

SANDVIK OSPREY LTD

LAND OFF JUNCTION 38, M4, MARGAM

ECOLOGY NOTE TO INFORM EIA SCOPING

FEBRUARY 2022



soltysbrewster
E C O L O G Y

4 Stangate House,
Stanwell Road,
Penarth,
Vale of Glamorgan,
United Kingdom.
CF64 2AA

Telephone:- 033 00 13 00 12
e-mail:- enquiry@soltysbrewster.co.uk
Web Site:- www.soltysbrewster.com

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1	-	Draft for review	28 th May 2021	Daniel Jones (Ecologist)	Dr M Watts (Director)	
2	Minor text amendments to Appendix II & IV	For issue	1 st June 2021	Daniel Jones (Ecologist)		
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1.0 INTRODUCTION

- 1.1 Soltys Brewster Ecology were commissioned by Sandvik Osprey Ltd to undertake an ecological appraisal of an area of land near Margam, Port Talbot. The site is located off Junction 38 of the M4 (central grid reference: SS 79275 86280). The site is proposed for the development of a metal processing facility. The findings of the appraisal are intended to inform an Environmental Impact Assessment (EIA) Scoping Opinion submission to the local planning authority (Neath Port Talbot Council – NPT).
- 1.2 The site is approx. 7.2ha in size and is currently used for agricultural purposes comprising of enclosed field boundaries, hedgerows and a small woodland copse. A plan showing the site location and overall site masterplan is shown in Appendix I.
- 1.3 The current report presents the findings of an ecological desk study and Extended Phase 1 Habitat survey undertaken at the proposed site in May 2021. The current report describes the existing ecological conditions, potential biodiversity impacts, recommended avoidance and mitigation measures and further survey work requirements needed to inform a future application and supporting Environmental Statement (ES) at the proposed site.

2.0 METHODOLOGY

- 2.1 In order to establish the baseline ecological conditions at the proposed site, a combination of desk-based consultation and Extended Phase 1 Habitat survey were undertaken in May 2021.

Desk study

- 2.2 The desk study involved consultation with the South East Wales Biodiversity Records Centre (SEWBRc) to identify any records of rare, protected or notable flora and fauna at the candidate site and within a radius of 1km extending from the central point of the proposed site. The search criteria also included information relating to the location and citation details (where available) for any sites designated for their nature conservation interest such as Sites of Special Scientific Interest (SSSI) or Sites of Importance for Nature Conservation (SINC).

Extended Phase 1 Habitat Survey

- 2.3 The fieldwork was undertaken on 12th May 2021 by a suitably experienced ecologist¹ and followed standard Phase 1 Habitat Survey protocol (JNCC, 2010) as amended by the Institute of Environmental Assessment (1995). All habitats within and immediately adjacent to the proposed site boundary were classified and mapped as accurately as possible. Habitats considered to have potential to support rare, protected or otherwise notable species of flora and fauna were noted, as were any direct signs of these species (e.g. Eurasian Badger *Meles meles* setts and dung-pits). Incidental observations of birds on or flying over the site were also recorded and any incidence of invasive weed species (e.g. Japanese knotweed *Fallopia japonica*) noted.
- 2.4 A map of habitats was drawn up and target notes were used to identify features of ecological interest. Where possible, habitats were cross-referenced to any relevant important UK or Wales priority habitats as identified under Section 7 of the Environment Act (Wales) 2016.
- 2.5 During the field survey any trees or structures at the proposed site were assessed for their potential to support roosting bats and were categorised in relation to the bat roosting features (BCT, 2016). The categories are as follows:
- **Known or confirmed roost**
 - **High** - A tree or structure 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 and surrounding habitat.

¹ Associate Member of the Chartered Institute of Ecology & Environmental Management (CIEEM)

- **Moderate** – A tree or structure with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status.
- **Low** – A structure with one or more potential roost sites that could be used by individual bats opportunistically. Or: A tree of sufficient size & age to contain PRFs (Potential Roost Features) but with none seen from the ground or features seen with only very limited roosting potential.
- **Negligible** – Negligible habitat features on site likely to be used by roosting bat

Survey Constraints

2.6 During the survey livestock (bulls and cows) were present within one of the smaller field parcels at the proposed site – field parcel located to the east of the woodland copse. This area of the site, and the tree located at Target Note 7, was instead surveyed from a safe distance with the use of binoculars. It is not considered that this constraint had an overall impact of the assessment of the site/site features and subsequent habitat mapping.

3.0 RESULTS

Desk Study

SEWBRc Records

- 3.1 Consultation with SEWBRc confirmed that the proposed site holds no designation for nature conservation. However, the proposed site is located within 500m of Eglwys Nunydd Reservoir Site of Special Scientific Interest (SSSI). The reservoir is designated for its reedbed and standing water habitats which are known to support a large number of wintering and migrant waterfowl. The site (Eglwys Nunydd) is also locally designated as a Site of Importance for Nature Conservation (SINC). The proposed site is also located within 100m of Junction 38 Wetland Complex SINC, which supports wet woodland, fen and purple-moor grass and rush pasture habitats. The proposed site has potential hydrological links to both Eglwys Nunydd Reservoir SSSI and Junction 38 Wetland Complexes SINC via a small number of ditches within the proposed site and surrounding area. A summary of the SEWBRc findings is included in Appendix II.
- 3.2 The data search returned a list of protected and priority species records within a 1km radius of the proposed site. This included multiple foraging and commuting records of Common and Soprano Pipistrelle *Pipistrellus pipistrellus/pygmaeus* associated directly with the proposed site itself, as well as a potential Pipistrelle roost within a tree cavity within the small woodland block. The data search included roosting records of Brown-Long Eared bat *Plecotus auritus* and Whiskered bat *Myotis mystacinus* within the 1km search radius. Margam Park Castle is located approx. 1.1km east of the proposed site – the castle and surrounding habitats are known to support a number of different roosting bats species such as Lesser and Greater Horseshoe bat *Rhinolophus hipposideros/ferrumequinum*, Daubenton's bat *M. daubentonii*, Brandt's bat *M. brandtii*, Natterer's bat *M. nattereri* and Barbastelle *Barbastella barbastellus*. However, the M4 corridor separates the Margam Park site from the proposed development site and is likely to present a barrier to the (regular) movement of terrestrial species and light-intolerant bat species (such as Horseshoe species).
- 3.3 Multiple records of Badger were identified within 1km of the proposed site, with the majority of these records (9no.) associated with roadkill sightings along the M4 carriageway. Other priority mammal species records included within 1km of the proposed site included those for Polecat *Mustela putorius*, Harvest Mouse *Micromys minutus* and European Hedgehog *Erinaceus europaeus*.
- 3.4 The data search included several recent records (> 45no.) of common reptiles within 1km of the proposed site, the majority of which were associated with the habitats at the Junction 38 Wetland Complex SINC to the west of the site. This included records of Common Lizard *Zootoca vivipara*, Grass Snake *Natrix helvetica* and Slow-Worm *Anguis fragilis*. Although the data search did not include any Great Crested Newt *Triturus cristatus* records

within the 1km search radius, there was single GCN records located further afield, approx. 1.1km west of the proposed site, associated with the ponds at the steelworks.

