

European Site	Location In Relation To Option	European Site Vulnerability / Impact Pathway
Basin Heaths SPA)		
Wimbledon Common SAC	11.1km east of LHR-ENR	LSE could not be discounted in the HRSA as a result of the option's surface access. Sections of the SAC are located within approximately 200 m of the A3, which may experience greater traffic flows as a result of the option. The SAC is identified as vulnerable to nitrogen deposition with levels currently exceeding the site-relevant critical load.

5.2.1 The type and degree of effect on each of these European sites will be dependent on the pollutant emitted and process contribution; the nature of the receiving environment; and the distance from the source, as discussed in further detail below.

5.2.2 In the below tables critical NOx levels are set nationally for all vegetation at 30 µg NOx/m^3 (annual mean) and 75 µg NOx/m^3 (24-hour mean). The tables in this section provide the critical nitrogen deposition loads for each habitat supporting interest features of the relevant protected site and details where exceedance occurs under the current baseline (current baseline taken to be as reported in APIS)[39].

MOLE GAP TO REIGATE ESCARPMENT SAC

5.2.3 Mole Gap to Reigate Escarpment SAC contains habitats that are adapted to low-nutrient conditions and the site is therefore considered potentially sensitive to additional airborne NOx, SO_2, NH_3 as well as atmospheric nitrogen deposition and acid deposition.

5.2.4 Due to the 9.5 km distance from LGW-2R, the potential air quality impact pathway for the SAC has been assessed in the HRSA as arising from non-airport related road transport only (part of the scheme's surface access). This is specifically as a result of the location of the SAC (in proximity to roads, which may experience greater traffic volumes as a result of the option) and the current evidence base, which identifies effects from road vehicles on vegetation < 200 m of roads[40].

5.2.5 Taking into account this potential impact-effect pathway, an assessment is provided below of the NOx critical level and nitrogen deposition critical load.

Table 5.2: Critical Loads and Baseline Nitrogen Deposition against Interest Features of Mole Gap to Reigate Escarpment SAC

Interest Feature	Empirical Critical Load (Kg N/Ha/Yr)	Nitrogen Deposition (2012 – 2014)
Taxus baccata woods	5-15	Maximum: 29.4 Minimum: 25.2 Average: 25.7
European dry heath	10-20	Maximum: 17.8 Minimum: 16.2 Average: 16.3

[39] Air Pollution Information Systems (APIS), 2016. *'Site Relevant Critical Loads' Tool*. [online] Accessed 19/01/2017.

[40] Natural England, 2016. Potential risk of impacts of nitrogen oxides from road traffic on designated nature conservation sites (NECR200). [online] Accessed 20/01/2017.

Interest Feature	Empirical Critical Load (Kg N/Ha/Yr)	Nitrogen Deposition (2012 – 2014)
Asperulo-Fagetum beech forests	10-20	Maximum: 29.4 Minimum: 25.2 Average: 25.7
Stable *xerothermophilous* formations with *Buxus sempervirens* on rock slopes (*Berberidion* pp)	5-15	Maximum: 29.4 Minimum: 25.2 Average: 25.7
Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites)	15-25	Maximum: 17.8 Minimum: 16.2 Average: 16.3
Bechstein`s bat (broad-leaved woodland)	10-20	Maximum: 29.4 Minimum: 25.2 Average: 25.7
Great crested newt (standing water)	There is no comparable habitat with an established critical load estimate available. The decision regarding sensitivity is to be taken at a site specific level since habitat sensitivity depends on N or P limitation.	Maximum: 15.8 Minimum: 13.7 Average: 15.4

ASHDOWN FOREST SAC (AND SUPPORTING HABITATS FOR ASHDOWN FOREST SPA)

5.2.6 Nitrogen deposition is identified in the Site Improvement Plan[41] as a key issue for the site.

5.2.7 The impact pathway for the SAC and SPA is assessed as resulting from surface access only.

Table 5.3: Critical Loads and Baseline Nitrogen Deposition against Interest Features of Ashdown Forest SAC (and SPA Habitats)

Interest Feature	Empirical Critical Load (Kg N/Ha/Yr)	Nitrogen Deposition (2012 – 2014)
Northern Atlantic wet heaths with *Erica tetralix*	10 – 20	Maximum: 15.3 Minimum: 13.4 Average: 14.1
European dry heaths	10 -20	Maximum: 15.3 Minimum: 13.4 Average: 14.1
Great crested newt (standing water)	No comparable habitat with established critical load estimate available. Decision to be taken at a site specific level since habitat sensitivity	Maximum: 15.8 Minimum: 12.2 Average: 14.1

[41] Natural England, 2014. *Site Improvement Plan Ashdown Forest*. [online] Accessed 20/01/2017. .

Interest Feature	Empirical Critical Load (Kg N/Ha/Yr)	Nitrogen Deposition (2012 – 2014)
	depends on N or P limitation.	

SOUTH WEST LONDON WATERBODIES SPA (AND RAMSAR)

5.2.8 The habitats supporting the site's qualifying features are considered particularly vulnerable to changes in water quality, which may result through increased nitrogen deposition.

Table 5.4: Critical Loads and Baseline Nitrogen Deposition against Interest Features of South West London Waterbodies SPA and Ramsar

Interest Feature	Empirical Critical Load (Kg N/Ha/Yr)	Nitrogen Deposition (2012 – 2014)
Northern shoveler breeding habitat	20 – 30	Maximum: 18.2 Minimum: 14.3 Average: 15.8
Northern shoveler wintering habitat	There is no comparable habitat with an established critical load estimate available. Decisions with regard to potential vulnerability are to be taken at a site specific level since habitat sensitivity depends on N or P limitation.	
Gadwall breeding habitat		Maximum: 11.9 Minimum: 10.6 Average: 11.6
Gadwall wintering habitat		

WINDSOR FOREST AND GREAT PARK SAC

5.2.9 The impact of atmospheric nitrogen deposition is identified as a key issue in the Site Improvement Plan[42]. On the basis that the impact pathway for the SAC results from non-airport related road transport (part of the scheme's surface access considerations) only, an assessment of critical NOx levels and nitrogen deposition critical loads is provided below.

