

Appendix 11A

Technical Note: Ecological Desk Study

WOOD

Development of Bristol Airport to Accommodate 12 Million Passengers Per Annum

Technical Note: Ecological Desk Study

1 INTRODUCTION

This report presents the results of a desk-based assessment undertaken by Johns Associates in support of the development proposals and planning application at Bristol Airport. The planning application boundary is hereafter referred to as “the site”.

The aim of the desk study is to collate existing ecological records for the site to help define the likely zone of influence of the proposed development and scope of detailed ecological surveys and assessment of potential ecological impacts. Obtaining existing records is an important part of the assessment process as it provides information on issues that may not be apparent during field surveys and assists in assessing the nature conservation value of Bristol Airport, the likely presence of rare or legally protected species, and identifies potential constraints to development. The data search was also used to identify any further surveys that may be required at the site.

2 METHODS USED

Existing non-statutory designated site information and records of notable and protected species were obtained from within the site boundary and a 2km buffer. This buffer was extended to 5km for bat records. This ecological information was sourced from Bristol Regional Environmental Records Centre (BRERC) in October 2017, which holds records for North Somerset and Bath and North-East Somerset areas.

The Multi-Agency Geographical Information for the Countryside (MAGIC) website (www.magic.gov.uk) was used to search for statutory designated sites of nature conservation importance within 5km of the site.

The Avon (Hayward, 2017), Bath and North-East Somerset, North Somerset, and South West Biodiversity Action Plans and the Section 41 list of habitats and species of the Natural Environment and Rural Communities (NERC) Act (UK Government, 2006) were also reviewed with reference to the habitats and species present, or likely to be present, within or adjacent to the site.

3 RESULTS

3.1 DESIGNATED SITES

3.1.1 Statutory Sites

There is one statutorily designated site at the international level within 5km of Bristol Airport. Further information is presented in Table 1 below. A plan showing the locations of these statutory sites is contained in Appendix A to this Technical Note.

Table 1 Special Areas of Conservation (SAC) located within 5km of Bristol Airport

Site Name	Reason for designation	Distance (from site boundary) and direction from site
North Somerset & Mendip Bats SAC	<p>Annex I habitats that are a primary reason for selection of this site:</p> <ul style="list-style-type: none">- Semi natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>)- <i>Tilio-Acerion</i> forests of slopes, screes and ravines <p>Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site:</p> <ul style="list-style-type: none">- Caves not open to the public <p>Annex II species that are a primary reason for selection of this site:</p> <ul style="list-style-type: none">- Lesser horseshoe bat <i>Rhinolophus hipposideros</i> hibernation site- Greater horseshoe bat <i>Rhinolophus ferrumequinum</i> hibernation and maternity site (this site supports 3% of the UK greater horseshoe bat population)	2km west

There are fourteen statutorily designated sites at the national level within 5km of the site. Of these sites, ten are Sites of Special Scientific Interest (SSSI), three are Local Nature Reserves (LNR) and one is an Area of Outstanding Natural Beauty (AONB). Further information is presented in Tables 2, 3 and 4.

Goblin Combe and Kings Wood are also managed as Avon Wildlife Trust reserves.

Table 2 Sites of Special Scientific Interest (SSSI) located within 5km of Bristol Airport

Site Name	Reason for designation	Distance (from site boundary) and direction from site
Lulsgate Quarry SSSI	Lulsgate Quarry is a disused quarry, renowned for its excellent exposure of an irregular unconformity surface lying between inclined Lower Carboniferous (Dinantian) Black Rock limestones and flat-bedded Upper Triassic ('Rhaetian') strata	520m east
Goblin Combe SSSI	<p>Goblin Combe comprises a steep-sided dry valley with extensive areas of limestone scree. The Combe supports semi-natural ancient woodland and areas of unimproved calcareous grassland and limestone heath. These woodland and grassland types now have a limited distribution in Great Britain.</p> <ul style="list-style-type: none"> - Nationally scarce stinking hellebore <i>Helleborus foetidus</i> and nationally scarce limestone fern <i>Gymnocarpium robertianum</i> are found on areas of limestone scree. Nationally scarce spring cinquefoil <i>Potentilla tabernaemontani</i> is found in grassland - Woodland supports a small colony of moonwort <i>Botrychium lunaria</i> - In the past Goblin Combe was the location for a long-term research project involving the transplanting of a number of nationally rare plant species, which are now naturalised within transplant plots. These include Somerset hair-grass <i>Koeleria vallesiana</i>, honewort <i>Trinia glauca</i> and the nationally scarce spiked speedwell <i>Veronica spicata</i> subsp. <i>hyrida</i> - Known population of dormice <i>Muscardinus avellanarius</i> - Feeding habitat for greater horseshoe bats <i>Rhinolophus ferrumequinum</i> - A number of Red Data book and nationally notable invertebrate species. Butterfly species include silver-washed fritillary <i>Argynnis paphia</i>, dark green fritillary <i>A. aglaia</i>, purple hairstreak <i>Quercusia quercus</i>, green hairstreak <i>Callophrys rubi</i> and dingy skipper <i>Erynnis tages</i> 	940m west
Hartcliff Rocks Quarry SSSI	Hartcliff Rocks Quarry provides excellent exposures of Triassic Dolomitic Conglomerate unconformably overlying Carboniferous Limestone.	1.7km east
King's Wood and Urchin Wood SSSI	One of the largest areas of ancient woodland remaining in Avon, characteristic of ash/field maple/dog's mercury woodland type. The presence of boundary banks and large pollarded small-leaved lime <i>Tilia</i>	2km west

Site Name	Reason for designation	Distance (from site boundary) and direction from site
	<p><i>cordata</i> on the periphery of the wood suggests that some of the boundaries have remained unchanged for centuries.</p> <ul style="list-style-type: none"> - Nationally rare plant purple gromwell <i>Lithospermum purpureocaeruleum</i> and the scarce angular Solomon's-seal <i>Polygonatum odoratum</i>. Of particular interest is the presence of wild service tree <i>Sorbus torminalis</i>, a species largely confined to ancient woodland. Many species characteristic of ancient woodland including moschatel <i>Adoxa moschatellina</i>, columbine <i>Aquilegia vulgaris</i>, pignut <i>Conopodium majus</i>, stinking iris <i>Iris foetidissima</i>, toothwort <i>Lathraea squamaria</i>, woodruff <i>Galium odoratum</i>, wood sorrel <i>Oxalis acetosella</i>, herb Paris <i>Paris quadrifolia</i>, early purple orchid <i>Orchis morio</i> and lily-of-the-valley <i>Convallaria majalis</i> - Nationally important populations of the rare and endangered greater horseshoe bat <i>Rhinolophus ferrumequinum</i> and dormice <i>Muscardinus avellanarius</i>, (recent studies indicate that the woodland has one of the highest densities of dormice recorded in Britain) - Nationally scarce Chrysomelid beetle <i>Clytra quadripunctata</i> associated with wood ant <i>Formica rufa</i> nests 	
Brockley Hall Stables SSSI	The roof void is used as a summer breeding roost by a substantial colony of greater horseshoe bats <i>Rhinolophus ferrumequinum</i> .	2.6km north west
Blagdon Lake SSSI	<p>This site consists of a large freshwater reservoir with peripheral areas of reedbed, carr, woodland and natural grassland.</p> <ul style="list-style-type: none"> - Diverse invertebrate flora, including ruddy darter <i>Sympetrum sanguineum</i> - Fish, including eel <i>Anguilla anguilla</i> and gudgeon <i>Gobio gobio</i> - Nationally important populations of wintering waterfowl, including teal <i>Anas crecca</i>, mallard <i>Anas platyrhynchos</i>, tufted duck <i>Aythya fuligula</i>, pochard <i>Aythya farina</i> - Breeding waterfowl, including mallard, shoveler, reed bunting <i>Emberiza schoeniclus</i> and sedge warbler <i>Acrocephalus schoenobaenus</i> - Sheltered bays with stands of reed sweet-grass <i>Glyceria maxima</i>, reed canary-grass <i>Phalaris arundinacea</i> and common reed <i>Phragmites communis</i> - Aquatic plants, including flowering rush <i>Butomus umbellatus</i>, and shoreweed <i>Littorella uniflora</i> 	3.4km south

Site Name	Reason for designation	Distance (from site boundary) and direction from site
	<ul style="list-style-type: none"> - Neutral grasslands bordering the Lake support a species-rich meadow flora, with saw-wort <i>Serratula tinctoria</i>, wild carrot <i>Daucus carota</i> and pepper saxifrage <i>Silaum silaus</i> 	
Plaster's Green Meadows SSSI	<p>Unimproved and traditionally managed species-rich neutral grassland meadows, bounded by hedges. The slowly permeable clay soils are slightly calcareous in nature and this is reflected in elements of the flora.</p> <ul style="list-style-type: none"> - Nationally rare common knapweed/crested dog's-tail <i>Centaurea nigra/Cynosurus cristatus</i> neutral grassland community, supporting a high component of herb species including saw-wort <i>Serratula tinctoria</i> and dyer's greenweed <i>Genista tinctoria</i>. The calcareous nature of the soil is reflected by cowslip <i>Primula veris</i>, fairy flax <i>Linum catharticum</i>, glaucous sedge <i>Carex flacca</i> and occasional salad burnet <i>Sanguisorba minor</i>. 	4.2km south east
Barns Batch Spinney SSSI	Exposures of the lower part of the classic Inferior Oolite limestone sequence of the Dundry area. This area was cited by the famous French geologist, Alcide d'Orbigny in 1850 as the English 'typesection' for the rocks of the Inferior Oolite, and is thus of great historic and stratigraphic importance.	4.5km east
Bourne SSSI	Temporary sections at this site have provided detailed information upon the composition of a north Mendip Pleistocene alluvial fan.	4.4km south
Tickenham, Nailsea and Kenn Moors SSSI	<p>The variety of soil types, together with the past and present management practices, has resulted in a wide range of rhyne and ditch types which support exceptionally rich plant communities.</p> <ul style="list-style-type: none"> - Locally uncommon open water species, such as water-violet <i>Hottonia palustris</i>, greater bladderwort <i>Utricularia vulgaris</i> and the liverwort <i>Riccia fluitans</i> are frequent and the nationally scarce hairlike and fen pondweeds <i>Potamogeton trichoides</i> and <i>P. coloratus</i> and whorled watermilfoil <i>Myriophyllum verticillatum</i> also occur - Many emergent species, such as tubular water-dropwort <i>Oenanthe fistulosa</i> - Diverse invertebrate fauna, including exceptional populations of Coleoptera with at least 12 nationally scarce species and two nationally rare (RDB3) species, nationally scarce breeding hairy dragonfly <i>Brachytron pratense</i> and variable damselfly <i>Coenagrion pulchellum</i>, nationally rare (RDB3) pea mussel <i>Pisidium pseudosphaerium</i>, nationally scarce soldier fly <i>Odontomyia ornate</i> 	4.8km north west

Table 3 Local Nature Reserves (LNR) located within 5km of Bristol Airport

Site Name	Reason for designation	Distance (from site boundary) and direction from site
Felton Common LNR	<p>The site comprises an open expanse of common land, the last significant remaining area of the once extensive Broadfield Down. A mosaic of habitats from acidic and calcareous grassland to scrub, including limestone heath, which supports a variety of plants, invertebrates and birds.</p> <p>Bird species include: kestrel, sky lark, song thrush, willow warbler, spotted flycatcher.</p>	0km west
Bucklands Pool/ Backwell Lake LNR	<p>The lake is a balancing pond constructed in the mid 1970's, which has become an important site for wildfowl and dragonflies. The site has an area of open water with a small island and marginal vegetation. It is a foraging area for bats.</p> <p>Bird species include gadwall, shoveler, pochard, tufted duck, grey heron and mute swans.</p>	4km north west
Cadbury Hill LNR	<p>An Iron Age hillfort, designated as a Scheduled Ancient Monument. The plateau comprises unimproved calcicole grassland on Carboniferous limestone, which is home to various species of butterflies and invertebrates. Bats and owls may be seen foraging across the site at dusk. Six hectares of woodland surround the hillfort, dominated by ash and field maple, with some elements of ancient woodland and veteran oak pollards on the upper slopes. The site also includes mesotrophic grassland on the lower slopes, including an orchid slope.</p>	4.3km west

Table 4 Areas of Outstanding Natural Beauty (AONB) located within 5km of Bristol Airport

Site Name	Reason for designation	Distance (from site boundary) and direction from site
Mendip Hills AONB	<p>The Mendip Hills have a very strong character defined by their geology and position rising abruptly from the Somerset Levels. Species-rich scarp slope woodlands, calcareous grassland and the sparsely settled open plateau defined by rectilinear dry-stone wall enclosures contrast with the Chew Valley with pattern of hedgerows, spring line settlements, and lakes.</p>	3km south

3.1.2 Non-Statutory Sites

There are 23 non-statutory designated nature conservation sites within 2km of Bristol Airport, which are Sites of Nature Conservation Interest (SNCI) or Wildlife Sites (WS). Further information on these sites is provided in Table 5 below. Regionally Important Geological Sites (RIGS) are not included here. A plan showing the locations of these non-statutory sites is contained in Appendix A to this Technical Note.

Table 5: Non-statutory wildlife sites located within 2km of Bristol Airport

Site Name	Site ref no.	Reason for designation	Grid reference	Distance (from site boundary) and direction from site
Felton Hill and Common	13823	Semi-improved and unimproved acidic grassland, with unimproved calcareous grassland and scrub	ST 516 651	0km
Garley's Wood	13795	Ancient semi-natural broad-leaved woodland with smaller areas of semi-improved neutral and improved grassland. Diverse ancient woodland ground flora	ST 500 663	350m north
Oatfield Wood	13813	Ancient semi-natural broadleaved woodland and semi-improved neutral grasslands. Diverse ancient woodland ground flora	ST 508 663	600m north
Brockley Combe, Cleeve Hill and Goblin Combe	13756	Ancient semi-natural broadleaved woodland much of which qualifies as Priority Habitat Upland Mixed Ashwoods with smaller areas of Priority Habitat Lowland Calcareous Grassland and Lowland Heathland	ST 478 667	300m west
Heall's Scars	13785	Semi-natural broadleaved woodland much of which qualifies as Priority Habitat Upland Mixed Ashwoods with semi-improved neutral grassland. Diverse ancient woodland ground flora	ST 496 667	500m north
Woodland south of Broadfield Farm	13779	Semi-natural broadleaved woodland, possible areas of Priority Habitat Lowland Mixed Deciduous Woodland, coniferous plantation, diverse limestone grassland. Includes part of Goblin Combe RIGS	ST 490 640	600m south west
High Wood, Lulsgate	13793	Ancient semi-natural broadleaved woodland, part of which may be Priority Habitat Lowland Mixed Deciduous Woodland.	ST 501 640	200m south
Oatfield Pool	13816	Semi-natural broadleaved woodland (carr), and swamp, with standing water and scrub	ST 508 667	950m north

Site Name	Site ref no.	Reason for designation	Grid reference	Distance (from site boundary) and direction from site
Hyatt's Wood	13803	Ancient semi-natural broadleaved woodland, which may include some areas of Priority Habitat Lowland Mixed Deciduous Woodland. Diverse ancient woodland ground flora	ST 502 671	1km north
May's Grove Coppice and adjacent field	13814	Semi-natural broad-leaved woodland with diverse ground flora that may qualify as Priority Habitat Lowland Mixed Deciduous Woodland. Diverse ancient woodland ground flora	ST 508 633	900m south
Lye Wood	13807	Semi-natural broad-leaved woodland with diverse ground flora that may qualify as Priority Habitat Lowland Mixed Deciduous Woodland. Diverse ancient woodland ground flora	ST 504 631	950m south
Little Horts Wood and Horts Wood	13777	Semi-natural broad-leaved woodland with diverse ground flora that may qualify as Priority Habitat Lowland Mixed Deciduous Woodland	ST 491 631	1.6km south
Scars Wood and adjacent field	13804	Ancient semi-natural broad-leaved woodland, on Ancient Woodland Inventory and qualifying as Priority Habitat Lowland Mixed Deciduous Woodland, with unimproved, semi-improved neutral and limestone grassland	ST 505 629	1.3km south
Tucker's Grove and Whitley Coppice	13773	Ancient semi-natural broad-leaved woodland, most of it on AWI (some as PAWS) and including areas of Priority Habitat Lowland Mixed Deciduous Woodland. Ancient woodland ground flora	ST 483 631	1.4km south west
Prestow Wood and Shippenhay's Wood	13769	Ancient semi-natural broad-leaved woodland, the majority of which is on AWI, and may include areas of Priority Habitat Lowland Mixed Deciduous Woodland. Diverse ancient woodland ground flora	ST 476 634	1.5km south west
Littler Plantation	13767	Semi-natural mixed woodland which may qualify as Priority Habitat Lowland Mixed Deciduous Woodland. Diverse ancient woodland ground flora	ST 473 635	1.7km south west
Ball Wood and Corporation Woods	13749	Ancient semi-natural broad-leaved woodland, with mixed woodland plantation. Contains Priority Habitat Upland Mixed Ashwoods. Diverse ancient woodland ground. Wide variety of invertebrates: at least two RDB & three Nationally Notable moths.	ST 458 645	1.6km west

Site Name	Site ref no.	Reason for designation	Grid reference	Distance (from site boundary) and direction from site
		Lesser & greater horseshoe bat, Daubenton's and brown long-eared bat and common dormouse		
Chelvey Wood	13774	Ancient semi-natural broadleaved woodland which may qualify as Priority Habitat Upland Mixed Ashwoods. Diverse ancient woodland ground flora	ST 485 674	1.4km north west
Cheston Combe and Backwell Hill	13783	Semi-natural broadleaved woodland with semi-improved neutral grassland	ST 498 678	1.5km north west
Bourton Combe	13808	Ancient semi-natural broadleaved woodland with mix deciduous plantation and scrub. Diverse ancient woodland ground flora. Dark green fritillary present, plus other butterflies and moths	ST 507 683	1.5km north
Batches Wood	13831	Ancient semi-natural and semi-natural broad-leaved woodland. Diverse ancient woodland ground flora	ST 519 676	1.8km north east
Steven's Farm Fields	13834	Neutral grassland. Species include salad burnet, black knapweed, common bird's-foot trefoil, devil's-bit scabious, betony, quaking grass	ST 524 673	1.9km north east
Barrow Rock Lane Fields	13837	Semi-improved neutral grassland. Species include salad Burnet, cowslip, primrose, purging flax, mouse-eared hawkweed, dyer's greenweed, common restharrow, betony, devil's-bit scabious, black knapweed, pepper saxifrage, pignut	ST 533 663	1.6km north

3.2 PRIORITY HABITATS

Lowland dry acid grassland is located within 0-1km east of Bristol Airport, associated with Fenton Hill and Common Wildlife Site.

Mixed deciduous woodland is present within 200m-2km south of Bristol Airport and within 0.5-2km to the north. Upland mixed ashwoods are present within 0.5-2km north and west of Bristol Airport.

Lowland meadows are present within 300m-1km north.

Other habitats associated with national and local Biodiversity Action Plans associated with Bristol Airport and/or the adjacent 2km include woodlands, grasslands, hedgerows, arable margins and eutrophic standing waters.

3.3 VETERAN TREES AND PONDS

Five ponds are highlighted as present by BRERC within the study area. These lie within 1-2km of Bristol Airport to the east, north east and north west. However, additional ponds nearby are known of, which are not present within the BRERC database (e.g. from Ordnance Survey mapping). Two ponds located north east of Bristol Airport, nearby to Barrow Gurney, are known to support great crested newt.

One veteran tree recorded by BRERC is located within 1.5-2 km north west of Bristol Airport, within woodland near Backwell. The tree is a hybrid lime *Tilia cordata* x *platyphyllos* (*T. x europaea*) and is estimated to be over 100 years old. Other veteran trees are likely to be present in the local area.

3.4 FLORA

Records from the last 10 years provided by BRERC have been reviewed as part of the desk study.

Three records of three species protected under international legislation were provided by BRERC, although these records are not associated with Bristol Airport itself. The species are listed under Appendix II of the CITES Convention (CITES, 2017) or EC CITES Annex B (European Commission, 2017), and are legally protected at an international level from trade through trade controls. Green-winged orchid *Anacamptis morio* was recorded in 2007 500m -1km north west of Bristol Airport. Snowdrop was recorded in 2017, 1-2km north of Bristol Airport. Cyclamen was recorded 1-2km west in 2010. Green-winged orchid is also listed as Near Threatened under IUCN 2001 (IUCN, 2001). In Britain, this category includes species which occur in 15 or fewer hectads, but do not qualify as Critically Endangered, Endangered or Vulnerable.

One record of spiked speedwell *Veronica spicata*, occurs within 1-2km west of Bristol Airport. This plant is nationally protected and listed under Section 13 (1a, 2a, 2b) of the Wildlife and Countryside Act 1981 (as amended) Schedule 8 (UK Government, 1981), which prohibits intentional picking, uprooting or destruction, and sale or offering of sale. Typical habitat of this species includes base-rich grassland or rocks.

Four records of bluebell *Hyanthoides non-scripta* occur within 0.5-2km of Bristol Airport. This species is protected nationally under Section 13(2) of the Wildlife and Countryside Act 1981 (as amended), which prohibits its sale or offering for sale.

Two records of invasive non-native species listed on Schedule 9 of the Wildlife & Countryside Act 1981 occur within 0.5-2km of Bristol Airport: three-cornered garlic *Allium triquetrum* and Japanese knotweed *Fallopia japonica*, although neither occur within the boundary of Bristol Airport. Three cornered garlic can dominate areas of roadsides banks and verges, hedgerows, woodland edges, field edges and waste ground. Japanese knotweed typically establishes within disturbed habitats of urban areas, by water courses, canals and on waste ground, usually in full sunshine. It is shade tolerant and occasionally invades woodland.

Five records of yellow bird's-nest *Monotropa hypopitys* occur 1.5-2km north of Bristol Airport. This is a Section 41 Species "of principal importance for the purpose of conserving biodiversity" covered under the NERC Act (2006) and therefore needs to be taken into consideration by a public body when performing any of its functions with a view to conserving biodiversity. The species is also classed as Endangered based on IUCN guidelines, as such it is facing a very high risk of extinction in the wild in the near future. The species is also present within the Avon BAP, BNES BAP and SW BAP. Typical habitat of the species is within shaded woodland on calcareous soils.

Corn marigold *Glebionis segetum*, a species listed as Vulnerable based on 2001 IUCN guidelines, was recorded in 2016 in Jubilee Stone Wood, which lies 1km north of Bristol Airport. The species is typically an annual weed of arable habitats.

Records of two additional plant species listed as Near Threatened under IUCN 2001 were also provided by BRERC. Three records of Autumn lady's-tresses *Spiranthes spiralis* from 2008 and 2011 were provided, which lies within 1-1.5km west of Bristol Airport in Goblin Combe. Pale St. John's wort *Hypericum montanum* was noted in Jubilee Stone Wood/Badgers Wood in 2016, which is located 1-2km north.

81 records of approximately 30 species listed as Least Concern under IUCN guidelines are present within 2km of Bristol Airport. Many such species are associated with ancient woodland and unimproved neutral, acid and calcareous grassland, and occur within 300m-2km of Bristol Airport. Such species include tutsan *Hypericum androsaemum*, stinking iris *Iris foetidissima*, toothwort *Latthaea squamaria*, great burnet *Sanguisorba officinalis* and carline thistle *Carlina vulgaris*. One record of a Least Concern species is given from within Bristol Airport itself: great lettuce *Lactuca virosa*, noted in 2013. This species occupies rank calcareous grassland, woodland margins, road-banks, quarries, tracks and rough ground.

Five species considered to be nationally scarce have been recorded from within 2km of Bristol Airport between 2009-2016. Four species occur within 1-2km to the west, including limestone fern *Gymnocarpium robertianum*, spring cinquefoil *Potentilla tabernaemontani*, *Brassica oleracea*, and fringed water-lily *Nymphoides peltata*. Scots pine *Pinus sylvestris* was recorded in the south west of Bristol Airport in 2013.

3.5 AMPHIBIANS AND REPTILES

A summary of amphibian and reptile records from the last 10 years provided by BRERC is presented in Table 6 below.

Table 6 Summary of records of notable and protected reptile and amphibian species

Latin Name	Common Name	Status				Location
		WCA	Habs Regs (UK Government, 2010)	SoPI	BANES/ Avon/ SW BAP	
<i>Triturus cristatus</i>	Great crested newt	✓	✓	✓	✓	One record of 11 adults from a location 1.2km south east of Bristol Airport from 2010. One record from a pond located 290m west of Bristol Airport. Although this record dates from the period 1980-1983, it describes presence of adults and a deterioration in quality of the pond for GCN due to dense growth of scrub and "flote grass". No European Protected Species licences have been granted within 2km of Bristol Airport for GCN
<i>Anguis fragilis</i>	Slow worm	✓		✓	✓	16 records for the period 2009-2015, most of which are from Goblin Combe, west of Bristol Airport. No records for Bristol Airport itself were provided

<i>Bufo bufo</i>	Common toad	✓		✓	✓	One record from a location 1-2km north of Bristol Airport in 2016
<i>Rana temporaria</i>	Common frog	✓			✓	One record from 2016 at a site 1-2km north of Bristol Airport
<i>Natrix natrix</i>	Grass snake	✓		✓	✓	One record from the last 10 years, from a wood 1-2km north of Bristol Airport
<i>Lissotriton vulgaris</i>	Smooth newt	✓		✓		One record from 2015 at a site 1-2km north of Bristol Airport
<i>Lissotriton helveticus</i>	Palmate newt	✓		✓		One record from 2015 at a site 1-2km north of Bristol Airport
<i>Vipera berus</i>	Adder	✓		✓	✓	Four records from the last 10 years (2007-2010) from areas of woodland located 1-2km west and north of Bristol Airport
<i>Zootoca vivipara</i>	Common lizard	✓		✓	✓	Two records (from 2008 and 2009) within woodland 1-2km west of Bristol Airport

3.6 BREEDING AND WINTERING BIRDS

A summary of bird records within 2km of Bristol Airport from the last 10 years is presented in Table 7. Due to the size of this data set, only those birds currently listed on the Amber or Red BoCC lists, Schedule 1 of the WCA or included in one (or all) of the local BAPs have been included.

Table 7 Summary of records of notable and legally protected bird species

Latin Name	Common Name	Status						Location
		WCA	Birds Directive (EC, 1979)	BANES/ Avon/ SW BAP	SoPI	Red Listed (Eaton, 2015)	Amber listed (Eaton, 2015)	
<i>Tyto alba</i>	Barn owl	✓		✓				Two records, one from within Bristol Airport in October 2012
<i>Chroicocephalus ridibundus</i>	Black-headed gull						✓	One record of 4 individuals from within Bristol

								Airport in December 2013
<i>Pyrrhula pyrrhula</i>	Bullfinch			✓	✓		✓	12 records within 1-2km of Bristol Airport
<i>Larus canus</i>	Common gull						✓	One record from within Bristol Airport in December 2013
<i>Loxia curvirostra</i>	Crossbill	✓						12 records from woodland located 1-2km west and south west of Bristol Airport
<i>Cuculus canorus</i>	Cuckoo			✓	✓	✓		One record 1-2km west of Bristol Airport from May 2010
<i>Prunella modularis</i>	Dunnock			✓	✓		✓	56 records, 13 from within Bristol Airport. All records from winter months between 2008 and 2013
<i>Ardea cinerea</i>	Grey heron			✓				Six records, two from within Bristol Airport at Downside, all recorded between October 2008 and March 2009
<i>Pluvialis apricaria</i>	Golden plover		✓	✓				Three records, all from within Bristol Airport during winter months in 2010 and 2012. Maximum count of 24 individuals
<i>Larus argentatus</i>	Herring gull			✓	✓	✓		Two records from within 1-2km north of Bristol Airport in

								spring/ summer 2017
<i>Falco subbuteo</i>	Hobby	✓						Six records, three from Bristol Airport during summer months in 2010 and 2012. Maximum count of one individual
<i>Delichon urbicum</i>	House martin			✓			✓	Three records from within 1-2km of Bristol Airport
<i>Passer domesticus</i>	House sparrow			✓	✓	✓		97 records in total, all from within 0-1km of Bristol Airport between 2010 and 2017. Maximum count of 20 individuals
<i>Falco tinnunculus</i>	Kestrel			✓			✓	21 records, four of which are directly associated with Bristol Airport. All records from summer and winter months during the period 2010 – 2013. Maximum count of one individual
<i>Vanellus vanellus</i>	Lapwing			✓	✓	✓		One record of a single bird in January 2009 from a site located 1.5-2km west of Bristol Airport
<i>Linaria cannabina</i>	Linnet			✓	✓	✓		Three records, one of which is directly associated with Bristol Airport (three individuals in August 2009)
<i>Poecile palustris</i>	Marsh tit			✓	✓	✓		Two records from 12km west of

								Bristol Airport in the summer and winter months of 2009 and 2012
<i>Falco peregrinus</i>	Peregrine	✓	✓	✓				Two records, both directly associated with Bristol Airport (winter months of 2009 and 2010, maximum count of two individuals)
<i>Turdus iliacus</i>	Redwing	✓				✓		Three records, one of which is directly associated with Bristol Airport (ten individuals in December 2013)
<i>Milvus milvus</i>	Red kite	✓	✓					Six records, two of which are directly associated with Bristol Airport (from spring and summer 2010, with a maximum count of ten individuals)
<i>Alauda arvensis</i>	Skylark			✓	✓	✓		Four records, one of which is directly associated with Bristol Airport (one individual in December 2013)
<i>Gallinago gallinago</i>	Snipe						✓	One record directly associated with Bristol Airport (five individuals in October 2010)
<i>Turdus philomelos</i>	Song thrush			✓	✓	✓		24 records in total, six of which are from within Bristol Airport at Downside during the winter months between 2007 and 2009

<i>Sturnus vulgaris</i>	Starling			✓	✓	✓		95 records, 24 of which are directly associated with Bristol Airport. Records occur between October and March in 2007-2013. Maximum count of 30 individuals
<i>Muscicapa striata</i>	Spotted flycatcher			✓	✓	✓		Four records within 1-2km north and west of Bristol Airport during summer months. Maximum count of one individual
<i>Columba oenas</i>	Stock dove						✓	Three records, one of which relates directly to Bristol Airport (one individual in December 2013)
<i>Hirundo rustica</i>	Swallow			✓				Five records within 1-2km of Bristol Airport
<i>Phylloscopus trochilus</i>	Willow warbler			✓			✓	Eight records from within 0.5-2km of Bristol Airport. Maximum count of 30 individuals in April 2010 500m east of Bristol Airport
<i>Phylloscopus sibilatrix</i>	Wood warbler			✓	✓	✓		One record 1-2km north of Bristol Airport in 2010
<i>Scolopax rusticola</i>	Woodcock					✓		Four records from within 1-2km of Bristol Airport (2007-2012)
<i>Emberiza citrinella</i>	Yellowhammer			✓	✓	✓		Seven records, three of which may be located within

								Bristol Airport (summer 2009 and 2012). Maximum count of 5 individuals
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3.7 BATS

Bat records provided by BRERC from the last 20 years are described in detail in the following sections. The current status of each of these species is summarized in Table 8.

3.7.1 Barbastelle (*Barbastella barbastellus*)

No roost records.

Three field records of one individual bat from September 2005 and 2007 located 4-5km west of Bristol Airport. Centred in Claverham, the record originated from the north and west boundary of the village. This record may indicate that Bristol Airport lies within the 6km radius Core Sustainance Zone (CSZ) (Bat Conservation Trust, 2016) for this species, if a roost is present outside of the current study area. CSZ refers to the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the resilience and conservation status of the colony using the roost.

3.7.2 Serotine (*Eptesicus serotinus*)

Five records of serotine roosts from four separate 1km squares are located 2-4km south west, west and north of Bristol Airport. A summer roost with a maximum count of 65 individuals in 2014 is located 3km to the north of Bristol Airport near Flax Bourton. A roost supporting 14 individuals was recorded in 2002 at Backwell, which is located 2km north west. No records of juveniles within roosts were received.

123 field records within 1km and 5km of Bristol Airport were provided by BRERC, although no records were received for the east of Bristol Airport. Of this total, 93 records originate from the village of Backwell and most occur within the summer months of 2003 and 2004. Other clusters of field records from the western and southern boundary of Brockley Wood, Goblin Combe and King's Wood, near the villages of Congresbury, Wrington and Cleve were also provided.

Serotine roost and field records within 4km of Bristol Airport suggest that the site lies within the CSZ of known roosts supporting this species.

3.7.3 Bechstein's (*Myotis bechsteinii*)

No roost or field records for this species.

3.7.4 Whiskered/Brandt's Bat (*Myotis mystacinus/brandtii*)

A single record of an individual roosting whiskered/Brandt's bat exists from a site 3.5km - 4km east of Bristol Airport near Dundry. This record dates from February 2008.

A single field record of a juvenile whiskered bat from 1998 at Colliter's Brook, 4.5-5km north east of Bristol Airport was provided by BRERC.

There are no roost or field records for these species within 1km of Bristol Airport, suggesting that the airport may not lie within the CSZ for these species. However, data held by BRERC is likely to be incomplete and BCT reports that the CSZ defined for these species may be inaccurate due to lack of data.

3.7.5 Daubenton's (*Myotis daubentonii*)

A single record from 2003 of a Daubenton's maternity roost, supporting 25 individuals was provided by BRERC as part of the desk study. This roost was located 5km north of Bristol Airport, near Wraxall and a watercourse named Land Yeo.

88 field records were provided for this species, mostly originating from the period 2001 - 2011. Seventy-two records relate to the area 4-5km west of Bristol Airport, along a section of the Congresbury Yeo river near Congresbury, where bats are likely to be using the linear riverine habitat as an important foraging/ commuting route. Ten records relate to Backwell Lake, 4-5km north west of Bristol Airport.

There are no roost or field records for this species within 2km of Bristol Airport, indicating that the application site may not lie within a CSZ for this species. However, data held by BRERC is likely to be incomplete and BCT reports that the CSZ defined for these species may be inaccurate due to lack of data.

3.7.6 Natterer's (*Myotis nattereri*)

There are five roost records for this species from two 1km-grid squares within the study area. A roost containing a single bat was recorded in December 2005 from a site located 2km - 3km south east of Bristol Airport. Given the timing of this record, it is considered likely to be a hibernation roost. In May 2011, a maximum count of 21 roosting bats were recorded from a 1km-grid square located 3-4km south of Bristol Airport (at the north of Blagdon Lake). Records in the same 1km square also exist dating from October and August 2010. A hibernation roost containing a single bat was recorded in November 1986 within a 1km square north west of Bristol Airport at Downside. This roost may therefore be located within the boundary of Bristol Airport, or within 1km of it. However, this record is greater than 20 years old, thereby reducing its reliability in providing a current assessment for this species.

One record of a dead bat found 4-5km north west of the site dates from 2002.

Presence of roost and field records within 4km of Bristol Airport indicate that the application site lies within the CSZ of known roosts supporting this species.

3.7.7 Leisler's (*Nyctalus leisleri*)

Two records from a 1km-grid square located 3.5km - 4.5km north east of Bristol Airport, near Barrow Big Wood date from October and November 2015. Both records are of two individual roosting bats, suggesting a likely hibernation roost at this location.

There are three records of foraging bats from locations between 2.5km and 5km north, north east and east of Bristol Airport. These records date from 2011 – 2016.

Presence of field records within 3km of Bristol Airport indicate that the application site lies within the CSZ of a known roost supporting this species.

3.7.8 Noctule (*Nyctalus noctula*)

Four records of roosting noctule bats in four individual 1km-grid squares were received from BRERC. A roost supporting 3 individuals was recorded in July 2003, at a location approximately 1.5km - 2.5km east of Bristol Airport near Winford Manor. A noctule roost was also recorded in May 2004 approximately 3-4km south of

Bristol Airport at the north shore of Blagdon Lake. A roost recorded in August 2016 is located 2.5km - 3.5km south west of Bristol Airport, near Wrington. A roost recorded in July 2001 is located 4-5km north east, near Barrow Common.