- 3.5 The desk study results included an extensive list protected bird species listed under Schedule 1 of the Wildlife and Countryside Act (1981) (as amended) within 1km of the proposed site. The majority of these records were associated with wetland bird species and located at Eglwys Nunydd Reservoir, Junction 38 Wetland Complex SINC and Margam Country Park Lake and, based on the habitats present at the proposed site, were not considered of particular ecological relevance to the proposal. However, one Barn Owl *Tyto alba* sighting was associated with habitats located directly within the proposed site. There were also records of S7 listed priority bird species within the 1km search radius such as Song Thrush *Turdus philomelos*, House Sparrow *Passer domesticus*, Tree Pipit *Anthus trivialis*, Skylark *Alauda arvensis*, Lapwing *Vanellus vanellus*, Linnet *Linaria cannabina*, Bullfinch *Pyrrhula pyrrhula* and Starling *Sturnus vulgaris*.
- 3.6 The data search included records for S7 priority listed invertebrate species within the 1km search radius including records of Brown-Banded Carder Bee *Bombus humilis*, Shril Carder Bee *B. sylvarum* and Moss Carder Bee *B. muscorum* as well as Small Blue *Cupido minimus*, Small Heath *Coenonympha pamphilus* and Grayling *Hipparchia semele* butterfly.
- 3.7 Invasive species listed under Schedule 9 of the Wildlife and Countryside Act (1981) (as amended) have been recorded within 1km of the candidate site including Japanese Knotweed, Himalayan Balsam *Impatiens glandulifera*, Montbretia *Crocsmia pottsii x aurea* = *C. x crocosmiflora*, Canadian Waterweed *Elodea canadensis* and Rhododendron *Rhododendron ponticum*.

Extended Phase 1 Habitat Survey

- 3.8 The distribution and extent of habitats recorded at the proposed site in May 2021 are illustrated on the Extended Phase 1 Habitat Plan with accompanying target notes in Appendix III. The proposed site comprises of a range of habitats including semi-improved neutral grassland, poor semi-improved grassland, improved grassland, marshy grassland, semi-natural broad-leaved woodland, dense/continuous scrub, scattered trees and scrub, hedgerows, stone wall and buildings.

Semi-improved neutral grassland

- 3.9 The proposed site contains a small area of semi-improved neutral grassland located at the northern boundary of the site along the verge of the A48 roundabout (Plate 1). Species present include Meadow Foxtail *Alopecurus pratensis*, Cock's Foot *Dactylis glomerata*, Red Fescue *Festuca rubra*, Common Bent *Agrostis capillaris*, Sedge (indicative of False Fox Sedge *Carex otrubae*), Hard Rush *Juncus inflexus*, Field Wood-Rush *Luzula campestris*, Common Vetch *Vicia sativa*, Ground Ivy *Glechoma hederacea*, Ragged Robin *Silene flos-cuculi*, Bugle *Ajuga reptans*,

Dandelion *Taraxacum officinale* agg., Colt's Foot *Tussilago farfara*, Red Campion *Silene dioica*, Field Forget-Me-Not *Myosotis arvensis*, Field Speedwell *Veronica persica*, Ox-Eye Daisy *Leucanthemum vulgare*, Ribwort Plantain *Plantago lanceolata*, Common Knapweed *Centaurea nigra*, Cuckoo Flower *Cardamine pratensis*, Yarrow *Achillea millefolium*, Herb Robert *Geranium robertianum*, Cinquefoil *Potentilla* sp., Thistle *Cirsium* sp., Nettle *Urtica dioica*, Hogweed *Heracleum sphondylium* and low-lying Bramble *Rubus fruticosus* agg. The grassland contains a distinct damper area which was classified as marshy grassland and is described in paragraph 3.13.

Plate 1 – Semi-improved neutral grassland and marshy grassland (northern extent of proposed site boundary).



Poor semi-improved grassland

3.10 The southern field parcel comprises of poor semi-improved grassland and is currently used for hay cutting (see cover image). The sward resembles a species-poor neutral grassland where Yorkshire Fog *Holcus lanatus*, Meadow Foxtail and Sweet Vernal Grass *Anthoxanthum odoratum* are the dominant grass species – although Perennial Rye Grass *Lolium perenne* is still frequent. Other plant species present include Cock's Foot, Annual Meadow Grass *Poa annua*, Hairy Sedge *Carex hirta*, Field Woodrush, Soft Rush *Juncus effusus*, Thistle, Dandelion, Creeping Buttercup *Ranunculus repens*, Cuckoo Flower, Red Clover *Trifolium pratense*, Common Daisy *Bellis perennis*, Common Mouse-Ear *Cerastium fontanum*, Field Speedwell, Ribwort Plantain, Common Sorrel *Rumex acetosa* and Silverweed *Potentilla anserina*.

Improved grassland

- 3.11 The proposed site contains smaller field parcels of grazed improved grassland (Plate 2). The grassland is characterised by a very short sward height and low floral diversity. Perennial Rye Grass, Common Daisy and Dandelion are present as well as occasional taller patches of Thistle and Nettle.

Plate 2 – Grazed improved grassland.



Marshy grassland

- 3.12 There are some small patches of marshy grassland located along the eastern site boundary along a small ditch (Plate 3). The vegetation here has not been grazed and contains Soft and Hard Rush as well as Water Cress *Nasturtium officinale* and Brooklime *Veronica beccabunga*.
- 3.13 There is also a small area of marshy grassland located towards the northern extent of the site boundary, within the SI neutral grassland (see Plate 1). This section of grassland shares characteristics with swamp habitats and contains small pools of standing water containing Reed Canary Grass *Phalaris arundinacea*, Yellow Flag Iris *Iris pseudacorus*, Water Dropwort *Oenanthe* sp., Hard Rush and unidentified Sedges.

Plate 3 – Marshy grassland located along small ditch.



Semi-natural broad-leaved woodland

- 3.14 A small woodland copse is located towards the centre of the proposed site. The woodland primarily consists of Sycamore *Acer pseudoplatanus* trees of mixed age but also contains several older Beech *Fagus sylvatica* trees. There are also stands of Hawthorn *Crataegus monogyna* and Willow *Salix* sp. scrub and standing deadwood.
- 3.15 A narrow woodland corridor runs along the eastern boundary of the proposed site to the Tyn-Y-Caeau farmhouse. The woodland block contains Sycamore, Beech and Ash *Fraxinus excelsior* trees.

Plate 4 – Small woodland copse.



Dense/continuous scrub

3.16 The proposed site contains small areas of dense Bramble, Willow and Hawthorn scrub.

Scattered trees and scrub

3.17 The proposed site contains occasional stands of scattered Sycamore, Hawthorn and Willow. There are also newly planted shrub and tree species located along the road verge near the A48 roundabout.

Hedgerows

3.18 Several hedgerow margins were identified at the proposed site, as described below:

Defunct species-rich hedgerow

3.19 A defunct species rich hedgerow margin is located towards the centre of the proposed site, separating the northern and southern field parcels. The hedge contains a number of woody species within a 30m section including Hawthorn, Blackthorn *Prunus spinosa*, Holly *Ilex aquifolium*, Hazel *Corylus avellana*, Willow and the occasional Sycamore tree. The hedgerow is 'gappy' and much of the ground flora has been heavily grazed. A post and wire fence runs parallel to the hedgerow.

Species-rich hedgerow with trees

3.20 A species-rich hedgerow with trees is located along the majority of the length of the proposed site's southern and eastern boundaries. This hedgerow also contains several woody species within a 30m section including Sycamore, Hazel, Hawthorn, Blackthorn and Rose *Rosa sp.*. The ground flora is also more diverse containing Ivy *Hedera helix*, Bluebell *Hyacinthoides non-scripta*, Red Campion, Lords-and-Ladies *Arum alpinum*, Ground Ivy, Cleavers *Galium aparine* and Nettle.

Plate 5 – Species-rich hedgerow with tree located along southern site boundary.



Wall

- 3.21 A dry-stone wall is located along the boundary of the proposed site to the Tyn-Y-Caeau farmhouse. The wall is short in height (typically less than 1m) and most of the wall is in a state of disrepair. Within the small woodland block there is also a derelict stone archway.

Buildings

- 3.22 The proposed site contains a small derelict outbuilding (located at Target Note 4) which has been overgrown with Bramble scrub. The structure comprises of a metal frame with corrugated metal wall panels – the roof and many of the wall panels are missing.
- 3.23 One of the buildings at Tyn-Y-Caeau farmhouse is also located along the eastern boundary of the proposed site (Target Note 11). The building comprises of stone walls with concrete roofing tiles. Much of the building's western elevation (elevation bordering the proposed site) is covered by dense ivy stems.