Table 5.5: Critical Loads and Baseline Nitrogen Deposition against Interest Features of Windsor Forest and Great Park SAC

Interest Feature	Empirical Critical Load (Kg N/Ha/Yr)	Nitrogen Deposition (2012 – 2014)
Old acidophilous oak woods with *Quercus robur* on sandy plains	10 -15	Maximum: 27.9 Minimum: 22.4 Average: 24.2
Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrublayer (*Quercion robori-petraeae* or *Ilici-Fagenion*)	10 – 20	Maximum: 27.9 Minimum: 22.4 Average: 24.2
Violet click beetle (critical load class: Fagus woodland)	10 – 20	Maximum: 27.9 Minimum: 22.4 Average: 24.2

[42] Natural England, 2014. *Site Improvement Plan Windsor Forest*. [online] Accessed 20/01/2017. .

BURNHAM BEECHES SAC

On the basis that the impact pathway for the SAC results from non-airport related road transport (part of the scheme's surface access considerations) only, an assessment of critical NOx levels and nitrogen deposition critical loads is provided below.

Table 5.6: Critical Loads and Baseline Nitrogen Deposition against Interest Features of Burnham Beeches SAC

INTEREST FEATURE	EMPIRICAL CRITICAL LOAD (KG N/HA/YR)	NITROGEN DEPOSITION (2012 – 2014)
Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrublayer (Quercion robori-petraeae or Ilici-Fagenion)	10 -20	Maximum: 26.9 Minimum: 24.8 Average: 25.6

THURSLEY ASH, PIRBRIGHT AND CHOBHAM SAC (AND THAMES BASIN HEATHS SPA)

5.2.10 On the basis that the impact pathway for the SAC and SPA results from non-airport related road transport (part of the scheme's surface access considerations) only, an assessment of critical NOx levels and nitrogen deposition critical loads is provided below.

Table 5.7: Critical Loads and Baseline Nitrogen Deposition against Interest Features of Thursley, Ash, Pirbright and Chobham SAC (and Thames Basin Heaths)

INTEREST FEATURE	EMPIRICAL CRITICAL LOAD (KG N/HA/YR)	NITROGEN DEPOSITION (2012 – 2014)
Depressions on peat substrates of the Rhynchosporion	10 - 15	Maximum: 16.9 Minimum: 12.7 Average: 13.9
Northern Atlantic wet heaths with *Erica tetralix*	10 - 20	Maximum: 16.9 Minimum: 12.7 Average: 13.9
European dry heaths (and supporting SPA interest features breeding nightjar, woodlark*, and Dartford warbler*	10 - 20	Maximum: 16.9 Minimum: 12.7 Average: 13.9

RICHMOND PARK SAC

5.2.11 On the basis that the impact pathway for the SAC results from non-airport related road transport (part of the scheme's surface access considerations) only, an assessment of critical NOx levels and nitrogen deposition critical loads is provided below.

Table 5.8: Critical Loads and Baseline Nitrogen Deposition against Interest Features of Richmond Park SAC

INTEREST FEATURE	EMPIRICAL CRITICAL LOAD (KG N/HA/YR)	NITROGEN DEPOSITION (2012 – 2014)
Stag beetle (Broadleaved mixed and yew woodland)	10 - 20	Maximum: 24.6 Minimum: 23.9 Average: 24.2

WIMBLEDON COMMON SAC

5.2.12 On the basis that the impact pathway for the SAC and SPA results from non-airport related road transport (part of the scheme's surface access considerations) only, an assessment of critical NOx levels and nitrogen deposition critical loads is provided below.

Table 5.9: Critical Loads and Baseline Nitrogen Deposition against Interest Features of Wimbledon Common SAC

Interest Feature	Empirical Critical Load (Kg N/Ha/Yr)	Nitrogen Deposition (2012 – 2014)
Northern Atlantic wet heaths with *Erica tetralix*	10 - 20	Maximum 14.3 Minimum: 14.3 Average: 14.3
European dry heaths	10 -20	Maximum: 14.3 Minimum: 14.3 Average: 14.3
Stag beetle (Broadleaved mixed and yew woodland)	10 -20	Maximum: 24.6 Minimum: 24.6 Average: 24.6

5.3 APPROPRIATE ASSESSMENT

BACKGROUND

5.3.1 In Section 5.2, sensitivities and critical loads have been identified for the interest features of European sites in proximity to the initial 15 km ZoI identified for LGW-2R and LHR-ENR schemes. For all of these European sites, current deposition levels for nitrogen (when compared to critical loads for the qualifying habitats) are recorded as close to, or in exceedance.

5.3.2 Exceedance of critical load does not necessarily infer ecosystem damage and conversely, changes in ecosystem function can occur below the thresholds set. It is recognised that further research is required; however, the existing data across a variety of habitats suggests that adverse effects occur as a result of excess nitrogen deposition[43], and this is the position adopted in this AA.

5.3.3 In addition, in this AA, those sites in exceedance or close to exceedance are considered more sensitive to additional nitrogen deposition in accordance with the protocol adopted by Natural England (2016)[44]. This is in recognition of the fact that whilst further exceedance may not directly lead to further damage, such additional exceedance is likely to take a site further away from the achievement of a given site's Conservation Objectives.

CURRENT AIR QUALITY BASELINE

5.3.4 The following European sites have been assessed as largely in 'Favourable Condition' despite an exceedance of critical load[45]:

- Mole Gap to Reigate Escarpment SAC;
- Ashdown Forest SAC (and habitats supporting SPA qualifying features);
- Windsor Forest and Great Park SAC;
- Burnham Beeches SAC; and
- Thursley Ash, Pirbright and Chobham SAC (and Thames Basin Heaths SPA qualifying features).