70 field records are concentrated to the north, west and south of Bristol Airport. 45 records originate in Backwell, which is located 2-5km north west. Foraging bats within the vicinity of Blagdon Lake were recorded in 2003, whilst in 2011, an adult female and an adult male were trapped at this location. Other clusters of field records occur to the west and south boundary of Brockley Wood, Goblin Combe and King's Wood, near the villages of Congresbury, Wrington and Cleeve. The closest foraging record dates from 2002 near Brockley Combe, which is situated 800m west of Bristol Airport. A small number of records originating from a railway line 4-5km from Bristol Airport suggests that this feature may act as a commuting/foraging corridor for this species.

Presence of roost and field records within 4km of Bristol Airport indicate that the application site lies within the CSZ of known roosts supporting this species.

3.7.9 Nathusius' pipistrelle (*Pipistrellus nathusii*)

Two records of this species originate from a 1km-grid square located at the west of Blagdon Lake, 4-5km south of Bristol Airport. Both records are of an individual roosting bat, in September 2009 and April 2011. One of these records is from a box survey.

There are four field records from the vicinity of the western shore of Blagdon Lake, recorded between 2008 and 2013. Two males were trapped at this location in April 2011.

Roost and field records for this species do not occur within 3km of Bristol Airport, indicating that the application site may not lie within a CSZ for a known roost supporting this species. However, data held by BRERC is likely to be incomplete and BCT reports that the CSZ defined for these species may be inaccurate due to lack of data.

3.7.10 Common pipistrelle (*Pipistrellus pipistrellus*)

Four roost records from four individual 1km-grid squares located 2km - 4km from Bristol Airport. Two records of a roost within a single 1km grid square are situated east of Butcombe, approximately 2.5km - 3.5km south east. Ten roosting individuals were recorded in February 2011, (likely hibernating), whilst two roosting individuals were recorded in May 2010. The remaining three records are of single roosting bats in three further 1km squares, recorded in summer months between 2015 and 2016.

Twenty field records from 2004 – 2016 were also provided by BRERC, mostly arising from areas to the north and west of Bristol Airport including the villages of Congresbury, Wrington and Cleeve, along the Congresbury Yeo and within Backwell and Nailsea.

Presence of roost and field records within 2km of Bristol Airport indicate that the application site lies within the CSZ of known roosts supporting this species.

3.7.11 Soprano pipistrelle (*Pipistrellus pygmaeus*)

There are fifteen roost records for this species from seven individual 1km-grid squares. Two records dating from October and November 2015 relate to roost(s) located near reservoirs at Barrow Gurney, 3km - 4.5km north east of Bristol Airport. Seven and 25 individual bats were recorded at this time. Remaining roost records are located within six 1km-grid squares close to Blagdon Lake, located 3-5km south of Bristol Airport. Records

date from summer and winter months between 2003 and 2011, with a maximum summer count of 56 individuals within a single roost.

Thirty field records dating from the period 2004 – 2016 were also provided by BRERC, and originate from areas to the north and west of Bristol Airport including the villages of Congresbury, Wrington and Cleeve, along the Congresbury Yeo, in Backwell and Nailsea, and within the vicinity of Blagdon Lake to the south.

Presence of roost and field records within 3km of Bristol Airport indicate that the application site lies within the CSZ of known roosts supporting this species.

3.7.12 Brown long-eared (*Plecotus auritus*)

Eleven roost records for this species were provided by BRERC within the desk study area, including a confirmed hibernation roost containing one bat, which was recorded in 1999 in King's Wood, 3-4km west of Bristol Airport. An undefined roost supporting 44 bats was also recorded in this area in 1999. Most other roost records relate to 1km-grid squares within King's Wood, Goblin Combe and Brockley Wood, at a distance of 800m - 5km from Bristol Airport. A roost recorded in 2008 is located 500m -1.5km to the east.

Sixteen field records dating from the period 1997 – 2016 were also received. The majority of these records originate from a similar area to the roost records, such as the wooded landscape to the west of Bristol Airport, and also to the north.

Presence of roost and field records within 3km of Bristol Airport indicate that the application site lies within the CSZ of known roosts supporting this species.

3.7.13 Grey long-eared (*Plecotus austriacus*)

There are no roost records for this species within 5km of Bristol Airport.

There is a single field record of a grey long-eared / brown long-eared bat dating from 2016 from an area approximately 3.5km - 4.5km north east of Bristol Airport.

There are no roost or field records for this species within 3km of Bristol Airport. Consequently, it is considered unlikely that the application site is located within a CSZ for a known roost supporting this species. However, data held by BRERC is likely to be incomplete and BCT reports that the CSZ defined for these species may be inaccurate due to lack of data.

3.7.14 Greater Horseshoe (*Rhinolophus ferrumequinum*)

There is a total of 199 roost records within 5km of Bristol Airport, concentrated to the west and north, although some roosts are located to the south and east.

The majority of records are located in or associated with the wooded landscape extending from the west to the north, in which Goblin Combe and King's Wood SSSI are located. A maternity roost for this species was recorded in 1999 approximately 2km - 3km west of Bristol Airport within King's Wood/Goblin Combe/Brockley Wood. At that time, the maternity roost supported 44 individuals.

There are four additional records of pre-parturition roosts located within two 1km-grid squares in a similar location to the roosts outlined above. These supported a maximum count of 95 bats in 2000 and 2001. An emergence count in Brockley Wood/Goblin Combe recorded 400 individuals in 2012, and 114 individuals in 2002.

Records from within the wooded landscape to the west and north of Bristol Airport indicate the presence of hibernation roosts located across the breadth of the woodland, within a total of six 1km-grid squares. The maximum count within such hibernation roosts is 42 individuals, recorded in 2001. There is a record of a hibernation roost for this species to the north west of Bristol Airport, at Downside.

In the wider landscape, roost records exist to the north, east and south of Bristol Airport. No further maternity roosts are recorded. Thirty-five records dating from the period 1997 - 2009 are located within a 1km-grid square approximately 3.5km - 4.5km from Bristol Airport. Records of one to six individuals occur throughout the year, suggesting both a hibernation and summer roost. One record of a hibernation roost containing a single bat dates from 2004, and relates to a 1km-grid square located at Winford, 2km - 3.5km east of Bristol Airport. Forty-five records originate from a 1km-grid square 2km - 3km to the east. All records date from winter months between 2000 and 2012, suggesting a hibernation roost.

Eighty-two field records are distributed across the study area to the north, west and south. Records occurring within 500m south of Bristol Airport date from 2001. Four records from an area within 500m to the north at Downside Road date from the period 1998 - 2000. Many of these records are from the hibernation period and may therefore be of hibernating individuals. However, this species can be active during this period in certain conditions.

Field records for the area to the east of Bristol Airport are few in number and are typically over 15 years old. Lack of records may be due to a combination of under-recording and absence of deciduous woodland, a more favoured foraging habitat for this species.

Presence of roost and field records within 3km of Bristol Airport indicate that the application site lies within the CSZ of known roosts supporting this species.

3.7.15 Lesser horseshoe (*Rhinolophus hipposideros*)

Two hundred and fifty-nine roost records in total were provided by BRERC for an area extending 5km from Bristol Airport for this species. Roost records are concentrated predominantly within woodland to the west, (including a number of woodland SSSIs), and also to the north of Bristol Airport where smaller fragments of deciduous woodland are present. Field records are typically from the same area, although field records for this species also exist for the more fragmented woodland 3km - 5km north east of Bristol Airport.

Of those records for areas of woodland to the west and north, only two relate to a maternity roost located within a 1km-grid square located approximately 3.5km - 4.5km north east of Bristol Airport near Barrow Wood. One hundred and eighty individuals were recorded at this location in 2003.

Lesser horseshoe hibernation roosts are mostly associated with the wooded landscape extending to the west and north of Bristol Airport. A 1km-grid square within Brockley Wood supported a maximum count of 59 hibernating individuals in 2009.

Three 1km-grid squares located 2km - 4km east of Bristol Airport also hold records of hibernation roosts. Forty-six records are associated with a 1km-grid square approximately 3.5km - 4.5km from Bristol Airport near Dundry, which supports hibernation roosts of greater horseshoe bats as well as lesser horseshoe bats. A maximum count of 87 lesser horseshoe bats was recorded in 2002 from this location. Forty-nine records relate to a 1km-grid square near Regil, 2km - 3km south east of Bristol Airport. This roost supported a maximum of 44 individuals in 2004.

Thirty-nine field records are distributed throughout areas of woodland within the Field records also exist for areas close to roost records east of Bristol Airport. Four records within 500m north of the application site at

Downside Road date from the period 1997 - 2000, demonstrating foraging activity within or adjacent to Bristol Airport itself.

Presence of roost and field records within 2km of Bristol Airport indicate that the application site lies within the CSZ of known roosts supporting this species.

Greater horseshoe bats and lesser horseshoe bats are likely to share roost locations within woodlands to the west of Bristol Airport, where statutory sites including Goblin Combe and King's Wood are located. There are more records of lesser horseshoe bat roosts in fragmented woodland to the north when compared with greater horseshoe records. The roost location(s) at Downside appears to support both lesser and horseshoe bats. Roosts located to the east of Bristol Airport, near Regil and Winford, also appear to support both lesser and greater horseshoe bats.

Table 8 Status of bat species recorded within 5km of Bristol Airport

Latin Name	Common Name	WCA	Habs Regs	BANES/ Avon/ North Somerset/ SW BAP	Species of Principal Importance
<i>Barbastella barbastellus</i>	Barbastelle	✓	✓	✓	✓
<i>Eptesicus serotinus</i>	Serotine	✓	✓	✓	
<i>Myotis brandtii</i>	Brandt's	✓	✓	✓	
<i>Myotis daubentonii</i>	Daubenton's	✓	✓	✓	
<i>Myotis mystacinus</i>	Whiskered	✓	✓	✓	
<i>Myotis nattereri</i>	Natterer's	✓	✓	✓	
<i>Nyctalus leisleri</i>	Leisler's	✓	✓	✓	
<i>Nyctalus noctula</i>	Noctule	✓	✓	✓	✓
<i>Pipistrellus nathusii</i>	Nathusius' pipistrelle	✓	✓	✓	
<i>Pipistrellus pipistrellus</i>	Common pipistrelle	✓	✓	✓	
<i>Pipistrellus pygmaeus</i>	Soprano pipistrelle	✓	✓	✓	✓
<i>Plecotus auritus</i>	Brown long-eared	✓	✓	✓	✓
<i>Plecotus austriacus</i>	Grey long-eared	✓	✓		

Latin Name	Common Name	WCA	Habs Regs	BANES/ Avon/ North Somerset/ SW BAP	Species of Principal Importance
<i>Rhinolophus ferrumequinum</i>	Greater horseshoe	✓	✓	✓	✓
<i>Rhinolophus hipposideros</i>	Lesser horseshoe	✓	✓	✓	✓

The MAGIC website provides details of the number of European Protected Species licences granted for bats within 5km of Bristol Airport. These are summarized in Table 9.

Table 9 European Protected Species licences granted for bats within 5km of Bristol Airport

Species	Details	Expiration year	Distance from Bristol Airport
Brown long-eared, lesser horseshoe	Destruction of a resting place	2015	3km west
Common pipistrelle, greater horseshoe, lesser horseshoe, soprano pipistrelle	Damage of a resting place Destruction of a resting place	2020	4.8km south west
Brown long-eared	Impact on a breeding site Damage of a breeding site Destruction of a breeding site	2025	4.5km south
Lesser horseshoe	Destruction of a resting place	2025	2km north west
Brown long-eared, lesser horseshoe	Destruction of a resting place	2026	2km north west
Brown long-eared, common pipistrelle, soprano pipistrelle		2018	3.4km south
Common pipistrelle, lesser horseshoe	Destruction of a resting place	2026	2.3km west
Brown long-eared, common pipistrelle	Destruction of a resting place	2021	3.8km west
Common pipistrelle, soprano pipistrelle, brown long-eared, Brandt's, lesser horseshoe, natterers, whiskered, serotine	Destruction of a resting place	2015	4.5km south

Species	Details	Expiration year	Distance from Bristol Airport
Lesser horseshoe, greater horseshoe	Impact on a breeding site Destruction of a breeding site Destruction of a resting place	2013	4.1km south west
Common pipistrelle	Destruction of a resting place	2013	3.5km south
Common pipistrelle, soprano pipistrelle, brown long-eared	Destruction of a resting place	2012	1km south east
Common pipistrelle	Destruction of a resting place	2009	Within the site
Brown long-eared, serotine	Impact on a breeding site Destruction of a breeding site Destruction of a resting place	2012	2.3km west

3.8 HAZEL DORMOUSE

There are 55 records of dormouse *Muscardinus avellanarius* from the last 10 years within 2km of Bristol Airport. These records are concentrated in three main areas: 800m - 2km west within Goblin Combe; 1.5km - 2km north within Jubilee Stone Wood; and 1km - 1.5km north east within Freeman's Quarry.

Nine records originate from Freeman's Quarry, dating between 2012 and 2014. Juveniles are recorded and as such, indicate a breeding site. A maximum count of nine individuals have been recorded.

Two hundred and thirty-seven records originate from Goblin Combe, dating between 2004 and 2015. Juveniles are also recorded from this site, indicating a breeding site. A maximum count of eight individuals have been recorded from Goblin Combe.

There are eight records from Jubilee Stone Wood in 2013, and a single record in 2016 for the same 1km square. Juveniles were recorded and as such, indicate a breeding site. A maximum count of four individuals were recorded.

The MAGIC website includes details of two European Protected Species Licences for dormouse granted for a site 1.2km north of Bristol Airport, near Hyattswood. A licence allowing impacts on a breeding site, destruction of a breeding site and destruction of a resting place expires in 2018. A licence allowing the same activities expired in December 2017.

3.9 BADGER

Badgers *Meles meles* and their setts are protected under the Protection of Badgers Act, 1992 (UK Government, 1992). The desk study identified 31 records of badgers within 2km of Bristol Airport from the last ten years.

Of these records, 17 are of dead badgers from road traffic collisions on Downside Road, Hyatts Wood Road and West Lane.

Three records relate to field signs only such as tracks and feeding remains. No juveniles have been recorded. One record is from within Bristol Airport near the western boundary, and comprises tracks identified in December 2013.

3.10 INVERTEBRATES

One hundred and seventy-seven records of notable and/or legally protected invertebrate species within 2km of Bristol Airport were provided by BRERC, all dating from the last 10 years.

The median wasp *Dolichovespula (Dolichovespula) media*, is a proposed BRERC Notable species. Two records originate from Tall Pines Golf Course, which is located less than 100m from Bristol Airport. These records date from 2011.

All other records relate to a band of woodland located between 250m and 2km west and north of Bristol Airport. This area of woodland includes Goblin Combe, Brockley Combe and Jubilee Stone Wood.

3.10.1 Butterflies

One hundred and twenty-three records of notable butterfly species were provided by BRERC.

Twenty-four records of the silver-washed fritillary, *Argynnis paphia*, a scarce species within the region, and three records of the dark green fritillary *Argynnis aglaja*, a rare species within the region and BANES BAP species, were recorded during the period 2007 – 2015 within the study area. Both species are recorded as breeding. The silver-washed fritillary was also recorded once in 2007 within woodland near Wrington, located 1-2km south west of Bristol Airport.

White admiral *Limenitis camilla* and grayling *Hipparchia semele*, are both rare species in the region, Section 41 Species of Principal Importance and Avon & BANES BAP species. Both were recorded once in 2008 within the study area.

Small heath *Coenonympha pamphilus pamphilus* and wall butterfly *Lasiommata megera* are Section 41 Species of Principal Importance and Avon BAP species. Small heath is recorded 36 times, most recently in 2015, including breeding records and a maximum count of 14 individuals. Two individual wall butterflies were recorded in 2014.

Grizzled skipper *Pyrgus malvae* and dingy skipper *Erynnis tages* are both rare species in the region, Section 41 Species of Principal Importance and Avon & BANES BAP species. There are ten records of grizzled skipper, occurring most recently in 2015, and including breeding records. A maximum count of seven individuals were recorded. Twenty-eight records of dingy skipper, occurring most recently in 2015, include breeding records with a maximum count of ten individual butterflies.

Green hairstreak *Callophrys rubi* and Essex skipper *Thymelicus lineola* are both species listed under the BANES BAP. Ten records of green hairstreak occur as recently as 2015, with breeding records and a maximum count of three individuals. One record of an adult Essex skipper dates from 2015.

3.10.2 Macro Moths

Thirty-five records of notable macro moth species were provided by BRERC.

Pretty chalk carpet *Melanthia procellata*, chalk carpet *Scotopteryx bipunctaria*, shaded broad-bar *Scotopteryx chenopodiata*, buff ermine *Spilosoma lutea*, small square-spot *Diarsia rubi* and ghost moth *Hepialus humuli* are all Section 41 Species of Principal Importance and also BAP priority species in the local area. All have a maximum count of one individual. Two records of pretty chalk carpet occur most recently in 2012. Two records of chalk carpet occur most recently in 2007. Two records of shaded broad-bar occur most recently in 2015. One record of buff ermine dates from 2012. One record of small square-spot and one record of ghost moth date from 2015.

Barred rivulet *Perizoma bifaciata* and satin beauty *Deileptenia ribeata* are both rare species in the BRERC region; satin beauty is also a BANES BAP species. Both are recorded once in the study area, in woodland to the west of the site.

3.10.3 Beetles

A beetle, *Cryptocephalus aureoles*, and a ground bug *Rhyparochromus pini*, are both Nationally Notable B species. Both were recorded once in 2014 in Goblin Combe.

3.10.4 Orthoptera

A scarce species in the BRERC region, mottled grasshopper *Myrmeleotettix maculatus*, was recorded once in Goblin Combe in 2015.

3.10.5 Diptera

A BANES BAP species of bee-fly, *Bombylius major*, was recorded in 2011 and 2015 in Goblin Combe.

3.11 NOTABLE MAMMAL SPECIES

Records dating from the last 10 years are summarised in Table 10.

Table 10 Notable mammal species recorded within 2km of Bristol Airport

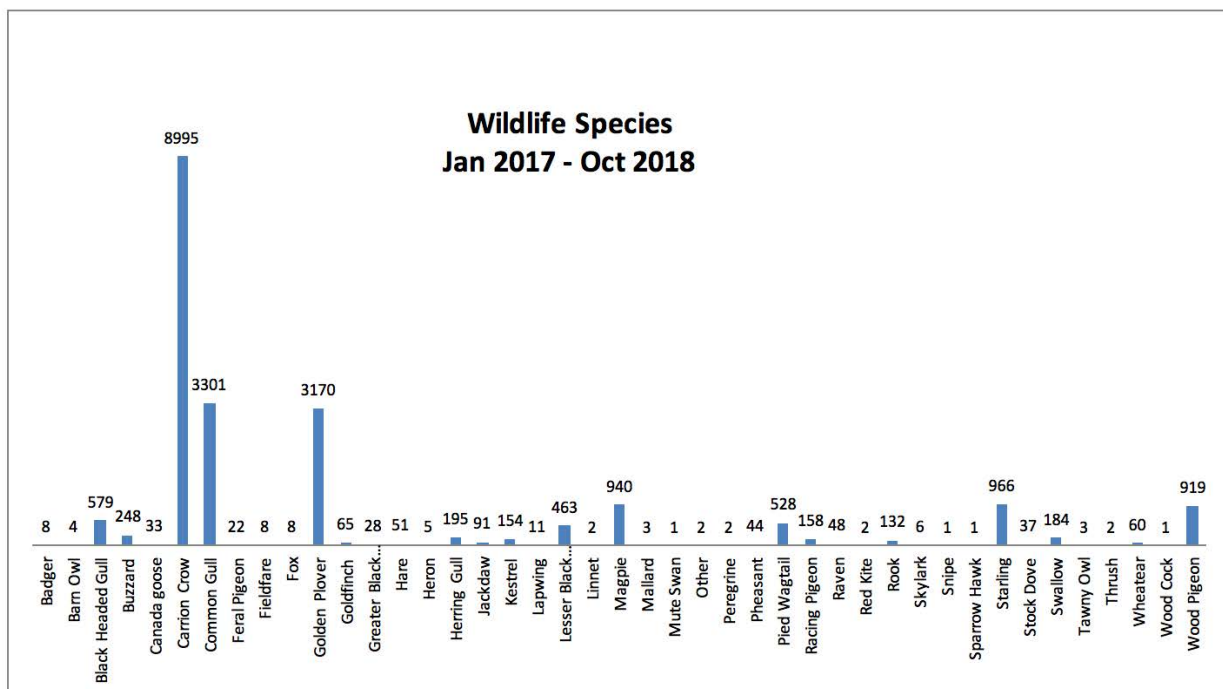
Latin Name	Common Name	Status				Location
		WCA	Habs Regs (UK Government, 2010)	SoPI	BANES/ Avon/ SW BAP	
<i>Erinaceus europaeus</i>	European hedgehog			✓	✓	Two records, both of dead individuals in the road (1-2km south and west of Bristol Airport)
<i>Lepus europaeus</i>	Brown hare			✓	✓	Five records, one of which is located within Bristol Airport (southern boundary), recorded most recently in 2015. Maximum count of one individual

<i>Neovison vison</i>	American mink	✓				Schedule 9 invasive species. One record from within Bristol Airport, located at the southern boundary (single animal in 2015)
<i>Apodemus flavicollis</i>	Yellow-necked mouse				✓	32 records in total, all located within 250m – 2km west of Bristol Airport in Goblin Combe (2007 – 2015) Maximum count of eight individuals. One record of three juveniles

3.12 BRISTOL AIRPORT AIRSIDE SAFETY UNIT RECORDS

A summary of incidental records of wildlife recorded by the Bristol Airport Airside Safety Unit team is presented in Figure 3.1.

Figure 3.1 Incidental Wildlife Records at Bristol Airport, Recorded by the Airside Safety Unit.



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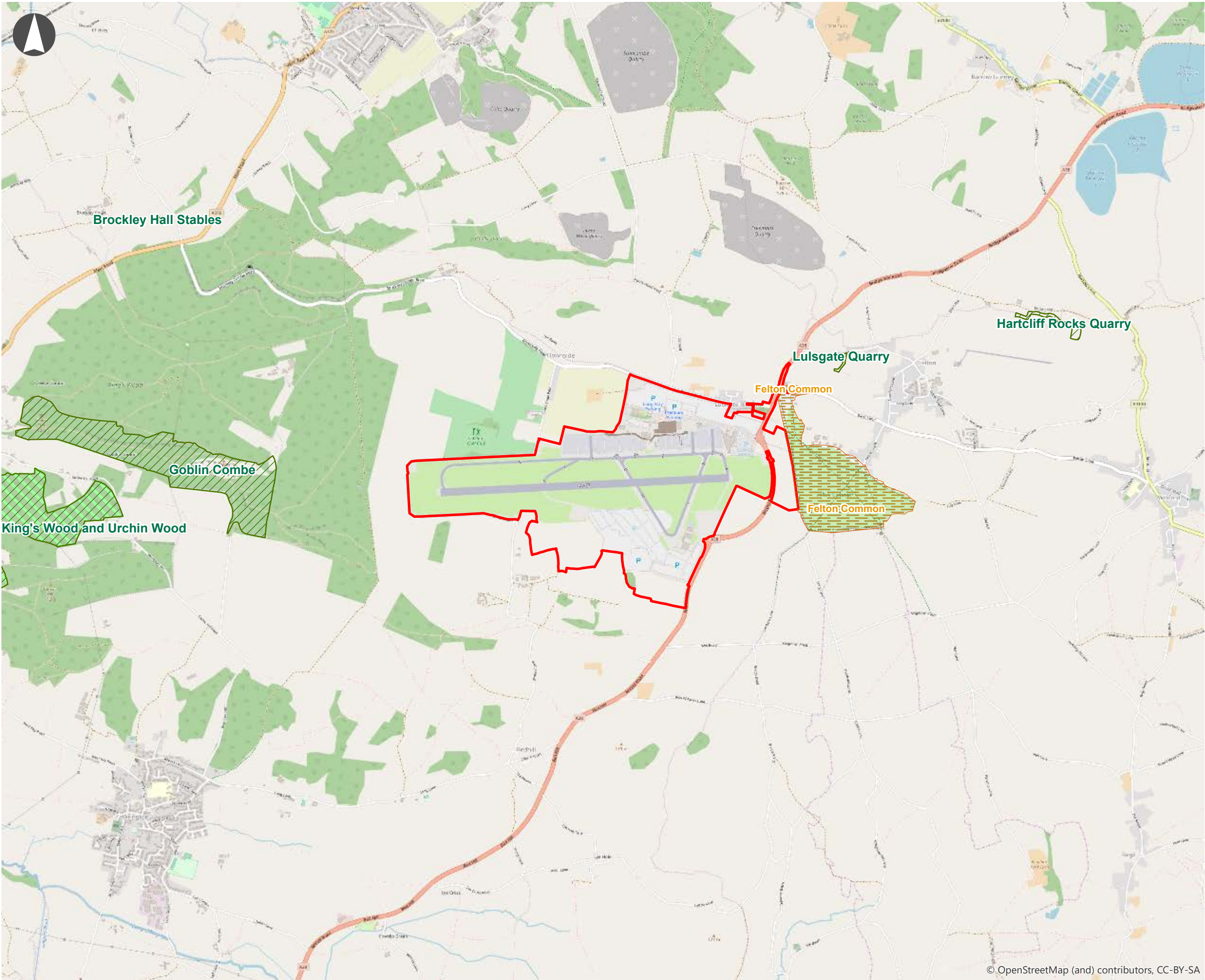
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APPENDIX A



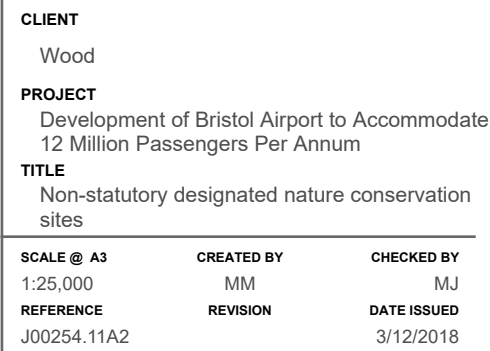
CLIENT
Wood




PROJECT
Development of Bristol Airport to Accommodate 12 Million Passengers Per Annum

TITLE
Statutory designated nature conservation sites

SCALE @ A3	CREATED BY	CHECKED BY
1:25,000	MM	MJ
REFERENCE	REVISION	DATE ISSUED
J00254.11A1		3/12/2018

- Planning Application Boundary
- Site of Special Scientific Interest
- Special Area of Conservation
- Local Nature Reserve



-  Planning Application Boundary
 Wildlife Trust Site
 Sites of Nature Conservation Interest (SNCI)

Appendix 11B

Technical Note: Updated Phase 1 Habitat Survey

WOOD

Development of Bristol Airport to Accommodate 12 Million Passengers Per Annum

Technical Note: Update Phase 1 Habitat Survey

1 INTRODUCTION

This report presents the results of an Extended Phase 1 Habitat survey undertaken during 2018 by Johns Associates in support of the 12mppa development proposals and planning application at Bristol Airport. It also provides a summary of historic Extended Phase 1 Habitat surveys (commencing in 2005 and other surveys completed that have been used to inform this and other ecological surveys carried out from 2005 and in 2018) carried out at Bristol Airport since 2005.

The planning application boundary is hereafter referred to as “the application site” and is illustrated on Figure 1 in Appendix A of this Technical Note.

An initial Extended Phase 1 Habitat Survey update (to previous surveys/outputs) was completed in March 2018 by ecologists employed by Johns Associates. The purpose was to support a preliminary ecological assessment of the 12mppa scheme and specifically to inform the proposed scope of detailed ecological surveys and investigations required to support the 12mppa planning application (alongside all historic information – see Section 3 below). This was summarised in Section 9 of the Scoping Report prepared by Wood (Wood, June 2018. Development of Bristol Airport to Accommodate 12 Million Passengers Per Annum) and submitted to North Somerset Council in support of a request for a formal Scoping Opinion relating to the Environmental Impact Assessment of the 12mppa planning application.

Information on the faunal elements was gathered during numerous visits to the Airport between April and October 2018 whilst undertaking a wide range of detailed Phase 2 ecological investigations.

Historically, the following faunal species have not been recorded (from surveys and incidental observations) between 2005 and 2018 within habitats associated with Bristol Airport:

- great crested newt;
- hazel dormouse;
- common reptiles.

A range of bat species are known to use features associated with the northern perimeter of Bristol Airport and Downside Road and the cattle grazed fields and southern perimeter features for foraging and commuting. Significant areas of Bristol Airport, (largely associated with the terminal building, areas used for car parking, airside operations and general aviation areas), support very little potential foraging/commuting habitats and are typically well-lit. Known roosts are limited to two artificial roosts in a woodland managed by Bristol Airport for nature conservation, located to the south of the southern long-stay parking facility, and an artificial roost located to the north west, near to Downside Road.

Badgers have previously been recorded at Bristol Airport, with separate clans associated with land in the north west of and south of the application site.

Common farmland, woodland and garden birds have previously been recorded, with the airfield grassland being managed for breeding skylark, whilst also having to comply strictly with CAA CAP772 Wildlife Hazard Management at Aerodromes.

Brown hare is regularly recorded using the airfield grassland and has also been observed using the Silver Zone Car Park.

Well-structured and suitable habitats that have the potential to support conservation notable species of invertebrates are typically limited at Bristol Airport because of the extensive areas of built, highly disturbed and well-lit infrastructure, the airfield grassland management regime required under CAP772, cattle grazing of species poor grassland to the south and the typically common nature of habitats, including in the wider local area.

A formal update to the botanical Phase 1 Habitat Survey of the application site was undertaken on the 18th and 19th July and 14th August 2018 by Jasmine Walters BSc(Hons) GradCIEEM of Johns Associates, also informed by detailed Phase 2 botanical surveys undertaken by Johns Associates in 2015 and 2016. The weather during the survey was dry and sunny with good visibility.

2 METHODOLOGY

2.1 PHASE 1 HABITAT SURVEY

Phase 1 Habitat Survey is the standardised system for classifying and mapping British Habitats (Handbook for Phase 1 Habitat survey – a technique for environmental audit (Joint Nature Conservancy Council, 2010)). The main output of this survey was an annotated habitat map and target notes together with descriptions of the recorded habitat types including a species list. All flora follow the nomenclature detailed in New Flora of the British Isles (3rd Edition) (Stace, 2010). Where appropriate, flora are given a descriptive score of abundance using the DAFOR scale, for which:

- D – Dominant
- A – Abundant
- F – Frequent
- O – Occasional
- R – Rare
- L – Locally (to be used as a prefix for any of the above)
- V – Very (to be used as a prefix for any of the above)

Legally protected and conservation notable species were recorded and the locations of any invasive species listed under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) and others were also mapped.

The survey benefited from the long history of ecological surveys undertaken at Bristol Airport, with notable survey effort commencing in 2005. As such, it could be considered that the 2018 survey provides a comprehensive update of historic surveys. Historic surveys are summarized in Section 3.

2.2 EXTENDED PHASE 1 HABITAT SURVEY

The Extended Phase 1 Habitat Survey is a modified approach to the Phase 1 Habitat Survey, extended for use in environmental assessment (Institute of Environmental Assessment, 1995¹) and is typical of the approach advocated by the Chartered Institute of Ecology and Environmental Management (CIEEM) in its Guidelines for Preliminary Ecological Assessment (December 2017). As such the survey included recording information associated with legally protected or conservation-notable faunal species that were directly observed, including: field signs, encountering animals and consideration of the suitability (or otherwise) of recorded habitats.

2.3 LIMITATIONS

This update was undertaken during a prolonged period of dry weather, potentially resulting in some plants being too dry to identify.

To minimise the limitations caused by these factors and to support the conclusions drawn in this assessment, survey data gathered during different times of year and during different weather conditions during previous surveys of the Site (since 2015) is also considered. As such, it is considered that an adequate update survey of the vegetation communities represented at Bristol Airport has been documented.

3 HISTORIC SURVEYS

A summary of historic ecological surveys completed at Bristol Airport and used to inform the update Extended Phase 1 Habitat Surveys carried out by Johns Associates in July and August 2018 is provided below.

A comprehensive Extended Phase 1 habitat survey was first completed in 2005 by Entec UK Ltd in support of planning application 09/P/1020/OT2. This was updated between 2005 and 2009 as part of the same planning application through the completion of Phase 2 faunal and botanical surveys (including NVC grassland, hedgerows, great crested newt, breeding bird, bats, reptiles, badger and dormouse).

Matt Johns BSc MSc CEnv MCIEEM FGS MIFM has been associated with all ecological surveys undertaken at Bristol Airport since 2005, therefore providing a significant level of continuity and knowledge of the ecological assets at Bristol Airport.

Johns Associates Ltd has been involved in the completion of ecological surveys at Bristol Airport since 2009. These have included:

- Surveys focusing on specific locations at Bristol Airport associated with localised development or operational works (including a small number of works requiring Natural England licences), together with monitoring implemented mitigation and enhancement associated with planning application 09/P/1020/OT2 since 2009;
- Extended Phase 1 Habitat Survey mapping updates across the airport in 2015 and 2016;
- Detailed Phase 2 grassland surveys associated with the main airfield in 2016, fields to the east of the A38 in 2015 and 2016, a small meadow off Downside Road, north of the north-east corner of Bristol Airport in 2015, the A38 cutting in 2015 and woodland owned by Bristol Airport located south of the Silver Zone Car Park in 2015;
- Hedgerow surveys carried out by Johns Associates in 2015 and 2017 and by Bristol Airport in 2016;

¹ Institute of Environmental Assessment (1996) Guidelines for Baseline Ecological Assessment. E and F.N. Spon.

- Dormouse surveys of relevant habitat in the south of the application site in 2015 and in the north of the application site in 2016;
- Reptile surveys in the north and east of the airfield in 2015 and 2017 and south of the airfield in 2015;
- Screening of buildings (and other artificial structures) and trees for their potential to support roosting bats in 2015 and 2016;
- Static bat detector and walking transect surveys in the northern parts of the application site in 2009 and south of the airfield in 2015, 2016 and 2017;
- Great crested newt surveys of all identified waterbodies within 500m of Bristol Airport in 2015;
- Badger surveys across the airport in 2013, 2015, 2016 and 2017, including a bait marking exercise associated with two clans located along the southern application site boundary in 2016;
- Incidental observations and records collected by Johns Associates including those associated with species listed above and birds and mammals (including brown hare), combined with regular records of bird and mammal presence and behavior collected daily by the Airport Safety Unit (ASU) to support the operational management work associated with aerodrome safeguarding and the strict requirements of CAA CAP772 Wildlife Hazard Management at Aerodromes (2017²).

4 RESULTS

4.1 SITE CONTEXT

Bristol Airport is located approximately 6km to the south west of the city of Bristol, adjacent to the A38, Bristol to Bridgewater Road and the suburbs of Withywood and Highridge. The Airport is situated on a ridge of high ground called Lulsgate Plateau. The area surrounding the airport is predominantly open rural undulating countryside with extensive woodland areas to the west and open farmland (typically grassland) and settlements to the north, east and south.

Bristol Airport itself is characterised by areas that are described as 'airside' and 'landside'. The airside components (i.e. those within the secure airfield fencing) are dominated by managed grasslands, areas of hard standing (taxiways, aprons, stands, access tracks, buildings and other airport infrastructure). The landside components are dominated by the terminal building and car parking to the north, with its circulation roads and other buildings, and the long-stay car parking areas to the south with associated buildings and circulation roads, (including other aviation related facilities), General Aviation hangers, apron and taxiways. These areas are typically well-lit. To the north, west and east the perimeter of Bristol Airport is adjacent to operational areas including the northside car park and roads and airside taxiways and runway terminus. These are typically darker, comprising grassland, hedgerows, and small areas of linear woodland. Land along the very southern boundary of Bristol Airport includes two cattle grazed fields with small areas of trees and scrub, a woodland and boundary features characterised by mature hedgerows and hedgerow trees.

4.2 HABITATS WITHIN AIRPORT LANDHOLDING

Appendix B contains the Phase 1 Habitat maps (Figures 2a to k) and target notes from the 2018 update surveys. Appendix C contains results from the Phase 2 botanical surveys completed in key areas at Bristol Airport in 2015 and 2016, which have also been used to inform the 2018 habitat surveys.