Invasive species

- 3.24 Two stands of Japanese Knotweed were identified at the north-east corner of the proposed site, located along the A48 carriageway (see Target Note 10).

Fauna

- 3.25 During the course of the survey, a search of field signs for protected or notable species was undertaken and the potential of the habitats to support these species considered. In the context of this report, these species meet any of the following criteria:
- Species protected by British or international law;
 - Priority species included on Section 7 (Environment Act, Wales);
 - Nationally rare or nationally scarce species;
 - Species of Conservation Concern (e.g. JNCC Red List, RSPB/BTO Red or Amber Lists);

Badger

- 3.32 Although the data search returned multiple records of a Badger within 1km of the proposed site, no evidence was found during the survey to suggest the current use of the site by Badger (e.g. setts, latrines or footprints). In addition, no obvious mammal pathways were through along the hedgerow and fence line boundaries. Despite this, the proposed site does offer suitable foraging habitats (e.g. woodland and SI grassland) and the occasional use of the site by Badger cannot be precluded.

Bats

- 3.33 The majority of the habitats present at the proposed site (e.g. open areas of improved grassland and poor semi-improved grassland) contain limited foraging resources for bats. However, the small woodland parcel and other linear habitats features (i.e. hedgerows and woodland corridor) were considered likely to support a number of locally commuting and foraging bats species. Both Common and Soprano Pipistrelle have been previously recorded at the site. These linear features at the site contain existing habitat connectivity to the wooded A48/M4 corridor and also to semi-natural/wet woodland habitats at the Junction 38 Wetland Complex SINC to the immediate west of the site. The street lighting associated with the road corridors east of the site is likely to limit their use by bat species known to be relatively intolerant of artificial light (e.g. Horseshoe & *Myotis* species).
- 3.34 The survey also identified several trees at the proposed site with potential to support roosting bats. This included 1no. tree with high potential, 1no. tree with moderate potential and 3no. trees with low potential. The mature Sycamore tree assessed to have high potential (Target Note 5) contains several large cavities on the main trunk (some with interconnecting holes) capable of supporting multiple roosting bats. The tree assessed to have moderate potential (Target Note 7) is located at the edge of the woodland parcel and is in a poor condition with significant decay on the main trunk. The decaying areas of wood contain a number of woodpecker holes which could support roosting bats. A small derelict shed at the proposed site was assessed to have negligible potential to support roosting bats (Target Note 4). One of the buildings at the adjacent farmhouse was assessed to have low potential to support roosting bats.

Birds

- 3.35 A number of birds were seen/heard at the proposed site during the survey including Blackbird *Turdus merula*, Jackdaw *Corvus monedula*, Blackcap *Sylvia atricapilla*, Robin *Erithacus rubecula*, Goldfinch *Carduelis carduelis*, Pied Wagtail *Motacilla alba*, Barn Swallow *Hirundo rustica* and Woodpigeon *Columba palumbus*. None of which are of particular conservation concern. The woodland, hedgerow and scrub habitats at the proposed site were considered likely to support a number of foraging and nesting bird species – during the survey a number of bird nests were noted within the tree canopies. The tree assessed to have high potential to support roosting bats, as described in paragraph 3.34 and Target Note 5, was also considered to have some suitability to support nesting Barn Owl, although no evidence was present to suggest active use (e.g. pellets, feathers).

Great Crested Newt

- 3.36 The data search did not include any recent records of Great Crested Newt (GCN) within 1km of the proposed site. The nearest record was identified over 1.1km west of the site, associated with freshwater habitats at the steelworks. Although the proposed site does contain suitable terrestrial habitats for GCN, with the hedgerow boundaries, woodland and dry-stone wall providing foraging resources and potential hibernaculum, there are

no ponds within a 500m radius that could support a breeding population. The main railway line (which separates the nearest GCN record from the proposed site) and the A48/M4 carriageway are likely to act as dispersal barriers for the species. As such, the presence of GCN at the proposed site was considered unlikely.

Hazel Dormouse

- 3.37 No records of Hazel Dormouse *Muscardinus avellanarius* were identified within 1km of the proposed site. Whilst the hedgerows and woodland at the site contain some suitable foraging resources for Dormouse (e.g. Hazel, Hawthorn, Bramble), structurally they are poor with much of the understorey growth heavily grazed (particularly along the defunct hedgerow and within the small woodland copse). As such, the presence of the species at the proposed site was considered unlikely. As noted for other species, the road corridors east of the site are also likely to limit the potential for dispersal/movement of any Dormice which may be present in woodland/hedgerow habitats to the west of the M4/A48 corridor.

Invertebrates

- 3.38 A small number of terrestrial invertebrates were seen during the survey including Common Carder Bee *Bombus pascuorum*, Brown-Banded Carder Bee, Red-Tailed Bumblebee *B. lapidarius* and Dock Bug *Coreus marginatus*. Of which, Brown-Banded Carder Bee (Plate 6) is listed as priority species under Section 7 of the Environment Act (2016) Wales. All invertebrate sightings were associated the areas of marshy semi-improved neutral grassland at the north of the proposed site. The habitat here contains a more diverse range of herbaceous species and as well as a mixture of wet and dry grassland and was considered likely to support other priority terrestrial invertebrate species.

Plate 6 – Brown-Banded Carder Bee



Reptiles

- 3.39 The data search returned multiple reptile records within 1km of the proposed site, mostly associated with the Junction 38 Wetland Complex SIN. The majority of the habitats at the proposed site (i.e. grazed improved grassland and poor SI grassland) were considered unsuitable to support common reptiles, and are likely lacking appropriate shelter and prey resources. However, the smaller areas of more species-rich grassland to the north of the site and the hedgerow and woodland margins were considered to have greater suitability to support a small number of common reptiles. These habitats are likely to contain suitable invertebrate prey resources and also contain shelter and hibernation opportunities (e.g. dry stone wall).

4.0 CONSIDERATIONS FOR EIA

4.1 The combination of desk study and Extended Phase 1 Habitat survey identified a range of habitats at the proposed site including poor semi-improved grassland, improved grassland, dense/continuous scrub, scattered trees and scrub, wall and buildings as well as priority habitats such as hedgerows, semi-improved neutral grassland, marshy grassland and semi-natural broad-leaved woodland. The habitats at the proposed site were considered suitable to support foraging/commuting and roosting bats, nesting birds, priority listed terrestrial invertebrates and common reptiles. The occasional use of the proposed site by Badger could also not be precluded. A summary of the potential biodiversity impacts and recommended avoidance and mitigation measures are described below as well as any further survey work requirements needed to inform a future application and an EIA/EcIA² at the proposed site.

4.2 Potential biodiversity impacts that may result from the proposed development include:

- Mortality, injury or disturbance of protected and priority species including:
 - Badger
 - Bats
 - Birds (nesting)
 - Reptiles
- Loss, fragmentation or disturbance of priority and important habitats including:
 - Semi-neutral broad-leaved woodland (lowland mixed deciduous woodland)
 - Hedgerows
 - Marshy grassland
 - Semi-improved neutral grassland (lowland meadows)
- Loss, fragmentation or disturbance of habitat connectivity features (in particular for foraging/commuting bats)
- Indirect damage or disturbance of statutory and non-statutory designated sites for nature conservation (e.g. via hydrological links & changes in water quality)
- Spread of invasive plant species

Badger

4.3 No evidence to suggest the current use of the site by Badger was found at proposed site during the survey. However, given the number of desk study records identified within 1km, the use of the site by individual Badgers on an occasional basis cannot be precluded. Impacts to Badger that could result from the proposed scheme include potential mortality, injury or disturbance during the construction phase of any future

² Ecological Impact Assessment
Sandvik Osprey Ltd
Land off Junction 38, M4, Margam
Ecology Note to Inform EIA Scoping
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development. Appropriate protective measures during this phase of development would include the covering of excavations overnight or the provision of a means of escape to minimise the risk to Badger and other mammals that may become trapped.