[43] Natural England, 2016. *The ecological effects of air pollution from road transport: an updated review (NECR199)*. [online] Accessed 20/01/2017.
[44] Natural England, 2016. Potential risk of impacts of nitrogen oxides from road traffic on designated nature conservation sites (NECR200). [online] Accessed 20/01/2017.
[45] Natural England, 2016. *Site Improvement Plans*. [online] Accessed 04/01/2016.

5.3.5 The following sites are not assessed as in 'favourable condition' and are in, or close to, exceedance of critical load:

- SW London Waterbodies SPA and Ramsar;
- Richmond Park SAC; and
- Wimbledon Common SAC.

5.3.6 In assessing the relevance of favourable condition status, it is noted that, to date, it has been difficult to attribute nitrogen deposition as a cause of unfavourable condition[46]. Furthermore, as described above, an exceedance does not necessarily infer damage, and the response of both individual species and communities to vehicle emissions is complex and not fully understood[47].

5.3.7 In the absence of data to provide evidence to the contrary, recourse is given to the Precautionary Principle for all the sites described in Sections 5.3.4 and 5.3.5 above. As such, where there is an existing exceedance, it is considered reasonably likely to be resulting in baseline adverse effects and potentially compromising the achievement of the Conservation Objectives of these European sites regardless of their condition status.

POTENTIAL EFFECTS OF CHANGES TO BASELINE AS A RESULT OF THE LGW-2R OPTION

Construction Effects

5.3.8 Air quality impacts associated with the construction of the option were not included in detailed air quality assessment. It is considered, in accordance with the Institute of Air Quality Management's Construction Dust Guidance[48], that a European site would be at risk of construction-related dust impacts within 50 m of the option's site boundary.

5.3.9 There are no European sites located within 50 m of the LGW-2R option's boundary and as such, this impact-effect pathway was screened out during the HRSA.

Surface Access Effects

5.3.10 Three European sites (Mole Gap to Reigate Escarpment SAC, Ashdown Forest SAC and Ashdown Forest SPA) are located in immediate proximity to major roads leading to Gatwick. Mole Gap to Reigate Escarpment SAC is located adjacent to the A217 and < 100 m of the M25 and A24. The A22 currently fragments Ashdown Forest SPA/SAC. All sites are assessed as particularly sensitive to additional deposition, being > 100% exceedance of the critical load.

5.3.11 Following the completion of initial air quality modelling[49] described in Section 4.1, more detailed and complex dynamic network modelling of the surface transport impacts of the shortlisted option was completed[50] to enable an understanding of the likely impacts.

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[46] JNCC, 2015. *A Framework for UK Research and Evidence Needs Relating to Air Pollution Impacts on Ecosystems, Version 1*. [online] Accessed 20/01/2017.

[47] Natural England, 2016. *The ecological effects of air pollution from road transport: an updated review (NECR199)*. [online] Accessed 20/01/2017.

[48] Institute of Air Quality Management, 2016. *Guidance on the assessment of dust from demolition and construction*. [online] Accessed 19/01/2017.

[49] The methodology used for this modelling can be found in the appendices to the Surface Access reports at: Airports Commission, 2014. Additional airport capacity: surface access analysis [online] Accessed 20/01/2017.

5.3.12 The maximum predicted annual mean concentrations of nitrogen oxides and nitrogen deposition fluxes were calculated for the option. At Mole Gap to Reigate Escarpment SSSI it was identified that the LGW-2R option would result in an additional 0.4 kgN/ha/yr, representing a 1.7% increase. An additional 3.4µg/m^3 NOx would also be emitted.

5.3.13 On the basis of the data provided and in the absence of further modelling (verified against monitoring), it is concluded that the additional contribution of these pollutants could act cumulatively with pre-existing sources of nitrogen deposition and potentially, in-combination with additional sources (from plans identified in Table 3.1) result in adverse effects on the integrity of the Mole Gap to Reigate Escarpment SAC, which is located in proximity to the SSSI boundary where modelling data was obtained.

5.3.14 It is acknowledged that the Mole Gap to Reigate Escarpment SAC is located further from the motorway than the Mole Gap to Reigate Escarpment SSSI (where data was obtained); however, the SAC is close enough to be affected by emissions from the motorway (particularly when emissions from the airport are considered in combination with future traffic growth).

5.3.15 Mole Gap to Reigate Escarpment SAC contains two priority habitats (those that are considered to be particular priorities for conservation at a European scale, and subject to special provisions in the Directive). These are semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (important orchid sites)[51] and *Taxus baccata* woods.

5.3.16 Ashdown Forest SAC/SPA is also located < 200 m of roads potentially leading to Gatwick (within the 15 km ZoI set during the HRSA). No data is currently available regarding the estimated nitrogen deposition rates at these European sites arising from the scheme.

5.3.17 In the absence of data to provide evidence to the contrary, recourse is given to the Precautionary Principle. It is considered reasonably likely that there will be an increase in traffic levels on the roads within 200 m of Ashdown Forest SAC/SPA with a corresponding increase in the baseline nitrogen deposition. As such, the air quality changes as a result of the option could act cumulatively and/or in-combination and result in adverse effects on the integrity of the SAC as detailed in Table 5.10 below.

Table 5.10: Relevant European Sites and Potential Effects of Air Quality Changes

SITE	INTEREST FEATURE	POTENTIAL EFFECT OF EXCEEDANCE	POTENTIAL ADVERSE EFFECT ON CONSERVATION OBJECTIVE
Mole Gap to Reigate Escarpment SAC	Taxus baccata woods	Changes in soil processes, nutrient imbalance, altered composition mycorrhiza and ground vegetation.	Potential to compromise the extent, distribution, structure and function of habitats and their supporting processes.
	European dry heath	Transition from heather to grass dominance, decline in lichens, changes in plant biochemistry, increased sensitivity to abiotic stress	
	Asperulo-Fagetum beech forests	Changes in ground vegetation and mycorrhiza, nutrient imbalance, changes soil fauna	

[50] Jacobs, 2015. *Module 6: Air Quality Local Assessment Detailed Emissions Inventory and Dispersion Modelling*. [online] Accessed 20/01/2017.