² Civil Aviation Authority. 2017. CAP 772 Wildlife Hazard Management at Aerodromes.

A total of 18 habitat types were recorded (not all within the land ownership boundary of Bristol Airport) during the course of the surveys. These are described in turn below.

4.2.1 Earth Bank

A number of soil bunds are present within the working area of the airport, denoted by target notes 5, 7, 8, 9, 10 & 11. Bunds generally have steeply sloping faces and a flat top, reaching up to 5m in height, such as the bund shown in

Plate 1. A range of vegetation types have become established, and are described below under the headings 'Broadleaf scattered trees', 'tall ruderal' and 'poor semi-improved grassland'.

A single earth bank is located within the development footprint between the Silver Zone Seasonal Car Park (Phase 1) and the Proposed Extension to the Silver Zone Car Park (Phase 2) areas (highlighted by Target Note 5).



Plate 1 Bund located at target note 5, supporting planted broadleaf trees and tall ruderal vegetation

4.2.2 Ephemeral / Short Perennial Vegetation

Small areas of ephemeral/short perennial vegetation are present within infrequently used car parking areas. Species present are common and typical of disturbed conditions, such as mayweed spp. *Matricaria* sp., ox-eye daisy *Leucanthemum vulgare*, silverweed *Potentilla anserina*, greater plantain *Plantago major*, ribwort plantain *Plantago lanceolata*, bristly ox-tongue *Picris echioides*, spear thistle *Cirsium vulgare* and curled dock *Rumex crispus*.

A small area of this habitat is associated with the proposed taxiway widening and fillets.

The majority of the airside grassland comprised poor semi-improved grassland at the time of survey in 2016, however several small areas of gravel or disused tarmac were developing an open species-rich grassland sward. Species recorded in these areas are listed in Table 1 below. Frequent species include glaucous sedge *Carex flacca*, fairy flax *Linum catharticum*, wild carrot *Daucus carota*, and upright brome. Such species are suggestive of a low nutrient, free draining calcareous substrate.

Table 1 Species and their abundance present within ephemeral/short perennial vegetation establishing upon airside gravel/tarmac

Scientific name	English name	DAFOR
<i>Achillea millefolium</i>	Yarrow	O
<i>Bromopsis erecta</i>	Upright brome	F
<i>Carex flacca</i>	Glaucous sedge	F

Scientific name	English name	DAFOR
Catapodium rigidum	Fern-grass	O
Centaureum erythraea	Common centaury	O
Cerastium glomeratum	Sticky mouse-ear	O
Daucus carota	Wild carrot	F
Erigeron acris	Blue fleabane	F
Festuca ovina	Sheep's fescue	F
Galium verum	Lady's bedstraw	O
Glechoma hederacea	Ground ivy	O
Hypochaeris radicata	Common cat's-ear	O
Leucanthemum vulgare	Oxeye daisy	O
Linum catharticum	Fairy flax	LF
Lotus corniculatus	Common bird's-foot trefoil	LF
Ranunculus bulbosus	Bulbous buttercup	R
Scorzonoides autumnalis	Autumn hawkbit	LF
Tripleurospermum inodorum	Scentless mayweed	LF

4.2.3 Amenity Grassland

Amenity grassland exists as small areas with closely managed swards within car parks or roadsides. The sward is regularly cut to a height of 5cm. Species diversity is largely limited to frequent perennial rye-grass *Lolium perenne*, cock's-foot *Dactylis glomerata*, dandelion *Taraxacum officinale* agg., white clover *Trifolium repens*, creeping cinquefoil *Potentilla reptans* and greater plantain (see Plate 2). Areas denoted by target note 17 (associated with the canopies to the front of the existing terminal, multi-storey car park and new gyratory road with surface car parking within the development footprint) support areas of grassland managed as an amenity sward but with a greater species diversity, alongside the constant species listed above. Such areas often merge into areas of more species-poor amenity grassland. Additional species present at target note 17 are listed within Table 2.

Table 2 Species and their abundance which occur in more species diverse areas of amenity grassland, additional to constant species. Such areas are denoted by target note 17.

Scientific name	English name	DAFOR
Achillea millefolium	Yarrow	F
Potentilla anserina	Silverweed	LF
Plantago lanceolata	Ribwort plantain	F
Leontodon hispidus	Rough hawkbit	LF
Succisa pratensis	Devil's-bit scabious	R
Ranunculus repens	Creeping buttercup	F
Trifolium pratense	Red clover	LO
Daucus carota	Wild carrot	LO
Festuca rubra	Red fescue	LF
Prunella vulgaris	Self-heal	LA
Rumex acetosa	Common sorrel	R
Linum catharticum	Fairy flax	R
Carex hirta	Hairy sedge	LO
Leucanthemum vulgare	Ox-eye daisy	LF
Centaurea nigra	Black knapweed	R
Lotus pedunculatus	Common bird's-foot trefoil	LF
Glechoma hederacea	Ground ivy	LO

Scientific name	English name	DAFOR
<i>Holcus lanatus</i>	Yorkshire fog	F
<i>Agrostis stolonifera</i>	Creeping bent	F



Plate 2 Amenity grassland

4.2.4 Improved Grassland

The Silver Zone seasonal car park supports a seeded improved grassland sward, denoted by target note 3. The area is used to accommodate parked cars, with seeded grassland established within reinforced grids. At the time of survey, perennial rye-grass was the most abundant species, with a large proportion of bare ground at the base of the sparse sward. Annual forb species have colonised bare ground in places (see Plate 3).



Plate 3 Improved grassland off site

4.2.5 Poor Semi-Improved Grassland

Airside

At the time a detailed Phase 2 botanical survey was completed in 2016, the airside grassland comprised a closed sward at a height of 20-30cm with no significant thatch or leaf litter present, and conditions were similar in 2018. The majority of the airside grassland comprised poor semi-improved grassland, within which two sub-communities are considered to be present; neutral poor semi-improved and calcareous poor semi-improved grassland.

The neutral grassland community was dominated by grasses including false oat-grass *Arrhenatherum elatius* and cock's-foot with locally frequent common bent *Agrostis capillaris*, Yorkshire fog *Holcus lanatus*, red fescue *Festuca rubra* and tall fescue *Schedonurus arundinaceus*. A small number of common forb species were recorded, as shown in Table 3 below, but none were recorded as more than occasional in the sward. Examples include dandelion, common mouse-ear *Cerastium fontanum*, field bindweed *Convolvulus arvensis* and ribwort plantain. It should be noted that species diversity was variable in different compartments, ranging from virtually no forb species to a sward supporting most forb species in Table 3 (albeit as occasional). This grassland is associated with the taxiway widening and fillets, taxiway widening and fillets (taxiway ALPHA) and east taxiway within the application site.

Some of the large airfield compartments supported similar species to those listed in Table 3 but with frequent upright brome *Bromopsis erecta* and occasional greater knapweed *Centaurea scabiosa*, bulbous buttercup *Ranunculus bulbosus*, and wild carrot *Daucus carota*. Upright brome in particular is a key indicator of calcareous grassland; and these areas should be classified as semi-improved calcareous grassland (albeit species-poor). Such areas noted as having upright brome prominent in the sward are denoted by target note 6. No attempt has been made to define the boundaries between species-poor semi-improved neutral and calcareous grassland as it is impossible to do this by eye given the recent vegetation management. In practice, there are likely to be transitions or zonations between neutral and calcareous vegetation types within the airfield grassland.

Management of the grassland is driven by the overriding safety need to avoid and minimise the risk of bird strike through minimising foraging resources for birds. It is understood that grassland on the airfield is regularly cut to a height of 8 inches at a frequency of 3 to 4 times a year, when flowering heads appear at roughly 10 inches; the arisings are removed. Fertiliser is occasionally applied to the grassland. Blast-furnace slag was applied to the grassland as agricultural liming material approximately 16 to 18 years ago, and it is understood that granulated lime is periodically applied.

Table 3 Species and their abundance within species poor semi-improved neutral grassland within the airside grassland

Scientific name	English name	DAFOR
<i>Achillea millefolium</i>	Yarrow	O
<i>Agrostis capillaris</i>	Common bent	LF
<i>Arrhenatherum elatius</i>	False oat-grass	F
<i>Cerastium fontanum</i>	Common mouse-ear	O
<i>Convolvulus arvensis</i>	Field bindweed	O
<i>Crepis capillaris</i>	Smooth hawk's-beard	R
<i>Dactylis glomerata</i>	Cock's-foot	F
<i>Festuca rubra</i>	Red fescue	LF
<i>Geranium molle</i>	Dove's-foot crane's-bill	O
<i>Heracleum sphondylium</i>	Hogweed	O
<i>Holcus lanatus</i>	Yorkshire fog	LF
<i>Lathyrus pratensis</i>	Meadow vetchling	R
<i>Lolium perenne</i>	Perennial rye-grass	O
<i>Plantago lanceolata</i>	Ribwort plantain	O
<i>Potentilla reptans</i>	Creeping cinquefoil	O

Scientific name	English name	DAFOR
<i>Ranunculus acris</i>	Meadow buttercup	O
<i>Ranunculus repens</i>	Creeping buttercup	O
<i>Rubus fruticosus</i> agg.	Bramble	R
<i>Rumex acetosa</i>	Sorrel	O
<i>Rumex crispus</i>	Curled dock	O
<i>Rumex obtusifolius</i>	Broad-leaved dock	O
<i>Schedonurus arundinaceus</i>	Tall fescue	LF
<i>Stellaria graminea</i>	Lesser stitchwort	O
<i>Taraxacum</i> agg.	Dandelion	O
<i>Trifolium pratense</i>	Red clover	O
<i>Urtica dioica</i>	Nettle	R
<i>Vicia cracca</i>	Tufted vetch	O

Proposed Extension to the Silver Zone Car Park (Phase 2) & Cornerpool

Poor semi-improved grassland covers fields located towards the south of the airport landholding, comprising the Proposed Extension to the Silver Zone Car Park (Phase 2) and Cornerpool (outside of the application site), which are managed through grazing. This habitat type is also present as small pockets of un-intensively managed grassland across the main working area of Bristol Airport.

The Proposed Extension to the Silver Zone Car Park (Phase 2) and the narrow fields located adjacent to the southern boundary of the field are denoted by target note 1. The majority of this area comprises poor semi-improved grassland, grazed by cattle. Frequent grass species include perennial rye grass, creeping bent *Agrostis stolonifera*, Yorkshire fog, cock's-foot and timothy *Phleum pratense*. Crested dog's-tail *Cynosurus cristatus* occurs at locally frequent abundance. Forb species are limited in abundance, and comprise ruderal species which are typical of nutrient enriched disturbed soils. Stands of creeping thistle *Cirsium arvense* are locally abundant, indicating a high intensity of grazing. Heavily poached ground, particularly to the west of the field, is also indicative of a high grazing intensity. Stands of nettle *Urtica dioica* and hogweed *Heracleum sphondylium* are locally abundant where cattle tend to congregate and deposit high volumes of manure, such as within the vicinity of the water trough. Spear thistle and woolly thistle *Cirsium eriophorum* occur at occasional abundance across the field, the latter of which also indicates calcareous soils. Other locally occasional forb species include greater plantain, yarrow *Achillea millefolium*, dandelion, common ragwort *Senecio jacobaea*, creeping buttercup *Ranunculus repens*, white clover *Trifolium repens*, dock and silverweed. The sward length at the time of survey was approximately 15cm and closed, with taller localised stands of thistles. There is no presence of a thatch layer at the base of the sward.

Cornerpool comprises a similar grassland sward species composition, sward physiognomy and management regime.

Table 4 Species and their abundance within species poor semi-improved neutral grassland within Cogloop 2

Common Name	Species Name	Abundance (DAFOR)
Perennial rye-grass	<i>Lolium perenne</i>	F
Creeping bent	<i>Agrostis stolonifera</i>	F
Yorkshire fog	<i>Holcus lanatus</i>	F
Cock's-foot	<i>Dactylis glomerata</i>	F
Timothy	<i>Phleum pratense</i>	F
Crested dog's-tail	<i>Cynosurus cristatus</i>	LF

Common Name	Species Name	Abundance (DAFOR)
Creeping thistle	<i>Cirsium arvense</i>	LA
Common nettle	<i>Urtica dioica</i>	LA
Hogweed	<i>Heracleum sphondylium</i>	LA
Spear thistle	<i>Cirsium vulgare</i>	O
Woolly thistle	<i>Cirsium eriophorum</i>	O
Creeping buttercup	<i>Ranunculus repens</i>	LO
White clover	<i>Trifolium repens</i>	LO
Greater plantain	<i>Plantago major</i>	LO
Yarrow	<i>Achillea millefolium</i>	LO
Dandelion	<i>Taraxacum officinale</i> agg.	LO
Common ragwort	<i>Senecio jacobaea</i>	LO
Silverweed	<i>Potentilla anserina</i>	LO
Dock	<i>Rumex</i> sp.	LO



Plate 4 Cattle grazed poor semi-improved grassland

Small Pockets

Poor semi-improved grassland is located as small pockets of un-intensively managed grassland across Bristol Airport, such as within car parking areas, at the newly constructed fire station and on bunds outside the application area.

Poor semi-improved swards established on bunds, such as the bund denoted by target notes 8 and 9, comprise abundant perennial rye grass, locally abundant self-heal *Prunella vulgaris*, and occasional ruderal species such as bristly ox-tongue, ox-eye daisy, dock *Rumex* sp. and spear thistle. Such pockets of poor semi-improved grassland are largely managed infrequently, with sward heights reaching up to 40cm in some places. Management is carried out through cutting.

Poor semi-improved grassland denoted by target note 15, east of the Admin Building outside of the development footprint, appears to receive no significant management. The lack of cutting has resulted in establishment of frequent bramble *Rubus fruticosus* agg. across the grassland sward, which is closed in character at a height of 40cm, and has a thatch layer of accumulated litter at the base. Anthills have established at the east of the habitat; this has been made possible through the lack of cutting. False-oat grass is abundant within the habitat, alongside frequent cock's-foot, red

fescue, creeping thistle and bramble. Ox-eye daisy occurs at locally frequent abundance, and forb species such as teasel *Dipsacus fullonum*, hogweed *Heracleum sphondylium*, ribwort plantain and self-heal occur at occasional abundance.

Table 5 Species and their abundance within poor semi-improved grassland located east of the Admin Building

Common Name	Species Name	Abundance (DAFOR)
False-oat grass	<i>Arrhenatherum elatius</i>	LA
Cock's-foot	<i>Dactylis glomerata</i>	F
Red fescue	<i>Festuca rubra</i>	F
Creeping thistle	<i>Cirsium arvense</i>	F
Bramble	<i>Rubus fruticosus</i>	F
Ox-eye daisy	<i>Leucanthemum vulgare</i>	LF
Yorkshire fog	<i>Holcus lanatus</i>	O
Dogwood	<i>Cornus sanguinea</i>	O
Teasel	<i>Dipsacus fullonum</i>	O
Hogweed	<i>Heracleum sphondylium</i>	O
Ground ivy	<i>Glechoma hederacea</i>	O
Ribwort plantain	<i>Plantago lanceolata</i>	O
Self-heal	<i>Prunella vulgaris</i>	O
Black knapweed	<i>Centaurea nigra</i>	R
Lords and ladies	<i>Arum maculatum</i>	R
Common ragwort	<i>Senecio jacobaea</i>	R



Plate 5 Small area of poor semi-improved grassland

4.2.6 Good Semi-Improved Grassland (Calcareous)

Airside

At the time of Phase 2 botanical survey in 2016 (see Appendix C) and during the re-survey in 2018, the airside grassland comprised a closed sward at a height of 20-30cm with no significant thatch or leaf litter present and similar conditions were noted in 2018. The majority of the airside grassland comprised poor semi-improved grassland, however a few small areas within the airside grassland supported a more species-rich calcareous grassland (albeit still semi-improved). These areas are outside of the application site. Frequent upright brome is indicative of calcareous grassland. Species

indicative of less improved calcareous conditions include downy oat-grass *Avenula pubescens*, quaking-grass *Briza media*, greater knapweed, wild basil *Clinopodium vulgare*, common spotted orchid *Dactylorhiza fuchsii*, rough hawkbit *Leontodon hispidus*, fairy flax *Linum catharticum* and cowslip *Primula veris*. The grassland cannot be classified as unimproved since most of these indicator forb species are only recorded as occasional in the sward as the vegetation is dominated by grass species, and other characteristic species that would indicate grassland with high species diversity (e.g. crested hair-grass *Koeleria macrantha*, wild thyme *Thymus polytrichus*, milkwort *Polygala* sp etc), are absent.

General management of airside grassland is described within the habitat description for poor semi-improved grassland. In addition to these practices, carefully tailored management for species-rich calcareous grassland is applied where possible to areas of habitat at the west of the airside area. These areas are not fertilised and are cut at the end of the flowering season.

Table 6 Species and their abundance within good semi-improved calcareous grassland located within airside grassland

Scientific name	English name	DAFOR
<i>Achillea millefolium</i>	Yarrow	O
<i>Agrostis capillaris</i>	Common bent	LF
<i>Arrhenatherum elatius</i>	False oat-grass	F
<i>Avenula pubescens</i>	Downy oat-grass	O
<i>Briza media</i>	Quaking-grass	O
<i>Bromopsis erecta</i>	Upright brome	F
<i>Centaurea nigra</i>	Black knapweed	O
<i>Centaurea scabiosa</i>	Greater knapweed	O
<i>Cerastium fontanum</i>	Common mouse-ear	O
<i>Clinopodium vulgare</i>	Wild basil	R
<i>Convolvulus arvensis</i>	Field bindweed	O
<i>Crepis capillaris</i>	Smooth hawk's-beard	R
<i>Dactylis glomerata</i>	Cock's-foot	O
<i>Dactylorhiza fuchsii</i>	Common spotted orchid	
<i>Daucus carota</i>	Wild carrot	O
<i>Festuca rubra</i>	Red fescue	LF
<i>Galium album</i>	Hedge bedstraw	O
<i>Galium verum</i>	Lady's bedstraw	O
<i>Glechoma hederacea</i>	Ground ivy	O
<i>Holcus lanatus</i>	Yorkshire fog	O
<i>Knautia arvensis</i>	Field scabious	R
<i>Lathyrus pratensis</i>	Meadow vetchling	O
<i>Leontodon hispidus</i>	Rough hawkbit	LF
<i>Leucanthemum vulgare</i>	Oxeye daisy	O
<i>Linum catharticum</i>	Fairy flax	LF
<i>Lolium perenne</i>	Perennial rye-grass	O
<i>Lotus corniculatus</i>	Common bird's-foot trefoil	O
<i>Medicago lupulina</i>	Black medick	O
<i>Plantago lanceolata</i>	Ribwort plantain	O
<i>Potentilla reptans</i>	Creeping cinquefoil	O
<i>Primula veris</i>	Cowslip	O
<i>Ranunculus acris</i>	Meadow buttercup	LF
<i>Ranunculus bulbosus</i>	Bulbous buttercup	O
<i>Rhytiadelphus squarrosus</i>	Springy turf-moss	O

Scientific name	English name	DAFOR
<i>Rubus fruticosus</i> agg.	Bramble	R
<i>Taraxacum</i> agg.	Dandelion	O
<i>Trifolium pratense</i>	Red clover	O
<i>Vicia cracca</i>	Tufted vetch	O
<i>Vicia sativa</i>	Common vetch	O
<i>Vicia sepium</i>	Bush vetch	O

A38 Cutting

The A38 roadside cutting (outside the application site) has resulted in an exposed calcareous substrate upon which a calcareous semi-improved grassland has established, as shown in Plate 6. Typically, the sward has an even grass : forb ratio, with a height of 25cm. Some areas of the cutting consist of stony sloped ground, with a very sparse sward dominated by forb species and a high proportion of bare ground. Management of the cutting appears to be infrequent, with only the flatter areas of the slope being topped and arisings left in place. A moderate thatch layer has accumulated upon flat ground as a result. The species composition of the sward is similar to that of the airside grassland presented in Table 6. Upright brome occurs abundantly in local patches, alongside other occasional or frequent grass species such as quaking grass, crested dog's-tail, cock's-foot and creeping bent. Occasional to frequent forb species include fairy flax, field scabious *Knautia arvensis*, common bird's-foot trefoil *Lotus corniculatus* and rough hawkbit. No orchids were observed within the sward. A small element of scattered scrub is present within the habitat, with rare occurrence of wayfaring tree *Viburnum lantana*.



Plate 6 Good semi-improved calcareous grassland located at A38 road cutting



Plate 7 Small blue butterfly observed within good semi-improved calcareous grassland

4.2.7 Good Semi-Improved Grassland (Neutral)

A small area within the Proposed Extension to the Silver Zone Car Park (Phase 2), denoted by target note 2, comprised good semi-improved neutral grassland, with forb species which may indicate slightly calcareous soils. The more species-rich sward is located on a shallow sloping bank at the west boundary of the field, which is likely to have established on soils with a lower nutrient content. The sward is very closely grazed on the slope (approximate height of 5cm), and consists of a greater cover of forb species which are typical of less nutrient enriched soils than in the wider area of poor semi-improved grassland within the Proposed Extension to the Silver Zone Car Park (Phase 2). Mouse-ear hawkweed *Pilosella officinalis* occurs in small locally abundant stands. Locally frequent forb/sedge species include spring sedge *Carex caryophyllea*, bird's-foot trefoil, and creeping cinquefoil. Rare and occasional forb species include self-heal, rough hawkbit, common ragwort, autumn hawkbit *Scorzoneroideis autumnalis*, and lady's bedstraw *Galium verum*. A greater number of finer leaved grass species are present within the sward than the surrounding poor semi-improved grassland, including frequent crested dog's-tail and sweet vernal-grass *Anthoxanthum odoratum* and occasional perennial ryegrass, cock's-foot and rough meadow-grass *Poa trivialis*.

Cornerpool field (outside the application site) predominantly comprises poor semi-improved grassland, however, small earthworks scattered across the field support pockets of a more diverse plant community, classified as good semi-improved grassland and denoted by target note 4. The soil situated on such earthworks is likely to be shallower and less nutrient-rich, allowing non-competitive species to establish. Forb and sedge species present include occasional salad burnet *Poterium sanguisorba*, rough hawk-bit, black medick *Medicago lupulina*, mouse-ear hawkweed, glaucous sedge *Carex flacca*, hoary plantain *Plantago media*, lady's bedstraw, common bird's-foot trefoil and red clover *Trifolium pratense*. Fescue *Festuca* sp. and crested dog's-tail are frequent grass species present within the sward.

Table 7 Species and their abundance within short turf good semi-improved grassland located in Cogloop 2

Common Name	Species Name	Abundance (DAFOR)
Mouse-ear hawkweed	<i>Pilosella officinalis</i>	VLA
Spring sedge	<i>Carex caryophyllea</i> ,	LF
Common bird's-foot trefoil	<i>Lotus corniculatus</i>	LF
Creeping cinquefoil	<i>Potentilla reptans</i>	LF
Self-heal	<i>Prunella vulgaris</i>	O
Rough hawkbit	<i>Leontodon hispidus</i>	O
Common ragwort	<i>Senecio jacobaea</i>	O
Autumn hawkbit	<i>Scorzoneroideis autumnalis</i>	O
Lady's bedstraw	<i>Galium verum</i>	O

Common Name	Species Name	Abundance (DAFOR)
Crested dog's-tail	<i>Cynosurus cristatus</i>	F
Sweet vernal-grass	<i>Anthoxanthum odoratum</i>	F
Rough meadow-grass	<i>Poa trivialis</i>	O
Perennial rye-grass	<i>Lolium perenne</i>	O
Cock's-foot	<i>Dactylis glomerata</i>	O
Salad burnet	<i>Poterium sanguisorba</i>	O
Glaucous sedge	<i>Carex flacca</i>	O
Hoary plantain	<i>Plantago media</i>	O
Black medick	<i>Medicago lupulina</i>	O
Fescue	<i>Festuca</i> sp.	F
Red clover	<i>Trifolium pratense</i>	O
Common sorrel	<i>Rumex acetosella</i>	LF



Plate 8 Good semi-improved grassland located upon small earthworks within Cornerpool field

Downside Meadows (outside the application site), comprises a tall (up to 1m) and tussocky semi-improved sward with no recent signs of management, resulting in a significant litter layer. The predominant species in the sward at frequent abundance included false oat-grass, cock's-foot, Yorkshire fog and red fescue. Grass species present at occasional abundance included tall fescue, sweet vernal grass, common bent and upright brome. Common couch *Elymus repens* is present in locally frequent patches. Along the southern boundary, the grassland grades into a stand of tall ruderal vegetation through lack of management, dominated by hogweed and nettle *Urtica dioica*. Frequent or locally frequent forb species include black knapweed *Centaurea nigra*, common sorrel *Rumex acetosa*, meadow vetchling *Lathyrus pratensis* and field bindweed. Occasional species include ribwort plantain, meadow buttercup *Ranunculus acris*, and common ragwort. Rare forb species include bush vetch *Vicia sepium* and betony *Stachys officinalis*.

Table 8 Species and their abundance within good semi-improved grassland at Downside Meadows

Scientific name	English name	DAFOR
<i>Arrhenatherum elatius</i>	False oat-grass	F
<i>Dactylis glomerata</i>	Cock's-foot	F
<i>Holcus lanatus</i>	Yorkshire fog	F
<i>Festuca rubra</i>	Red fescue	F
<i>Elytrigia repens</i>	Common couch	LF

Scientific name	English name	DAFOR
<i>Agrostis capillaris</i>	Common bent	O
<i>Anthoxanthum odoratum</i>	Sweet vernal-grass	O
<i>Bromopsis erecta</i>	Upright brome	O
<i>Schedonorus arundinacea</i>	Tall fescue	O
<i>Heracleum sphondylium</i>	Hogweed	F
<i>Urtica dioica</i>	Common nettle	LF
<i>Centaurea nigra</i>	Common knapweed	F
<i>Convolvulus arvensis</i>	Field bindweed	F
<i>Rumex acetosa</i>	Sorrel	F
<i>Lathyrus pratensis</i>	Meadow vetchling	LF
<i>Rumex crispus</i>	Curled dock	LF
<i>Plantago lanceolata</i>	Ribwort plantain	O
<i>Achillea millefolium</i>	Yarrow	O
<i>Cirsium arvense</i>	Creeping thistle	O
<i>Anthriscus sylvestris</i>	Cow parsley	O
<i>Ranunculus acris</i>	Meadow buttercup	O
<i>Senecio jacobaea</i>	Common ragwort	O
<i>Potentilla anserina</i>	Silverweed	R
<i>Vicia sepium</i>	Bush vetch	R
<i>Stachys officinalis</i>	Betony	R

4.2.8 Tall Ruderal

This habitat type is typically dominated by common and widespread species such as common nettle, hogweed and creeping thistle. Tall ruderal vegetation is typically found within recently disturbed soil, such as soil bunds and within less frequently managed areas of habitat, such as in association with scrub, woodland and unmanaged grassland.

Soil bunds and banks situated at the south of Bristol Airport and within car park areas, are denoted by target notes 5 (between the Silver Zone seasonal car park [Phase 1] and the Proposed Extension to the Silver Zone Car Park [Phase 2]), 7, 10 & 11. The bunds support a similar assemblage of tall ruderal vegetation beneath young planted broadleaf trees. Species present include woolly thistle, spear thistle, creeping cinquefoil, ribwort plantain and common ragwort. Competitive grass species are present at occasional to frequent abundance, but the bunds are considered to be predominantly covered by ruderal forb species.

An area of habitat mosaic is denoted by target note 15, within which tall ruderal vegetation forms an increasingly larger part through lack of regular cutting of the grassland habitat. Creeping thistle and nettle are abundant species, with occasional common ragwort and teasel also present.



Plate 9 Bund covered by tall ruderal vegetation and young broadleaf trees

4.2.9 Scattered Scrub

Scattered and continuous scrub is present throughout Bristol Airport, usually associated with infrequently managed grassland, grazed grassland and soil bunds. Typical species comprise frequent bramble and occasional elder *Sambucus nigra*.



Plate 10 Scattered scrub occurring at the base of a tree belt

4.2.10 Dense Scrub

The Proposed Extension to the Silver Zone Car Park (Phase 2) and Cornerpool field (outside the application site) have small thickets of dense scrub established within the open field grassland habitat. Woody species present include frequent hawthorn *Crataegus monogyna*, blackthorn *Prunus spinosa*, elder and bramble. Dense scrub reaches up to 4m in places, with the tallest hawthorn scrub opened up at the base by cattle to form a canopy. Stands of nettle are present at the base of dense scrub thickets.

Within the area of habitat mosaic denoted by target note 15, dense scrub is predominantly composed of hazel, bramble and elder. Following recent management, the stands of dense scrub stand at 0.5 - 1m in height within this area.



Plate 11 Dense thickets of scrub located within Cogloop 2 field

4.2.11 Introduced Shrub

Customer facing areas of Bristol Airport, such as road sides and within car parks, are frequently subject to shrub planting. Species planted include dogwood *Cornus sanguinea*, wayfaring tree *Viburnum lantana*, rhododendron, rock rose *Cistus sp.*, and holly *Ilex aquifolium*. Shrubs are closely managed and occasionally planted with herbaceous perennials at the base, such as lavender *Lavandula sp.*



Plate 12 Introduced shrubs planted at the edges of roads within the airport

4.2.12 Species-Rich Defunct/Intact Hedgerow

Species-rich hedgerows support a diverse number of woody species. Woody species recorded within all hedgerows within the Site are listed in

Table 10, alongside a general level of abundance representative of all hedgerows across the Site.

Species-rich hedgerows are largely concentrated towards the north west, south and east of Bristol Airport, where the boundary lies adjacent to agricultural land (for example, the Silver Zone seasonal car park [Phase 1] and the Proposed Extension to the Silver Zone Car Park [Phase 2]) and changes to land use have been less numerous. Hedgerows recorded

at or within the boundary of the Site are described further within Table 9. Hedgerows previously classified as important have retained their hedgerow reference number within this survey.

Hedgerows are managed at varying degrees of intensity. Hedgerows located near the runway are managed intensively to a low height for safety purposes. Hedgerows located within car parks at the north of the Site are managed regularly for amenity purposes. Other hedgerows receive very little management, and are outgrown and defunct. All management is carried out through flailing.



Plate 13 Species-rich intact hedge

4.2.13 Species-poor Defunct/Intact Hedgerow

Species-poor hedgerows are generally similar in species composition to species-rich hedgerows, albeit supporting a more limited number of woody species listed in

Table 10. Woody species recorded within all hedgerows within the Site are listed in

Table 10, alongside a general level of abundance representative of all hedgerows within the Site.

Species-poor hedgerows were located in car parking areas (including the multi-storey car park) but were predominantly recorded in the north west, south and east of the application site, where the boundary lies adjacent to agricultural land and changes to land use have been less numerous. Hedgerows recorded at or within the boundary of the Site are described further within Table 9 and are displayed on Figure 2a-k in Appendix A.



Plate 14 Defunct species-poor hedgerow

Table 9 Classification and description of hedgerows situated upon or within the boundary of the application site

Hedgerow Reference Number	Within the development footprint?	Classification	Hedgerow Description
H1	NO	Defunct species-rich	Mature defunct hedgerow with semi-mature trees, located on top of a steep south-facing bank. Woody species included hazel <i>Corylus avellana</i> , holly, hawthorn, ash <i>Fraxinus excelsior</i> , hornbeam <i>Carpinus betulus</i> , blackthorn <i>Prunus spinosa</i> . Ground flora included cock's-foot, dog's-mercury <i>Mercurialis perennis</i> , false-oat grass, ground ivy <i>Glechoma hederacea</i> , germander speedwell <i>Veronica chamaedrys</i> , herb-robert <i>Geranium robertianum</i> common nettle, bramble, wood-mellick <i>Melica uniflora</i> , creeping cinquefoil, cleavers <i>Galium aparine</i> , agrimony <i>Agrimonia eupatoria</i> , daisy <i>Bellis perennis</i> , common ragwort, celandine <i>Ranunculus ficaria</i> , lord's-and-ladies <i>Arum maculatum</i> , primrose <i>Primula vulgaris</i> and bluebell <i>Hyacinthoides non-scripta</i> . Some mature hazel and ash coppice stools present. Small wooded copse adjacent to western extent of hedge.
H2	NO	Defunct species-rich	Defunct outgrown hedgerow with a sunken wide ditch/double track adjacent to the east (now occupied by dense scrub/mixed plantation broadleaved woodland). Woody species include hawthorn, ash, hazel (including old coppice stools) and blackthorn.
H3	NO	Intact species-rich	Defunct outgrown hedgerow. Woody species included hawthorn, ash, hazel (including old coppice stools) and blackthorn. Current management by flailing, to an approximate height of 4-5m.
H7	NO	Defunct species-poor	Two parallel outgrown hedgerows, dominated by veteran field maple <i>Acer campestre</i> growing on small raised banks. The canopy of the field maple reaches approximately 10m in height. A sunken track is now occupied by poor semi-improved grassland and scrub.

Hedgerow Reference Number	Within the development footprint?	Classification	Hedgerow Description
H9	NO	Defunct species-rich	Hedgerow with an un-diverse ground flora and defunct structure, but with presence of woody species such as hazel, hawthorn and blackthorn. Current management through flailing, although this is un-intensive. An approximate height of 4m and width of 1m is maintained.
H12	YES	Intact species-rich	Hedgerows situated on a small bank, with remains of an old degraded dry-stone wall present at the base of some hedges. Un-diverse ground flora is present, although a diversity of woody species was noted, including; hazel, blackthorn, hawthorn, ash, holly and field maple. Evidence of past management by hedge laying and coppicing evident. Current management through flailing, although this is un-intensive. An approximate height of 4m and width of 1m is maintained.
H4, H5, H6, H8, H10, H11, H13, H14	NO	Intact species-rich	Hedgerows situated on a small bank, with remains of an old degraded dry-stone wall present at the base of some hedges. Un-diverse ground flora is present, although a diversity of woody species was noted, including; hazel, blackthorn, hawthorn, ash, holly and field maple. Evidence of past management by hedge laying and coppicing evident. Current management through flailing, although this is un-intensive. An approximate height of 4m and width of 1m is maintained.
H15	NO	Defunct species-rich	The southern section of this hedge is in better condition than the northern section due to a less intensive management regime. The northern section, directly adjacent to the airfield, is managed intensively at an unusually low height of 1m due to safety requirements of the functioning airport. The southern section is outgrown to a height of 4m. Diversity of woody species is limited to hawthorn, blackthorn, elder and ash.
H16	NO	Defunct species-rich	Species present include wild privet <i>Ligustrum vulgare</i> , dogwood, hawthorn, hazel, rose <i>Rosa</i> sp and wayfaring tree. Ground flora is dominated by dog's mercury alongside species such as red campion <i>Silene dioica</i> , common nettle, ivy <i>Hedera helix</i> and hedge bedstraw <i>Galium mollugo</i> . Large gaps up to 1-2m in length are present, and the hedge is approximately 1m in width and 1m in height. The hedge sits on a small bank, and runs parallel to an adjacent hedge (H15) for the majority of its length. The parallel hedges define the old route of the A38 which lay within the centre of the hedges prior to its relocation. Current management of the hedge is through flailing, although signs of previous management (laying) are evident by mature growth of horizontal branches at the base of the hedge.
H17, H18	NO	Defunct species-rich	Hedgerows with a similar species composition to H16. Cattle disturbance has resulted in large gaps of 1-2m in length within the hedgerows, and the hedge is approximately 1m in width and 1m in height. Current management of the hedge is through flailing.
H19	NO	Defunct species-rich	Species present include wayfaring tree, whitebeam <i>Sorbus aria</i> agg., spindle <i>Euonymus europaeus</i> , field maple, ash, hazel,

Hedgerow Reference Number	Within the development footprint?	Classification	Hedgerow Description
			blackthorn, hawthorn, rose and dogwood. Ground flora is dominated by dog's mercury and ivy, alongside a diverse range of additional herbaceous species such as greater stitchwort <i>Stellaria holostea</i> , hedge woundwort <i>Stachys sylvatica</i> , common nettle, hedge bedstraw, cat's-ear <i>Hypochaeris radicata</i> , red clover, bluebell and self-heal. The hedge is well established on a small bank and is approximately 4m in width, with no gaps occurring across its length and a dense structure maintained at the base. The hedge appears to be tightly flailed on a regular basis; signs of previous management include laying and coppicing.
H20, H21	NO	Defunct species-rich	Hedgerows are similar in species composition to H24, H27, H28 and H30. However, they are flailed to a lower height of 1m, with a width of 1m, due to their proximity to the runway.
H24, H27, H28, H30	NO	Intact species-rich	Hedgerows with a diverse range of woody species, including hazel, blackthorn, field maple, holly, dogwood, privet, ash and elder. An un-diverse ground flora is present. Hedgerows are compact in shape, with dense growth at the base. Current management is through flailing to a height of 2m and 3m in width, with past management practices evident by laid limbs of shrubs. The western part of H27 has been removed.
H22	NO	Defunct species-poor	Outgrown hedge situated on a degraded dry-stone wall. Hawthorn is abundant, with other woody species including holly and elder. Bramble has filled gaps within the hedgerow. The canopy height reaches, with an approximate width of 3m. The hedgerow is unmanaged.
H23	NO	Defunct species-poor	The hedgerow is old in age, evident by thickly grown limbs. It has been an outgrown hedge in the past, although is now topped to a height of 4m, with a defunct base. Current management is through flailing, to a width of 1m. Woody species present include hawthorn, blackthorn, hazel and elder. The ground flora is species-poor and dominated by ivy.
H25	YES	Defunct species-poor	Hedgerow managed to a height of 1m and width of 0.5m through close flailing. Gaps are present within the hedgerow, made for the purpose of path/road access.
H26	NO	Intact species-rich	A mature, outgrown hedgerow with improved grassland at the base. The hedgerow reaches an approximate height of over 5m, with a canopy width of 4m.
H29	NO	Intact species-rich	Intact hedgerow at the southern end, however the hedgerow structure degrades heavily towards the northern end. Woody species present include hazel and holly. Gaps at the northern end of the hedgerow are filled by bramble and rosebay willowherb. The hedgerow is flailed to approximately 1m in height and 1m in width.
H31	YES	Intact species-poor	Hedgerow managed to a height of 1m and width of 0.5m through close flailing.