Bats

- 4.4 The survey identified several trees at the proposed site with potential to support roosting bats including 1no. tree with high potential, 1no. tree moderate potential and 3no. trees with low potential. Impacts to bats via the removal of these trees could include the loss of potential roost sites as well as potential morality, injury or disturbance of roosting bats. As such, further survey work will be required to establish the presence/absence of roosting bats and to inform any mitigation measures and licencing requirements. In accordance with the Bat Conservation Trust best practice guidelines (BCT, 2016), it is recommended that for trees assessed to have high potential three survey visits are undertaken between May – September comprising of at least a separate dusk and dawn survey. For trees with moderate potential two survey visits, comprising of a separate dusk and dawn survey, are recommended. Given the trees at the site are easily accessible a potential roost feature (PRF) inspection could be also undertaken to determine the presence/absence of roosting bats (dependant on health and safety restrictions).
- 4.5 Trees assessed to have a low potential do not require any further survey work under the current guidelines. However, on a precautionary basis if any trees with low potential were to be removed appropriate mitigation measures would include a soft-felling approach, where trees/branches are section felled and cut tree limbs are carefully lowered and left grounded overnight to allow any bats present to leave (Jackson, 2015). Works should be also undertaken in winter or early spring as to avoid times when bats are most sensitive to disturbance.
- 4.6 The linear habitat features at the proposed site including the hedgerow margins, narrow woodland corridor and woodland copse were considered likely to support a range of foraging and commuting bats species. Common and Soprano Pipistrelle have been previously recorded at the site and several different bat species are known to roost in the surrounding area. The proposed site also contains existing connectivity to suitable bat habitats in the wider landscape such as woodland at Junction 38 Wetland Complex SINC and along the M4/A48 corridor. The layout plan included in Appendix I indicates that two internal roads are proposed through the small woodland copse and hedgerow separating the north and south of the site. In the absence of mitigation measures, potential impacts arising from the proposed development could include the loss, fragmentation and disturbance of important connectivity routes and flight paths for commuting and foraging bats. Additional road or building lighting could also impact on bat flight/feeding areas and appropriate design would need to be considered for any retained/proposed vegetation corridors (see Advice Note in Appendix IV), In order to establish how and which bat species are using the proposed site it is recommended that further activity surveys (manual transects and automated surveys) are undertaken. The survey findings would be used

to inform the final development design and any particular mitigation/avoidance measures (e.g. lighting design and habitat retention). Based on the availability of suitable habitats at the proposed site the minimum level of survey recommended in the best practice guidelines (BCT, 2016) would be considered appropriate in the first instance to achieve a representative sample of bat activity across the site³. This would comprise 3no. activity survey visits in spring, summer and autumn in appropriate weather conditions. Separate automated/static surveys (minimum one static per transect) would also be required, with each session recording for 5 consecutive nights *in situ* per season. The location of the static detectors (e.g. Anabat Swift units) would be focused on the areas likely to be subject to development impacts (e.g. location of hedgerow and woodland breaches).

Birds

- 4.7 The habitats at the proposed site were considered likely to support a number of foraging and tree/scrub nesting bird species. Under the Wildlife and Countryside Act (1981) (as amended) all wild birds and their nests are protected against damage or destruction whilst in use or being built. In the absence of mitigation, the proposed development could result in the potential mortality, injury or disturbance of nesting birds during the constructive phase. Appropriate mitigation measures would include the undertaking of any vegetation works (such as tree and scrub removal) outside of the nesting bird season i.e., undertaken between September – February.

Reptiles

- 4.8 The habitats located at the proposed site were considered to have a low potential to support common reptiles. The larger areas of grazed improved grassland and poor semi-improved grassland were considered of limited suitability for reptiles - lacking appropriate shelter and likely subject to regular disturbance from livestock. However, the smaller sections of semi-improved grassland, marshy grassland and woodland/hedgerow margins, in particular those located towards the northern extent of the proposed site, were considered of greater suitability and were considered likely to support a small/individual population of common reptiles.
- 4.9 In the absence of mitigation measures, impacts to common reptiles could include potential mortality, injury or disturbance during the construction phase of the proposed development and potential habitat loss, fragmentation and disturbance. However, the proposed layout plan indicates that the areas of the site considered most suitable to support reptiles are unlikely to be impacted by the scheme layout. Provided this remains unchanged no further targeted survey work is recommended. Instead, appropriate mitigation measures could include a sensitive approach to vegetation clearance at the site. This would include cutting of fringe grassland and boundary vegetation via a two-stage directional process to minimise risks to reptiles (and amphibians) that may be present.

³ Further surveys may be required if these surveys reveal higher levels of bat activity than predicted.

Priority habitats

- 4.10 The proposed site supports priority habitats listed under Section 7 of the Environment Act (Wales) 2016 including broad-leaved semi-natural woodland (lowland mixed deciduous woodland), semi-improved neutral grassland (lowland meadows) and hedgerows as well as other habitats of ecological importance such as marshy grassland. Potential biodiversity impacts resulting from the proposed development include the loss, fragmentation and disturbance of these habitats – the current proposed layout plan indicates that sections of marshy grassland, woodland and hedgerow will be lost as part of the development design. Impacts could be avoided by the retention of these features (as far as practicable) and by on-site compensation measures such as habitat creation and the incorporation of a detailed habitat management strategy.

Designated sites

- 4.11 The desk study identified that the proposed site is located within 500m of Eglwys Nunydd Reservoir SSSI SINC and within 100m of Junction 38 Wetland Complex SINC. It is not expected that the proposed development will directly impact the SSSI site. However, there is some potential for indirect impacts to occur during the construction phase of any future development such as through changes to water and air quality via increased pollution. There is a small ditch present at the proposed site which may have hydrological links to the SSSI site. These impacts could be avoided/mitigated for through the implementation of a pollution prevention plan and drainage strategy for the site.
- 4.12 There is also some potential that protected and priority species associated the SSSI/SINC sites are using the habitats present at the proposed site as part of their foraging/commuting range. As discussed in paragraph 4.6 the proposed site contains existing connectivity to the woodland habitats at Junction 38 Wetland Complex SINC through the central hedgerow. Removal or part removal of this hedgerow may result in the loss, fragmentation and disturbance of important habitat connectivity features (for bats in particular). Further survey work is required to establish how bats are using this feature and inform the final development design.

Invasive species

- 4.13 The survey found incidences of Japanese Knotweed at the proposed site. The species is listed under Schedule 9 of the Wildlife and Countryside Act (1981) (as amended) meaning it is offence to plant or otherwise cause the species to grow in the wild. Although the area in which the stands are located is unlikely to be impacted under the proposed layout plan, there is a low potential for the species to spread during any future construction work. Avoidance and mitigation measures would include the clear demarcation of Japanese Knotweed stems during the construction phase and the control of the species at the site either through appropriate removal or by management/herbicide treatment.

REFERENCES

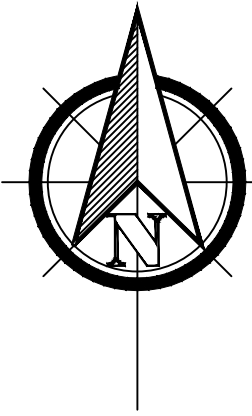
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APPENDIX I OVERALL SITE MASTERPLAN



Margam Green Energy Power Station

Balancing Pond

Western Bio Energy Power Station

WB

Chy Tank

Tank

El Sub Stas

HOV'S ONLY ENTRANCE. SIGNAGE TO BE INSTALLED TO PROMPT LORRIES TURNING LEFT

2.8m HIGH PALISADE FENCE AROUND PERIMETER OF SECURITY BARRIER.

ELECTRIC CHARGING PORTS FOR 2 SPACES.

OFFICE BLOCK FFL +9.000m

ATTENDANCE POD

ELECTRIC CHARGING PORTS FOR 6 SPACES.

CYCLE SHELTER 28 SPACES.