[51] JNCC, 2017. *6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (Festuco-Brometalia), (note that this includes the priority feature "important orchid rich sites")*. [online] Accessed 27/01/2017.

Site	Interest Feature	Potential Effect Of Exceedance	Potential Adverse Effect On Conservation Objective
	Stable xerothermophilous formations with *Buxus sempervirens* on rock slopes (*Berberidion* pp)	Increase in tall grasses, decline in diversity, increased mineralization, N leaching; surface acidification.	
	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites):	Increase in tall grasses, decline in diversity, increased mineralization, N leaching; surface acidification.	
	Bechstein`s bat broad-leaved woodland):	Changes in soil processes, nutrient imbalance, altered composition mycorrhiza and ground vegetation	Potential to compromise the supporting processes on which the habitats of qualifying species rely and the populations and distribution of qualifying species.
	Great crested newt	Eutrophication of aquatic habitats and changes to structure and function of terrestrial habitats.	
Ashdown Forest SAC (and SPA Habitats)	Northern Atlantic wet heaths with *Erica tetralix*	Transition heather to grass. Ericaceous species susceptible to frost and drought	Potential to compromise the extent, distribution, structure and function of habitats and their supporting processes.
	European dry heaths	Transition from heather to grass dominance, decline in lichens, changes in plant biochemistry, increased sensitivity to abiotic stress.	

POTENTIAL EFFECTS OF CHANGES TO BASELINE AS A RESULT OF LHR-ENR SCHEMES

Surface Access

5.3.18 Eight European sites are located in immediate proximity (< 200 m) to major roads leading to Heathrow. All sites are assessed as vulnerable to nitrogen deposition and are currently in exceedance (or in the case of SW London Waterbodies, are close to exceedance). Further investigations are required with regard to the effects of nitrogen deposition on the qualifying features of the sites in order to quantify any changes resulting from the schemes.

5.3.19 The maximum predicted annual mean concentrations of nitrogen oxides and nitrogen deposition fluxes were calculated for SW London Waterbodies SPA and Ramsar and it was identified that the LHR-ENR option would result in additional deposition. The greatest change being at Staines Moor SSSI: 2.2 kg/N/ha/yr (representing an increase of 19.6%).

5.3.20 It is concluded that this additional contribution could take the site further away from the achievement of its Conservation Objectives. In addition, it is considered that it could act in combination with other sources of nitrogen deposition and result in adverse effects on the integrity of the SPA and Ramsar. There would, in addition, potentially be a new exceedance of the ambient NOx Critical Level at the South West London Waterbodies SPA/Ramsar (an annual mean ambient NOx concentration emitted of up to 51.3 µg/m^3; the Critical Level for annual mean NOx concentration is 30 µg/m^3). As a result, further investigation is required regarding the sensitivity of the habitats to concentrations of ambient NOx. In the absence of evidence to the contrary and with recourse to the Precautionary Principle, it is considered reasonably likely that the air quality impacts of option will contribute additional NOx-related adverse effects on the integrity of the European site.

5.3.21 Wimbledon Common SAC, Thames Basin Heaths SPA, Thursley SAC, Windsor Park SAC, Richmond Park SAC and Burnham Beeches SAC are located within proximity to roads potentially leading to Heathrow. No data is currently available regarding the estimated nitrogen deposition rates at these European sites arising from the scheme. In the absence of data to provide evidence to the contrary, and in accordance with the Precautionary Principle, it is considered reasonably likely that there will be an increase in traffic at these roads and that corresponding air quality impacts will act cumulatively and in-combination and result in adverse effects on the integrity of the European sites as detailed in Table 5.11 below.

Option Specific and Construction Impacts

5.3.22 It is recognised that there are insufficient details at this plan level with regard to construction to enable a robust assessment of associated impacts. However, current understanding is that the LHR-ENR option would potentially remove a section of Staines Moor SSSI and the remaining area would be located in immediate proximity to the LHR-ENR option boundary.

5.3.23 In addition, given the probable size and duration of construction, the air quality assessment (using IAQM guidance) would class the construction works for LHR-ENR as High Risk[52].

Further studies are required regarding the sensitivity to dust of the habitats within immediate (< 50 m) proximity as well as any construction-related impacts as a result of surface access improvement works. Sufficient uncertainty remains at present to establish the absence of adverse air quality-related construction effects and as such, adverse effects are assumed.

Table 5.11: Relevant European Sites and Potential Effects of Air Quality Changes

Site	Interest Feature	Potential Effect Of Exceedance Of Critical Load	Potential Adverse Effect On Conservation Objective
South West London Waterbodies SPA	Northern shoveler and Gadwall	Eutrophication, Changes in the species composition of macrophyte communities, increased algal productivity and a shift in nutrient limitation of phytoplankton from N to P.	Potential to compromise the supporting processes on which the habitats of qualifying features rely and the populations and distribution of qualifying features within the site.
Windsor Forest and Great Park SAC	Old acidophilous oak woods with *Quercus robur* on sandy plains	Decrease in mycorrhiza, loss of epiphytic lichens and bryophytes, changes in ground vegetation.	Potential to compromise the extent, distribution, structure and function of habitats and their supporting processes.
	Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrublayer (*Quercion robori-petraeae* or *Ilici-Fagenion*)	Changes in ground vegetation and mycorrhiza, nutrient imbalance, changes soil fauna.	
	Violet click beetle (critical load class: Fagus woodland)	Changes in soil processes, nutrient imbalance, altered composition mycorrhiza and ground vegetation.	Potential to compromise the supporting processes on which the habitats of qualifying species rely and the populations and distribution of qualifying species within the

[52] Institute of Air Quality Management, 2016. *Guidance on the assessment of dust from demolition and construction*. [online] Accessed 19/01/2017.