Table 10 Woody species and their general abundance within hedgerows found across the Site.

Scientific name	English name	DAFOR
<i>Corylus avellana</i>	Hazel	F
<i>Ilex aquifolium</i>	Holly	LO
<i>Prunus spinosa</i>	Blackthorn	F
<i>Rubus fruticosus</i>	Bramble	F
<i>Fraxinus excelsior</i>	Ash	O
<i>Rosa</i> sp.	Rose	O
<i>Acer campestre</i>	Field maple	LF
<i>Sambucus nigra</i>	Elder	O
<i>Crataegus monogyna</i>	Hawthorn	F
<i>Quercus robur</i>	Oak	LO
<i>Mercurialis perennis</i>	Dog's mercury	VLF
<i>Hedera helix</i>	Ivy	LA
<i>Cornus sanguinea</i>	Dogwood	LO
<i>Ligustrum vulgare</i>	Privet	R
<i>Viburnum lantana</i>	Wayfaring tree	R
<i>Euonymus europaeus</i>	Spindle	R
<i>Clematis vitalba</i>	Traveller's joy	R
<i>Arum maculatum</i>	Lords and ladies	R

4.2.14 Broadleaf/Coniferous Scattered Trees

Scattered broadleaved trees are present as standards within hedgerows, particularly at the south of the Site (e.g. the Proposed Extension to the Silver Zone Car Park (Phase 2) within the application site), and most commonly are found to be oak *Quercus robur* and ash. Hedgerow trees were typically the oldest trees within Bristol Airport, and were commonly estimated to be over 50-100 years old.

There are many planted broadleaf and coniferous trees within the application site. Species such as silver birch *Betula pendula* are frequently planted within car park areas (including the multi-storey car park, canopies to the front of the existing terminal, and the new gyratory road with surface car parking), and are approximately 20 years old. Soil bunds located towards the south of the application site are denoted by target notes 5 & 7. The bunds (outside of the application site) have been planted with a range of broadleaved trees which are spaced approximately 3m apart, and are approximately 5 years in age. Species include hazel, willow *Salix* sp., silver birch, and hawthorn. Trees are currently no more than 3m in height.



Plate 15 Young planted broadleaf trees on bunds

4.2.15 Mixed Plantation Woodland

At the south-east boundary of Bristol Airport (outside the application site) broadleaf and coniferous trees have been planted on a north and west facing slope. The canopy height reaches approximately 15m and does not appear to be subject to any current management practices.

4.2.16 Broadleaved Semi-Natural Woodland

Cornerpool Wood comprises a small broad-leaved woodland (outside the application site), with a large central glade. The canopy is generally dominated by mature ash with occasional oak standards. The canopy cover is generally sparse at approximately 40% cover overall and this has allowed secondary canopy species and species more typical of the understory layer to colonise the canopy, including wych elm *Ulmus glabra*, cherry *Prunus avium*, hazel, and hawthorn. The understory is generally sparse at around 15 to 30% cover, although denser clumps of bramble and gooseberry *Ribes uva-crispa* are establishing where there are substantial breaks in the canopy. Ground flora species include locally abundant dog's-mercury, ground ivy, rough meadow-grass, nettle and bramble. In a small area, wood speedwell *Veronica montana*, wood anemone *Anemone nemorosa* and wood sedge *Carex sylvatica* are located at rare abundance. Introduced garden species have been recorded, including daffodil cultivars and the hybrid Spanish bluebell *Hyacinthoides x massartiana*. Target note 12 denotes the presence of old hazel coppice stools within the woodland, and mature field maple trees along the southern and western boundary of the woodland, indicative of the woodland being of ancient origin.

Table 11 Species recorded from on-site broadleaved semi-natural woodland habitat

Scientific name	English name	DAFOR
<i>Fraxinus excelsior</i>	Ash	F
<i>Quercus robur</i>	Oak	F
<i>Ulmus glabra</i>	Wych elm	O
<i>Prunus avium</i>	Wild cherry	O
<i>Acer campestre</i>	Field maple	LF
<i>Corylus avellana</i>	Hazel	O
<i>Crataegus monogyna</i>	Hawthorn	O
<i>Rubus fruticosus</i> agg.	Bramble	LF
<i>Ribes uva-crispa</i>	Gooseberry	LF
<i>Sambucus nigra</i>	Elder	O

Scientific name	English name	DAFOR
<i>Mercurialis perennis</i>	Dog's mercury	LA
<i>Glechoma hederacea</i>	Ground ivy	LA
<i>Silene dioica</i>	Red campion	O
<i>Geum urbanum</i>	Wood avens	O
<i>Geranium robertianum</i>	Herb Robert	O
<i>Rumex sanguineus</i>	Wood dock	O
<i>Brachypodium sylvaticum</i>	False wood-brome	O
<i>Poa trivialis</i>	Rough meadow-grass	LF
<i>Plantago lanceolata</i>	Ribwort plantain	O
<i>Veronica montana</i>	Wood speedwell	R
<i>Anemone nemorosa</i>	Wood anemone	R
<i>Carex sylvatica</i>	Wood sedge	R
<i>Urtica dioica</i>	Common nettle	LA
<i>Heracleum sphondylium</i>	Hogweed	LF
<i>Articum minus</i>	Lesser burdock	LF
<i>Hyacinthoides x massartiana</i>	Hybrid bluebell	O
<i>Narcissus</i> spp.	Daffodil cultivars	O
<i>Ilex aquifolium</i>	Holly	O
<i>Ligustrum vulgare</i>	Honeysuckle	O
<i>Cornus sanguinea</i>	Dogwood	O
<i>Carpinus betulus</i>	Hornbeam	O
<i>Moehringia trinervia</i>	Three-nerved sandwort	R
<i>Adoxa moschatellina</i>	Moschatel	R



Plate 16 Mature growth of field maple

4.2.17 Standing Open Water

A stone built pond (within the Proposed Extension to the Silver Zone Car Park [Phase 2]) is denoted by target note 14. It is surrounded by steep sided natural stone walls on three sides, with a sloping access way from the north, poached by cattle. Vegetation includes trailing bramble and nettle with duckweed (*Lemna* sp) present on the pond surface. No other standing water/ponds are present within the application site.



Plate 17 Small pond located at target note 14

4.2.18 Buildings

A range of buildings are present across Bristol Airport (including at the south terminal extension, west terminal extension, service yard and multi-storey car park within the application site). Buildings vary in age and construction style.



Plate 18 Large building located at the north of the Site

4.3 HABITATS IMMEDIATELY ADJACENT TO BRISTOL AIRPORT

4.3.19 Arable

To the south of the application site (including the Proposed Operational Extension to the Silver Zone Car Park [Phase 1] and the Proposed Extension to the Silver Zone Car Park [Phase 2]), a small number of fields have been recently cultivated for intensive arable production of wheat. No field headlands were apparent, with crops sown up to the field boundaries.



Plate 19 Wheat crop

4.3.20 Poor Semi-Improved Grassland

Poor semi-improved grassland fields located to the south of the Proposed Extension to the Silver Zone Car Park (Phase 2), situated outside of application site boundary, are similar in semi-improved grassland sward species composition, sward physiognomy and management to the Proposed Extension to the Silver Zone Car Park (Phase 2) and Cornerpool. Species present which are additional to those seen within the Proposed Extension to the Silver Zone Car Park (Phase 2) include locally occasional black knapweed, meadow buttercup and ribwort plantain. Such fields are typically grazed by cattle, as indicated by target note 23.

Poor semi-improved grassland fields located to the north of the application site are similar in semi-improved grassland sward species composition to the Proposed Extension to the Silver Zone Car Park (Phase 2) and Cornerpool located within the application site boundary. A number of fields have been recently cut for hay and as such have a short sward height of 10cm, as indicated by target note 22. Other fields are being used to accommodate parked cars, as indicated by target note 24.

Poor semi-improved grassland within Felton Common is located to the east of the application site. Grassland had been recently cut at the time of survey, as indicated by target note 22.



Plate 20 Recently topped grassland within field located east of the A38

4.3.21 Improved Grassland

Improved grassland is present to the south, west and north of the application site. Species diversity within the sward is poor, with abundant perennial rye-grass, white clover and a small number of addition grass and forb species. Improved grassland is typically grazed by livestock, or cut for hay/silage. Some areas of improved grassland are used to park vehicles, as indicated by target note 24.

4.3.22 Broadleaved Semi-Natural Woodland

A small area of secondary woodland is located south of Downside Road (at the site of the proposed A38 highway improvements which is partially within the application site). The canopy is dominated by sycamore *Acer pseudoplatanus*, with an approximate canopy cover of 70%. A small range of coniferous species are present, including yew *Taxus baccata* and box *Buxus sempervirens*, however the canopy cover of such species is not considered to reach 10%, and as such the woodland is not classified as mixed woodland. Within areas of more open canopy, understory species such as locally frequent to occasional hawthorn, elder, holly, blackthorn, yew and box are present. The ground flora is mostly shaded, particularly within the centre of the woodland, with a small cutting located at the centre of the woodland, aligned approximately east to west and up to 5m deep. Within the cutting, hart's tongue fern *Asplenium scolopendrium* and scaly male fern *Dryopteris affinis* grow at frequent abundance. Dog's mercury, wild garlic *Allium ursinum* and ivy grow at locally frequent to locally abundant cover. Ground flora situated beneath open areas of the canopy supports abundant establishment of sycamore seedlings. Towards the southern boundary of the woodland, adjacent to domestic gardens, the area of woodland denoted by target note 13 has been subject to dumping of garden waste. As a result, a small number of non-native tree, shrub and herbaceous species have established, including the Schedule 9 invasive non-native variegated yellow archangel *Lamiastrum galeobdolon* subsp. *argentatum*. No recent management of the woodland is evident.

Table 12 Species recorded from off-site broadleaved semi-natural woodland habitat at Location KK

Scientific name	English name	DAFOR
<i>Acer pseudoplatanus</i>	Sycamore	A
<i>Fraxinus excelsior</i>	Ash	R
<i>Crataegus monogyna</i>	Hawthorn	LF
<i>Rubus fruticosus</i> agg.	Bramble	LO
<i>Sambucus nigra</i>	Elder	O
<i>Ilex aquifolium</i>	Holly	O
<i>Prunus spinosa</i>	Blackthorn	O
<i>Symphoricarpos albus</i>	Snowberry	O
<i>Leylandii</i> sp.	Leylandii	R
<i>Hedera helix</i>	Ivy	LA
<i>Rosa</i> sp.	Rose	LO
<i>Buxus sempervirens</i>	Box	LF
<i>Taxus baccata</i>	Yew	O
<i>Asplenium scolopendrium</i>	Hart's tongue fern	F
<i>Dryopteris affinis</i>	Scaly male-fern	F
<i>Mercurialis perennis</i>	Dog's mercury	LF
<i>Circaea lutetiana</i>	Enchanter's nightshade	LF
<i>Geum urbanum</i>	Wood avens	O
<i>Geranium robertianum</i>	Herb Robert	O

Scientific name	English name	DAFOR
<i>Urtica dioica</i>	Common nettle	LF
<i>Allium ursinum</i>	Wild garlic	LF
<i>Vicia sepium</i>	Bush vetch	R
<i>Hypericum androsaemum</i>	Tutsan	LO
<i>Carex pendula</i>	Pendulous sedge	R
<i>Lamium galeobdolon</i> subsp. <i>argenteum</i>	Variegated yellow archangel	R
<i>Arum maculatum</i>	Lords and ladies	LO



Plate 21 Cutting within woodland located south of Downside Road

4.3.23 Standing Open Water

Target note 16 denotes a large and a small pond, named Abspit Pond (outside the application site). Marginal vegetation located at the larger pond includes bulrush *Typha latifolia*, soft rush *Juncus effusus*, sweet-grass *Glyceria* sp. and bramble. The smaller pond is constructed of natural stone, and is deep with shallow margins. The ponds are shaded by broadleaved semi-natural woodland on the west margin. A small number of other standing waterbodies are present within 500m west and south of the south-west corner of Bristol Airport.

4.3.24 Hedgerows

Both species-rich and species-poor defunct and intact hedgerows occur outside the application site boundary. They are similar in species composition and character to hedgerows described within Bristol Airport.

5 SUMMARY

Fields at Bristol Airport located at the south of the application site and beyond the southern application site boundary are all similar in grassland community composition and physiognomy, scrub matrix, and management through cattle grazing. Grassland management through cattle, sheep and horse grazing also occurs in the south, west and east of the application site. Grassland management by cutting is common to the east and north of the application site, and within the application site where areas of amenity and poor semi-improved grassland occur. A small area of land located outside of the application site boundary to the south is used for intensive arable crop production.

Small areas of good semi-improved grassland, both neutral and calcareous, are present within Bristol Airport but typically outside of the development footprint. These areas comprise Downside Meadows, a small area of the Proposed Extension to the Silver Zone Car Park (Phase 2), within the development footprint at the taxiway widening and fillets, at the margins of the airfield and part of the A38 cutting and former A38 road within the airfield. Downside meadows is currently managed in a limited way, the airfield and the A38 cutting/former road is managed on a regular and specific basis in accordance with CAA CAP772 and the Proposed Extension to the Silver Zone Car Park (Phase 2) is currently grazed.

Hedgerows are present throughout Bristol Airport and adjacent to its boundary, particularly where land use remains agricultural. Species-rich hedgerows are located within these agricultural areas (including the boundaries to the Proposed Operational Extension to the Silver Zone Car Park (Phase 1) and the Proposed Extension to the Silver Zone Car Park (Phase 2). Management of hedgerows is light or absent, and carried out through flailing.

Small fragments of semi-natural broadleaf woodland are present within and adjacent to Bristol Airport. Such woodland is currently unmanaged. Other areas of plantation woodland are present within Bristol Airport, as are areas of introduced shrubs. A substantial area of woodland is present to the west.

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

APPENDIX A

[illegible]

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		Date: 12/09/2018 Project: BRISTOL AIRPORT	
01 4.10.18 Updates in line with Wood PLC comments		DJA EH	
Date: 12/09/2018 Project: MPPA INTERIM INFRASTRUCTURE MASTER PLAN		DJA EH	
Title: EXISTING SITE PLAN - South		Drawing No: 17090-00-100-043	
Rev	Date	Amendment	By
1	1:12/50	A0	AH
			01

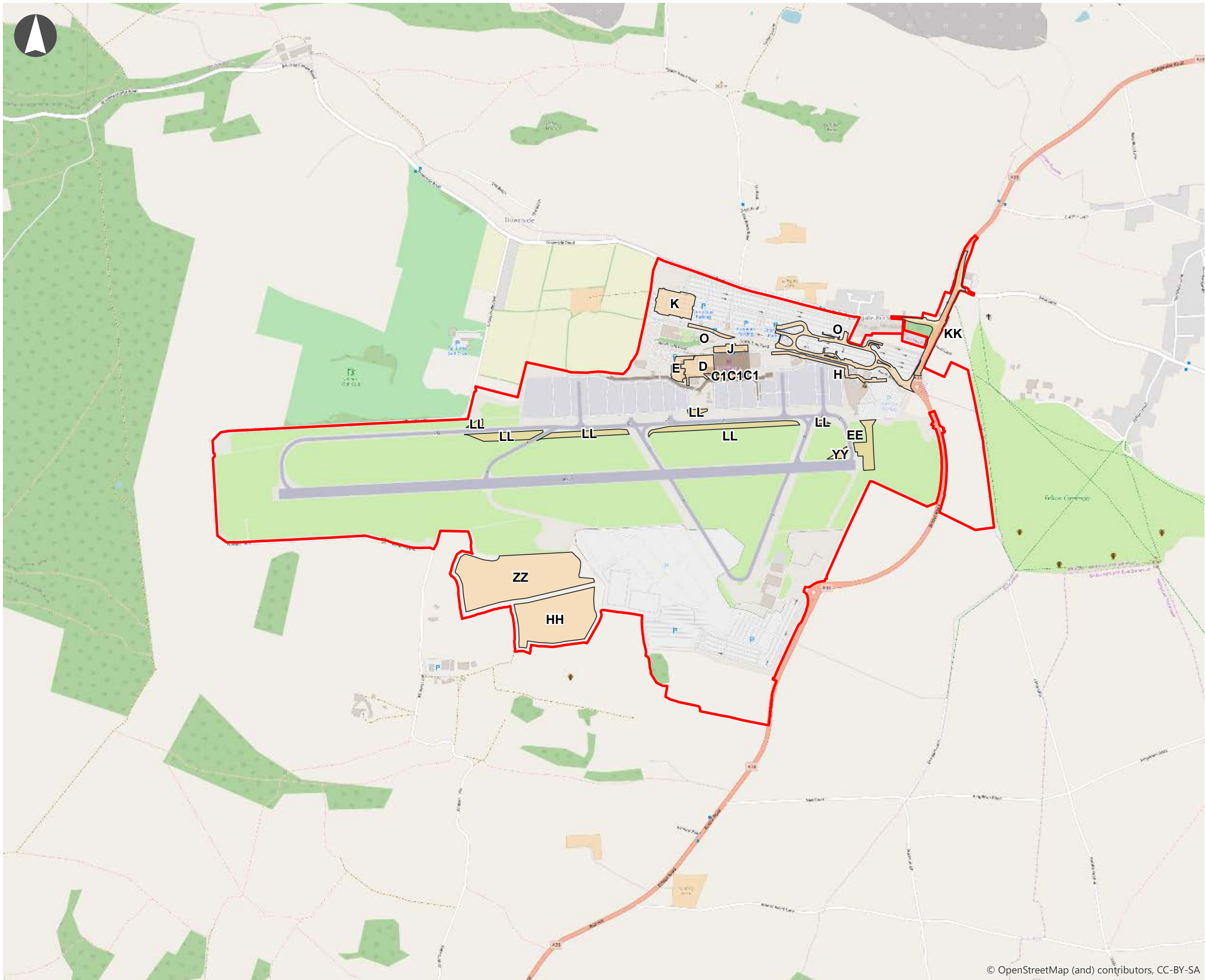




- | | |
|---|---|
|  | EXISTING BUILDINGS |
|  | PROPOSED BUILDINGS -
(15mmpa APPLICATION) |
|  | EXISTING APRON / HARD
STANDING |
|  | CAR PARKING |
|  | EXISTING CONSENTED AND PROPOSED
OPERATIONAL DEVELOPMENTS -
(10mmpa APPLICATION) |
|  | OPERATIONAL
IMPROVEMENTS TO
RUNWAYS / TAXIWAYS |
|  | LANDSCAPING |
|  | PROPOSED APRON /
HARD STANDING |
|  | AIRPORT OWNERSHIP
BOUNDARY |

[illegible]

APPENDIX B



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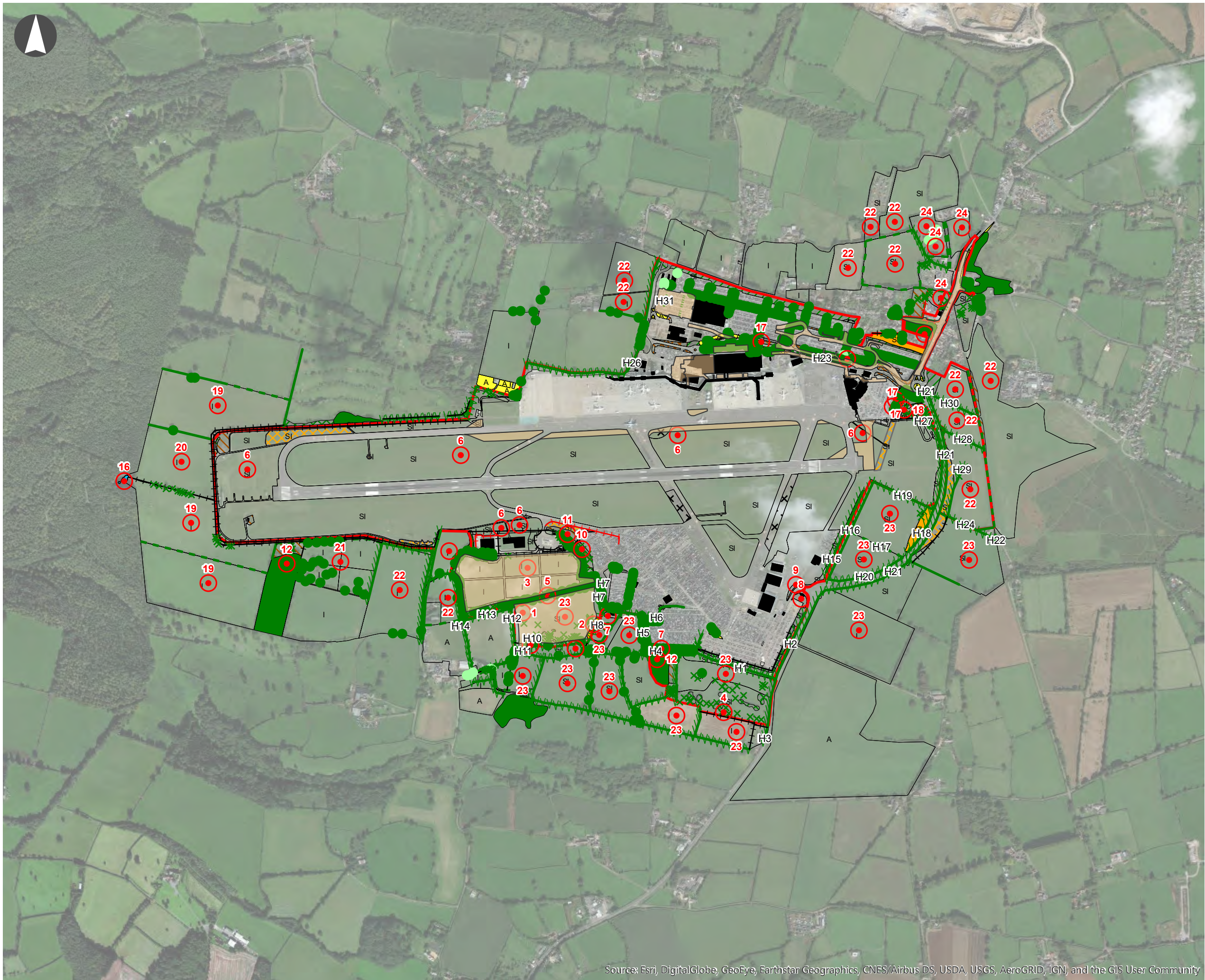
PROJECT
Development of Bristol Airport to Accommodate 12 Million Passengers Per Annum

TITLE
Identified Zones of Influence from TODD Proposed Site Plan (17090-00-100-035)

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1:12,500	MM	MJ
REFERENCE	REVISION	DATE ISSUED
J00254.11B1		3/12/2018

- Planning Application Boundary
- Zones of Influence

Reference	Description
C1	South Terminal Extension
D	West Terminal Extension
E	New Service Yard
G	Walkway to East Pier
H	East Pier with VCCs
J	New Canopy to Front of Existing Terminal
K	Additional Multi-Story Car Park
O	New Gyratory Road with Internal Surface Car Parking
EE	New East Taxiway
HH	Surface Parking on Cogloop 2
KK	Proposed Roadworks on A38
LL	Taxiway Widening and Fillets
ZZ	Proposed Year Round Operation and Installation of Lighting



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PROJECT
Development of Bristol Airport to Accommodate
12 Million Passengers Per Annum

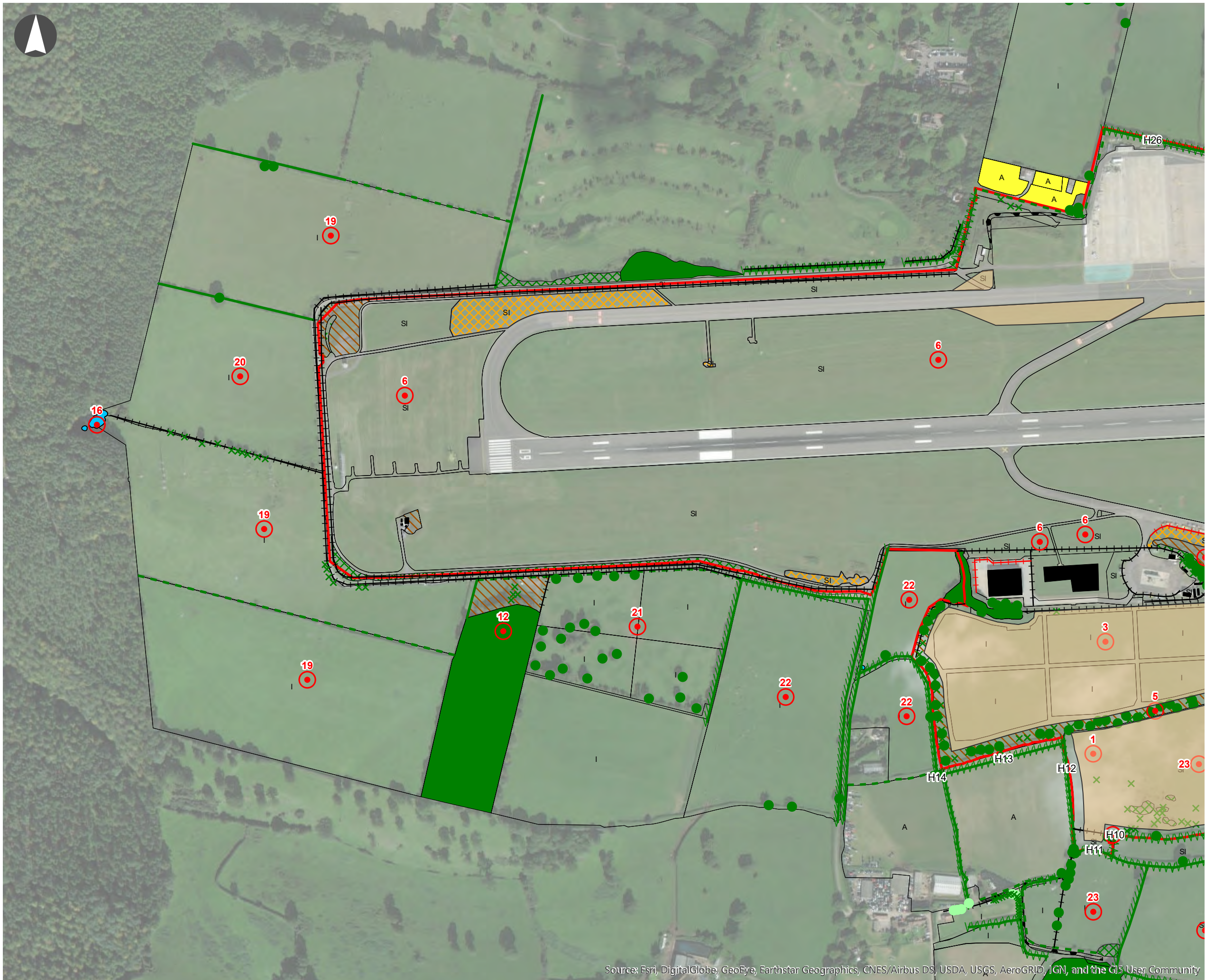
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REFERENCE	REVISION	DATE ISSUED
J00254.11B2		3/12/2018

- Planning Application Boundary
- Zones of Influence
- Target Note
- A2.2 - Scattered scrub
- A3.1 - Broadleaved tree
- A3.2 - Coniferous tree
- J2.1.1 - Intact hedge - native species-rich
- J2.1.2 - Intact hedge - species-poor
- J2.2.1 - Defunct hedge - native species-rich
- J2.2.2 - Defunct hedge - species-poor
- J2.4 - Fence
- J2.5 - Wall
- A1.1.1 - Broadleaved woodland - semi-natural
- A1.1.2 - Broadleaved woodland - plantation
- A1.3.2 - Mixed woodland - plantation
- A2.1 - Scrub - dense/continuous
- A2.2 - Scrub - scattered
- B2.2 - Neutral grassland - semi-improved
- B3.2 - Calcareous grassland - semi-improved
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- C3.1 - Other tall herb and fern - ruderal
- G1 - Standing water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J1.3 - Cultivated/disturbed land - ephemeral/short perennial
- J1.4 - Introduced shrub
- J2.8 - Earth bank
- J3.6 - Buildings
- J4 - Bare ground
- J5 - Other habitat

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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PROJECT
Development of Bristol Airport to Accommodate 12 Million Passengers Per Annum

TITLE
Phase 1 Habitat Survey Detail: Western Extent

SCALE @ A3 1:5,000	CREATED BY MM	CHECKED BY MJ
REFERENCE J00254.11B2a	REVISION	DATE ISSUED 3/12/2018

- Planning Application Boundary
- Zones of Influence
- Target Note
- A2.2 - Scattered scrub
- A3.1 - Broadleaved tree
- A3.2 - Coniferous tree
- J2.1.1 - Intact hedge - native species-rich
- J2.1.2 - Intact hedge - species-poor
- J2.2.1 - Defunct hedge - native species-rich
- J2.2.2 - Defunct hedge - species-poor
- J2.4 - Fence
- J2.5 - Wall
- A1.1.1 - Broadleaved woodland - semi-natural
- A2.1 - Scrub - dense/continuous
- A2.2 - Scrub - scattered
- B3.2 - Calcareous grassland - semi-improved
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- C3.1 - Other tall herb and fern - ruderal
- G1 - Standing water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J2.8 - Earth bank
- J3.6 - Buildings
- J4 - Bare ground
- J5 - Other habitat

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



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PROJECT

Development of Bristol Airport to Accommodate
12 Million Passengers Per Annum

TITLE

Phase 1 Habitat Survey Detail: Southern Extent

SCALE @ A3

1:5,000

REFERENCE

J00254.11B2b

CREATED BY

MM






























REVISION

CHECKED BY

MJ

DATE ISSUED

3/12/2018

-  Planning Application Boundary
-  Zones of Influence
-  Target Note
-  A2.2 - Scattered scrub
-  A3.1 - Broadleaved tree
-  A3.2 - Coniferous tree
-  J2.1.1 - Intact hedge - native species-rich
-  J2.1.2 - Intact hedge - species-poor
-  J2.2.1 - Defunct hedge - native species-rich
-  J2.2.2 - Defunct hedge - species-poor
-  J2.4 - Fence
-  J2.5 - Wall
-  A1.1.1 - Broadleaved woodland - semi-natural
-  A1.3.2 - Mixed woodland - plantation
-  A2.1 - Scrub - dense/continuous
-  B2.2 - Neutral grassland - semi-improved
-  B3.2 - Calcareous grassland - semi-improved
-  B4 - Improved grassland
-  B6 - Poor semi-improved grassland
-  C3.1 - Other tall herb and fern - ruderal
-  G1 - Standing water
-  J1.1 - Cultivated/disturbed land - arable
-  J1.2 - Cultivated/disturbed land - amenity grassland
-  J1.3 - Cultivated/disturbed land - ephemeral/short perennial
-  J1.4 - Introduced shrub
-  J2.8 - Earth bank
-  J3.6 - Buildings
-  J4 - Bare ground
-  J5 - Other habitat

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



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Development of Bristol Airport to Accommodate
12 Million Passengers Per Annum

TITLE
Phase 1 Habitat Survey Detail: South Eastern
Extent

SCALE @ A3	CREATED BY	CHECKED BY
1:5,000	MM	MJ
REFERENCE	REVISION	DATE ISSUED
J00254.11B2c		3/12/2018

- Planning Application Boundary
- Zones of Influence
- Target Note
- A2.2 - Scattered scrub
- A3.1 - Broadleaved tree
- J2.1.1 - Intact hedge - native species-rich
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.4 - Fence
- A1.1.1 - Broadleaved woodland - semi-natural
- A1.3.2 - Mixed woodland - plantation
- A2.1 - Scrub - dense/continuous
- B2.2 - Neutral grassland - semi-improved
- B3.2 - Calcareous grassland - semi-improved
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- C3.1 - Other tall herb and fern - ruderal
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J1.3 - Cultivated/disturbed land - ephemeral/short perennial
- J1.4 - Introduced shrub
- J2.8 - Earth bank
- J3.6 - Buildings
- J5 - Other habitat





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Development of Bristol Airport to Accommodate 12 Million Passengers Per Annum

TITLE

Phase 1 Habitat Survey Detail: North Eastern Extent

SCALE @ A3

1:5,000

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MJ


REFERENCE


J00254.11B2d


REVISION


DATE ISSUED


3/12/2018


- 


Planning Application Boundary
- 


Zones of Influence
- 


Target Note
- 


A2.2 - Scattered scrub
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A3.1 - Broadleaved tree
- 


A3.2 - Coniferous tree
- 


J2.1.1 - Intact hedge - native species-rich
- 


J2.1.2 - Intact hedge - species-poor
- 


J2.2.2 - Defunct hedge - species-poor
- 


J2.4 - Fence
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
J2.5 - Wall
- 


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
A1.1.2 - Broadleaved woodland - plantation
- 


A2.1 - Scrub - dense/continuous
- 


A2.2 - Scrub - scattered
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B2.2 - Neutral grassland - semi-improved
- 


B3.2 - Calcareous grassland - semi-improved
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
B4 - Improved grassland
- 


B6 - Poor semi-improved grassland
- 

C3.1 - Other tall herb and fern - ruderal
- 

J1.2 - Cultivated/disturbed land - amenity grassland
- 

J1.3 - Cultivated/disturbed land - ephemeral/short perennial
- 

J1.4 - Introduced shrub
- 

J3.6 - Buildings
- 

J5 - Other habitat

TARGET NOTES (FLORA AND FAUNA)

- 1) Location HH within the development footprint. The majority of the field commonly referred to as Cogloop 2 comprises poor semi-improved grassland, grazed by cattle. Stands of creeping thistle *Cirsium arvense* are locally abundant, indicating a high intensity of grazing. Heavily poached ground, particularly to the west of the field, is also indicative of a high grazing intensity. Stands of nettle *Urtica dioica* are locally abundant where cattle tend to congregate and deposit high volumes of manure, such as within the vicinity of the water troughs. Habitat structure and diversity for notable species of invertebrates, reptiles and amphibians¹ are poor, although a small stone/concrete lined waterbody is present in the south west corner of this field. An artificial badger sett is located within a bund that runs adjacent to its northern boundary, beyond the direct boundary with Cogloop 1. The cattle grazed grassland and perimeter hedges/trees are known to support foraging and commuting bats and include bird and bat boxes previously installed by Johns Associates on behalf of Bristol Airport. The habitats are known to support common species of farmland birds. These features are suitable for dormouse, but this species has not been historically recorded at Bristol Airport. Brown hare (that are regularly observed within the airfield) are known to have been previously observed in the Cogloop 1 field even after its transition to a car park.
- 2) Location HH within the development footprint. A small area within Cogloop 2, located upon a shallowly sloping bank at the west boundary of the field, supports a good semi-improved grassland flora typical of neutral conditions, but in poor condition. The sward is very closely grazed upon the slope, and consists of a greater cover of forb species which are typical of less nutrient enriched soils than in the wider area of poor semi-improved grassland within Cogloop 2. Mouse-ear hawkweed *Pilosella officinalis* occurs in small locally abundant stands. Locally frequent forb/sedge species include spring sedge *Carex caryophylla*, bird's-foot trefoil *Lotus corniculatus*, and creeping cinquefoil *Potentilla reptans*. Rare and occasional forb species include self-heal *Prunella vulgaris*, rough hawkbit *Leontodon hispidus*, common ragwort *Senecio jacobaea*, autumn hawkbit *Scorzonera autumnalis*, and lady's bedstraw *Galium verum*. A greater number of finer leaved grass species are present within the sward than the surrounding poor semi-improved grassland, including frequent crested dog's-tail *Cynosurus cristatus* and sweet vernal-grass *Anthoxanthum odoratum*, and occasional perennial ryegrass *Lolium perenne*, cock's-foot *Dactylis glomerata* and rough meadow-grass *Poa trivialis*.
- 3) Location ZZ within the development footprint. The field commonly referred to as Cogloop 1 supports a seeded improved grassland sward. The area is used to accommodate parked cars, with a seeded grassland established within reinforced grids. The perimeter of this area is known to support foraging and commuting bats and common farmland birds. Hedgerow trees include bird and bat boxes previously installed by Johns Associates on behalf of Bristol Airport. These features, where located in the west and south of Cogloop 1 are suitable for dormouse, but this species has not been historically recorded at Bristol Airport.
- 4) Outside of the development footprint. Small earthworks scattered across the field support pockets of a more diverse plant community, classified as good semi-improved grassland. Forb and sedge species present include occasional salad burnet *Poterium sanguisorba*, rough hawk-bit *Leontodon hispidus*, black medick *Medicago lupulina*, mouse-ear hawkweed, glaucous sedge *Carex flacca*, hoary plantain *Plantago media*, lady's bedstraw, common bird's-foot trefoil and red clover *Trifolium pratense*. Fescue *Festuca sp.* and crested dog's-tail are frequent grass species present within the sward. This area is known to support foraging and commuting species

¹ Historic surveys for these species have only confirmed the presence of small number of smooth and palmate newt associated with the pond, which will use certain terrestrial habitat features (e.g. refuge habitat within the perimeter hedge). Great crested newt and reptiles have not been recorded.

of bats and includes two artificial night-perch roosts installed previously by Johns Associates and Bristol Airport. This area is managed for nature conservation purposes by Bristol Airport, alongside cattle grazing.