SECURITY GATE ACCESS TO PRODUCTION UNIT

PUMPING STATION FFL +9.500m

SERVICES AREA FFL ±10.000m

ARGON TANK

5 SHIPS TO BE SITUATED IN THE RECYCLING AREA.

2.8m HIGH PALISADE FENCE AROUND PERIMETER OF SUBSTATION.

SUB STATION FFL +10.500m

LAB FFL +11.000m

PRODUCTION UNIT FFL +11.000m

2 SHIPS TO BE SITUATED HERE.

AMENITY BLOCK FFL +11.600m

CYCLE SHELTER 28 SPACES.

CYCLE STANDS 24 SPACES.

ELECTRIC CHARGING PORTS FOR 10 SPACES.

4m WIDE DOUBLE ACCESS GATE FOR CONTRACTOR USE ONLY.

EXISTING GAS PIPE

2.4m HIGH PALISADE FENCING AROUND TRANSFORMER.

KEY

- SITE BOUNDARY LINE
- NEW FENCING LINE.
- CATEGORY A TREE (HIGH) (HIGHLY DESIRABLE FOR RETENTION)
- CATEGORY B TREE (MODERATE) (DESIRABLE FOR RETENTION)
- CATEGORY C TREE (LOW) (OPTIONAL FOR RETENTION)
- CATEGORY U TREE (POOR) (UNSUITABLE FOR RETENTION)
- PROPOSED SUDS FEATURES.
- TRANSFORMERS
- SERVICE FILTER.

ASD No: 20.62
Drawing No: 002
Scale: 1:500 @ A3

Rev: D

No.	REVISION	by	date	No.	REVISION	by	date	No.	REVISION	by	date	No.	REVISION	by	date
A	MAIN CAR PARKING LAYOUT UPDATED TO REFLECT COMMENTS MADE BY ARCHITECTURAL REPORT. ATTENDANCE POD MOVED TO WEST OF OFFICE BLOCK TO AVOID FLOOD ZONE. SITE BOUNDARY LINE UPDATED TO INCORPORATE UPDATED ACCESS JUNCTION.	K.J.	07.10.21												
B	MAJOR AMENDMENTS MADE TO OVERALL SITE PLAN. TRANSFORMERS AND SERVICE FILTERS ADDED TO THE DRAWING. TREE CONSTRAINTS PLAN ADDED TOO.	J.M.	26.10.21												
C	MAJOR AMENDMENTS MADE TO PLANT, ROOF PLANS ADDED TO DRAWING.	J.M.	26.10.21												
D	MASTERPLAN UPDATED TO REFLECT NEW POSITION OF HOV ACCESS ROAD	K.J.	25.01.22												

NOTES

1. Do not scale from this drawing
2. All dimensions to be checked on site
3. All built drawings are prepared, in part, based upon information furnished by others. While this information is believed to be reliable, James & Nicholas LLP assumes no responsibility for the accuracy of its built drawings or for any errors or omissions that may have been incorporated into them as a result of incorrect information provided to us by others. Those relying on an As built drawing are advised to obtain independent verification of its accuracy.

REFER ALSO TO THE FOLLOWING:

Drawings:

Bending Schedules:

CLIENT

SANDVIK

Job title

DEVELOPMENT SITE, PORT TALBOT, SANDVIK OSPREY LTD.

Job No:

20.62

Drawing No:

002

Rev:

D

Job No:

20.62

Drawing No:

002

Rev:

D

Scale:

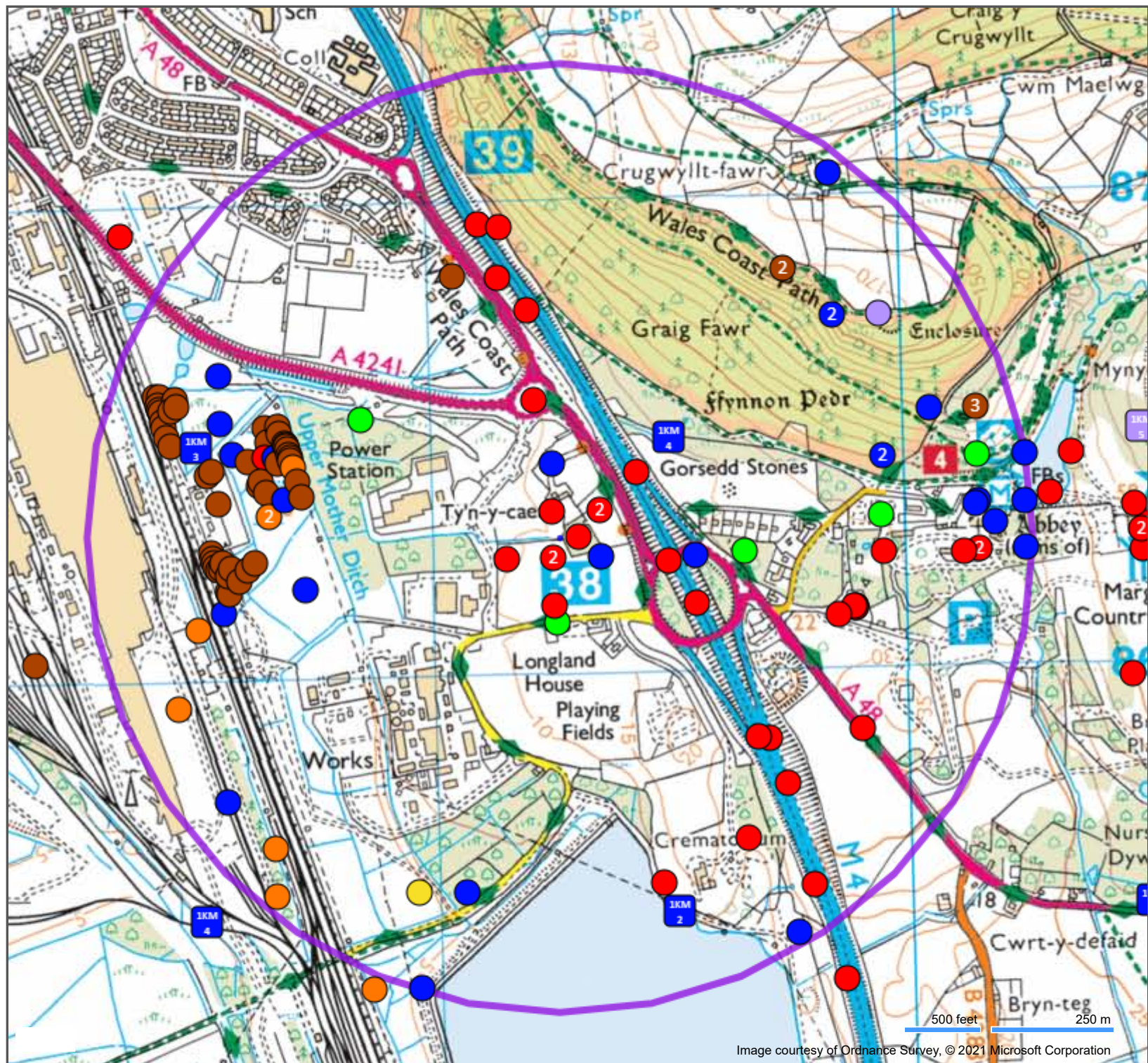
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James&nicholas

Grove House, Grove Place, Port Talbot SA13 1XA • Tel 01639 885431 • Fax 01639 891687
admin@jamesandnicholas.com • www.jamesandnicholas.com
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APPENDIX II DESK STUDY INFORMATION RECEIVED FROM SEWBR_eC



Key

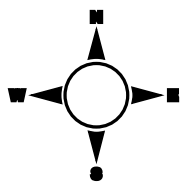
- Search Location
- Search Buffer (1000m)
- Bees, Wasps, Ants and Sawflies
- Birds
- Butterflies and Moths
- Fish
- Mammals
- Other Invertebrates
- Plants
- Reptiles and Amphibians

APPENDIX III EXTENDED PHASE 1 HABITAT SURVEY PLAN & TARGET NOTES

Target Note	Description/Comment
Birds seen/ heard: Blackbird, Jackdaw, Blackcap, Robin, Goldfinch, Pied Wagtail, Barn Swallow, Woodpigeon Invertebrates seen: Common Carder Bee, Brown-Banded Carder Bee, Red-Tailed Bumblebee, Dock Bug	
1	Small ditch leading through area of dense scrub and marshy grassland.
2	Ash tree with low potential to support roosting bats. Tree contains thick ivy cover and several small crevices associated with knot holes and broken branches. 
3	Ash tree with low potential to support roosting bats located immediately south of TN2. See description above.
4	Small derelict shed overgrown with bramble scrub. Structure comprises of metal frame and metal wall/roof covering. Roof and some wall panels missing. Negligible potential to support roosting bats. 
5	Mature Sycamore tree at woodland copse edge. Tree contains several large interconnecting cavities on the main trunk. Cavities are capable of support multiple roosting bats. Tree assessed to have a high potential to support roosting bats. Tree was also considered to be of some suitability to support nesting Barn Owl, although no evidence present to suggest current use (e.g. pellets, feathers).