Site	Interest Feature	Potential Effect Of Exceedance Of Critical Load	Potential Adverse Effect On Conservation Objective
			site.
Burnham Beeches SAC	Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrublayer (Quercion robori-petraeae or Ilici-Fagenion)	Changes in ground vegetation and mycorrhiza, nutrient imbalance, changes soil fauna.	Potential to compromise the extent, distribution, structure and function of qualifying natural habitats and their supporting processes.
Thursley, Ash, Pirbright and Chobham SAC	Depressions on peat substrates of the Rhynchosporion	Increase sedges and vascular plants, negative effects on bryophytes.	Potential to compromise the extent, distribution, structure and function of qualifying natural habitats and their supporting processes.
	Northern Atlantic wet heaths with *Erica tetralix*	Transition heather to grass. Ericaceous species susceptible to frost and drought	
	European dry heaths (and supporting SPA interest features breeding nightjar, woodlark *and Dartford warbler*	Transition from heather to grass dominance, decline in lichens, changes in plant biochemistry, increased sensitivity to abiotic stress.	
Wimbledon Common SAC	Northern Atlantic wet heaths with *Erica tetralix*	Transition heather to grass. Ericaceous species susceptible to frost and drought.	Potential to compromise the extent, distribution, structure and function of qualifying natural habitats and their supporting processes.
	European dry heaths	Transition from heather to grass dominance; decline in lichens, changes in plant biochemistry, increased sensitivity to abiotic stress.	
	Stag beetle (broad-leaved mixed woodland)	Changes in soil processes, nutrient imbalance, altered composition mycorrhiza and ground vegetation.	Potential to compromise the supporting processes on which the habitats of qualifying species rely and the populations and distribution of qualifying species within the site.

5.4 SUMMARY OF POTENTIAL EFFECTS ON INTEGRITY

Table 5.12: Summary Of Potential Effects On Integrity As A Result Of The Construction And Operation Of The Schemes

EUROPEAN SITE	LGW-2R	LHR-ENR	CONSTRUCTION EFFECTS	OPERATION EFFECTS
Mole Gap to Reigate Escarpment SAC	Yes	No	None currently identified. However, surface access improvement Schemes may result in localised impacts.	N-Deposition
Ashdown Forest SAC (and SPA Habitats)	Yes	No	None currently identified. However, surface access improvement Schemes may result in localised impacts.	N-Deposition
South West London Waterbodies SPA	No	Yes	Dust-related impacts from option-specific development. Surface access improvement Schemes may result in localised impacts.	N-Deposition
Windsor Forest and Great Park SAC	No	Yes	None currently identified. However, surface access improvement Schemes may result in localised impacts.	N-Deposition
Burnham Beeches SAC	No	Yes	None currently identified. However, surface access improvement Schemes may result in localised impacts.	N-Deposition
Thursley, Ash, Pirbright and Chobham SAC	No	Yes	None currently identified. However, surface access improvement Schemes may result in localised impacts.	N-Deposition
Wimbledon Common SAC	No	Yes	None currently identified. However, surface access improvement Schemes may result in localised impacts.	N-Deposition

5.5 AVOIDANCE AND MITIGATION MEASURES

5.5.1 Air quality impacts have been assessed as having the potential to result in adverse effects on the integrity of European sites in proximity to Gatwick and Heathrow Airport and as such it is necessary that the National Policy Statement (NPS) takes account of this.

5.5.2 Avoidance and mitigation measures should be fully incorporated into the NPS, in order to remove the risks that have been identified at this strategic level, notwithstanding that fact that further detailed assessment and application of avoidance and mitigation measures will be required at the project level HRA. As detailed mitigation has not been designed at this stage, the NPS should provide high level direction to ensure that such requirements are given full consideration at the project stage HRA.

5.5.3 It is considered likely that with the implementation of a Construction Environmental Management Plan (CEMP), temporary dust impacts during the construction-phase will be minimised. In addition, mitigation can be incorporated into the detailed design including the type, use and timing of vehicles and equipment to reduce emissions.

5.5.4 Traffic emissions generated are determined as a result of the number and type (including performance technology) of vehicles; the speed driven; and congestion levels. As described by Natural England[53], mitigation options require focus on these factors, for example by:

- → Reducing traffic flows in numbers and vehicle type (through traffic restrictions, road relocation, behaviour change);
- → Improving traffic flow and efficiency (traffic control systems to reduce emissions at sensitive sites, road space design and management, driver education); and
- → Promotion of low-emission vehicles (for example the implementation of low emission zones in proximity to sensitive sites).

5.5.5 It will be necessary to demonstrate the ability of sustainable transport plans, in particular the use of carbon-efficient and non-road transport to negate or reduce impacts on European sites during operation and furthermore, measures/incentives to facilitate their implementation should be provided.

5.5.6 The Airports Commission Final Report[54] described that, in parallel with the approvals process, a major shift in mode-share should be implemented for those working at the airport. A focus on employee behaviour change, rail investment and congestion charges for motor vehicles are suggested measures to achieve this.

5.5.7 Congestion charges and improved infrastructure for Ultra Low Emission Vehicles for passengers may also be considered.

5.5.8 In addition, the development and application of appropriate air quality management plans and independently certified offsetting options (including for example, renewable energy and fuel-switching) should also be considered within the further development of the NPS.

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[53] Natural England, 2016. *The ecological effects of air pollution from road transport: an updated review (NECR199)*. [online] Accessed 27/01/2017.
[54] Airports Commission, 2015. *Final Report*. [online] Accessed 06/01/2016.

5.6 EFFICACY OF MITIGATION PROPOSALS AND RESIDUAL EFFECTS

5.6.1 It is considered reasonably likely that construction-phase indirect air quality related impacts can be appropriately mitigated using tried and tested best-practice methods contained within a CEMP as described above.

5.6.2 The efficacy of the mitigation proposals during operation cannot however be demonstrated in the absence of further data. In this strategic AA, given the information currently available, there is uncertainty that the potential adverse effects could be avoided via mitigation.