- 5) Between Locations ZZ and HH within the development footprint. A recently created soil bund with two sloping faces, supporting establishing tall ruderal vegetation, and a flat top, which supports planted broadleaf trees. An area of this bund incorporated an active artificial badger sett installed by Johns Associates on behalf of Bristol Airport.
- 6) Location LL within the development footprint. Area of grassland noted to support species-poor semi-improved grassland but which is dissimilar to wider area of the habitat in that it supports frequent upright brome *Bromopsis erecta* and occasional greater knapweed *Centaurea scabiosa*, bulbous buttercup *Ranunculus bulbosus*, and wild carrot *Daucus carota*. Upright brome in particular is a key indicator of calcareous grassland; and these areas should be classified as semi-improved calcareous grassland (albeit species-poor). No attempt has been made to define the boundaries between species-poor semi-improved neutral and calcareous grassland as it is impossible to do this by eye given the recent vegetation management. In practice, there are likely to be numerous transitions or zonations between neutral and calcareous vegetation types within the airfield grassland.
- 7) Outside of the development footprint. A soil bund which is similar in character to that denoted by target note 5.
- 8) Outside of the development footprint. A soil bank has been recently excavated upon the north facing slope, leaving a bare soil surface upon which vegetation has not yet established. The west facing slope of the bank has not been excavated, and supports a poor semi-improved grassland sward, similar to that established upon the bund at target note 9.
- 9) Outside of the development footprint. A soil bank with a north west facing slope. The slope of the bund supports a poor semi-improved grassland flora, consisting of abundant perennial rye grass *Lolium perenne* and occasional ruderal species such as bristly ox-tongue *Helminthotheca echioides*, ox-eye daisy *Leucanthemum vulgare*, dock *Rumex sp.* and spear thistle *Cirsium vulgare*. Self-heal *Prunella vulgaris* is very locally abundant at the south of the Site. The top of the bank supports a belt of planted shrubs.
- 10) Outside of the development footprint. A soil bank with a north east facing slope. Dense scrub has established at the south of the bank, with a more open area of scattered scrub overlying tall ruderal vegetation towards the northern half of the bank.
- 11) Outside of the development footprint. A soil bund with a north east facing slope. This bund is similar in character to the bank denoted by target note 10, although the scattered scrub vegetation overlying tall ruderal vegetation has been recently cut back at the time of survey.
- 12) Outside of the development footprint. Presence of old hazel *Corylus avellana* coppice stools within the woodland, and mature field maple *Acer campestre* trees along the southern and western boundary of the woodland, are indicative of the woodland being of ancient origin. This woodland is managed by Bristol Airport for nature conservation and includes numerous bat boxes, a wooden bat house, converted bat roosts in a former latrine building and air raid shelter.

- 13) Location KK within the development footprint. Small block of broadleaved woodland dominated by sycamore. The southern boundary of the woodland is subject to significant influence from adjacent domestic gardens. Piles of garden waste have been dumped, with establishment of a Schedule 9 invasive species, variegated yellow archangel *Lamium galeobdolon* subsp. *argenteum*, present at rare abundance. Non-native species such as snowberry and *leylandii* also grow within this area. The habitats associated with this area are likely to support common species of farmland, woodland and garden birds, and provide opportunities for foraging bats, badger and could support dormouse and other common mammal species. No habitats that were likely to support conservation notable species of invertebrates were identified.
- 14) Location HH within the development footprint. Stone built pond surrounded by steep sided natural stone walls on three sides, with a sloping access from the north, poached by cattle. Vegetation at the pond margin includes bramble and nettle *Urtica dioica* with duckweed *Lemna* sp present on the pond surface. The pond is heavily shaded by adjacent hedgerow and scrub. This pond has been previously surveyed and only small numbers of common and palmate newt have been recorded.
- 15) Outside of the development footprint. A mosaic of habitats is located east of the Admin Building, across a small area. The habitats have been subject to recent management comprising; hazel coppicing, ragwort removal, plantation broadleaved woodland removal, and strimming of tall ruderal vegetation, associated with delivery of the Reserve Matters associated with planning application ref O9/P/1020/OT2. Habitats present at the time of survey include tall ruderal vegetation, dense and scattered scrub, and poor semi-improved grassland. A lack of management historically has resulted in significant encroachment of tall ruderal and scattered scrub vegetation, predominantly bramble, nettle and creeping thistle, into the grassland sward, which is closed in character at a height of 40cm and has a thatch layer of accumulated litter at the base. Anthills have established at the east of the habitat. False-oat grass is abundant within the grassland sward, alongside frequent cock's-foot, creeping thistle and bramble *Rubus fruticosus* agg. Ox-eye daisy occurs at locally frequent abundance, and forb species such as teasel *Dipsacus fullonum*, hogweed *Heracleum sphondylium*, ribwort plantain and self-heal occur at occasional abundance.
- 16) Outside of the development footprint. Two ponds located adjacent to broadleaved semi-natural woodland. These are known to support breeding great crested newt, smooth newt and palmate newt.
- 17) Locations J, K and O within the development footprint. Small areas of amenity grassland, which is typically composed of constant frequent species perennial rye-grass, greater plantain, dandelion and white clover *Trifolium repens*, support a greater species diversity. Species such as hairy sedge *Carex hirta*, devil's-bit scabious *Knautia arvensis*, black knapweed, fairy flax *Linum catharticum* and bird's-foot trefoil are present at low abundance and in localised areas
- 18) Outside of the development footprint. Storage of building materials and three shipping containers situated upon poor semi-improved grassland.
- 19) Outside of the development footprint. Permanent grassland which is not grazed at the time of survey. Suitable for foraging bats including horseshoe bat species.
- 20) Outside of the development footprint. Permanent grassland managed by sheep grazing at the time of survey. Suitable for foraging bats including horseshoe bat species.

- 21) Outside of the development footprint. Permanent grassland managed by horse grazing at the time of survey. Suitable for foraging bats including horseshoe bat species.
- 22) Outside of the development footprint. Permanent grassland which is not grazed and has been recently cut at the time of survey. Includes an area of species rich calcareous grassland associated with the A38 cutting. Suitable for foraging bats including horseshoe bat species.
- 23) Permanent grassland managed by cattle grazing at the time of survey, including Location HH. Suitable for foraging bats including horseshoe bat species.
- 24) Location KK located within the development footprint. Permanent grassland managed by infrequent cutting, and used to accommodate parked cars at the time of survey. Potential for common reptiles and dormouse in marginal ruder/scrub habitats.

APPENDIX C



BRISTOL AIRPORT

BIODIVERSITY ACTION PLAN IMPLEMENTATION

GRASSLAND AND WOODLAND TECHNICAL REPORT V1.0

1 INTRODUCTION

Bristol Airport was granted outline planning permission for the development of the airport in 2009 (09/P/1020/OT2). A range of ecological mitigation measures was required as part of delivering the construction phases of the development, documented in a Nature Conservation Strategy and Biodiversity Action Plan. As part of this, several areas of botanical interest identified during the original surveys undertaken in support of the planning application were proposed for a management regime designed to enhance the value of these habitats. This technical note sets out a detailed and up-to-date botanical baseline for these key habitats in 2015.

2 AREAS SURVEYED

The areas subject to detailed botanical survey are shown on Figure 2.1 below.



Figure 2.1. Areas subject to detailed botanical survey

3 METHODOLOGY

3.1 Grassland survey

3.1.1 Downside meadow

Grassland vegetation in the Downside meadow was subject to National Vegetation Classification (NVC) survey. The field survey was undertaken by a suitably qualified and experienced botanist from Johns Associates on the 23rd July 2015 in good weather conditions. A total of five randomly selected samples were taken from each homogenous stand of vegetation, using a 2x2 metre quadrat. Quadrats were not taken from within transitional or mosaic habitats.

Vegetation in each quadrat was recorded using the Domin scale (where cover was assessed by eye as a vertical projection onto the ground of all the live, above-ground parts of the plants in the quadrat):

Cover of 91–100% is recorded as Domin	10
76–90%	9
51–75%	8
34–50%	7
26–33%	6
11–25%	5
4–10%	4
<4% with many individuals	3
<4% with several individuals	2
<4% with few individuals	1

The field data was compiled into floristic tables, which express the frequency that each species occurred within the five samples taken, and the range of abundance scores that were attributed to each species. Floristic tables for each vegetation community have been provided as Appendix 1 to this report. This information was analysed using the community descriptions and floristic tables provided in British Plant Communities Volume 3 Grasslands and Montane Communities¹.

3.1.2 Botanical inventory – A38 grassland and road cutting

The A38 grassland had been cut recently prior to the survey on the 23rd July 2015.

Grassland that has been recently cut, mown or grazed should be treated with caution as many species of plant will no longer be apparent; and therefore the vegetation community could be significantly under-valued. As such, it was not possible to accurately characterise

¹ Rodwell, J. S. ed., 1992. *British Plant Communities. Volume 3. Grassland and montane communities*. Cambridge University Press.

the vegetation community using the NVC survey methodology and no quadrats were sampled.

However, the surveyor did take a botanical inventory of the grassland, recording species vegetatively where possible. This information was used to compile a species list for the A38 grassland, attributing descriptive scores of abundance to each species using the DAFOR scale:

D	Dominant
A	Abundant
F	Frequent
O	Occasional
R	Rare
L	Local (prefix that can be applied to any of the above).

In addition, an area of developing limestone grassland was noted during the survey on the recent A38 road cutting (see Figure 2.1 above). Although this area was outside the scope of the commissioned survey, it is within Bristol Airport ownership, and therefore a detailed botanical inventory of this vegetation community was also compiled.

3.2 Woodland survey – Corner Pool Wood

The fieldwork was undertaken on the 17th June 2015 when weather conditions were good and during the optimal period for survey of lowland woodland habitats. The British National Vegetation Classification (NVC) prescribes a protocol to be used in sampling woodland vegetation (Rodwell, 1991²). It is based on sampling five quadrats per stand³ at different

² Rodwell, J. S. ed., 1991. *British Plant Communities. Volume 1. Woodlands and Scrub*. Cambridge University Press.

scales with the largest quadrat (for sampling the tree canopy) measuring 50m x 50m. This works well in extensive woodlands where collective quadrat data are subsequently combined to provide a floristic table. However, the area of woodland that formed the focus of the current survey was too small for a standard sampling approach. The whole (semi-natural) stand was therefore split into two separate quadrats for sampling canopy and understorey layers, whilst a 10m x 10m quadrat was positioned within each plot to sample field layer species. Vegetation in each quadrat was recorded using the Domin scale (see Section 3.1.1 above). The information was analysed using surveyor experience and detailed vegetation descriptions provided by Rodwell (1991).

As a tool for vegetation description, the NVC has limitations, especially with respect to plant communities arising from, or influenced by significant levels of human disturbance. It does not, for example, classify new plantations but usually works quite well where introduced trees have been planted over an existing woodland ground flora. Many modern woodlands have been extensively modified and so historical maps and evidence of historical woodland ownership and management can provide additional valuable context to woodland structure and floristics. The assessment therefore also included a search of online map archives to determine the likely age of the woodland in the survey area. Physical clues to age were also sought during the fieldwork and included the presence of historical wood-banks, signs of traditional silvicultural management (such as old coppice stools) and populations of plants considered to have high fidelity with ancient woodlands.

³ Contiguous or separate areas of vegetation likely to be classified as the same NVC community/sub-community.

4 RESULTS

4.1 Downside meadow

One homogenous grassland vegetation community was identified in Downside meadow.

This comprised a tall (up to 1.4m) sward with no recent signs of management (see Plates 4.1 and 4.2). The grassland community was located on a slight north-facing slope and bordered by an overgrown hedge to the south and properties and gardens to the north. No quadrats were sampled from areas close to the site boundaries as they were either overgrown with ruderal species (see Plate 4.3) or were affected by dumping of garden/construction waste from adjacent properties (see Plate 4.4).

The floristic table for this grassland community is provided in Appendix 1. In summary, community constants included false oat-grass *Arrhenatherum elatius*, cock's-foot *Dactylis glomerata* and *Holcus lanatus*. The predominance of these coarse-leaved tussock grasses is indicative of MG1 *Arrhenatherum elatius* grassland in the NVC (Rodwell, 1993). Other survey results indicating the grassland should be classified as MG1 are:

- The tall tussocky structure of the grassland: MG1 is a grassland typified by lack of management such as grazing or mowing;
- The large umbellifer hogweed *Heracleum sphondylium* is a frequent community associate of MG1 grassland;
- The presence of a layer of fine-leaved grasses and small dicotyledons beneath the layer of coarse grasses, including red fescue *Festuca rubra*, dandelion *Taraxacum* *agg.*, sorrel *Rumex acetosa* and ribwort plantain *Plantago lanceolata*, is indicative of MG1;

- The presence of ground litter, interspersed with sparse patches of bare soil and thin wefts of the bryophytes *Kindbergia praelongum* and *Brachythecium rutabulum*, is indicative of MG1.

Other constant species recorded within the vegetation community included common knapweed *Centaurea nigra* (which was also abundant in the sward), common bent. *Agrostis capillaris* and sweet vernal-grass *Anthoxanthum odoratum*. Frequent community associates included oxeye daisy *Leucanthemum vulgare* and lady's-bedstraw *Galium verum*. The frequency and relative abundance of these species is likely to be indicative of the MG1d *Centaurea nigra* sub-community, which is richer and more varied compared to other sub-communities.

However, note that the grassland in quadrat 5 (taken from the east of the site), whilst still comprising MG1 vegetation, was noticeably more species-poor and lacked species such as common knapweed, oxeye daisy and lady's bedstraw. However, several species typically viewed as negative indicator species, including creeping thistle *Cirsium arvense* and broad-leaved dock *Rumex obtusifolius* were instead present.



Plate 4.1 . Grassland community, Downside meadow



Plate 4.2. Quadrat 4



Plate 4.3. Tall ruderal vegetation adjacent to southern hedge



Plate 4.4. Waste dumped from adjacent properties on the northern boundary

4.2 A38 grassland

The grassland in the fields adjacent to the A38 had been recently cut (see Plate 4.5). The mower had been set fairly high and the sward was approximately 20cm high at the time of survey. All arisings had been left *in-situ* (see Plate 4.6).

The sward was generally dense and closed with a thatch developing comprised of red fescue, litter from cutting and the moss *Rhytidiadelphus squarrosus*. In places, patches of low-growing scrub (less than 20 cm high) were colonising, including grey willow *Salix cinerea*, rose *Rosa sp.*, bramble *Rubus fruticosus agg.* and hawthorn *Crataegus monogyna* (see Plate 4.7). These characteristics of the grassland vegetation indicate that regular

management over a period of time is likely to have comprised regular topping with the mower height set at around 9" and with all arisings left *in-situ*. Some evidence of rabbit grazing was also apparent.

Species recorded in this grassland community are listed in Table 2 in Appendix 1. The sward appeared to be dominated by grasses, particularly false oat-grass, common bent, cock's-foot, red fescue and Yorkshire fog. Forb species were generally sparse, but typical species included common vetch *Vicia sativa*, common bird's-foot trefoil *Lotus corniculatus*, hogweed and curled dock *Rumex crispus*.

The results of this survey should be treated with caution due to the recent cut of the grassland: species present in the community may no longer be apparent and therefore the vegetation community could be significantly under-valued.



Plate 4.6. A38 grassland



Plate 4.7. Arisings left *in-situ*, A38 grassland



Plate 4.8. Patches of low-growing scrub, A38 grassland

4.3 A38 road cutting

An area of grassland on a cutting adjacent to the A38 appears to have recently established (see Plate 4.9). The grassland appears to have established on relatively nutrient-poor thin soils and in places, the sward is sparse and low-growing with patches of bare stony ground and limestone bedrock (see Plate 4.10).

Species recorded in this grassland community are listed in Table 3 in Appendix 1. The sward was species-rich and a number of species indicative of unimproved limestone grassland were recorded, including fairy flax *Linum catharticum*, bee orchid *Ophrys apifera*, upright brome *Bromopsis erecta*, small scabious *Scabiosa columbaria*, salad burnet *Poterium*

sanguisorba, and greater knapweed *Centaurea scabiosa*. It is possible that the sward has developed partially from a seed mix.



Plate 4.9. Limestone grassland developing on the A38 cutting



Plate 4.10. A38 road cutting: sparse open grassland with patches of bare ground and bedrock

4.4 Cornerpool wood

Cornerpool Wood comprises a small broad-leaved woodland situated on a gentle south-facing slope. The woodland is comprised of two connected strips (sampled as two separate quadrats) with a large central glade (see Plate 4.13).

The canopy is generally dominated by ash *Fraxinus excelsior* with occasional oak *Quercus robur* standards (see Plate 4.12). Most of the ash are notable mature trees with a number of rot holes and standing dead wood. However, the canopy cover is generally sparse at approximately 40% cover overall and this has allowed secondary canopy species and species more typical of the understory layer to colonise the canopy, including wych elm *Ulmus glabra*, cherry *Prunus avium*, hazel *Corylus avellana*, and hawthorn *Crataegus monogyna*.

The understory is generally sparse at around 15 to 30% cover, although denser clumps of bramble *Rubus fruticosus* agg. and gooseberry *Ribes uva-crispa* are establishing where there are substantial breaks in the canopy. A number of old hazel coppice stools were present which appeared to have been fairly recently coppiced with the regrowth at approximately 1m high (see Plate 4.14). Other typical understorey species included hawthorn and elder *Sambucus nigra*.

The ground flora varied within the wood as follows:

- Within quadrat 1, the field layer was dominated by dog's-mercury *Mercurialis perennis* and ground ivy *Glechoma hederacea* (see Plate 4.11) with a range of other typical woodland species at low cover, such as red campion *Silene dioica*, herb bennett *Geum urbanum*, herb robert *Geranium robertianum*, wood dock *Rumex sanguineus* and false brome *Brachypodium sylvaticum*.
- Within quadrat 2 (see Plate 4.12), the open canopy had led to the development of a grassy field layer dominated by rough meadow-grass *Poa trivialis*. Although most species recorded in this quadrat were typical of slightly-shaded grassland (e.g. red campion, herb bennett, ribwort plantain), several ancient woodland indicators were also recorded in a small patch in this quadrat, but were not found anywhere else within the site, including wood speedwell *Veronica montana*, wood anemone *Anemone nemorosa*, and wood sedge *Carex sylvatica*.

- Wherever there were open breaks in the canopy, particularly in the central glade, the ground flora was typically dominated by tall ruderal species, including nettle *Urtica dioica*, burdock *Articum minus* and bramble (see Plate 4.16). In places, this tall ruderal vegetation was over 2m high and may indicate some local nutrient enrichment. Care was taken not to sample field layer quadrats in this vegetation.

There were a number of indications of previous disturbance to the woodland vegetation, including the following:

- In places, the ground was uneven and rough, including patches of made ground. A small borrow pit with steep banks was noted in the south east of the woodland.
- Introduced garden species were recorded in quadrat 2, including daffodil cultivars and the hybrid Spanish bluebell *Hyacinthoides x massartiana*.

Some evidence of woodland management was apparent, including the following:

- Planting along the eastern boundary of the woodland (see Plate 4.15), including hazel, holly *Ilex aquifolium*, field maple and wild privet *Ligustrum vulgare*. A field to the west of the woodland had also been planted with similar species (see Plate 4.18) plus dogwood *Cornus sanguinea*, ash and hornbeam *Carpinus betulus*. The planting was not generally in good condition with tree shelters, ties and stakes still present and with a number of failures.
- All hazel stools had been recently coppiced, possibly at the same time as the planting was undertaken. Arisings from woodland clearance had been left as brash piles. Most coppice regrowth appeared to have suffered from some deer damage.



Plate 4.11. Woodland in quadrat 2



Plate 4.12. Woodland in quadrat 2



Plate 4.13. Large central glade



Plate 4.14. Recently coppiced hazel stool



Plate 4.15. Planting along the eastern site boundary



Plate 4.16. Patch of tall ruderal vegetation dominating ground flora beneath a canopy gap



Plate 4.17. Old boundary field maple



Plate 4.18. Planting to west of Corner Pool Wood

4.4.1 Ancient woodland?

Much has been written about the fidelity of certain woodland species with ancient woodland. However, there is still much disagreement about which species are reliable indicators of ancient woodland, stemming mainly from natural variation in species ecology and distribution in different regions. It has long been known that many woodland plants are slow to colonise new sites and this is one of the main reasons why many woodland indicators show such high fidelity to old and undisturbed sites. Unfortunately, very few ancient woodland indicators are strictly confined to apparently old woods, but the presence of a well-populated and diverse community of such species can often be cited as evidence of a long-wooded site.

Rose (1999) identifies a number of species considered to be reliable indicators of ancient woodland in southern England. Species with a high fidelity to such places that were present within the surveyed woodland, albeit at very low cover and abundance (rare), include wood

anemone, wood speedwell, three-nerved sandwort *Moehringia trinervia*, moschatel *Adoxa moschatellina* and wood sedge. Although Rose also considers bluebell *Hyacinthoides non-scripta* to be a widespread AWI, others disagree. Rackham (2006) considers it to be strongly indicative of ancient woodland only in eastern England and Lincolnshire although old woodlands remain its stronghold in most other areas apart from the north and west.

The 1:10,560 Epoch 1 1884–1894 map of the area (Figure 4.1) shows that Corner Pool Wood was already mature woodland in the late nineteenth century (www.british-history.ac.uk) which further increases the likelihood that it can be described as ancient woodland. Although Corner Pool Wood is not included on Natural England's Ancient Woodland Inventory, it should be noted that woodlands smaller than 2ha are frequently omitted from this dataset.

The presence of the following features is also likely to indicate ancient woodland:

- Old hazel coppice stools.
- Old field maple *Acer campestre* along the southern and western boundaries (see Plate 4.17).

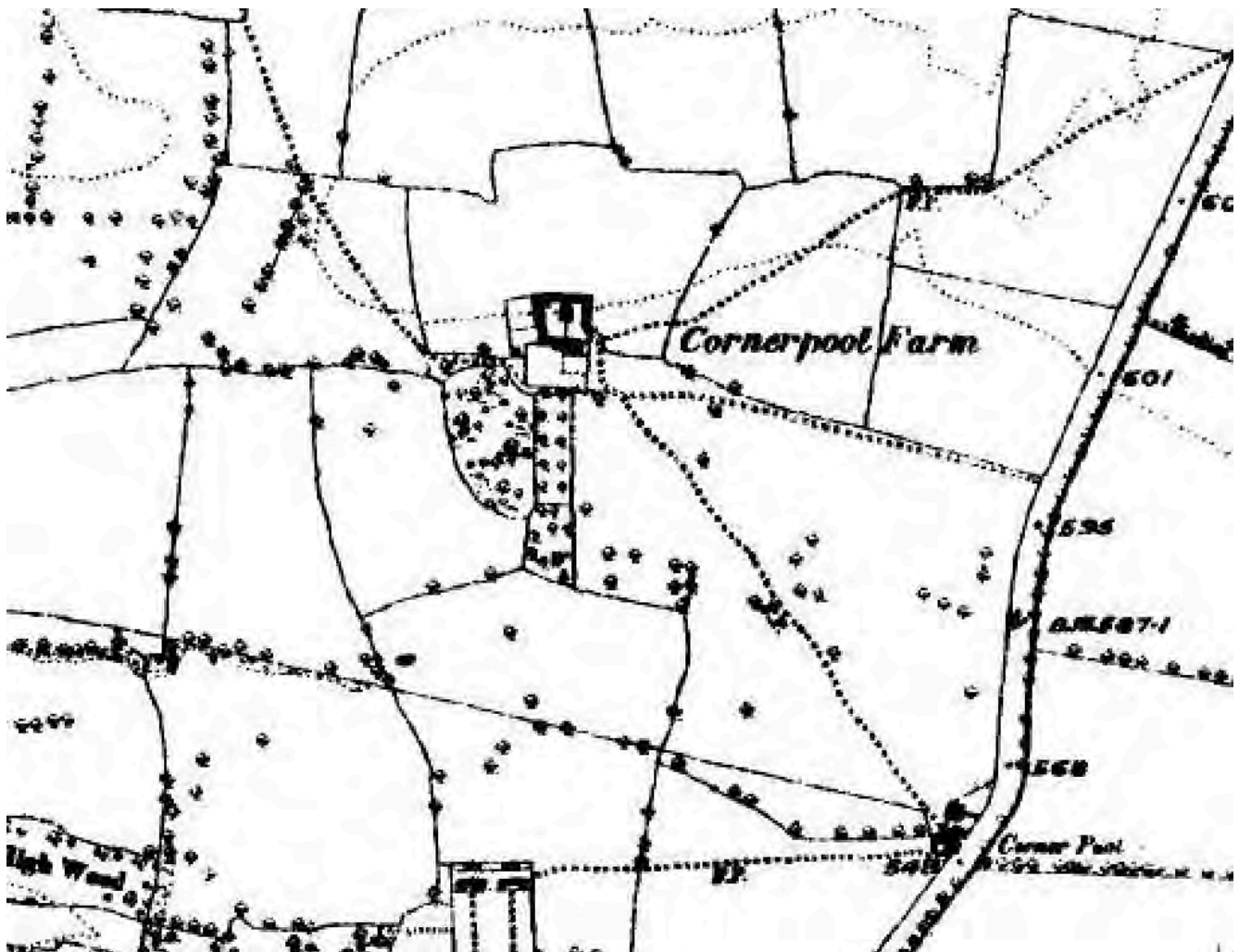


Figure 4.1. OS Map name 011/NE', in Map of Somerset (Southampton, 1884-1894), <http://www.british-history.ac.uk/os-1-to-10560/somerset/011/ne> [accessed 7 August 2015].

4.4.2 NVC community

The woodland vegetation shows some affinities to W8 *Fraxinus excelsior* – *Acer campestre* – *Mercurialis perennis* vegetation, which is the typical community of calcareous soils in the lowlands of southern Britain. In essence, the general diagnostic characters of the woody component for this community are provided by ash, field maple and hazel (although there are many regional and other variations). The main diagnostic character of the field layer is the occurrence of dog's mercury (which was particularly the case for quadrat 1) together with mixtures of bluebell, enchanter's nightshade *Circaea lutetiana*, herb bennett, lords-

and-ladies *Arum maculatum* and dog-violet (all of which were recorded in the woodland at varying frequency/ cover).

However, the fit to W8 vegetation is poor and this is primarily due to the history of disturbance. Gaps in the canopy have been colonised by species such as wych elm and cherry which are not typical of W8 canopy. Ground disturbance and nutrient enrichment has also resulted in the predominance of opportunistic ruderal species such as nettle and bramble: the area of typical woodland ground flora is small; and the occurrence of ancient woodland indicators is rare.

It should be noted that as a tool for vegetation description, the NVC has limitations, especially with respect to plant communities arising from, or influenced by significant levels of human disturbance.

5 RECOMMENDATIONS

5.1 Downside meadow

- The grassland comprises a ubiquitous vegetation type, but is more species-rich than the typical impoverished sub-community.
- Regular management is required to prevent coarse ruderal species from dominating and to allow opportunities for the fine-leaved grasses and small dicotyledons to flourish.
- Grazing would be the preferred option but is probably not practical for this site.
- Management should therefore comprise at least an annual cut during the period August to early October with all arisings removed from the site or to a sacrificial area (e.g. as a habitat pile on the area which has been subject to dumping of waste from adjacent properties).

- It is recommended that the strip of ruderal vegetation adjacent to the southern hedge is retained as important shelter and over-wintering habitat for invertebrates. Management should comprise cutting 1 /3 of this vegetation back every year (i.e. cut on a 3 year cycle).

5.2 A38 grassland

- A survey should be undertaken in summer 2016 prior to any cutting of the vegetation to allow accurate characterisation of the community.
- Further management recommendations would follow this survey. However, in the interim, it is important to remove all cuttings/ arisings from the grassland to prevent it from becoming nutrient-enriched.

5.3 A38 road cutting

- No management currently recommended. However, regular monitoring is proposed to allow management to be implemented if necessary (e.g. where coarse grasses and scrub appear to be colonising at the expense of the limestone grassland community).

5.4 Cornerpool Wood

- At this stage, no management within Corner Pool Wood is recommended. Shrubs and trees should be allowed to develop to better-establish the canopy and understorey and reduce the predominance of tall ruderal vegetation in the field layer.
- Regular botanical monitoring should be undertaken to determine the point at which management should commence (e.g. coppicing).
- It is recommended that shelters, stakes and ties are removed from planted trees and shrubs.