	
6	Mature Beech with very thick ivy cover, which may obscure view of other potential roost features. Multiple bird nests within the tree canopy. Tree assessed to have a low potential to support roosting bats.
7	Decaying Scyamore tree at woodland copse edge. Significant decay on main trunk which contains several woodpecker holes which may support roosting bats. Tree assessed to have a moderate potential to support roosting bats. 
8	Mature Beech tree located at base of derelict stone archway. Tree contains several shallow crevices associated with knot-holes and joining limbs. Tree assessed to have low potential to support roosting bats.

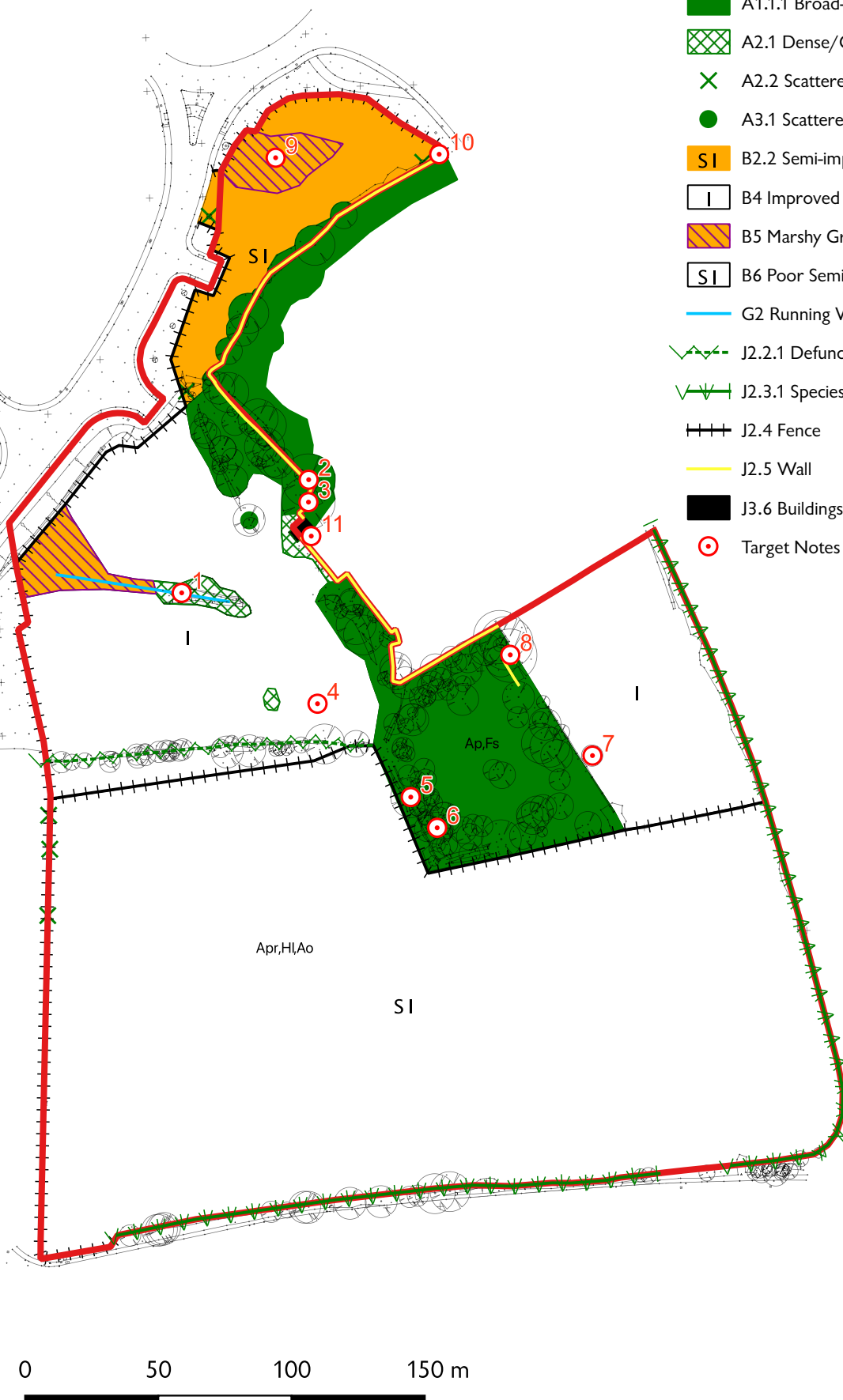
9	Small area of marshy grassland/standing water within SI neutral grassland. Area appears to hold water on a seasonal basis with a few shallow pools remaining. Reed canary grass, water dropwort, yellow flag iris and unidentified sedges present.
10	Stands of Japanese Knotweed located at edge of SI neutral grassland field boundary. 
11	One building that is part of the adjacent farmhouse is located along the proposed site's eastern boundary. The building comprises of stone walls and concrete roof tiles and is in a poor condition. The western elevation contains thick ivy cover and there are some holes present in the roofing tiles where bats could enter the internal structure. The building was assessed to have low potential to support roosting bats. 



Key

- Site Boundary
- A1.1.1 Broad-leaved Semi-natural Woodland
- A2.1 Dense/Continuous Scrub
- X A2.2 Scattered Scrub
- A3.1 Scattered Broad-leaved Trees
- B2.2 Semi-improved Neutral Grassland
- B4 Improved Grassland
- B5 Marshy Grassland
- B6 Poor Semi-improved Grassland
- G2 Running Water
- ~ J2.2.1 Defunct Species-rich Hedgerow
- ~ J2.3.1 Species-rich Hedgerow with Trees
- + + + J2.4 Fence
- J2.5 Wall
- J3.6 Buildings
- ⊙ Target Notes

Ac = *Acer pseudoplatanus*
Ao = *Anthoxanthum odoratum*
Apr = *Alopecurus pratensis*
Fs = *Fagus sylvatica*
Hl = *Holcus lanatus*



0 50 100 150 m

PRELIMINARY	PLANNING	DESIGN	TENDER	CONSTRUCTION
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Sandvik Osprey Ltd

Land off Junction 38, M4, Margam

Extended Phase 1 Habitat Survey Plan

E21102201/DR01

DJ

MW

21 May 2021

soltysbrewster
E C O L O G Y

4 Stangate House
Stanwell Road
Penarth
Vale of Glamorgan
CF64 2AA

Tel: 033 00 13 00 12

Email: enquiry@soltysbrewster.co.uk

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APPENDIX IV ADVICE NOTE ON BATS & LIGHTING

The following is an extract from the **Bat Conservation Trust and Institution of Lighting Professionals (2018)** guidance note on **Bats and Artificial lighting in the UK**. Section 3 contains advice on how to mitigate for the impacts of artificial lighting on bats. Full citation:

Bat Conservation Trust & Institution of Lighting Professionals (2018) Bats and artificial lighting in the UK. Guidance Note 08/18. Bat Conservation Trust, London.