5.7 EFFECTS IN COMBINATION WITH OTHER PLANS AND PROJECTS

5.7.1 In the context of known air quality conditions and interest feature vulnerabilities, and the possibility of cumulative effects as a result of the implementation of either the option's surface access strategies, the precautionary approach at this strategic level requires that adverse effects are assumed. It therefore cannot at this stage be ruled out that the schemes could act in-combination with other plans and projects being brought forward (such as those described in Table 1.1 above), which may alone result in changes to air quality and in particular, nitrogen deposition.

5.8 CONCLUSION

5.8.1 It is considered likely that a number of the potential adverse effects described above will be able to be ruled out through detailed design. However, at this plan stage it is not possible to exclude the possibility of adverse effects given that more detailed project design information, and detailed proposals for mitigation, is not presently available.

6 EFFECTS OF CHANGES TO WATER QUALITY AND QUANTITY

6.1 INTRODUCTION

6.1.1 The dynamics of European sites and the composition, assemblage and diversity of associated species can be significantly affected by changes to water quality, quantity and flow. Relevant sites include designated water courses, estuaries and other wetland environments; however, habitats such as heathlands and grasslands can also be affected (hydrological changes may affect terrestrial habitats, for example through groundwater). Inputs of toxic compounds and pesticides may result in negative effects on the health of aquatic life. Increased nutrient levels (for example through effluent discharge) can result in eutrophication. In addition, physical changes from scour may materialise in receiving ecosystems through changes to the flow and quantity of water.

6.1.2 The Biodiversity Assessment[55], identified that the construction and operation of the schemes may result in impacts on the local water environment. Relevant activities identified are as follows:

- The diversion and culverting of several watercourses for LGW-2R and LHR-ENR schemes;
- Increases in the risk of contaminants during construction and operation (for example through the use of de-icing fluid) for LGW-2R and LHR-ENR schemes;
- Potential changes to flow as a result of flooding for LGW-2R and LHR-ENR schemes; and
- Should additional abstraction and discharge occur as a result of increased water demand at LHR-ENR, there is the potential for additional impacts on flow.

6.1.3 Taking account of the potential impacts described above and in consideration of the likely ZoI of the proposed schemes, the HRSA concluded that LSE would potentially occur as a result of changes in water quality.

6.2 RELEVANT EUROPEAN SITES

6.2.1 The European sites identified in the HRSA as sensitive to water quality or quantity and the potential impact pathways are provided in Table 6.1. Hydrological impacts on European sites arising from the LGW-2R option were screened out at the HRSA stage.

Table 6.1 Relevant European Sites and Potential Water Quantity and Quality Impact Pathway

European Site	Location In Relation To Option	European Site Vulnerability / Impact Pathway
South West London Waterbodies SPA Ramsar	Adjacent to LHR-ENR	The option has the potential to result in impacts to hydrological systems such as the River Colne and wetland environments adjacent to the SPA that support interest features.

[55] Jacobs, 2014. *7. Biodiversity: Baseline*. [online] Accessed 04/01/2016.

South West London Waterbodies SPA and Ramsar

6.2.2 A large series of waterbodies have been historically created in the south west London area as a result of the development of water-supply reservoirs and the gravel extraction industry. Seven of these waterbodies were designated in 2000 as the SW London Waterbodies SPA. Hundreds of migratory wintering Gadwall and Shoveler spend the winter on and around these waterbodies and their numbers are significant at a European level.

6.2.3 Some sites appear to be favoured by one species more than the other whilst some are used by both, and individual birds move from one waterbody to another. The waterbodies are also of national importance to a number of other species of wintering wildfowl, namely cormorant (*Phalcrocorax carbo*), great crested grebe (*Podiceps cristatus*), tufted duck (*Aythya fuligula*), pochard (*Aythya farina*), and coot (*Fulica atra)*.

6.2.4 As described by Briggs and in detail in Section 2 of this assessment, the SPA designation implies that component sites are biologically connected. However, there are more than 50 other waterbodies within the area that contribute to the region's waterfowl interest. Twenty of these were originally included in the pre-selection stage, but were subsequently omitted from the designation.

6.2.5 In accordance with Article 6(3) of the Habitats Directive, for the purpose of this AA the complex of SPA and SSSI components (and additional components forming potential functionally linked habitat for which there is no current baseline) are considered in the assessment. Further assessment will be required at the project-level to define the extent of functionally linked habitat and that affected by the option.

Table 6.2: South West London Waterbodies SPA Components

SPA COMPONENT	SUB-SITE	DISTANCE FROM HEATHROW AIRPORT
Staines Moor	King George VI Reservoir	850 m southwest
	Staines Reservoir	650 m southwest
Wraysbury and Hythe End Gravel Pits	Wraysbury Gravel Pit – North	3700 m southwest
	Wraysbury Gravel Pit - South	4100 m southwest
Kempton Park Reservoirs	Kempton Reservoir East	5100 m southeast
	Redhouse	4700 m southeast
Knight and Bessborough Reservoirs	-	7300 m southeast
Sunnymeads Gravel Pits	Wraysbury Gravel Pit – North	4400 m west
	Wraysbury Gravel Pit - South	4100 m west
Thorpe Park Gravel Pit (Pit 1)	-	9400 m southwest
Wraysbury Reservoir	-	1900 m west

6.3 APPROPRIATE ASSESSMENT

CURRENT WATER QUALITY/QUANTITY BASELINE

6.3.1 The AC's Water Quantity and Quality Assessment has identified that the majority of the water bodies in the ZoI of the LHR-ENR schemes are classified as Artificial/Heavily Modified Water Bodies (A/HMWB) currently not achieving Good Ecological Status in accordance with the objectives of the Water framework Directive.

6.3.2 Further investigations are required as to water quality and quantity status of the European sites (and functionally linked habitats) and specifically how this currently influences the functioning of the habitat and the population and distribution of qualifying features. This is necessary in order to quantify the effects of any changes as a result of the option.