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6/8/15

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APPENDIX 1. DETAILED SURVEY RESULTS

Table 1. Floristic table for the Downland meadow community

Species			Domin recorded per quadrat				
Scientific Name	English name	Frequency	Q1 ST51140 65601	Q2 ST51149 65601	Q3 ST51173 65588	Q4 ST51191 65585	Q5 ST51256 65554
COMMUNITY CONSTANTS							
<i>Arrhenatherum elatius</i>	False oat-grass	V	8	8	7	7	9
<i>Holcus lanatus</i>	Yorkshire fog	V	4	4	3	5	5
<i>Dactylis glomerata</i>	Cock's-foot	V	4	2	3	4	2
<i>Agrostis capillaris</i>	Common bent	V	4	4	4	2	4
<i>Kindbergia praelongum</i>	Common feather-moss	V	3	3	3	3	1
<i>Centaurea nigra</i>	Common knapweed	IV	5	8	8	8	-
<i>Convolvulus arvensis</i>	Field bindweed	IV	2	3	2	2	-
<i>Anthoxanthum odoratum</i>	Sweet vernal-grass	IV	2	1	1	2	-
<i>Plantago lanceolata</i>	Ribwort plantain	IV	4	4	4	4	-
<i>Ranunculus acris</i>	Meadow buttercup	IV	2	1	1	3	-
<i>Festuca rubra</i>	Red fescue	IV	3	3	3	4	-
<i>Rumex acetosa</i>	Sorrel	IV	1	1	2	2	-
COMMUNITY ASSOCIATES							
<i>Brachythecium rutabulum</i>	Rough stalked feather-moss	III	2	2	-	3	-
<i>Taraxacum agg</i>	Dandelion	III	1	1	-	1	-
<i>Glechoma hederacea</i>	Ground ivy	III	1	-	1	1	-
<i>Leucanthemum vulgare</i>	Oxeye daisy	III	-	2	2	2	-

Species			Domin recorded per quadrat				
Scientific Name	English name	Frequency	Q1 ST51140 65601	Q2 ST51149 65601	Q3 ST51173 65588	Q4 ST51191 65585	Q5 ST51256 65554
<i>Heracleum sphondylium</i>	Hogweed	III	-	-	1	1	5
<i>Galium aparine</i>	Cleavers	II	2	-	-	-	-
<i>Poa pratensis</i>	Smooth meadow-grass	II	2	-	1	-	-
<i>Trisetum flavescens</i>	Yellow oat-grass	II	-	2	1	-	-
<i>Plagiomnium undulatum</i>	Hart's-tongue thyme-moss	II	-	2	2	-	-
<i>Lathyrus pratensis</i>	Meadow vetchling	II	-	-	3	-	4
<i>Elytrigia repens</i>	Common couch	I	1	-	-	-	-
<i>Oxyrrhynchium hians</i>	Swartz's feather-moss	I	1	-	-	-	-
<i>Senecio jacobaea</i>	Common ragwort	I	-	-	-	1	-
<i>Galium verum</i>	Lady's bedstraw	I	-	5	-	-	-
<i>Prunella vulgaris</i>	Selfheal	I	-	2	-	-	-
<i>Anthriscus sylvestris</i>	Cow parsley	I	-	-	1	-	-
<i>Agrostis stolonifera</i>	Creeping bent	I	-	-	1	-	-
<i>Rumex obtusifolius</i>	Broad-leaved dock	I	-	-	-	-	1
<i>Cirsium arvense</i>	Creeping thistle	I	-	-	-	-	5
<i>Poa trivialis</i>	Rough meadow-grass	I	-	-	-	-	1
OTHER SPECIES IN THE STAND							
<i>Rumex crispus</i>	Curled dock	N/A	-	-	-	-	-
<i>Cerastium fontanum</i>	Common mouse-ear	N/A	-	-	-	-	-
<i>Urtica dioica</i>	Common nettle	N/A	-	-	-	-	-
<i>Ranunculus repens</i>	Creeping buttercup	N/A	-	-	-	-	-
<i>Cirsium vulgare</i>	Spear thistle	N/A	-	-	-	-	-
<i>Potentilla reptans</i>	Creeping cinquefoil	N/A	-	-	-	-	-
<i>Centaurea scabiosa</i>	Greater knapweed	N/A	-	-	-	-	-

Table 2. Botanical inventory: A38 grassland

Species		
Scientific name	English name	DAFOR
<i>Achillea millefolium</i>	Yarrow	R
<i>Aethusa cynapium</i>	Fool's parsley	R
<i>Agrostis capillaris</i>	Common bent	A
<i>Agrostis stolonifera</i>	Creeping bent	O
<i>Anthoxanthum odoratum</i>	Sweet vernal-grass	O
<i>Arrhenatherum elatius</i>	False oat-grass	A
<i>Carex flacca</i>	Glaucous sedge	R
<i>Cerastium fontanum</i>	Common mouse-ear	O
<i>Chamerion angustifolium</i>	Rosebay willowherb	O
<i>Cirsium arvense</i>	Creeping thistle	O
<i>Cirsium vulgare</i>	Spear thistle	O
<i>Convolvulus arvensis</i>	Field bindweed	O
<i>Crataegus monogyna</i> (sapling)	Hawthorn	O
<i>Crepis capillaris</i>	Smooth hawk's-beard	R
<i>Dactylis glomerata</i>	Cock's-foot	F
<i>Epilobium parviflorum</i>	Hoary willowherb	R
<i>Festuca rubra</i>	Red fescue	F
<i>Geranium dissectum</i>	Cut-leaved crane's-bill	O
<i>Geranium molle</i>	Dove's-foot crane's-bill	O
<i>Glechoma hederacea</i>	Ground ivy	R
<i>Heracleum sphondylium</i>	Hogweed	LF
<i>Holcus lanatus</i>	Yorkshire fog	F
<i>Lathyrus pratensis</i>	Meadow vetchling	O
<i>Leontodon hispidus</i>	Rough hawkbit	R
<i>Lolium perenne</i>	Perennial rye-grass	O
<i>Lotus corniculatus</i>	Common bird's-foot trefoil	LF
<i>Mentha arvensis</i>	Corn mint	R
<i>Myosotis arvensis</i>	Field forget-me-not	R
<i>Phleum pratense</i>	Timothy	O
<i>Plantago lanceolata</i>	Ribwort plantain	O
<i>Poa trivialis</i>	Rough meadow-grass	O
<i>Potentilla reptans</i>	Creeping cinquefoil	R
<i>Prunella vulgaris</i>	Selfheal	R
<i>Pulicaria dysenterica</i>	Common fleabane	R
<i>Ranunculus acris</i>	Meadow buttercup	R
<i>Ranunculus repens</i>	Creeping buttercup	R
<i>Rhytidiadelphus squarrosus</i>	Springy turf-moss	F

Species		
Scientific name	English name	DAFOR
<i>Rosa arvensis</i>	Field rose	O
<i>Rosa canina</i>	Dog rose	R
<i>Rubus fruticosus agg.</i>	Bramble	O
<i>Rumex acetosa</i>	Common sorrel	R
<i>Rumex crispus</i>	Curled dock	LF
<i>Rumex obtusifolius</i>	Broad-leaved dock	LF
<i>Salix cinerea (sapling)</i>	Grey willow	O
<i>Senecio jacobaea</i>	Common ragwort	O
<i>Stellaria graminea</i>	Lesser stitchwort	R
<i>Taraxacum agg</i>	Dandelion	O
<i>Trifolium dubium</i>	Lesser trefoil	R
<i>Trifolium pratense</i>	Red clover	O
<i>Trifolium repens</i>	White clover	O
<i>Trisetum flavescens</i>	Yellow oat-grass	R
<i>Urtica dioica</i>	Nettle	O
<i>Veronica persica</i>	Common field-speedwell	R
<i>Vicia cracca</i>	Tufted vetch	R
<i>Vicia sativa</i>	Common vetch	F
<i>Vicia sepium</i>	Bush vetch	O

Table 3. Botanical inventory: A38 road cutting

Species		
Scientific name	English name	DAFOR
<i>Ophrys apifera</i>	Bee orchid	LF
<i>Lotus corniculatus</i>	Common bird's-foot trefoil	A
<i>Leucanthemum vulgare</i>	Oxeye daisy	LF
<i>Leontodon hispidus</i>	Rough hawkbit	F
<i>Achillea millefolium</i>	Yarrow	F
<i>Linum catharticum</i>	Fairy flax	A
<i>Medicago lupulina</i>	Black medick	F
<i>Prunella vulgaris</i>	Selfheal	F
<i>Festuca ovina</i>	Sheep's fescue	F
<i>Arrhenatherum elatius</i>	False oat grass	LA
<i>Dactylis glomerata</i>	Cock's-foot	F
<i>Centaurea nigra</i>	Common knapweed	F
<i>Galium verum</i>	Lady's bedstraw	F
<i>Plantago lanceolata</i>	Ribwort plantain	F
<i>Calliergonella cuspidata</i>	Pointed spear-moss	F
<i>Senecio jacobaea</i>	Common ragwort	O
<i>Anthoxanthum odoratum</i>	Sweet vernal-grass	O
<i>Scabiosa columbaria</i>	Small scabious	F
<i>Potentilla anserina</i>	Silverweed	O
<i>Centaurea scabiosa</i>	Greater knapweed	O
<i>Rhytidiadelphus squarrosus</i>	Springy turf-moss	F
<i>Holcus lanatus</i>	Yorkshire fog	F
<i>Cynosurus cristatus</i>	Crested dog's-tail	O
<i>Bromopsis erecta</i>	Upright brome	F
<i>Crepis capillaris</i>	Smooth hawk's-beard	O
<i>Cirsium vulgare</i>	Spear thistle	O
<i>Glechoma hederacea</i>	Ground ivy	O
<i>Poterium sanguisorba</i>	Salad burnet	R
<i>Trifolium repens</i>	White clover	R
<i>Viburnum lantana</i> (Sapling)	Wayfaring tree	R
<i>Galium album</i>	Hedge bedstraw	R
<i>Geranium pratense</i>	Meadow crane's-bill	O
<i>Ligustrum vulgare</i> (Sapling)	Wild privet	R
<i>Vicia cracca</i>	Tufted vetch	R

Table 4. Quadrat data, Corner Pool Wood

Species		Domin score	
Scientific name	English name	Quadrat 1	Quadrat 2
Canopy (entire stand)			
<i>Fraxinus excelsior</i>	Ash	6	6
<i>Ulmus glabra</i>	Wych elm	4	–
<i>Quercus robur</i>	English oak	2	4
<i>Crataegus monogyna</i>	Hawthorn	4	4
<i>Prunus avium</i>	Cherry	4	4
<i>Sambucus nigra</i>	Elder	1	–
<i>Corylus avellana</i>	Hazel	1	–
<i>Betula pubescens</i>	Downy birch	–	4
<i>Acer campestre</i>	Field maple	2	–
Understorey (entire stand)			
<i>Corylus avellana</i>	Hazel	4	5
<i>Crataegus monogyna</i>	Hawthorn	4	4
<i>Rubus fruticosus agg.</i>	Bramble	4	4
<i>Sambucus nigra</i>	Elder	–	2
<i>Ilex aquifolium</i>	Holly	4	–
<i>Acer campestre</i>	Field maple	1	–
<i>Ribes uva-crispa</i>	Gooseberry	4	–
<i>Prunus spinosa</i>	Blackthorn	1	–

Species		Domin score	
Scientific name	English name	Quadrat 1	Quadrat 2
<i>Rosa canina</i>	Dog rose	1	–
Field layer (10 x 10m quadrat)			
<i>Urtica dioica</i>	Nettle	4	7
<i>Mercurialis perennis</i>	Dog's–mercury	9	–
<i>Rumex sanguineus</i>	Wood dock	2	5
<i>Galium aparine</i>	Cleavers	2	3
<i>Glechoma hederacea</i>	Ground ivy	7	4
<i>Hyacinthoides non-scripta</i>	Bluebell	3	–
<i>Geranium robertianum</i>	Herb robert	4	2
<i>Rubus fruticosus agg.</i>	Bramble	4	–
<i>Geum urbanum</i>	Herb bennett	3	3
<i>Brachypodium sylvaticum</i>	False brome	4	–
<i>Viola odorata</i>	Sweet violet	2	–
<i>Poa trivialis</i>	Rough meadow–grass	4	8
<i>Alliaria petiolata</i>	Garlic mustard	1	–
<i>Silene dioica</i>	Red campion	1	–
<i>Veronica chamaedrys</i>	Germander speedwell	2	4
<i>Circaea lutetiana</i>	Enchanter's nightshade	4	–
<i>Hyacinthoides x massartiana</i>	Hybrid bluebell	–	5
<i>Ranunculus repens</i>	Creeping buttercup	–	4

Species		Domin score	
Scientific name	English name	Quadrat 1	Quadrat 2
<i>Narcissus sp.</i>	Daffodil (garden cultivar)	–	4
<i>Plantago lanceolata</i>	Ribwort plantain	–	2
<i>Veronica montana</i>	Wood speedwell	–	1
<i>Arrhenatherum elatius</i>	False oat-grass	–	2
<i>Anemone nemorosa</i>	Wood anemone	–	1
<i>Ficaria verna</i>	Celandine	–	2
<i>Carex sylvatica</i>	Wood sedge	–	1
<i>Brachythecium rutabulum</i>	A moss	2	–
<i>Thamnobryum alopecurum</i>	A moss	3	–
<i>Neckera complanata</i>	A moss	1	–
<i>Didymodon insulanus</i>	A moss	1	–
<i>Bryum capillare</i>	A moss	1	–
<i>Kindbergia praelongum</i>	A moss	–	1
Other species in the field layer (outside the sampled quadrats)			
<i>Stachys sylvatica</i>	Hedge woundwort	–	–
<i>Rumex obtusifolius</i>	Broad-leaved dock	–	–
<i>Epilobium hirsutum</i>	Great willowherb	–	–
<i>Dactylis glomerata</i>	Cock's-foot	–	–
<i>Cirsium fontanum</i>	Common mouse-ear	–	–
<i>Holcus lanatus</i>	Yorkshire fog	–	–

Species		Domin score	
Scientific name	English name	Quadrat 1	Quadrat 2
<i>Cirsium arvense</i>	Creeping thistle	–	–
<i>Arctium minus</i>	Burdock	–	–
<i>Senecio jacobaea</i>	Ragwort	–	–
<i>Cirsium vulgare</i>	Spear thistle	–	–
<i>Viola riviniana</i>	Common dog-violet	–	–
<i>Lysimachia nummularia</i>	Creeping-jenny	–	–
<i>Primula vulgaris</i>	Primrose	–	–
<i>Dryopteris filix-mas</i>	Male fern	–	–
<i>Schedonurus giganteus</i>	Giant fescue	–	–
<i>Vicia sepium</i>	Bush vetch	–	–
<i>Deschampsia cespitosa</i>	Tufted hair-grass	–	–
<i>Moehringia trinervia</i>	Three-nerved sandwort	–	–
<i>Adoxa moschatellina</i>	Moschatel	–	–
<i>Arum maculatum</i>	Lords-and-ladies	–	–
<i>Hedera helix</i>	Ivy	–	–
<i>Asplenium scolopendrium</i>	Hart's-tongue fern	–	–



DOWNSIDE MEADOW AND AIRSIDE GRASSLAND BOTANICAL SURVEY

BIODIVERSITY ACTION PLAN IMPLEMENTATION

ON BEHALF OF BRISTOL INTERNATIONAL AIRPORT

1. INTRODUCTION

Bristol Airport was granted outline planning permission for the development of the airport in 2009 (09/P/1020/OT2). A range of ecological mitigation measures was required as part of delivering the construction phases of the development, documented in a Nature Conservation Strategy and Biodiversity Action Plan. As part of this, several areas of botanical interest identified during the original surveys undertaken in support of the planning application were proposed for a management regime designed to enhance the value of these habitats. This technical note sets out a detailed and up-to-date botanical baseline for Downside Meadow and the extensive airside grasslands in 2016.

2. METHODOLOGY

The field surveys were undertaken by a qualified and experienced expert botanist from Johns Associates Ltd on the 15th September 2016 and the 5th October 2016.

The airfield grassland had been cut recently prior to the survey as part of a frequent (3 weekly) cutting regime throughout the growing season¹. Grassland that has been recently cut, mown or grazed should be treated with caution as many species of plant will no longer be apparent; and therefore the vegetation community could be inaccurately classified or characterised. As such, it was not possible to accurately characterise the vegetation community using the NVC survey methodology and no quadrats were sampled.

In addition, the Downside Meadow was subject to NVC survey in 2015. Upon visiting the site, it was clear that the vegetation community remained unchanged in terms of species composition, physiognomy, structure and management. As such, it was felt that sampling the vegetation with quadrats was not necessary and would not add any value or information in terms of monitoring for the Airport BAP.

¹ Jim Callaway (Airside Operations Officer) *Pers. Com.*

² Reported in: (Entec UK Ltd, June 2009). Environmental Statement: Development and Enhancement of Bristol

As such, the surveyor undertook a botanical inventory of both the airside grassland and Downside Meadow, recording species vegetatively where possible. This information was used to compile a species list for both areas, attributing descriptive scores of abundance to each species using the DAFOR scale:

D	Dominant
A	Abundant
F	Frequent
O	Occasional
R	Rare
L	Local (prefix that can be applied to any of the above).

The area covered by the botanical inventory survey is shown on Figure 1 below.

Survey limitations

The surveys were undertaken relatively late in the season. In addition, the airside grassland had been subject to regular cuts throughout the 2016 growing season. As such, it was possible that species present in the vegetation communities may have been absent from the sward at the time of survey and may have been missed (particularly early-flowering species). Nevertheless, the data obtained is deemed to give a reasonable overall picture of the vegetation communities and associated ecological value.



Figure 1. Area covered by botanical inventory survey

3. RESULTS AND DISCUSSION

3.1. Downside Meadow

The grassland vegetation community in Downside meadow comprised a tall (up to 1.4m) sward with no recent signs of management. The grassland community was located on a slight north-facing slope and bordered by an overgrown hedge to the south and



properties and gardens to the north. The grassland was rank and tussocky with a significant litter layer. Along the southern boundary, the grassland was grading into a stand of tall ruderal vegetation (dominated by hogweed *Heracleum sphondylium* and nettle *Urtica dioica*).

The species list for this grassland community is provided in Table 1 below. In summary, the predominant species in the sward comprised false oat-grass *Arrhenatherum elatius*, cock's-foot *Dactylis glomerata* and *Holcus lanatus*. Frequent or locally frequent species included black knapweed *Centaurea nigra*, ribwort plantain *Plantago lanceolata*, red fescue *Festuca rubra*, common bent *Agrostis capillaris*, meadow vetchling *Lathyrus pratensis* and field bindweed *Convolvulus arvensis*.

The grassland community was considered virtually identical to that recorded in 2015 in terms of species composition, structure and physiognomy. The only differences noted were as follows:

- A couple of areas were being subject to regular mowing, presumably on an informal basis by neighbours occupying adjacent properties. This included an access track to a shed running along the northern boundary; and a circuit in the east of the site, which appeared to be in use as a go-kart track.
- Areas of tall ruderal vegetation had increased in size since the survey in 2015. This is indicative of the lack of management of the grassland vegetation, resulting in successional changes towards an eventual scrub/ woodland community.
- A strip of annual meadow flowers had been planted within the grassland measuring approximately 10x1m. A range of species were recorded here, some of which were not native, including bugloss *Anchusa arvensis*, cornflower *Centaurea cyanus*, clary sp *Salvia sp.*, and catchfly sp. *Silene sp.* A large number of bees were noted as being associated with this flowering strip. Subsequent discussion with Melanie King (Environment Manager, Bristol Airport) confirmed that BIA had cultivated and sown this strip.

Table 1. Botanical inventory, Downside Meadow

Scientific name	English name	DAFOR
<i>Achillea millefolium</i>	Yarrow	O
<i>Agrostis capillaris</i>	Common bent	F
<i>Anthoxanthum odoratum</i>	Sweet vernal-grass	O
<i>Anthriscus sylvestris</i>	Cow parsley	O
<i>Arrhenatherum elatius</i>	False oat-grass	A
<i>Brachythecium rutabulum</i>	Rough stalked feather-moss	O
<i>Calystegia sp.</i>	Bindweed sp.	R
<i>Centaurea nigra</i>	Common knapweed	LF
<i>Cerastium fontanum</i>	Common mouse-ear	R
<i>Cirsium arvense</i>	Creeping thistle	O
<i>Convolvulus arvensis</i>	Field bindweed	F
<i>Dactylis glomerata</i>	Cock's-foot	F
<i>Elytrigia repens</i>	Common couch	O
<i>Epilobium parviflorum</i>	Hoary willowherb	R



Scientific name	English name	DAFOR
<i>Festuca rubra</i>	Red fescue	F
<i>Galium aparine</i>	Cleavers	O
<i>Galium verum</i>	Lady's bedstraw	O
<i>Glechoma hederacea</i>	Ground ivy	O
<i>Heracleum sphondylium</i>	Hogweed	F
<i>Holcus lanatus</i>	Yorkshire fog	F
<i>Lathyrus pratensis</i>	Meadow vetchling	LF
<i>Leucanthemum vulgare</i>	Oxeye daisy	O
<i>Phleum pratense</i>	Timothy	O
<i>Plantago lanceolata</i>	Ribwort plantain	F
<i>Poa trivialis</i>	Rough meadow-grass	R
<i>Potentilla reptans</i>	Creeping cinquefoil	R
<i>Prunella vulgaris</i>	Selfheal	R
<i>Ranunculus acris</i>	Meadow buttercup	O
<i>Ranunculus repens</i>	Creeping buttercup	O
<i>Rumex acetosa</i>	Sorrel	O
<i>Rumex crispus</i>	Curled dock	R
<i>Rumex obtusifolius</i>	Broad-leaved dock	O
<i>Senecio jacobaea</i>	Common ragwort	O
<i>Taraxacum agg</i>	Dandelion	O
<i>Urtica dioica</i>	Common nettle	R

3.2. Airside grassland

Generally, the airside grassland was characterised by a luxuriant closed sward, approximately 20 to 30cm high with no significant thatch or leaf litter. Very few flowering heads were evident at the time of survey, which meant that the majority of species had to be identified vegetatively. Species composition and structure of the grassland appeared to have changed very little from the NVC surveys undertaken in 2007².

Four separate grassland types were noted during the survey, each of which has been described below.

Species-poor semi-improved neutral grassland

This vegetation type covered large swathes of the airfield grassland. The grassland community was dominated by grasses, including false oat-grass and cock's-foot with locally frequent common bent, Yorkshire fog, red fescue and tall fescue *Schedonurus arundinaceus*. A small number of common forb species were recorded as shown in Table 2 below, but none were recorded as more than occasional in the sward. Examples include dandelion *Taraxacum agg.*, common mouse-ear *Cerastium fontanum*, field bindweed *Convolvulus arvensis* and ribwort plantain *Plantago lanceolata*. It should be noted that species diversity was variable in different compartments, ranging from

² Reported in: (Entec UK Ltd, June 2009). Environmental Statement: Development and Enhancement of Bristol International Airport. Appendix A. Ecological Baseline Report.

virtually no forb species, to a sward supporting most forb species in Table 2 (albeit as occasional).

Table 2. Species recorded in species-poor semi-improved neutral grassland

Scientific name	English name	DAFOR
<i>Achillea millefolium</i>	Yarrow	O
<i>Agrostis capillaris</i>	Common bent	LF
<i>Arrhenatherum elatius</i>	False oat-grass	F
<i>Cerastium fontanum</i>	Common mouse-ear	O
<i>Convolvulus arvensis</i>	Field bindweed	O
<i>Crepis capillaris</i>	Smooth hawk's-beard	R
<i>Dactylis glomerata</i>	Cock's-foot	F
<i>Festuca rubra</i>	Red fescue	LF
<i>Geranium molle</i>	Dove's-foot crane's-bill	O
<i>Heracleum spondylium</i>	Hogweed	O
<i>Holcus lanatus</i>	Yorkshire fog	LF
<i>Lathyrus pratensis</i>	Meadow vetchling	R
<i>Lolium perenne</i>	Perennial rye-grass	O
<i>Plantago lanceolata</i>	Ribwort plantain	O
<i>Potentilla reptans</i>	Creeping cinquefoil	O
<i>Ranunculus acris</i>	Meadow buttercup	O
<i>Ranunculus repens</i>	Creeping buttercup	O
<i>Rubus fruticosus agg.</i>	Bramble	R
<i>Rumex acetosa</i>	Sorrel	O
<i>Rumex crispus</i>	Curled dock	O
<i>Rumex obtusifolius</i>	Broad-leaved dock	O
<i>Schedonurus arundinaceus</i>	Tall fescue	LF
<i>Stellaria graminea</i>	Lesser stitchwort	O
<i>Taraxacum agg.</i>	Dandelion	O
<i>Trifolium pratense</i>	Red clover	O
<i>Urtica dioica</i>	Nettle	R
<i>Vicia cracca</i>	Tufted vetch	O

Species-poor semi-improved calcareous grassland

Some of the large airfield compartments supported similar species to those listed in Table 2 above but with frequent upright brome *Bromopsis erecta* and occasional greater knapweed *Centaurea scabiosa*, bulbous buttercup *Ranunculus bulbosus*, and wild carrot *Daucus carota*. Upright brome in particular is a key indicator of calcareous grassland; and these areas should be classified as semi-improved calcareous grassland (albeit species-poor).

Areas noted as having upright brome prominent in the sward are shown on Figure 2 below. No attempt has been made to define the boundaries between species-poor semi-improved neutral and calcareous grassland as it is impossible to do this by eye given the

recent vegetation management. In practice, there are likely to be transitions or zonations between neutral and calcareous vegetation types within the airfield grassland.

Species-rich semi-improved calcareous grassland

A few small areas within the airside grassland supported a more species-rich calcareous grassland (albeit still semi-improved). These areas have been shown on Figure 2 below with species listed in Table 3. Frequent upright brome is indicative of calcareous grassland. Species indicative of less improved calcareous conditions include downy oat-grass *Avenula pubescens*, quaking-grass *Briza media*, greater knapweed, wild basil *Clinopodium vulgare*, common spotted orchid *Dactylorhiza fuchsii*, rough hawkbit *Leontodon hispidus*, fairy flax *Linum catharticum* and cowslip *Primula veris*.

The grassland cannot be classified as unimproved for the following reasons:

- most of these indicator species are only recorded as occasional in the sward as the vegetation is dominated by grass species; and
- the absence of other characteristic species that would indicate grassland with high species diversity (e.g. crested hair-grass *Koeleria macrantha*, wild thyme *Thymus polytrichus*, milkwort *Polygala sp* etc).

Table 3. Species recorded in species-rich semi-improved calcareous grassland

Scientific name	English name	DAFOR
<i>Achillea millefolium</i>	Yarrow	O
<i>Agrostis capillaris</i>	Common bent	LF
<i>Arrhenatherum elatius</i>	False oat-grass	F
<i>Avenula pubescens</i>	Downy oat-grass	O
<i>Briza media</i>	Quaking-grass	O
<i>Bromopsis erecta</i>	Upright brome	F
<i>Centaurea nigra</i>	Black knapweed	O
<i>Centaurea scabiosa</i>	Greater knapweed	O
<i>Cerastium fontanum</i>	Common mouse-ear	O
<i>Clinopodium vulgare</i>	Wild basil	R
<i>Convolvulus arvensis</i>	Field bindweed	O
<i>Crepis capillaris</i>	Smooth hawk's-beard	R
<i>Dactylis glomerata</i>	Cock's-foot	O
<i>Dactylorhiza fuchsii</i>	Common spotted orchid ³	
<i>Daucus carota</i>	Wild carrot	O
<i>Festuca rubra</i>	Red fescue	LF
<i>Galium album</i>	Hedge bedstraw	O
<i>Galium verum</i>	Lady's bedstraw	O
<i>Glechoma hederacea</i>	Ground ivy	O
<i>Holcus lanatus</i>	Yorkshire fog	O
<i>Knautia arvensis</i>	Field scabious	R

³ Jim Callaway *Pers. Com.* (no residual orchid spikes apparent at the time of survey).



Scientific name	English name	DAFOR
<i>Lathyrus pratensis</i>	Meadow vetchling	O
<i>Leontodon hispidus</i>	Rough hawkbit	LF
<i>Leucanthemum vulgare</i>	Oxeye daisy	O
<i>Linum catharticum</i>	Fairy flax	LF
<i>Lolium perenne</i>	Perennial rye-grass	O
<i>Lotus corniculatus</i>	Common bird's-foot trefoil	O
<i>Medicago lupulina</i>	Black medick	O
<i>Plantago lanceolata</i>	Ribwort plantain	O
<i>Potentilla reptans</i>	Creeping cinquefoil	O
<i>Primula veris</i>	Cowslip	O
<i>Ranunculus acris</i>	Meadow buttercup	LF
<i>Ranunculus bulbosus</i>	Bulbous buttercup	O
<i>Rhytidiadelphus squarrosus</i>	Springy turf-moss	O
<i>Rubus fruticosus agg.</i>	Bramble	R
<i>Taraxacum agg.</i>	Dandelion	O
<i>Trifolium pratense</i>	Red clover	O
<i>Vicia cracca</i>	Tufted vetch	O
<i>Vicia sativa</i>	Common vetch	O
<i>Vicia sepium</i>	Bush vetch	O

Open grassland colonising gravel/ tarmac (short perennial/ ephemeral)

Several small areas of gravel or disused tarmac (shown on Figure 2) are developing an open species-rich grassland sward. Species recorded in these areas are listed in Table 4 below.

Table 4. Species recorded in open grassland colonising gravel/ tarmac

Scientific name	English name	DAFOR
<i>Achillea millefolium</i>	Yarrow	O
<i>Bromopsis erecta</i>	Upright brome	F
<i>Carex flacca</i>	Glaucous sedge	F
<i>Catapodium rigidum</i>	Fern-grass	O
<i>Centaureum erythraea</i>	Common centaury	O
<i>Cerastium glomeratum</i>	Sticky mouse-ear	O
<i>Daucus carota</i>	Wild carrot	F
<i>Erigeron acris</i>	Blue fleabane	F
<i>Festuca ovina</i>	Sheep's fescue	F
<i>Galium verum</i>	Lady's bedstraw	O
<i>Glechoma hederacea</i>	Ground ivy	O
<i>Hypochaeris radicata</i>	Common cat's-ear	O
<i>Leucanthemum vulgare</i>	Oxeye daisy	O
<i>Linum catharticum</i>	Fairy flax	LF
<i>Lotus corniculatus</i>	Common bird's-foot trefoil	LF
<i>Ranunculus bulbosus</i>	Bulbous buttercup	R

Scientific name	English name	DAFOR
<i>Scorzoneroide autumnalis</i>	Autumn hawkbit	LF
<i>Tripleurospermum inodorum</i>	Scentless mayweed	LF



Figure 2. Airside grassland

Grassland management

Information on airside grassland management was obtained from Jim Callaway (Airside Operations Manager). Management of the grassland is driven by the overriding safety need to avoid and minimise the risk of bird strike. As part of this, it is essential that food sources for birds are minimised: the sward must be kept closed to reduce foraging opportunities on the ground; flowering period should be minimised to reduce foraging opportunities presented by seeds and nectaring invertebrates; and the grassland thatch must be minimised to reduce the suitability of the habitat to voles (a large vole population would attract high-risk predator species such as buzzard).

The following factors also influence the management of the airside grassland:

- Management should not commence until late March – April after wintering gulls have dispersed (in order to avoid attracting large numbers of gulls to the freshly-cut grassland);
- Management is weather-dependent and must be undertaken in dry periods with no rain;
- Cutting the grassland is subject to contractor availability and therefore depends on when Airside Operations is able to book the work in; and
- Initial management of all areas of airside grassland must have been completed by May (the start of the summer schedule).

Taking all of these factors into account, it is understood that the airside grassland is subject to the following management:



- Grassland on the airfield is regularly cut (3 to 4 times a year);
- Grassland is cut when flowering heads appear at roughly 10 inches. Grassland is cut to 8 inches;
- Grass is foraged and taken off-site by the contractor;
- Fertiliser is occasionally applied to the grassland; and
- Blast-furnace slag was applied to the grassland as agricultural liming material approximately 15 to 16 years ago. It is understood that Airside Operations intend to apply granulated lime to the grassland next year.

Despite these strict safety objectives, it is considered that the grassland is currently being managed as far as possible to optimise its biodiversity value. Examples include:

- Presence of at least 20 pairs of breeding skylark on the airside grassland in 2016, with cutting timed and managed to avoid impacts to active nests;
- Presence of a healthy hare population associated with the airside grassland;
- Presence of large areas of semi-improved neutral and calcareous grassland supporting a reasonable diversity of species (as opposed to unsympathetic management of the airfield, which would be likely to result in a dull improved sward such as a rye-grass ley);
- Carefully tailored management for small areas recognised as supporting more species-rich calcareous grassland (e.g. the verge and embankment grassland shown on Figure 2). These areas are not fertilised and are cut at the end of the flowering season.

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Appendix 11C

Technical Note: Great Crested Newt Surveys

WOOD

Development of Bristol Airport to Accommodate 12 Million Passengers Per Annum

Technical Note: Great Crested Newt Surveys

1 INTRODUCTION

This Technical Note presents the results of great crested newt (*Triturus cristatus*) surveys undertaken during 2018 by Johns Associates in support of the 12mppa development proposals and planning application at Bristol Airport. It also provides a summary of historic surveys for great crested newt carried out by Bristol Airport since 2007.

The planning application boundary is hereafter referred to as “the application site”. The potential Zone of Influence of the development associated with great crested newt (GCN) has been set at 500m from the application site boundary, reflecting typical distances used for great crested newt surveying and Natural England licencing (see www.gov.uk).

The aim of the surveys was to update the historic baseline and to re-confirm the presence or likely absence of GCN (and other amphibians) which may be present within the Zone of Influence and the application site, to assess the population size class of any great crested newt populations present and identify possible constraints to development and opportunities that could be delivered through the development proposals.

The application site boundary and surrounding land within the Zone of Influence of the development proposals associated with great crested newt at the time of the survey is shown on Figure 1 in Appendix A.

2 METHODS USED IN 2018

2.1 AVAILABILITY OF POTENTIAL GREAT CRESTED NEWT BREEDING HABITAT

A detailed review of amphibian records provided by the local records centre, Ordnance Survey 1:25,000 mapping, aerial imagery from Google Earth, and known waterbodies from historic surveys associated with Bristol Airport confirmed the presence of eight water bodies within 500m of the application site (one more than had previously been identified in 2005 and 2015). These are illustrated in Figure 2 in Appendix A.

Habitat Suitability Index (HSI) Surveys

The Habitat Suitability Index (HSI) is a method of quantifying the suitability of a water body to support great crested newt (GCN)¹. All identified ponds within 500m were visited in March 2018 and Habitat Suitability Index (HSI) assessments completed.

The calculation of HSI requires that the following ten key variables are recorded and assigned a numerical value:

- Location within Britain;
- Pond area;
- Pond drying (based on both local knowledge and field evidence);
- Water quality;
- Percentage perimeter shaded;
- Presence or absence of waterfowl;
- Presence or absence of fish;
- Number of ponds situated within 1km;
- Suitability of terrestrial habitat; and
- Percentage of macrophyte cover.

The resulting scores can then be interpreted, as indicated in Table 1.

Table 1: Habitat Suitability Index score and interpretation

HSI Score	Pond Suitability for GCN
<0.5	Poor
0.5	Below average
0.6	Average
0.7	Good
>0.8	Excellent

¹ Oldham et al. (2000). Evaluating the Suitability of Habitat for the Great Crested Newt (*Triturus cristatus*). Herpetological Journal, Vol. 10, pp. 143– 155.

2.2 PRESENCE/ABSENCE SURVEYS

All eight waterbodies (numbered 1 to 8 in Figure 2) were subject to further assessment comprising presence/absence surveys following the standard methodology recommended by www.gov.uk and within the Great Crested Newt Mitigation Guidelines². Surveys were undertaken by experienced, Natural England-licensed surveyors (Matthew Johns 2016-20431-CLS-CLS, and Kerry White 2017-29693-CLS-CLS).

A minimum of four survey visits are necessary: four visits are required to determine presence/ likely absence and an additional two visits are required if GCN are recorded during any/ all of the first four visits, in order to determine likely population size.

The surveys were undertaken in suitable weather conditions between early-May and mid-June, with at least two of these visits undertaken in the peak period of mid-April to mid-May (for presence/ absence purposes).

At least three survey methods were employed per survey visit in accordance with best practice guidance. The methods adopted are described below.

Egg Search: this method was carried out during each survey visit (until the point that great crested newt eggs are discovered) to identify newt eggs typically folded into aquatic and/ or emergent vegetation. Where aquatic vegetation exists, this was systematically searched.

Bottle Trapping: this was carried out using submerged transparent plastic two litre bottles on every survey visit. Bottle trap densities (approximately one trap per two metres of pond margin) were kept constant for the survey period. Bottles were set late evening and collected early next morning;

Torch Survey: a 1,000,000-candlepower torch was used to search each pond for great crested newt adults after dark (although folded leaves indicating eggs can also be seen) on each survey visit. Care was taken to avoid direct disturbance of animals with the main beam of the torch.

The evening air temperature, turbidity and extent of vegetation cover in each pond was recorded on each visit (all surveys were undertaken when the evening air temperature was greater than 5°C) and local weather conditions were also noted.

2.3 POPULATION SIZE CLASS ASSESSMENT SURVEYS

Further surveys were carried out on those waterbodies where great crested newts were confirmed as being present (waterbodies 1, 2 and 3 only – see Figure 2). In combination with the four presence/ absence surveys, they enable an assessment of the population size class to be made. The surveys:

- use torch surveys and bottle trapping on each visit;
- comprise 6 visits in total (including surveys at ponds where great crested newts have been found during the first 4 presence/absence visits);
- visit between early-May and mid-June with at least 3 visits in peak season (usually mid-April to mid-May).

Results from multiple ponds can be combined if the newts regularly move between them, but only for counts obtained on the same visit.

² English Nature 2001. *Great Crested Newt Mitigation Guidelines*. English Nature: Peterborough.

The following information was recorded during each additional survey visit:

- maximum adult count per pond per night;
- peak count per pond overall;
- total site count.

Populations can then be classed as:

- small - maximum counts up to 10 individuals;
- medium - maximum counts between 11 and 100; or
- large - maximum counts over 100.

2.4 LIMITATIONS AND CONSTRAINTS

No limitations or constraints with regard to the field surveys were encountered.

3 SUMMARY OF HISTORIC SURVEYS

In 2005 Entec UK Ltd undertook great crested newt surveys of all waterbodies within 500m of Bristol Airport. The surveys confirmed a small population of great crested newt (maximum count of 2) in one waterbody; Abspitt Pond (the smaller pond of the two at this location), which is situated approximately 320m west of the western boundary of Bristol Airport.

In 2015 Johns Associates Ltd conducted further presence/absence surveys of ponds located within a 500m buffer zone associated with Bristol Airport. The results of these surveys concluded a small-medium population size class of GCN (maximum count of 9) in the two Abspitt Ponds.

GCN records obtained from the Bristol Environmental Records Centre (BRERC) in 2017 include evidence of GCN populations in ponds beyond the 500m buffer zone to the north east of the Bristol Airport boundary (see Appendix 11A to Chapter 11: Biodiversity of the Development of Bristol Airport to Accommodate 12 Million Passengers Per Annum Environmental Statement for full details).

4 RESULTS

4.1 HABITAT SUITABILITY INDEX ASSESSMENT





The detailed results of the HSI Assessments are presented in Table 2 below.





**Table 2: ARGUK GCN HIS
Calculator**

Pond Name		P1	P2	P3	P4
Grid Ref		ST4850265102	ST4849665081	ST4851365208	ST4858964646
SI No	SI Description	SI Value	SI Value	SI Value	SI Value
1	Geographic location	1	1	1	1
2	Pond area	0.05	1	0.05	0.03
3	Pond permanence	1	0.9	0.5	0.1
4	Water quality	1	1	1	0.33
5	Shade	1	1	1	0.2
6	Water fowl effect	0.67	0.67	1	1
7	Fish presence	1	1	1	1
8	Pond Density	0.7	0.7	0.7	1
9	Terrestrial habitat	1	1	1	1
10	Macrophyte cover	1	1	1	0.5
HSI Score		0.69	0.92	0.67	0.40
Pond suitability		Average	Excellent	Average	Below Average
Pond Name		P5	P6	P7	P8
Grid Ref		ST4957264759	ST4990864515	ST4993664278	ST4933963754
SI No	SI Description	SI Value	SI Value	SI Value	SI Value
1	Geographic location	1	1	1	1
2	Pond area	0.02	0.05	0.05	0.1
3	Pond permanence	0.1	0.9	1	1
4	Water quality	0.33	0.33	0.67	0.67
5	Shade	1	0.2	0.5	1
6	Water fowl effect	1	0.67	1	1
7	Fish presence	1	1	1	0.67
8	Pond Density	1	0.6	0.67	0.65
9	Terrestrial habitat	1	1	1	1
10	Macrophyte cover	0.8	0.3	0.8	0.8
HSI Score		0.47	0.45	0.62	0.69
Pond suitability		Below Average	Below Average	Average	Average

Table 3 provides a summary description and photograph of each of the waterbodies.