3. Mitigation of artificial lighting impacts on bats

This section provides a simple process which should be followed where the impact on bats is being considered as part of a proposed lighting scheme. It contains techniques which can be used on all sites, whether a small domestic project or larger mixed-use, commercial or infrastructure development. It also provides best-practice advice for the design of the lighting scheme for both lighting professionals and other users who may be less familiar with the terminology and theory.

The stepwise process and key follow-up actions are outlined in the flowchart overleaf, and are followed throughout the chapter.

The questions within this flow chart should be asked as early as possible, so that necessary bat survey information can be gathered in advance of any lighting design or fixing of overall scheme design.

Effective mitigation of lighting impacts on bats depends on close collaboration from the outset between multiple disciplines within a project. Depending on the specific challenges this will almost certainly involve ecologists working alongside architects and/or engineers; however, lighting professionals and landscape architects should be approached when recommended by your ecologist. This should be done as early in your project as possible in order to ensure mitigation is as effective as it can be and to minimise delays and unforeseen costs.

Step 1: Determine whether bats could be present on site

If your site has the potential to support bats or you are at all unsure, it is highly recommended that an ecologist is appointed to advise further and conduct surveys, if necessary. This information should be collected as early as possible in the design process, and certainly before lighting is designed, so as to avoid the need for costly revisions.

If any of the following habitats occur on site, and are adjacent to or connected with any of these habitats on or off site, it is possible that newly proposed lighting may impact local bat populations:

- Woodland or mature trees
- Hedgerows and scrub
- Ponds and lakes
- Ditches, streams, canals and rivers
- Infrequently managed grassland
- Buildings – pre 1970s or in disrepair

If you are unsure about whether bats may be impacted by your project, and an ecologist has not yet been consulted, sources of information on the presence of bats within the vicinity of your site include the following.

- Local environmental records centres (LERC) – Will provide third-party records of protected and notable species for a fee. Search <http://www.alerc.org.uk/> for more information.
- National Biodiversity Network Atlas – Provides a resource of third-party ecological records searchable online at <https://nbnatlas.org>. Typically this is less complete than LERC data. Please note: Some datasets are only accessible on a non-commercial basis, while most can be used for any purpose, as long as the original source is credited.
- Local authority planning portals – Most local planning authorities have a searchable online facility detailing recent planning applications. These may have been accompanied by ecological survey reports containing information on bat roosts and habitats.
- Defra's MAGIC map – Provides an online searchable GIS database including details of recent European protected species licences and details of any protected sites designated for bat conservation.

The professional directory at the website of the Chartered Institute of Ecology and Environmental Management (www.cieem.net) will provide details of ecologists in your area with the relevant

Step 1

Could bats be present on site?

Consult local sources of ecological information or seek advice from an ecologist

Step 2

Determine the presence of – or potential for – roosts, commuting habitat and foraging habitat and evaluate their importance.

Appoint ecologist to carry out daytime and, if necessary, night-time bat surveys and to evaluate the importance of the site's features and habitats to bats.

Step 3

Avoid lighting on key habitats and features altogether.

No illumination of any roost entrances and associated flightpaths, nor on habitats and features used by large numbers of bats, by rare species or by highly light-averse species.

Step 4

In other locations of value for bats on site, apply mitigation methods to reduce lighting to a minimum.

Spatial design

Building design

Landscaping

Set dark habitat buffers and acceptable lux limits with ecologist guidance

Step 5

Demonstrate compliance with lux limits and buffers.

Lighting professional to prepare final lighting scheme design and/or lux calculations or undertake baseline light surveys as necessary. Post-completion bat and lighting monitoring may be required.

skills/experience. The early involvement of a professional ecologist can minimise the likelihood of delays at the planning stage (if applicable) and ensure your project is compliant with conservation and planning legislation and policy.

It should be noted that the measures discussed in this document relate only to the specific impacts of lighting upon bat habitat features on or adjacent to the site. If loss or damage to roosting, foraging or commuting habitat is likely to be caused by other aspects of the development, separate ecological advice will be necessary in order to avoid, mitigate or compensate for this legally and according to the ecologist's evaluation.

Step 2: Determine the presence of – or potential for – roosts, commuting habitat and foraging habitat and evaluate their importance

Your ecologist will visit the site in order to record the habitats and features present and evaluate their potential importance to bats, and the likelihood that bats could be affected by lighting both on and immediately off site. This may also include daytime building and tree inspections. On the basis of these inspections further evening surveys may be recommended, either to determine the presence of roosts within buildings and/or trees or to assess the use of the habitats by bats by means of a walked survey. Such surveys may be undertaken at different times during the active season (ideally May to September) and should also involve the use of automated bat detectors left on site for a period of several days. The surveys should be carried out observing the recommendations within the Bat Conservation Trust's Bat Surveys for Professional Ecologists: Good Practice Guidelines (Collins, 2016).

The resulting report will detail the relative conservation importance of each habitat feature to bats (including built structures, if suitable). The ecologist's evaluation of the individual features will depend on the

specific combination of contributing factors about the site, including:

- The conservation status of species recorded or likely to be present
- Geographic location
- Type of bat activity likely (breeding, hibernating, night roosting, foraging etc)
- Habitat quality
- Habitat connectivity off-site
- The presence of nearby bat populations or protected sites for bats (usually identified in a desk study)

The evaluation of ecological importance for each feature is most commonly expressed on a geographic scale from Site level to International level, or alternatively in terms of that feature's role in maintaining the 'favourable conservation status' of the population of bats using it.

The ecologist should set out where any key bat roost features and/or habitat areas (ie flightpath habitat and broader areas of foraging habitat) lie on a plan of the site or as an ecological constraints and opportunities plan (ECOP) together with their relative importance. The ECOP and report can then be used to help guide the design of the lighting strategy as well as the wider project.

Step 3: Avoid lighting on key habitats and features altogether

As has been described in 'Artificial lighting', above, there is no legal duty requiring any place to be lit. British Standards and other policy documents allow for deviation from their own guidance where there are significant ecological/environmental reasons for doing so. It is acknowledged that in certain situations lighting is critical in maintaining safety, such as some industrial sites with 24-hour operation. However in the public realm, while lighting can increase the perception of safety and security, measureable benefits can be subjective. Consequently, lighting design should be flexible and be able to fully take into account the presence of protected species

and the obligation to avoid impacts on them.

Sources of lighting which can disturb bats are not limited to roadside or external security lighting, but can also include light spill via windows, permanent but sporadically operated lighting such as sports floodlighting, and in some cases car headlights. Additionally, glare (extremely high contrast between a source of light and the surrounding darkness – linked to the intensity of a luminaire) may affect bats over a greater distance than the target area directly illuminated by a luminaire and must also be considered on your site.

It is important that a competent lighting professional is involved in the design of proposals as soon as potential impacts (including from glare) are identified by the ecologist in order to avoid planning difficulties or late-stage design revision. Your lighting professional will be able to make recommendations about placement of luminaires tailored to your specific project.

Where highways lighting schemes are to be designed by the local planning authority (LPA) post-planning, an ecology officer should be consulted on the presence of important bat constraints which may impact the design and illuminance in order for the scheme to remain legally compliant with wildlife legislation.

Where adverse impacts upon the 'favourable conservation status' of the bat population using the feature or habitat would be significant, an absence of artificial illumination and glare, acting upon both the feature and an appropriately-sized buffer zone is likely to be the only acceptable solution. Your ecologist will be best placed to set the size of such a buffer zone but it should be sufficient to ensure that illumination and glare is avoided and so the input of a lighting professional may be required. Further information on demonstrating an absence of illumination via lux/illuminance contour plans is provided in Step 5.