Potential Effects of Changes to Baseline as a Result of Heathrow Extended Northern Runway Scheme

6.3.3 The LHR-ENR option would require the diversion of several rivers and streams and the incorporation of a number of significant culverts. The incorporation of careful design and mitigating features will be required due to the potential for adverse effects on water quality and quantity from such major diversions.

6.3.4 Changes to water quality within the SPA and Ramsar or functionally linked habitat could also occur through the release of contaminants during construction or operation (for example, cleaning agents and de-icers).

6.3.5 None of the watercourses that will be impacted upon by LHR-ENR directly feed the SPA (the reservoir water is abstracted from the Thames). In addition, functionally linked habitats are only likely to be indirectly associated with those waterbodies requiring diversion (i.e. during flood events or via ground water). However, further investigation as to the likelihood that impacts will arise to habitats utilised by interest features as well as the effects of the any changes to both the quality and quantity of water on the interest features will be necessary at the project-level HRA once further details are available. It is likely that mitigation can be introduced to reduce the significance of, or entirely avoid, impacts; however, for the purposes of this AA, recourse is given to the Precautionary Principle and adverse effects are considered likely on the integrity of the European sites, as detailed in 6.3 below.

Table 6.3: Potential Effects of Water Quantity/Quality Changes as a result of LHR-ENR

SITE	INTEREST FEATURE	POTENTIAL EFFECT OF CHANGES TO WATER QUANTITY/QUALITY	POTENTIAL ADVERSE EFFECT ON CONSERVATION OBJECTIVE
South West London Waterbodies SPA/Ramsar	Northern shoveler and Gadwall	Eutrophication, Changes in the species composition of macrophyte communities, increased algal productivity and a shift in nutrient limitation of phytoplankton from N to P. This habitat degradation could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality	Potential to compromise The extent and distribution of the habitats of the qualifying features The structure and function of the habitats of the qualifying features The supporting processes on which the habitats of qualifying features rely; The population of each of the qualifying features The distribution of the qualifying features within the site

6.4 AVOIDANCE AND MITIGATION MEASURES

The AC's Water Quantity and Quality assessment suggests that a number of mitigation measures are integrated into the design to minimise the impact on water quality and quantity, as described in Table 6.4 below. The extensive listing provided in table 6.4 is reflective of the well-understood baseline regarding the mitigation techniques available to address water quality and flow impacts. This baseline is not so readily available for other impacts identified in this strategic-level AA. Where demonstrated that there is hydrological connectivity to habitats used by interest features (under the current baseline), these measures in turn would minimise the impact on SW London Waterbodies SPA and Ramsar.

Table 6.4: Mitigation of Effects of Water Quantity/Quality Changes

IMPACT / FEATURE	POTENTIAL MITIGATION MEASURE
Channel Creation	→ Design should incorporate variations in flow, depth and width to provide a variety of habitats; → Materials used should be environmentally appropriate and include timber and local rock rather than concrete or sheet piling; → Realigned channels should be similar in length, width, depth and gradient to the old (original) channel (if appropriate to the flow and sediment regimes); → Design should incorporate naturalised bed material (which could be characteristic of natural reaches of the same watercourse or neighbouring watercourses); → Banks should be vegetated with native species (to promote stability); → Channel design should be such to naturally convey the full range of flows from high to low; → Possible storage and transfer of original/natural substrate from a redundant channel to a realigned channel should be considered; → New river lengths, widths, depths and gradients should not compromise flow conveyance in adjoining downstream or upstream reaches; and, → Design should consider location of areas of contaminated land. Mitigation could include lining of the channel.
River Realignment	→ Design should incorporate variations in flow, depth and width to provide a variety of habitats; → Materials used should be environmentally appropriate and include timber and local rock rather than concrete or sheet piling; → Realigned channels should be similar in length, width, depth and gradient to the old (original) channel (if appropriate to the flow and sediment regimes); → Design should incorporate naturalised bed material (which could be characteristic of natural reaches of the same watercourse or neighbouring watercourses); → Banks should be vegetated with native species (to promote stability); → Channel design should be such to naturally convey the full range of flows from high to low; → Possible storage and transfer of original/natural substrate from a redundant channel to a realigned channel should be considered; → New river lengths, widths, depths and gradients should not compromise flow conveyance in adjoining upstream or downstream

Impact / Feature	Potential Mitigation Measure
	reaches; and, → Design should consider location of areas of contaminated land. Mitigation could include lining of the channel.
Culverting	→ Design should consider the passage of both water and sediment for a range of flows; → Design should consider the potential for partial or complete blockage of the culvert by debris or sediment during high flow events; → Culvert gradient should be matched to the gradient of an existing stream to avoid erosion at the head or tail of the culvert; → Reduction of river length by shortening the river planform should be avoided → Keeping length of a culvert to a minimum; → Depressing the invert of a culvert to allow for the formation of a natural bed. This could potentially be filled using excavated (and stored) material from the channel being replaced; → A culvert of similar cross-sectional size should be used; → Roughness of culvert inverts should be increased to help reduce the velocity of the water; and, → There should be consideration of potential use of lighting options (dependent on surroundings and available resources).
Water Quality	Construction: → Development and implementation of a CEMP including: Procedures to respond to any environmental incidents, Pollution prevention and material storage handling measures to be implemented → Details about location specific risks to groundwater and surface water quality and specific mitigation measures required at each location. Groundwater and surface water monitoring requirements to be carried out before and during construction and during operation. → Storage of potentially polluting substances including fuel, oils, de-icer and other chemicals to be located away from surface watercourses and areas with permeable soils. → Storage of excavated materials would be minimised and any temporary storage would located away from surface watercourses and areas with permeable soils. → Any contaminated water from excavation or dewatering activities would be passed to attenuation features such as treatment wetlands, ponds or storage tanks. There would be no direct discharge of contaminated water to surface watercourses. Operation: → Runoff from operational areas where activities such as de-icing, aircraft cleaning and aircraft servicing takes place should be passed to attenuation and treatment features. There should be no direct discharge of contaminated water to surface watercourses. The capacity and treatment levels to be achieved by the drainage system should be agreed with the Environment Agency and/or sewerage undertaker as appropriate, during the design phase. → Storage of potentially polluting substances including fuel, oils, de-icer and other chemicals to be located away from surface watercourses and areas with permeable soils.