Table 3: Waterbody Summary and HSI results

Water body Ref.	Description	Photo	HSI Grade
P1	A large pond in woodland – Abspit Pond. Accessible to sheep on the north-eastern margin. Vegetation includes bulrush, soft rush, sweet grass and trailing bramble. A pair of Mallard ducks were present during the assessment.		Average
P2	A small pond in woodland. A round pond constructed of natural stone. Deep with shallow margins. Vegetation includes soft rush, sweet grass, common reed and trailing bramble.		Excellent
P3	A series of deep, water-filled ruts located along a track within close proximity to Abspit Ponds P1 & P2. Vegetation includes sweet grass, buttercup and sedge species.		Average
P4	A low hollow adjacent to grazed grassland and under woodland edge and tree canopy. This feature had <5cm water depth during the HSI visit and was dry during the presence/ absence survey.		Below average

Water body Ref.	Description	Photo	HSI Grade
P5	This is a concrete-lined, former cattle drinking pond that holds water but was dry during the 2018 survey period and is known to be dry during most summer months (including the 2015 GCN surveys).		Average
P6	Stone built pond surrounded by steep sided natural stone walls on three sides, with a sloping access way from the north, poached by cattle. Vegetation includes trailing bramble and nettle (<i>Urtica dioica</i>) with duckweed (<i>Lemnaceae sp</i>) present on the pond surface.		Below average
P7	Located within a woodland copse. Vegetation in pond limited to occasional sweet grass and trailing bramble with duckweed present on the pond surface. Dead leaves and brashings within pond.		Average
P8	A small pond in a residential garden. The pond is lined with plastic liner and is heavily vegetated (predominantly Canadian pond weed, yellow flag, and marsh marigold).		Average

4.2 PRESENCE/ABSENCE AND POPULATION CLASS ASSESSMENTS

The results of the presence/ absence and population size class assessments of the eight waterbodies are presented in Tables 4 to 11 and comprise the standard template used in the Natural England Great Crested Newt EPS licence application methodology (available from www.gov.uk).

Table 4: Presence/Absence and Population Size Class Assessment Results for Waterbody P1

Pond reference (e.g. "Pond 1") - below				Method:	Torch			Bottle-trap			Net			Egg search	Larvae
Waterbody 1					Torch power:			No. of traps used in pond:						eggs found?	larvae found? (any method)
No. of survey visits to this pond:		6			>= 1,000,000 cp			11-50 traps							
Sex/life stage:				Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.			
(1) Date:	Air temp	Veg cover	Turbidity		3	3							No	No	
10/05/2018	10	3	2	Adult totals:	6			0			0				
(2) Date:	Air temp	Veg cover	Turbidity					2					No	No	
14/05/2018	15.5	3	2	Adult totals:	0			2			0				
(3) Date:	Air temp	Veg cover	Turbidity					3	4				No	No	
17/05/2018	14	3	2	Adult totals:	0			7			0				
(4) Date:	Air temp	Veg cover	Turbidity					2					No	No	
22/05/2018		3	2	Adult totals:	0			2			0				
(5) Date:	Air temp	Veg cover	Turbidity		1	1		3	2				No	No	
31/05/2018		3	2	Adult totals:	2			5			0				
(6) Date:	Air temp	Veg cover	Turbidity					1	2				Yes	No	
07/06/2018	17	3	2	Adult totals:	0			3			0				
(7) Date:	Air temp	Veg cover	Turbidity												
				Adult totals:	0			0			0				
(8) Date:	Air temp	Veg cover	Turbidity												
				Adult totals:	0			0			0				
Peak adult count for this pond in any one visit (by torch, trap or net):				7											
Comments and constraints:															

Table 5: Presence/Absence and Population Size Class Assessment Results for Waterbody P2

Pond reference (e.g. Pond 2)				Method:	Torch			Bottle-trap			Net			Egg search eggs found?	Larvae larvae found? (any method)
Waterbody 2					Torch power:			No. of traps used in pond:							
No. of survey visits to this pond:		6			>= 1,000,000 cp			11-50 traps							
Sex/life stage:				Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.			
(1) Date:	Air temp	Veg cover	Turbidity	Adult totals:	2	2		0		0			No	No	
10/05/2018	10	2	2												
(2) Date:	Air temp	Veg cover	Turbidity	Adult totals:	2	1		1	1				Yes	No	
14/05/2018	15.5	2	2		3			2		0					
(3) Date:	Air temp	Veg cover	Turbidity	Adult totals:				1						No	
17/05/2018	14	2	2		0			1		0					
(4) Date:	Air temp	Veg cover	Turbidity	Adult totals:										No	
22/05/2018	13	2	2		0			0		0					
(5) Date:	Air temp	Veg cover	Turbidity	Adult totals:		1		2						No	
31/05/2018	13	2	2		1			2		0					
(6) Date:	Air temp	Veg cover	Turbidity	Adult totals:				2	2					No	
07/06/2018	14	2	2		0			2		0					
(7) Date:	Air temp	Veg cover	Turbidity	Adult totals:											
					0			0		0					
(8) Date:	Air temp	Veg cover	Turbidity	Adult totals:											
					0			0		0					
Peak adult count for this pond in any one visit (by torch, trap or net):				3											
Comments and constraints:															

Table 6: Presence/Absence and Population Size Class Assessment Results for Waterbody P3

Pond reference (e.g. Pond 3)				Method:	Torch			Bottle-trap			Net			Egg search	Larvae
Waterbody 3					Torch power:			No. of traps used in pond:						eggs found?	larvae found? (any method)
No. of survey visits to this pond:		6					>= 1,000,000 cp			1-10 traps					
Sex/life stage:				Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.			
(1) Date:	Air temp	Veg cover	Turbidity										Yes	No	
10/05/2018	10	3	2	Adult totals:			0			0					
(2) Date:	Air temp	Veg cover	Turbidity											No	
14/05/2018	15.5	3	2	Adult totals:			0			0					
(3) Date:	Air temp	Veg cover	Turbidity											No	
17/05/2018	14	3	2	Adult totals:			0			0					
(4) Date:	Air temp	Veg cover	Turbidity							2				No	
22/05/2018	11	3	2	Adult totals:			0			2					
(5) Date:	Air temp	Veg cover	Turbidity											No	
31/05/2018	13	3	2	Adult totals:			0			0					
(6) Date:	Air temp	Veg cover	Turbidity											No	
07/06/2018	14	3	2	Adult totals:			0			0					
(7) Date:	Air temp	Veg cover	Turbidity												
				Adult totals:			0			0					
(8) Date:	Air temp	Veg cover	Turbidity												
				Adult totals:			0			0					
Peak adult count for this pond in any one visit (by torch, trap or net):							2								
Comments and constraints:															

Table 7: Presence/Absence Survey Results for Waterbody P4

Pond reference (e.g. Pond 4)				Method:	Torch			Bottle-trap			Net			Egg search	Larvae
Waterbody 4					Torch power:			No. of traps used in pond:						eggs found?	larvae found? (any method)
No. of survey visits to this pond:		6													
Sex/life stage:				Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.			
(1) Date:	Air temp	Veg cover	Turbidity	Adult totals:	0		0			0					
10/05/2018	10														
(2) Date:	Air temp	Veg cover	Turbidity	Adult totals:	0		0			0					
14/05/2018	15.5														
(3) Date:	Air temp	Veg cover	Turbidity	Adult totals:	0		0			0					
17/05/2018	14														
(4) Date:	Air temp	Veg cover	Turbidity	Adult totals:	0		0			0					
22/05/2018	11														
(5) Date:	Air temp	Veg cover	Turbidity	Adult totals:	0		0			0					
31/05/2018	13														
(6) Date:	Air temp	Veg cover	Turbidity	Adult totals:	0		0			0					
07/06/2018	14														
(7) Date:	Air temp	Veg cover	Turbidity	Adult totals:	0		0			0					
(8) Date:	Air temp	Veg cover	Turbidity	Adult totals:	0		0			0					
Peak adult count for this pond in any one visit (by torch, trap or net):					0										
Comments and constraints:				Waterbody 4 was dry on all 6 survey visits											

Table 8: Presence/Absence Survey Results for Waterbody P5

Pond reference (e.g. Pond 5)				Method:	Torch			Bottle-trap			Net			Egg search	Larvae		
Waterbody 5					Torch power:			No. of traps used in pond:						eggs found?	larvae found? (any method)		
No. of survey visits to this pond:		6		Sex/life stage:			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.		
(1) Date:	Air temp	Veg cover	Turbidity	Adult totals:			0			0			0				
10/05/2018	10																
(2) Date:	Air temp	Veg cover	Turbidity	Adult totals:			0			0			0				
14/05/2018	15.5																
(3) Date:	Air temp	Veg cover	Turbidity	Adult totals:			0			0			0				
17/05/2018	14																
(4) Date:	Air temp	Veg cover	Turbidity	Adult totals:			0			0			0				
22/05/2018	11																
(5) Date:	Air temp	Veg cover	Turbidity	Adult totals:			0			0			0				
31/05/2018	13																
(6) Date:	Air temp	Veg cover	Turbidity	Adult totals:			0			0			0				
07/06/2018	14																
(7) Date:	Air temp	Veg cover	Turbidity	Adult totals:			0			0			0				
(8) Date:	Air temp	Veg cover	Turbidity	Adult totals:			0			0			0				
Peak adult count for this pond in any one visit (by torch, trap or net):							0										
Comments and constraints:				Waterbody 5 was dry on all survey visits													

Table 9: Presence/Absence Survey Results for Waterbody P6

Pond reference (e.g. Pond 6)					Method:	Torch			Bottle-trap			Net			Egg search	Larvae
Waterbody 6						Torch power:			No. of traps used in pond:						eggs found?	larvae found?
No. of survey visits to this pond:		4				>= 1,000,000 cp			1-10 traps			(any method)				
Sex/life stage:					Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.			
(1) Date:	Air temp	Veg cover	Turbidity	1	Adult totals:	0		0			0			No	No	
10/05/2018	10	3														
(2) Date:	Air temp	Veg cover	Turbidity	1	Adult totals:	0		0			0			No	No	
14/05/2018	15.5	3														
(3) Date:	Air temp	Veg cover	Turbidity	1	Adult totals:	0		0			0			No	No	
17/05/2018	14	3														
(4) Date:	Air temp	Veg cover	Turbidity	1	Adult totals:	0		0			0			No	No	
22/05/2018	11	3														
(5) Date:	Air temp	Veg cover	Turbidity		Adult totals:	0		0			0					
(6) Date:	Air temp	Veg cover	Turbidity		Adult totals:	0		0			0					
(7) Date:	Air temp	Veg cover	Turbidity		Adult totals:	0		0			0					
(8) Date:	Air temp	Veg cover	Turbidity		Adult totals:	0		0			0					
Peak adult count for this pond in any one visit (by torch, trap or net):					0											
Comments and constraints:																

Table 10: Presence/Absence Survey Results for Waterbody P7

Pond reference (e.g. Pond 7)					Method:	Torch			Bottle-trap			Net			Egg search	Larvae
Pond 7						Torch power:			No. of traps used in pond:						eggs found?	larvae found? (any method)
No. of survey visits to this pond:			4			>= 1,000,000 cp			11-50 traps							
Sex/life stage:					Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.			
(1) Date:	Air temp	Veg cover	Turbidity		Adult totals:	0			0			0		No	No	
10/05/2018	10	3	2													
(2) Date:	Air temp	Veg cover	Turbidity		Adult totals:	0			0			0		No	No	
14/05/2018	15.5	3	2													
(3) Date:	Air temp	Veg cover	Turbidity		Adult totals:	0			0			0		No	No	
17/05/2018	14	3	2													
(4) Date:	Air temp	Veg cover	Turbidity		Adult totals:	0			0			0		No	No	
22/05/2018	11	3	2													
(5) Date:	Air temp	Veg cover	Turbidity		Adult totals:	0			0			0				
(6) Date:	Air temp	Veg cover	Turbidity		Adult totals:	0			0			0				
(7) Date:	Air temp	Veg cover	Turbidity		Adult totals:	0			0			0				
(8) Date:	Air temp	Veg cover	Turbidity		Adult totals:	0			0			0				
Peak adult count for this pond in any one visit (by torch, trap or net):						0					0					
Comments and constraints:																

Table 11: Presence/Absence Survey (6 visits) Results for Waterbody P8

Pond reference (e.g. Pond 8)				Method:	Torch			Bottle-trap			Net			Egg search eggs found?	Larvae larvae found? (any method)
Waterbody 8					Torch power:			No. of traps used in pond:							
No. of survey visits to this pond:					>= 1,000,000 cp										
Sex/life stage:				Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.			
(1) Date:	Air temp	Veg cover	Turbidity								0	0		No	No
10/05/2018	10	4	1	Adult totals:	0			0			0				
(2) Date:	Air temp	Veg cover	Turbidity								0	0		No	No
14/05/2018	15.5	4	1	Adult totals:	0			0			0				
(3) Date:	Air temp	Veg cover	Turbidity								0	0		No	No
17/05/2018	14	4	1	Adult totals:	0			0			0				
(4) Date:	Air temp	Veg cover	Turbidity								0	0		No	No
22/05/2018	11	4	1	Adult totals:	0			0			0				
(5) Date:	Air temp	Veg cover	Turbidity												
31/05/2018	13	4	1	Adult totals:	0			0			0				
(6) Date:	Air temp	Veg cover	Turbidity												
07/06/2018	14	4	1	Adult totals:	0			0			0				
(7) Date:	Air temp	Veg cover	Turbidity												
				Adult totals:	0			0			0				
(8) Date:	Air temp	Veg cover	Turbidity												
				Adult totals:	0			0			0				
Peak adult count for this pond in any one visit (by torch, trap or net):										0					
Comments and constraints: It was not possible to trap effectively due to the presence of a rubber pond liner and dense vegetation. Good visibility of the pond watercolumn and bed and amphibians (only common species were recorded) was possible by moving surface vegetation systematically during torching, due to low turbidity and small size of pond. No GCN were observed by torching, netting or from egg searching. 6 visits completed in total.															

The overall results are presented below:

- Waterbody P1: Great crested newt present, evidence of breeding found, peak count of 7.
- Waterbody P2: Great crested newt present, evidence of breeding found, peak count of 3.
- Waterbody P3: Great crested newt present, evidence of breeding found, peak count of 2.
- Waterbody P4: Great crested newt absent – waterbody dry.

- Waterbody P5: Great crested newt absent – waterbody dry.
- Waterbody P6: Great crested newt absent.
- Waterbody P7: Great crested newt absent.
- Waterbody P8: Great crested newt absent.

5 SUMMARY

5.1 GREAT CRESTED NEWT

Great crested newts were recorded in only three of the water bodies surveyed during 2018: P1, P2 and P3, which are located close together within the eastern margins of Kings Wood and Urchin Wood, approximately 300m west of the western perimeter of Bristol Airport. None of the other waterbodies located within 500m of Bristol Airport supported great crested newt.

The population size class assessment from the 2018 survey was 8, based on a combined peak count using the Natural England Great Crested Newt EPS Licence Method Statement Excel workbook. This represents a small population size class. Surveys from 2005 and 2015 also recorded great crested newt in this location only (maximum count of 2 from Pond P2 in 2005 and maximum combined count of 9 from Ponds P1 and P2 in 2015). The survey results in 2018 are therefore consistent with previous surveys and the population seems to be stable, with evidence of breeding recorded in 2018 in all three waterbodies.

Based on criteria within the Natural England Great Crested Newt EPS Licence Method Statement Excel workbook it is considered that the following is a representative site status assessment of this small metapopulation:

- Qualitative: minor importance – small population;
- Qualitative: moderate – breeding on site; habitats common in area;
- Functional: moderate importance – probably some dispersal to/from nearby population(s);
- Contextual: population size class typical of area.

5.2 OTHER AMPHIBIAN SPECIES

Palmate newt and common frog were also recorded during the course of the surveys. Key results are set out below (per waterbody):

Pond P1:	Large numbers of palmate newts recorded: peak count of 48 adults and evidence of breeding observed.
Pond P2:	Palmate newts recorded: peak count of 15 adults and evidence of breeding observed. Larval and adult frogs observed.
Pond P3:	Large numbers of palmate newts recorded: peak count of 32 adults observed.
Pond P4:	Dry – none observed.

Pond P5: Dry – none observed.

Pond P6: A single palmate newt seen.

Pond P7: Palmate newts recorded: peak count of 21 adults and evidence of breeding observed.

Pond P8: Large numbers of palmate newts recorded: peak count of 32 adults observed.

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APPENDIX A



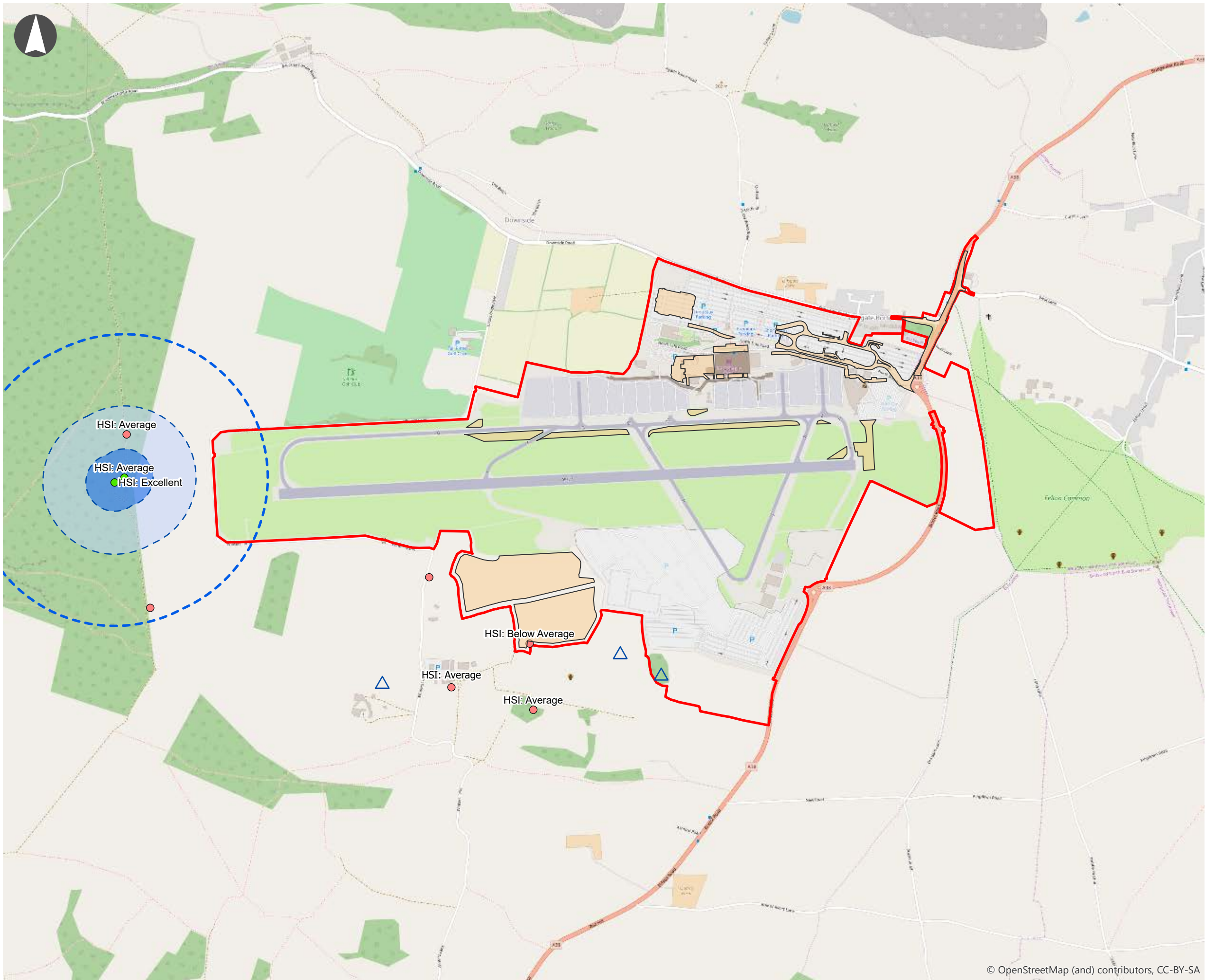
CLIENT
Wood

PROJECT
Development of Bristol Airport to Accommodate
12 Million Passengers Per Annum

TITLE
Great Crested Newt Survey
Areas and Waterbodies

SCALE @ A3	CREATED BY	CHECKED BY
1:12,500	MM	MJ
REFERENCE	REVISION	DATE ISSUED
J00254.11C1		3/12/2018

- Planning Application Boundary
- Zones of Influence
- Waterbody within 500m
- Waterbody no longer present
- 500m GCN Buffer



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PROJECT
Development of Bristol Airport to Accommodate 12 Million Passengers Per Annum

TITLE
Great Crested Newt Survey
Survey Results

SCALE @ A3	CREATED BY	CHECKED BY
1:12,500	MM	MJ
REFERENCE	REVISION	DATE ISSUED
J00254.11C2		3/12/2018

- Planning Application Boundary
- Zones of Influence
- Waterbody no longer present
- Survey Results**
- GCN Presence
- GCN Absence
- GCN Buffers**
- 100m
- 250m
- 500m

Appendix 11D

CONFIDENTIAL Technical Note: Badger Surveys

WOOD

Development of Bristol Airport to Accommodate 12 Million Passengers Per Annum

CONFIDENTIAL Technical Note: Badger Surveys

1 INTRODUCTION

This report presents the results of badger (*Meles meles*) surveys undertaken during 2018 by Johns Associates in support of the 12mppa development proposals and planning application at Bristol Airport. It also provides a summary of historic surveys for badger carried out at Bristol Airport since 2005.

The planning application boundary is hereafter referred to as “the application site”. The potential Zone of Influence of the development associated with badgers is the whole planning application boundary (noting that badgers are known to be present in the north and south of Bristol Airport and to access the airside grassland). This reflects the mobility of the species and general guidance for potential future badger licencing (see www.gov.uk).

The aim of the 2018 surveys was to update the historic baseline and to confirm the continuing presence or likely absence of badger within the Zone of Influence. The surveys were also used to identify possible constraints to development and opportunities that could be delivered through the proposals.

Figure 1 in Appendix A to this Technical Note shows the application site boundary together with the extent of the likely Zone of Influence, based on the historical survey data (also shown on Figure 1).

2 METHODS USED IN 2018

2.1 ASSESSMENT OF HABITAT SUITABILITY

Land within the application site boundary and in immediately adjacent areas was assessed for its suitability to support badgers. Suitable areas typically include woodland, scrub and the landscape bunds associated with the perimeter of the car parking areas. Suitable areas for foraging were also assessed, including areas of grassland within and adjacent to Bristol Airport. Available habitat in the wider local area was also reviewed using Google Earth Pro. Previous survey results were also evaluated.

2.2 FIELD SURVEYS

A survey of suitable areas of habitat within the application site boundary and in immediately adjacent areas was carried out by a suitably qualified and experienced ecologist from Johns Associates Ltd in April 2018, with an update survey completed in September 2018. Incidental observations between these dates were also taken into account in the baseline described in Section 4 of this Technical Note. The surveys involved a search for characteristic signs of badger activity including setts, latrines/dung pits, paths, fence push-ups, hairs caught on fences, vegetation or in spoil heaps, paw prints and feeding signs.

Standard survey methods were followed, as detailed in <https://www.gov.uk/guidance/badgers-surveys-and-mitigation-for-development-projects> and Harris, Cresswell & Jeffries, 1989.

All badger setts were classified according to their status (e.g. as main, annex, subsidiary or outlier) and the level of activity at the sett also recorded (e.g. entrances in use, partially used, disused), as defined below. All signs of badger recorded during the survey (e.g. setts, footprints, latrines, fence push-ups, scratched trees or soil, hairs in spoil or caught on fencing and obvious pathways through vegetation) were mapped.

- **Main setts.** These are in continuous use; they are large, well-established, often extensive and may have large spoil heaps outside the entrances. There are likely to be well-worn paths leading to the sett. It is where the cubs are most likely to be born. There is only one main sett per social group of badgers.
- **Annex setts.** These occur in close association with the main sett (usually within 150m), and are linked to the main sett by clear, well-used paths. Annex setts consist of several holes, but they are not necessarily in use all the time, even if the main sett is very active. If a second litter of cubs are born, this may be where they are reared.
- **Subsidiary setts.** These usually comprise five holes or more, but are not in continuous use and are usually some distance from the main sett (50m or more). There is no obvious path connecting them to the main sett and their 'ownership' can often only be determined by bait-marking.
- **Outlying setts.** These consist of only one or two entrance holes. They can be found anywhere within the territory and usually have small spoil heaps, indicating that they are not very extensive underground. There are no obvious paths connecting them to other setts, they are only used sporadically and often used by foxes or rabbits when not occupied by badgers.

The size, status and level of activity of each sett was partly assessed by counting the number of entrance holes. The degree of use of each entrance hole was classified as follows:

- **Well-used holes.** These are clear of any debris or vegetation and are obviously in regular use. There may be evidence of recent excavation or fresh footprints.
- **Partially-used holes.** These are not in regular use and have debris such as twigs or leaves in the entrance and moss or other plants growing in or around the entrance. A minimal amount of clearance would be necessary for badgers to continue using the hole.
- **Disused holes.** These are holes which have not been in use for some time and would require a considerable amount of clearance before they could be used. A very long-disused hole may be just a depression in the ground and the remains of a spoil heap.

2.3 LIMITATIONS AND CONSTRAINTS

No limitations or constraints with regard to the field surveys were encountered.

3 SUMMARY OF HISTORIC SURVEYS

In 2005 Entec UK Ltd undertook badger surveys across Bristol Airport, which were updated in 2009. The surveys confirmed the presence of badger in the south and north of the Airport.

Johns Associates undertook Badger surveys across Bristol Airport in 2013, 2015, 2016 and 2017, including a bait marking exercise along the southern airfield boundary in 2016.

Badger records obtained from the Bristol Environmental Records Centre (BRERC) in 2017 included evidence of badger within 2km of Bristol Airport.

4 RESULTS

4.1 HABITAT SUITABILITY

Bristol Airport includes a range of habitats and features that are suitable for use by badger. The survey work conducted from 2005 onwards has confirmed the presence of three main setts on airport-owned land (assumed to be three clans based on a bait-marking exercise carried out in 2016 and the distance between identified main setts and evidence recorded in 2018), and accessed by a fourth clan with a main sett located off-site. Badgers can (typically) access all external areas at Bristol Airport, although access into the airside grassland areas is limited to a small number of locations. The flat expanse of airside grassland is typically limited and therefore sub-optimal for activities such as sett excavation. However, it does offer significant areas of foraging opportunity e.g. for earthworms.

Large parts of Bristol Airport are unsuitable for sett construction as they comprise well-lit areas of hard standing, flat reinforced surfacing, buildings or other infrastructure. Significant parts of these areas include surface car parking. The northern boundary of Bristol Airport includes earth landscape bunds supporting mature trees as well as hedgerows, some of the boundary is directly adjacent to wider areas of grassland and gardens also suitable for foraging. Land to the east of the A38 provides a wider range of suitable habitats including plantation woodland, hedgerows and grassland, particularly within and adjacent to Felton Common. Land to the west of the airfield comprises hedgerows, grassland and woodland. Extensive landscape bunds with mature planting are also present along the southern boundary of Bristol Airport and provide excellent conditions for sett construction and expansion, foraging and connectivity to wider habitat areas, with grassland, woodland and hedgerows present in the wider local area. The south-eastern component of Bristol Airport includes a small woodland and cattle-grazed field managed for nature conservation.

The risk of road traffic accidents within Bristol Airport is considered to be limited due to the speed restrictions already in force and good levels of illumination. The Airport Safety Unit have not recorded collisions between badgers and aircraft.

Some of the sloping/raised planted margins of Bristol Airport support badger setts. These are described in more detail in Section 4.2.

4.2 CURRENT (2018) BADGER CLANS, SETTS AND ACTIVITY

Figure 2 in Appendix A provides an indicative confidential location plan for recorded badger setts at Bristol Airport.

Clan A

Badger Clan A is associated with the south west of Bristol Airport and adjacent land. The associated main sett (A) is an artificial sett constructed by Johns Associates Ltd under a Natural England licence in 2016 and incorporated into the landscape bund associated with land referred to as the Silver Zone seasonal car park (Phase 1) and forming the boundary between the Proposed Operational Extension to the Silver Zone Car Park (Phase 1) and the Proposed Extension to the Silver Zone Car Park (Phase 2) (please refer to Appendix 11B of Chapter 11: Biodiversity of the Development of Bristol Airport to Accommodate 12 Million Passengers Per Annum Environmental Statement). This is adjacent to the proposed development footprint.

Main Sett A is an extensive multi-chambered artificial sett with numerous opportunities to expand the sett through open chamber walls, as well as creating new setts in the hundreds of metres of very extensive earth bund around the perimeter of the Proposed Operational Extension to the Silver Zone Car Park (Phase1). The bund also provides extensive foraging opportunities.

The artificial sett was located close to an outlier sett (Outlier A1) in the hedgerow south of the Proposed Extension to the Silver Zone Car Park (Phase 2), and a second outlier north of the Proposed Operational Extension to the Silver Zone Car Park (Phase 1) (Outlier A2), which are both still in use with new holes and fresh spoil being evident in September 2018.

Main sett A is well used with recent evidence of sett expansion (newly excavated soil outside entrances), as well as other evidence including, prints, hairs, fresh latrines and bedding. This is despite recent car park construction and operation. Evidence of current sett expansion in main sett is illustrated by Plate 1.



Plate 1 Fresh spoil providing evidence of sett extension



Plate 2 Foraging habitat associated with the Proposed Extension to the Silver Zone Car Park (Phase 2) within the development footprint and adjacent to Main Sett A.

Clan B

Badger Clan B is associated with the south east of Bristol Airport and adjacent land. The main sett (B) is constructed in a well-established landscape bund that runs south of the eastern part of the Silver Zone seasonal car park and is therefore exposed to relatively high levels of disturbance from car park operations and lighting. The bund feature has established plantation trees, scrub and ruderal vegetation over its surface. A more recent extension to the landscape bunds in this part of the airport provides additional foraging and sett building opportunities. The eastern part of the bund also includes a smaller Annex sett (Annex B1). Nearby cattle grazed grassland provides good foraging habitat. A small woodland copse includes outlier setts (Outlier B2). Signs of badger activity included latrines, scratch marks, bedding, fresh spoil, prints, paths and hairs.

Clan C

Badger Clan C is associated with the north west of the airport and adjacent farm land. A main sett (C) is located partially within airport owned land and extends to the adjacent Cooks Farm grassland. Established trees and scrub are located over the sett which is likely to extend under a large concrete slab, forming part of the operational airport, as well as under the boundary between the adjacent grassland field and perimeter landscape planting of Bristol Airport. The sett is exposed to a reasonable level of disturbance from vehicles and other operational activities. Signs of badger activity include latrines, scratch marks, bedding, fresh spoil, prints, paths and hairs. One currently not active outlier, that may be associated with Clan C, has been located on the edge of Downside Road with connectivity to Main Sett C along the airport/Downside Road landscape bund/planting. No other associated setts have been located within Bristol Airport owned land.

Clan D

No main sett has been located for likely Clan D within Bristol Airport-owned land and it is believed this is located within Felton Common or adjacent boundary gardens. There are numerous pathways across fields

east of the A38 owned by Bristol Airport, with evidence including prints and hairs. A small number of outlier setts are associated with hedgerows within these fields.

5 SUMMARY

Bristol Airport supports a badger population comprising at least four clans, with main setts for three of these clans being located on airport-owned land and associated with raised land formed from landscape bunds. These are also located in areas where disturbance occurs, including noise, vibration and lighting, demonstrating the ability of the badger population to become habituated to the conditions typically associated with Bristol Airport.

Bristol Airport land provides sett building/expansion, foraging, resting and commuting habitats (including access to the airfield grassland). A small opportunity for drinking water exists in the form of a stone pond in the south west corner of the proposed Extension to the Silver Zone Car Park (Phase 2), and any associated cattle troughs in this location and within land to the east owned by Bristol Airport but which is also grazed.

The Zone of Influence/ development footprint is not considered to affect badger setts or other functional habitat associated with Clans B, C or D.

The development proposals associated with the Proposed Extension to the Silver Zone Car Park (Phase 2) have the potential to impact Clan A and its functional habitat. However, integrated mitigation measures will take account of the badgers at this location, whilst alternative suitable habitat exists elsewhere in the wider environment and at Bristol Airport.

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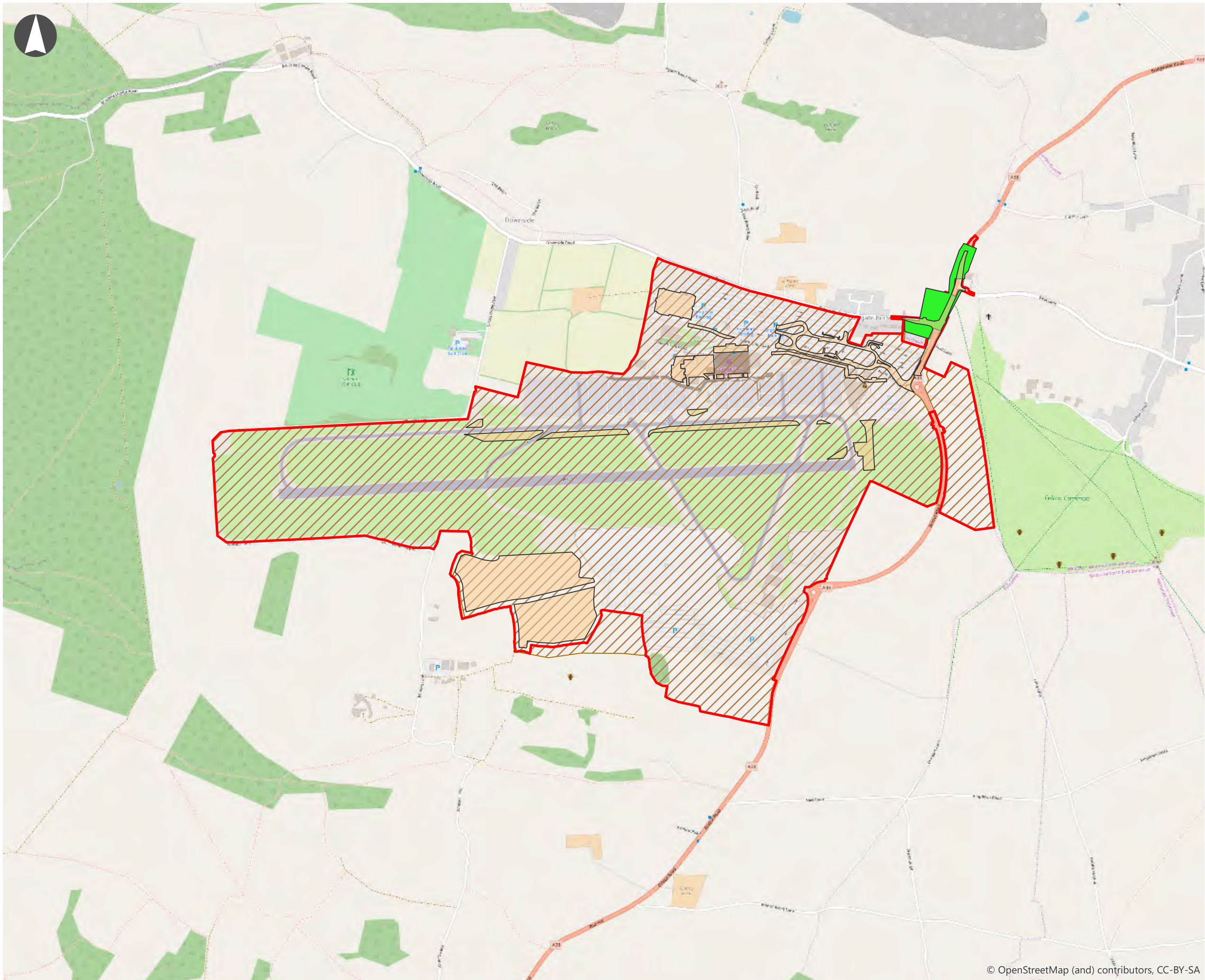
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APPENDIX A



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ASSOCIATES

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PROJECT

Development of Bristol Airport to Accommodate
12 Million Passengers Per Annum

TITLE

Badger Survey Areas

SCALE @ A3

1:12,500

REFERENCE

J00254.11D1

CREATED BY

MM

REVISION

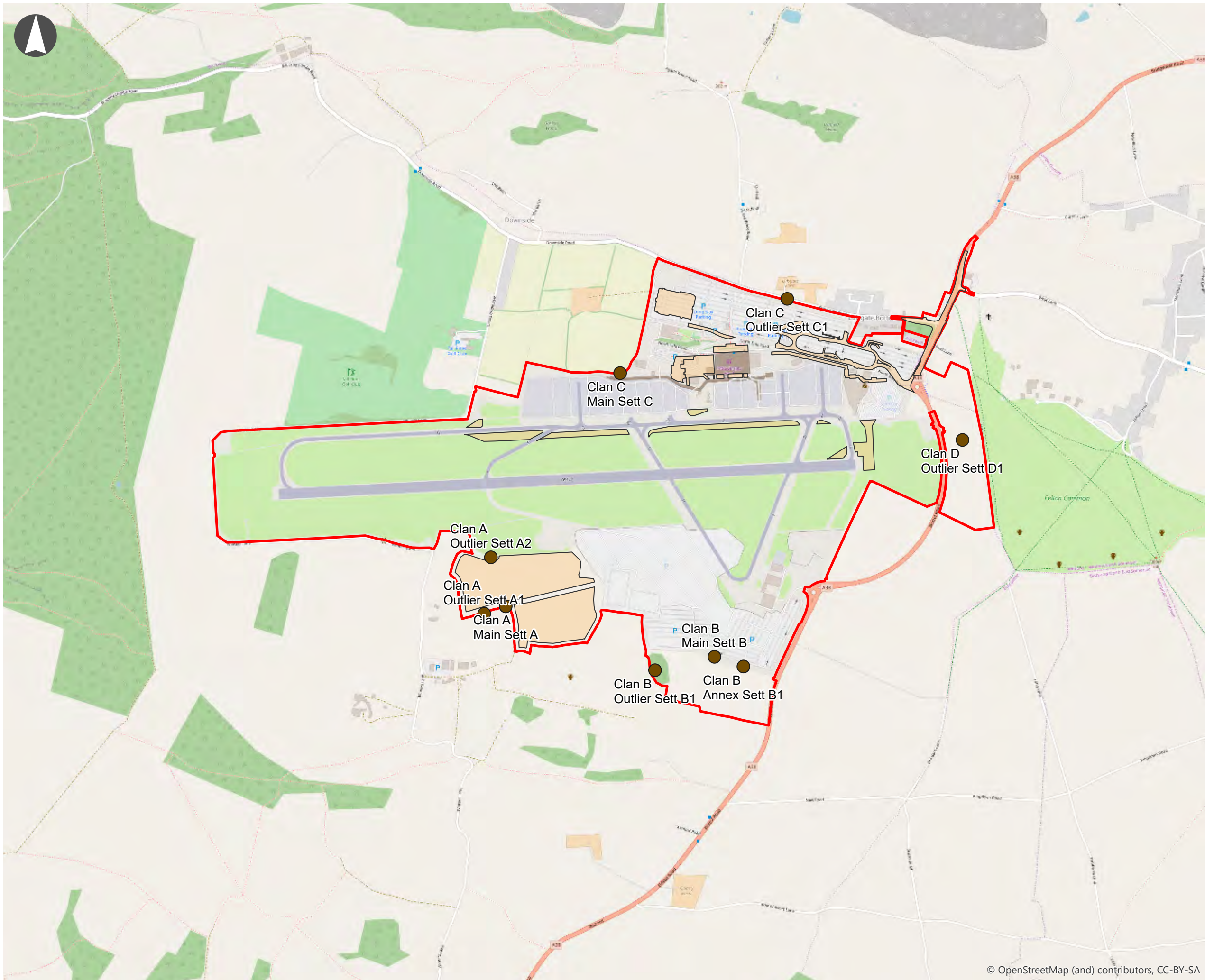
CHECKED BY

MJ

DATE ISSUED

3/12/2018

-  Planning Application Boundary
-  Zones of Influence
-  Historic Badgers Survey Area
2005-2018
-  2018 Survey Area ONLY



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PROJECT

Development of Bristol Airport to Accommodate
12 Million Passengers Per Annum

TITLE

Badger Survey Results

SCALE @ A3

1:12,500

REFERENCE

J00254.11D2

CREATED BY

MM

REVISION

CHECKED BY

MJ

DATE ISSUED

3/12/2018

- Zones of Influence
- Planning Application Boundary
- Sett Locations

Appendix 11E

Technical Note: Bat Surveys

WOOD

Development of Bristol Airport to Accommodate 12 Million Passengers Per Annum

Technical Note: Bat Surveys

1 INTRODUCTION

This report presents the results of bat surveys undertaken during 2018 by Johns Associates in support of the 12mppa development proposals and planning application at Bristol Airport. It also provides a summary of historic surveys for bats carried out by Bristol Airport since 2005.

The planning application boundary is hereafter referred to as “the application site”. The potential Zone of Influence of the development associated with bats is considered to be:

- Habitats at Bristol Airport and adjacent to it that are associated with the application site boundary and that are subject to a change in suitability for foraging or commuting bats. These areas are specifically limited to two locations. The first is an area of woodland at the Downside Road and A38 Junction, together with small marginal areas of the A38 close to the Airport Tavern that are associated with proposed highway improvement works. These areas are also referred to as A38 highway improvements. The second is a cattle-grazed field south of the current Silver Zone seasonal car park in the south west of Bristol Airport, also referred to as the Proposed Extension to the Silver Zone Car Park (Phase 2) and the introduction of permanent use of the existing and adjacent car parking and lighting to the north, also referred to as the Proposed Operational Extension to the Silver Zone Car Park (Phase 1).
- Trees, buildings and other structures associated with the development proposals that have potential for roosting bats (potential building roosts were limited to the Airport Tavern and the Fuel Storage building);
- Any increase in illumination of the boundary habitats at Bristol Airport that are known to support foraging and commuting bats;

A range of bat species are known to use the perimeter features associated with the northern Bristol Airport perimeter and the adjacent Downside Road for foraging and commuting and the cattle grazed fields and southern airport perimeter features. Significant areas of Bristol Airport, largely associated with the northern terminal, northern car parking areas, airside operations areas, the southern long stay car park and general aviation areas, support very little potential foraging/ commuting habitat and are typically well-lit. Known roosts are limited to two artificial roosts in a woodland managed by Bristol Airport for nature conservation, to the south of the southern long-stay car parking and an artificial roost located to the north west, near to Downside Road.

The aim of the bat surveys was to update the historic baseline and to re-confirm the presence or absence of foraging, commuting and roosting bats which may be present within the Zone of Influence and the application site (specifically the Proposed Extension to the Silver Zone Car Park (Phase 2) and A38 highway improvements), to assess the relative intensity and function of bat activity present, and identify possible constraints to development and opportunities that could be delivered through the development proposals.

This updated baseline has been used to consider potential effects on the local bat population associated with Bristol Airport, but also nearby known bat roosts, the North Somerset and Mendip Bat Special Area of Conservation (SAC) and constituent Sites of Special Scientific Interest (SSSI).

The survey design and the analysis of the data has also been specifically designed to be compliant with, and support the full application of the North Somerset and Mendip Bat SAC Supplementary Planning Document¹ (SPD).

2 METHODS USED IN 2018

2.1 HABITAT SUITABILITY ASSESSMENT

A detailed desk study of records of bats and known bat roosts was completed and can be found in Appendix 11A to Chapter 11: Biodiversity of the Development of Bristol Airport to Accommodate 12 Million Passengers Per Annum Environmental Statement.

A formal phase 1 habitat survey of the areas due to be affected by the proposals was completed on 17 July 2018 by Jasmine Walters BSc (Hons) Grad CIEEM. Appendix 11B to Chapter 11: Biodiversity of the Development of Bristol Airport to Accommodate 12 Million Passengers Per Annum Environmental Statement provides full details.

An assessment was also completed of the land use and component habitat matrix and formation data in order to finalise the Integrated Habitat System (IHS) mapping that is required to ascertain the value of the habitat to horseshoe bats.

The survey identified the habitat types currently present across the application site and in immediately adjacent areas. The survey followed the standardised system for classifying and mapping British Habitats Handbook for Phase 1 Habitat survey – a technique for environmental audit (Joint Nature Conservancy Council, 2010). Additional guidance on field data requirements for the purposes of IHS classification were followed as detailed in IHS (v 2.0) Habitat Mapping to GIS and IHS Definitions Version 2-001 (Somerset Environmental Records Centre (SERC), 2006).

The main output of this survey was an annotated habitat map and target notes together with descriptions of the recorded habitat types. All flora follows the nomenclature detailed in New Flora of the British Isles (3rd Edition) (Stace, 2010).

During the course of the survey, available habitats were assessed for their suitability to support horseshoe bat species for roosting, commuting and foraging purposes.

This survey was completed in accordance with Guidelines for Preliminary Ecological Appraisal (CIEEM, 2017) and BS 42020:2013 Biodiversity - Code of practice for planning and development (British Standards Institute, 2013).

Survey results were then digitised into GIS to facilitate the calculation of the extents of each habitat type.

¹ North Somerset and Mendips Bats Special Area of Conservation (SAC) Guidance on Development (North Somerset Council, 2017)

2.2 POTENTIAL BUILDING AND TREE ROOST ASSESSMENTS

All buildings and all trees associated with the Zone of Influence of the development were subject to both external, and where appropriate and possible, internal inspections for potential roost features (PRFs) that could support bats in accordance with Bat Survey Guidelines for Professional Ecologists: Good Practice Guidelines (Bat Conservation Trust, 2016).

Highly experienced and licenced bat ecologists, Lis Weidt BSc (Hons) GradCIEEM (Licence number: 2015-10314-CLS-CLS) and Ben Mitchell BSc (Hons) MCIEEM (Licence number 2015-11990-CLS-CLS), conducted the survey to ensure an accurate evaluation of the suitability of the building or tree to support roosting bats. This allowed the classification of buildings and trees as per Table 1 to inform the requirement for the number of subsequent emergence/ re-entry surveys to give a sufficient confidence in an absence result.

The building and tree inspections were carried out from the ground, on a ladder, and by climbing surveys of trees where required, with the use of close focusing binoculars, an endoscope and a torch, as required.

Where areas were not accessible due to unacceptable safety risks, a precautionary approach was taken to the assessment of the suitability of the structure for bats.

Table 1 Guidelines for assessing the potential suitability of proposed development sites for bats, based on presence of habitat features within the landscape, to be applied using professional judgement (Bat Conservation Trust, 2016).

Suitability	Description Roosting habitats	Commuting and foraging habitats
Negligible	Negligible habitat features on site likely to be used by roosting bats.	Negligible habitat features on site likely to be used by commuting or foraging bats.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions (a) and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation). A tree of sufficient size and age to contain Potential Roost Features (PRF) but with none seen from the ground or features seen with only very limited roosting potential (b).	Habitat that could be used by small numbers of commuting bats such as a gappy hedgerow or unvegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitat. Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions (a) and surrounding habitat but unlikely to support a roost of high importance/ value for the local bat population (c).	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.

Suitability	Description Roosting habitats	Commuting and foraging habitats
High	A structure or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions (a) and surrounding habitat.	Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. High-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, tree-lined watercourses and grazed parkland. Site is close to and connected to known roosts.
<p>a. For example, in terms of temperature, humidity, height above ground level, light levels or levels of disturbance.</p> <p>b. This system of categorisation aligns with BS8596:2015 Surveying for bats in trees and woodland (BSI,2015).</p> <p>c. Assessment is made with respect to roost type only – the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed</p>		

2.3 EMERGENCE/RE-ENTRY SURVEYS

Only two buildings (Airport Tavern and Fuel Storage Depot) and no trees were considered to support potential roosting features and were then subject to detailed emergence/re-entry surveys. The same survey of the Old Terminal Building was also completed in 2018 and is reported in this Appendix for completeness.

Emergence surveys of the three buildings commenced 15 minutes before sunset and continued for 2 hours after sunset. Re-entry surveys commenced 2 hours before sunrise. This follows the survey guidance as detailed in Bat Survey Guidelines for Professional Ecologists: Good Practice Guidelines (Bat Conservation Trust, 2016).

The number of surveyors used is detailed in Table 2 below.

Table 2 Building Emergence/Re-Entry Survey Details

Building		Survey Type	Number of Surveyors	Date	Weather	Lead Surveyor
B51	Administration Building (Old Terminal)	Re-entry	4	27.06.18	Light breeze, Dry, Warm	Lis Weidt BSc (Hons) GradCIEEM
		Emergence	3	12.07.18	Calm, Dry, Warm	Juliet Reid BSc (Hons) MCIEEM
		Emergence	3	23.07.18	Light breeze, Dry, Warm	Ben Mitchell BSc (Hons) MCIEEM

Building		Survey Type	Number of Surveyors	Date	Weather	Lead Surveyor
B143	Fuel Farm	Emergence	3	21.06.18	Calm, Dry, Warm	Juliet Reid BSc (Hons) MCIEEM
Airport Tavern	Junction of A38 and Downside Road	Emergence	4	18.06.18	Light breeze, Dry, Warm	Juliet Reid BSc (Hons) MCIEEM
		Emergence	4	11.07.18	Calm, Dry, Warm	Kerry White BSc (Hons) GradCIEEM

All surveyors were equipped with a highly sensitive Elekon BatLogger M ultrasonic detector. The surveyors were positioned in order to have an unrestricted view of the all elevations and the roof of the buildings, in particular any identified potential roost features within the detection range of the ultrasonic detector.

All bat activity observed during the survey period was recorded with particular attention being given to any emerging or re-entering bats, the number of bats and the number and locations of any points of entry or exit from the building. Bat detector recordings were analysed following the survey in order to confirm the identification of the bats recorded emerging/re-entering during the surveys. Additional notes on particular recordings/species of note will also be included.

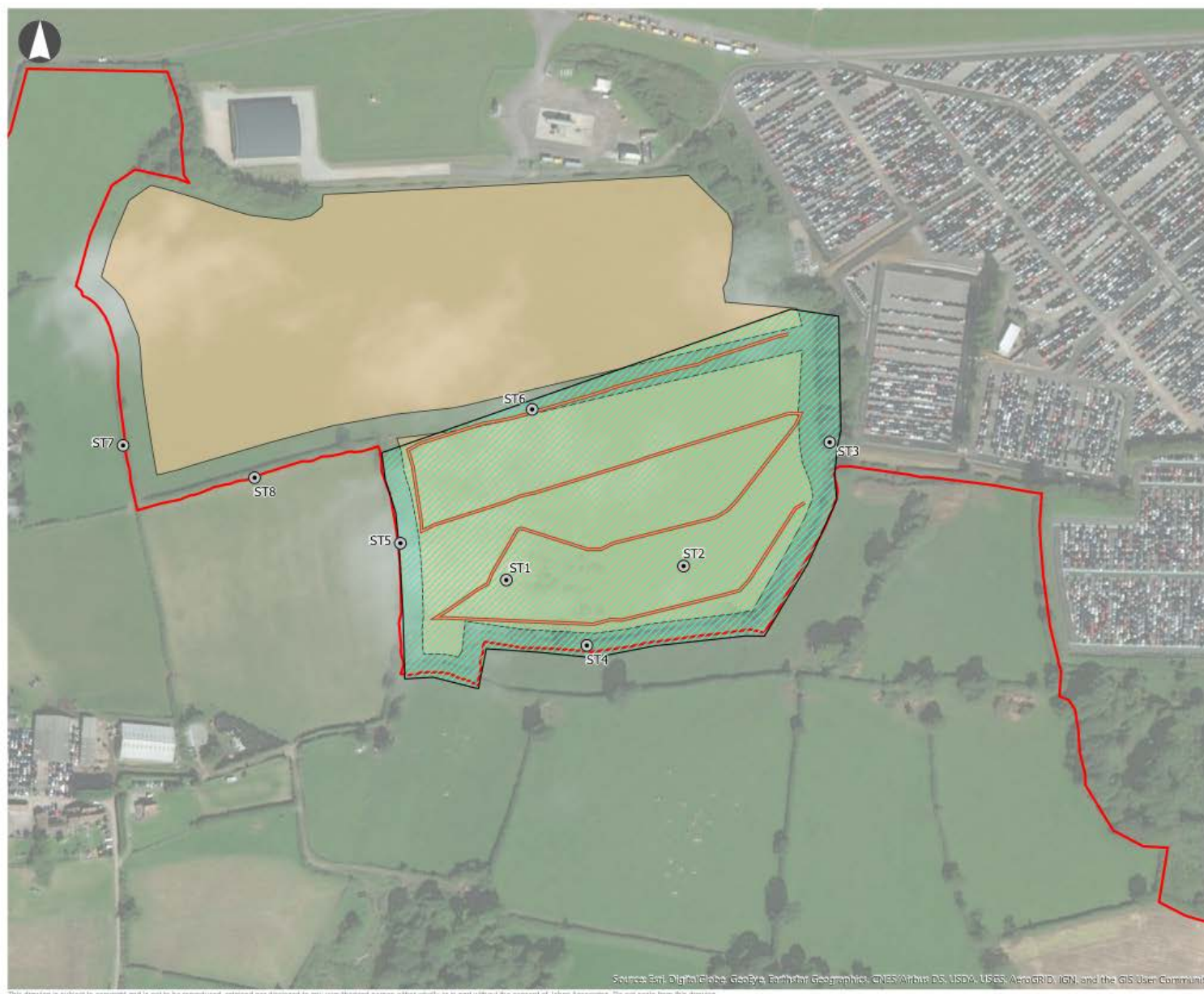
2.4 ACTIVITY TRANSECT SURVEYS

Transect surveys were designed to comply with current industry guidelines (Bat Conservation Trust, 2016) and the North Somerset and Mendips Bats Special Area of Conservation (SAC) Guidance on Development (North Somerset Council, 2017).

The transect routes (see Figure 11E3a and Figure 2 (11E3b)) were surveyed on the dates detailed in Table 3 and Table 4 respectively, and were designed to sample all habitats present on site with a focus on habitats identified as having moderate or high suitability for bats. The transect covered the full zone of influence areas associated with the location of A38 highway improvements and the Proposed Extension to the Silver Zone Car Park (Phase 2) with appropriate listening points to sample all habitats present within the transect route evenly. Surveys were carried out in suitable weather conditions (above 15°C with no rain and light wind) and commenced at sunset and continued for 3 hours.

Elekon Batlogger M detectors were used for all surveys with GPS data for all bat recordings logged.

Figure 1 (11E3a) Zone A Activity Transect Route



JOHNS ASSOCIATES

CLIENT
Wood

PROJECT
Development of Bristol Airport to Accommodate 12 Million Passengers Per Annum

TITLE
2018 Bat Baseline Survey Areas - Zone A

SCALE @ A3	CREATED BY	CHECKED BY
1:2,500	JS	MJ
REFERENCE	REVISION	DATE ISSUED
J00254.11E3a		3/12/2018

- Planning Application Boundary
- Zones of Influence
- Static Detector Locations
- Crossing Point Survey Location
- 2018 Bat Activity Transect
- Survey Zone
- Emergence and Activity

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Figure 2 (11E3b) Zone B Activity Transect Route

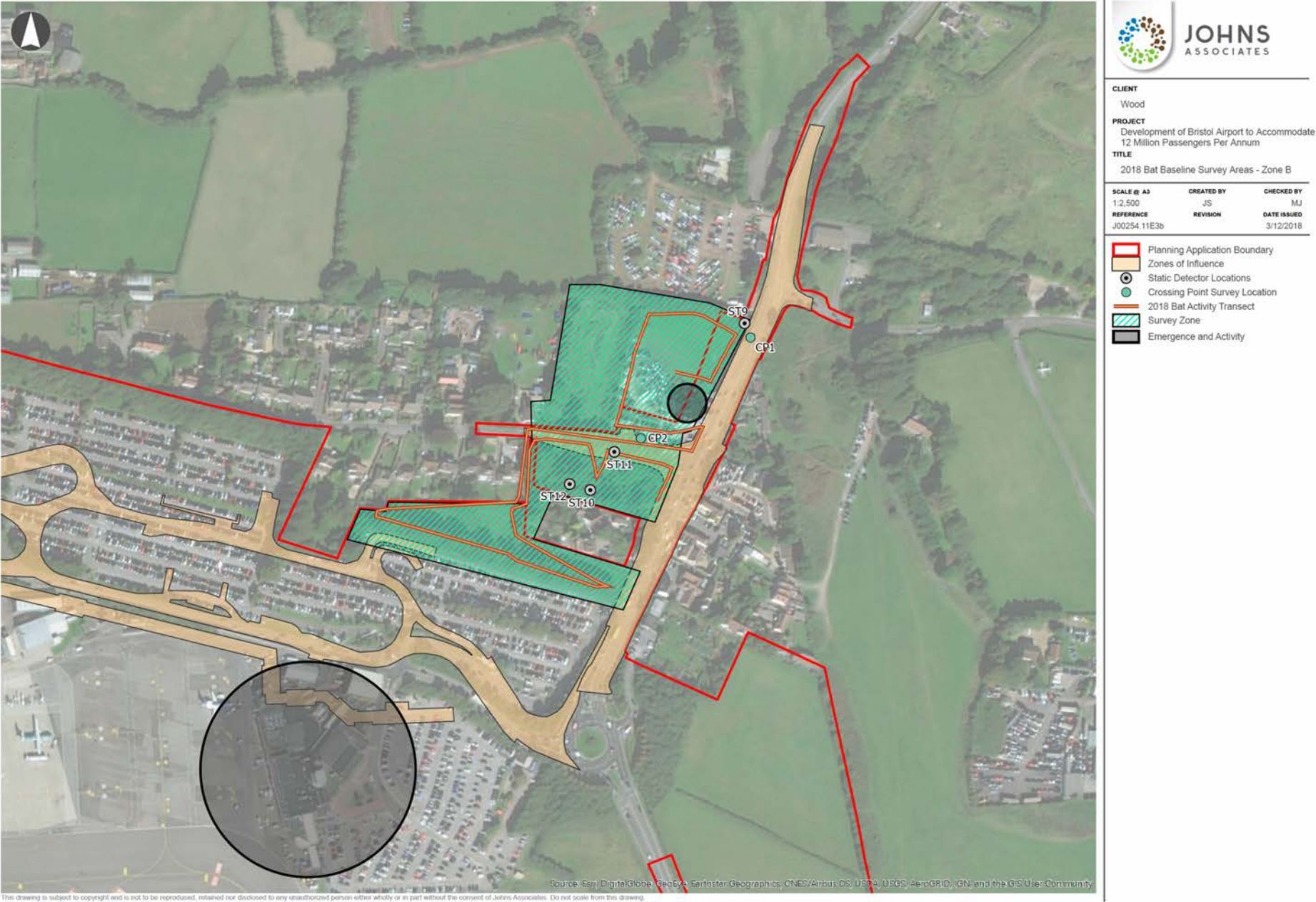


Table 3 Zone A Activity Transect Dates

Survey Date	Lead Surveyor	Direction
25.04.18	Kerry White BSc (Hons) GradCIEEM	Northwards
22.05.18	Kerry White BSc (Hons) GradCIEEM	Southwards
19.06.18	Lis Weidt BSc (Hons) GradCIEEM	Northwards
28.06.18	Kerry White BSc (Hons) GradCIEEM	Southwards
02.07.18	Kerry White BSc (Hons) GradCIEEM	Northwards
26.07.18	Matt Johns BSc MSc CEnv FGS MCIEEM MIFM	Southwards
17.08.18	Jasmine Walters BSc (Hons) GradCIEEM	Northwards
28.08.18	Matt Johns BSc MSc CEnv FGS MCIEEM MIFM	Southwards
07.09.18	Tom Johnston BSc (Hons) GradCIEEM	Northwards
08.10.18	Tom Johnston BSc (Hons) GradCIEEM	Southwards

Table 4 Zone B Activity Transect Dates

Survey Date	Lead Surveyor	Direction
22.05.18	Juliet Reid BSc (Hons) MCIEEM	Southwards
11.06.18	Lis Weidt BSc (Hons) GradCIEEM	Northwards
20.06.18	Lis Weidt BSc (Hons) GradCIEEM	Southwards
03.07.18	Lis Weidt BSc (Hons) GradCIEEM	Northwards
26.07.18	Lis Weidt BSc (Hons) GradCIEEM	Southwards
21.08.18	Jasmine Walters BSc (Hons) GradCIEEM	Northwards
28.08.18	Tom Johnston BSc (Hons) GradCIEEM	Southwards
04.09.18	Tom Johnston BSc (Hons) GradCIEEM	Northwards
19.09.08	Tom Johnston BSc (Hons) GradCIEEM	Southwards
08.10.18	Kerry White BSc (Hons) GradCIEEM	Northwards

An appropriately qualified lead ecologist and an assistant walked at a constant speed along the planned route, pausing at stopping points for a set period of time. The start/end points were alternated on consecutive visits to reduce survey bias. All bat calls were recorded using an Elekon Batlogger M ultrasonic bat detector which provides high definition and GPS referenced recordings in combination with direct observations i.e. number of bats, flight direction, flight height and behaviour (e.g. commuting or foraging).

2.4.1 Limitations

Access to Zone B (A38 highway improvements) was only obtained in May 2018, therefore, there is an absence of bat data for the month of April for this zone. The cumulative survey effort across the survey period has been adjusted to account for the lack of data capture during this month to ensure that the target of >50 nights of automated detector data was achieved.

In addition, on the surveys on 04.09.18 and 28.08.18 the start of some surveys were delayed due to temporary access restrictions. However, the survey duration of 3 hours was observed (where this was not constrained by dawn) and therefore the surveys are considered to be valid, albeit not ideal.

2.5 ROAD CROSSING POINT SURVEYS

These were designed to determine whether bats are using regular flightpaths to cross the existing A38 and therefore to enable prediction of the impacts of the proposed highway improvement works to the A3.

The survey methodology is based on WC1060 Development of a cost-effective method for monitoring the effectiveness of mitigation for bats crossing linear transport infrastructure (J. Altringham & A. Berthinussen, 2015); and is also based on Johns Associates' experience undertaking crossing point surveys e.g. relating to the A303 Stonehenge improvement scheme in 2017. The survey consisted of visual observations of bats crossing the A38 at a particular point over 60 min periods post dusk or pre-dawn.

Observations consisted of counts of all commuting bats, with data on flight height, direction and distance from the linear habitat feature (pre-construction), paired with echolocation recordings for species identification.

A total of eight survey visits were completed as detailed in **Table 5** and **Table 6**.

The surveys completed in both July and August were "back to back" surveys where the crossing points were monitored at dusk and then dawn in the same night. Two surveyors were deployed at each location on opposite sides of the road. A maximum distance of 20m was observed between surveyor locations to ensure detection of lesser horseshoe **bats**.

Elekon Batlogger M detectors were used for all surveys.

The location of the crossing points and surveyor locations are contained in Figure 6.

Table 5 Crossing Point 1

Survey Date	Lead Surveyor	
06.06.18	Ben Mitchell BSc (Hons) MCIEEM	Dusk
25.06.18	Jasmine Walters BSc (Hons) GradCIEEM	Dusk
26.06.18	Kerry White BSc (Hons) GradCIEEM	Dawn
16.07.18	Juliet Reid BSc (Hons) MCIEEM	Dusk
17.07.18	Lis Weidt BSc (Hons) GradCIEEM	Dawn
13.08.18	Lis Weidt BSc (Hons) GradCIEEM	Dusk
14.08.18	Ben Mitchell BSc (Hons) MCIEEM	Dawn
18.09.18	Tom Johnston BSc (Hons) GradCIEEM	Dusk
16.10.18	Tom Johnston BSc (Hons) GradCIEEM	Dusk

Table 6 Crossing Point 2

Survey Date	Lead Surveyor	
06.06.18	Lis Weidt BSc (Hons) GradCIEEM	Dusk
28.06.18	Juliet Reid BSc (Hons) MCIEEM	Dusk
29.06.18	Jasmine Walters BSc (Hons) GradCIEEM	Dawn
16.07.18	Kerry White BSc (Hons) GradCIEEM	Dusk
17.07.18	Jasmine Walters BSc (Hons) GradCIEEM	Dawn
13.08.18	Jasmine Walters BSc (Hons) GradCIEEM	Dusk
14.08.18	Kerry White BSc (Hons) GradCIEEM	Dawn
10.09.18	Kerry White BSc (Hons) GradCIEEM	Dusk
16.10.18	Kerry White BSc (Hons) GradCIEEM	Dusk

2.6 AUTOMATED DETECTOR SURVEYS

The site has been assessed as presenting high suitability for bats (BCT, 2016) and is located within Bat Consultation Zone B of the North Somerset Mendips Bat SAC (NSC, 2017). As such, automated detector surveys were required to ascertain the use of the site by bats throughout the active season for bats (April-October inclusive).

Furthermore, the level of survey effort detailed in Table 7 was required to comply with the North Somerset and Mendips Bats Special Area of Conservation (SAC) Guidance on Development (North Somerset Council, 2017) to calculate the activity score multiplier used to calculate the Habitat Unit Value of the affected habitats:

Table 7 SPD Survey Criteria

Criteria	Requirement	Action
Focus of survey effort	Particular focus on linear features and areas of scrub and pasture	Detector locations chosen to target all key habitats. Microphone locations were designed to detect horseshoe bats utilizing both sides of linear features by raising the microphone above the vegetation and selecting locations along linear features in breaks in the vegetation.
Number of automated Detectors	Number will respond to number of suitable linear features but the objective would be to sample each habitat component equally.	12 locations were identified to ensure sufficient coverage of all suitable habitats equally.

Criteria	Requirement	Action
Spatial Distribution of detectors	Enough detectors should be deployed so that each location is monitored	The survey was designed to obtain a minimum of 10 recording nights per location per month. 6 detectors were used in rotation between two points each month.
Volume of survey effort	Period of deployment should be to achieve at least a total of 50 nights out of 214 (~25%)	The minimum total number of recording nights set at 10/month allows for poor weather and provides a margin for technical faults and other constraints such as vandalism events that are inherent risks in the deployment of automated detectors. Over the survey period the aspiration was to obtain 70 nights of data to ensure that the minimum of 50 nights was achieved.
Temporal distribution of survey effort	50 days from April to October and would include at least on working week (interpreted as 5 days) in each of the months of April, May, August, September and October	Surveys were initiated at the earliest possible point within the survey period and continued through into October. Any shortfalls in a single month were to be mitigated by additional nights in subsequent months to ensure temporal cover.

Six Elekon BatLogger C high sensitivity omnidirectional automated ultrasonic detectors were deployed and systematically moved between locations within each month to obtain sufficient volume of data for each location. These units have been selected as they are extremely durable and reliable whilst displaying best in class sensitivity. This is of key importance on sites with known presence of bat species that are difficult to detect (e.g. horseshoe bats). Solar panels have been used to supplement the power supply to ensure that there is the lowest likelihood of power failures. Table 8 contains information relating to the detector locations and serial numbers, whilst the configuration of trigger settings is detailed in Table 9.

Table 8 Automated Detector Locations and Serial Numbers

Location	Area Reference	Location Description	Detector Serial Numbers Used (last unique 4 digits)
ST1	Zone A (Proposed Extension to the Silver Zone car park [Phase 2])	Large hawthorn on western boundary of scrub matrix habitat. Microphone located at 3.5m on pole.	1368/1281/1282

Location	Area Reference	Location Description	Detector Serial Numbers Used (last unique 4 digits)
ST2	Zone A (Proposed Extension to the Silver Zone car park Phase 2)	Isolated scrub patch in centre of field ~25m from any boundary features to ensure that any horseshoe bats detected were within open field habitat and not associated with boundary habitats. Microphone positioned at 1.5m on large prominent stem.	1367/1283/1281
ST3	Zone A (Proposed Extension to the Silver Zone car park Phase 2)	Mature ash on southern limit of woodland adjacent to field gate and gap between south eastern hedgerow and woodland. Microphone located facing south at 2.5m high.	1366/1367/1284
ST4	Zone A (Proposed Extension to the Silver Zone car park Phase 2)	Under mature ash in centre of hedgerow with clear detection radius of but sides of hedgerow through large gap. Microphone positioned on pole at 2m facing east.	SM2.1/1279/1286
ST5	Zone A (Proposed Extension to the Silver Zone car park Phase 2)	Mature hedgerow. Microphone positioned on 4.5m pole extending 1m proud of the top of the hedgerow facing south to ensure detection to 0.5m above ground level on both sides of hedgerow.	1367/SM2.1/1286
ST6	Zone A (Proposed Extension to the Silver Zone car park Phase 2)	Grassland bund. Microphone positioned on pole at base of bund at 2.5m facing south. Only southern side of feature covered.	1366/1282/1284
ST7	Zone A (Proposed Extension to the Silver Zone car park Phase 2)	Mature hedgerow. Microphone positioned on 4.5m pole extending 1m proud of the top of the hedgerow facing south to ensure detection to 0.5m above ground level on both sides of hedgerow.	1367/1281
ST8	Zone A (Proposed	Mature hedgerow. Microphone positioned on 4.5m pole extending 1m proud of the top of the hedgerow facing east to ensure	1366/1284/1282

Location	Area Reference	Location Description	Detector Serial Numbers Used (last unique 4 digits)
	Extension to the Silver Zone car park Phase 2)	detection to 0.5m above ground level on both sides of hedgerow.	
ST9	Zone B (A38 highway improvements)	Mature hedgerow. Microphone positioned on 4.5m pole extending 1m proud of the top of the hedgerow facing west over gap to ensure detection to 0.5m above ground level on both sides of hedgerow.	1280/1283
ST10	Zone B (Proposed Extension to the Silver Zone car park Phase 2)	Semi Natural woodland. Microphone positioned on 5m pole in canopy above clearing facing north east.	1282/1285
ST11	Zone B (Proposed Extension to the Silver Zone car park Phase 2)	Semi Natural woodland edge along southern pavement on Downside Road. Microphone positioned on low branch at 2m facing north over road.	1283
ST12	Zone B (Proposed Extension to the Silver Zone car park Phase 2)	Semi Natural woodland. Microphone positioned on 2m pole to cover ground level in clearing facing north east.	1285

Detector deployment periods were designed to record a minimum of 10 consecutive nights of bat activity to allow for 5 nights of unsuitable weather conditions within that period to ensure that the survey effort for that month will still qualify (see Section 2.7.1 of this Appendix).

A stratified detector deployment strategy was adopted, whereby detectors are grouped by factors (such as similar habitat quality or connective value) to ensure that the surveys are systematic and some semi-quantitative analysis can be conducted to identify areas of high relative importance for bats.

The automated detectors were configured to record for a maximum of 15 seconds after being triggered and would cease to record in the absence of no further trigger events within this period. Pre-trigger and post trigger settings were designed to capture approach and exit phases of bat calls.

The “period” trigger was used to reduce the large volume of insect recordings recorded and thus preserve battery life and reduce the volume of noise files without compromising the detectability and recording of bat calls. This filter algorithm measures the periodicity of the waveform as it is received so that only sinusoidal