Impact / Feature	Potential Mitigation Measure
Weirs	→ Installation of fish passes and/or diversion channels to bypass the main weir structure; → Careful design of weir layout; → Headwalls and wing walls to be set within the line of the bank and married into the surroundings; → Use of soft engineering (i.e. willow and reed pilling or imported natural stone) rather than hard engineering solutions. This should minimise the risk of downstream erosion; → Careful selection of construction material. Soft engineering techniques would be preferred to lessen the impact on hydromorphological quality; → Planting of weir sides with native plants for channel stability; Seeking latest advice on weir design and mitigation measures from the Environment Agency and Natural England; and, → Using alternative/compensation ecological mitigation measures (e.g. nesting boxes, backwaters, bankside planting, otter ramps).

6.5 EFFICACY OF MITIGATION PROPOSALS AND RESIDUAL EFFECTS

6.5.1 It is considered likely that a number of potential adverse effects described above will be able to be mitigated through detailed design. However, at this plan stage it is not possible to exclude the likelihood of adverse effects given that more detailed project design information, and detailed proposals for mitigation, is not presently available. Such project detail would need to be reviewed against a baseline assessment at the SPA/Ramsar.

6.5.2 Given the information currently available, there is uncertainty that all of the potential adverse effects identified could be avoided via mitigation.

6.6 EFFECTS IN COMBINATION WITH OTHER PLANS AND PROJECTS

In the context of known interest feature vulnerabilities, and the possibility of adverse effects as a result of the implementation of the LHR-ENR option, the precautionary approach at this strategic level requires that adverse effects are assumed. It is therefore also assumed that the schemes could act in-combination with other plans being brought forward which may alone result in changes to water quantity or quality. These potential effects are summarised in Table 6.5.

Table 6-5: Potential Water Quality and Flow Effects in Combination with Other Plans and Projects

Other Plan / Policy	South West London Waterbodies SPA Ramsar
NPS for National Networks	Other projects in proximity creating changes to water quality and quantity could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality.
NPS for Waste Water	Other projects in proximity creating disturbance could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality.

OTHER PLAN / POLICY	SOUTH WEST LONDON WATERBODIES SPA RAMSAR
High Speed Rail (London - West Midlands) Act 2017	Highly unlikely that effects would occur within a ZoI that would result in effects in combination
Crossrail Act 2008	Highly unlikely that effects would occur within a ZoI that would result in effects in combination
Local Development Plans	Other projects in proximity creating disturbance could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality.
Local Mineral and Waste Plans	Mineral extraction issues are identified as a cumulative disturbance effect. Other projects in proximity creating disturbance could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality.
London Plan	Other projects in proximity creating disturbance could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality.
River Thames Flood Relief Scheme	Thames flood relief scheme occurs in close proximity creating disturbance could lead to species displacement both within the site and areas beyond the site, fragmentation, increased competition within the site and areas beyond the site, increased pressure on habitats within the site and areas beyond the site, increased energetic use leading to reduced breeding success and potentially mortality. Thames flood relief scheme also offers potential for positive effects through indirect habitat creation.

6.7 CONCLUSION

6.7.1 It is considered likely that a number of the potential adverse effects described above will be able to be ruled out through detailed design. However, at this plan stage it is not possible to exclude all of the likelihood of adverse effects given that more detailed project design information, and detailed proposals for mitigation, is not presently available.

7 SUMMARY OF ASSESSMENT

7.1.1 The short listed schemes for LHR-ENR and LGW-2R have been subject to a strategic plan-stage HRA. It was concluded, through the AA stage of the HRA, that the development of a new runway at either site would be likely to have an adverse effect on European site integrity or that sufficient uncertainty remained.

7.1.2 The AA conclusions are summarised in Table 7.1 below.

7.1.3 LHR-ENR resulted in the same impact types on the same European sites as LHR-NWR. LGW-2R resulted in fewer types of impact at fewer European sites than LHR-ENR and LHR-NWR. However, it should be noted that impacts from LGW-2R as a result of changes to air quality, could not be discounted at Mole Gap to Reigate Escarpment SAC. This SAC contains a priority natural habitat type (refer to 5.3.14), which is defined as one in danger of disappearance, and for the conservation of which the European Community has particular responsibility.

Table 7.1: Summary of Appropriate Assessment for LHR-ENR and LGW-2R

Potential Impact	Option	European Site Where Adverse Effect Cannot Be Ruled Out
Disturbance	Gatwick Airport Second Runway	-
	Heathrow Airport Extended Northern Runway	South West London Waterbodies SPA South West London Waterbodies Ramsar
Operational management	Gatwick Airport Second Runway	-
	Heathrow Airport Extended Northern Runway	South West London Waterbodies SPA South West London Waterbodies Ramsar
Habitat Loss / Fragmentation	Gatwick Airport Second Runway	-
	Heathrow Airport Extended Northern Runway	South West London Waterbodies SPA South West London Waterbodies Ramsar
Air Quality	Gatwick Airport Second Runway	Mole Gap to Reigate Escarpment SAC Ashdown Forest SAC Ashdown Forest SPA
	Heathrow Airport Extended Northern Runway	South West London Waterbodies SPA South West London Waterbodies Ramsar Windsor Forest and Great Park SAC Richmond Park SAC Burnham Beeches SAC Thursley, Ash, Pirbright and Chobham SAC Wimbledon Common SAC Thames Basin Heaths SPA

Potential Impact	Option	European Site Where Adverse Effect Cannot Be Ruled Out
Water Quality and Quantity	Gatwick Airport Second Runway	-
	Heathrow Airport Extended Northern Runway	South West London Waterbodies SPA South West London Waterbodies Ramsar