Because different species vary in their response to light disturbance (as discussed in section 1 'Bats'), your ecologist will be able to provide advice tailored to the specific conditions on your project, however examples of where the no-lighting approach should be taken in particular include:

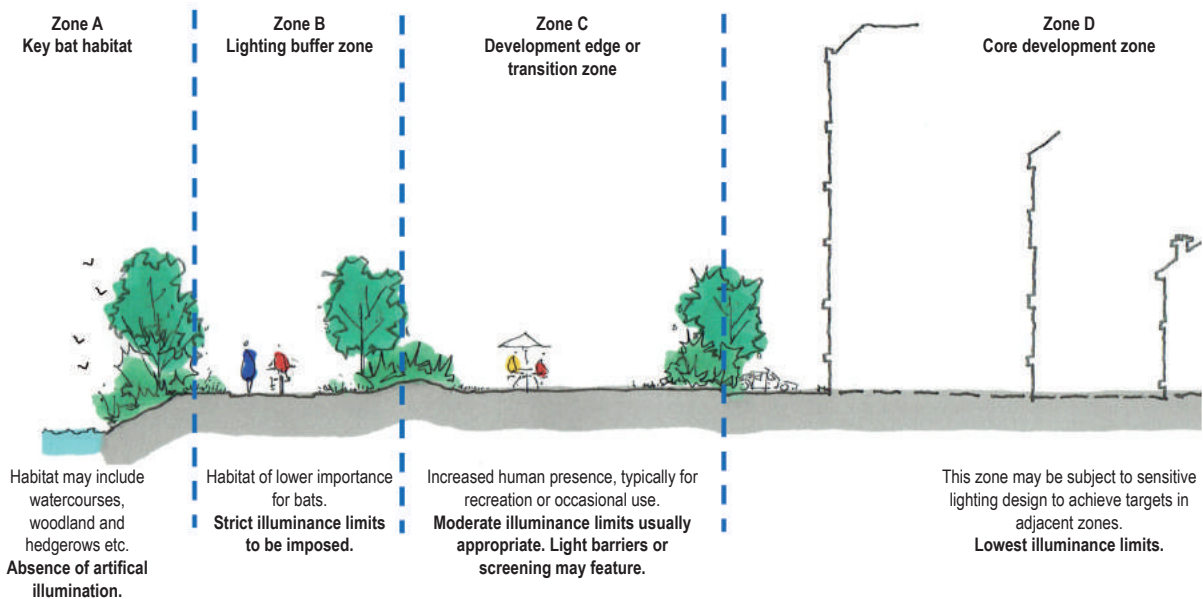
- Roosting and swarming sites for all species and their associated flightpath/commuting habitat.
- Foraging or commuting habitat for highly light-averse species (greater and lesser horseshoe bats, some *Myotis* bats, barbastelle bats and all long-eared bats).
- Foraging or commuting habitat used by large numbers of bats as assessed through survey.
- Foraging or commuting habitat for particularly rare species (grey long-eared bat, barbastelle, small *Myotis*, Bechstein's bat and horseshoe bats).
- Any habitat otherwise assessed by your ecologist as being of importance to maintaining the 'favourable conservation status' of the bat population using it.

Completely avoiding any lighting conflicts in the first place is advantageous because not only would proposals be automatically compliant with the relevant wildlife legislation and planning policy, but they could avoid costly and time-consuming additional surveys, mitigation and post-development monitoring. Furthermore, local planning authorities are likely to favour applications where steps have been taken to avoid such conflicts.

Step 4: Apply mitigation methods to reduce lighting to agreed limits in other sensitive locations – lighting design considerations

Where bat habitats and features are considered to be of lower importance or sensitivity to illumination, the need to provide lighting may outweigh the needs of bats. Consequently, a balance between a reduced lighting level appropriate to the

Example of illuminance limit zonation



ecological importance of each feature and species, and the lighting objectives for that area will need to be achieved.

It is important to reiterate the legal protection from disturbance that bats receive under the Wildlife and Countryside Act 1981, as amended. Where the risk of offences originating from lighting is sufficiently high, it may be best to apply the avoidance approach in Step 3.

Advice from an ecologist and lighting professional will be essential in finding the right approach for your site according to their evaluation. The following are techniques which have been successfully used on projects and are often used in combination for best results.

Dark buffers, illuminance limits and zonation

Dark buffer zones can be used as a good way to separate habitats or features from lighting by forming a dark perimeter around them. Buffer zones rely on ensuring light levels (levels of illuminance measured in lux) within a certain distance of a feature do not exceed certain defined limits. The buffer zone can be further subdivided into zones of increasing illuminance limit radiating away from the feature. Examples of this application are given in the figure above.

Your ecologist (in collaboration with a lighting professional) can help determine the most appropriate buffer widths and illuminance limits according to the value of that habitat to bats (as informed by species and numbers of bats, as well as the type of use).

Appropriate luminaire specifications

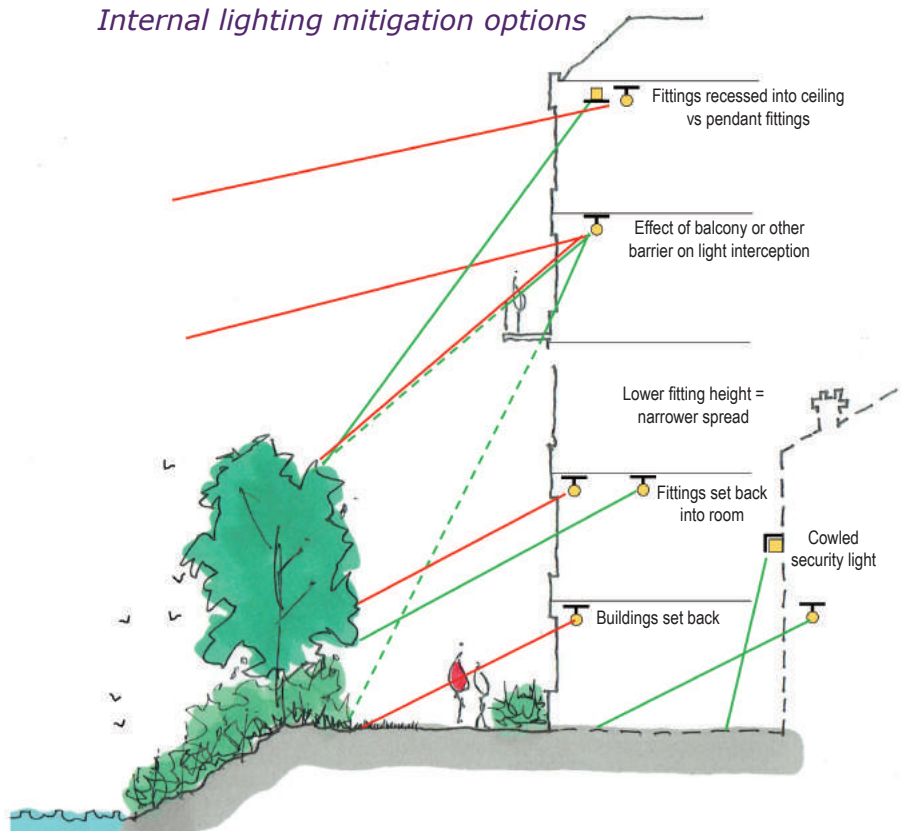
Luminaires come in a myriad of different styles, applications and specifications which a lighting professional can help to select. The following should be considered when choosing luminaires.

- All luminaires should lack UV elements when manufactured. Metal halide, fluorescent sources should not be used.
- LED luminaires should be used where possible due to their sharp cut-off, lower intensity, good colour rendition and dimming capability.
- A warm white spectrum (ideally <2700Kelvin) should be adopted to reduce blue light component.
- Luminaires should feature peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats (Stone, 2012).
- Internal luminaires can be recessed where installed in proximity to windows to reduce glare and light spill. (See figure overleaf.)
- The use of specialist bollard or low-level downward directional luminaires to

retain darkness above can be considered. However, this often comes at a cost of unacceptable glare, poor illumination efficiency, a high upward light component and poor facial recognition, and their use should only be as directed by the lighting professional.

- Column heights should be carefully considered to minimise light spill.
- Only luminaires with an upward light ratio of 0% and with good optical control should be used – See ILP Guidance for the Reduction of Obtrusive Light.
- Luminaires should always be mounted on the horizontal, ie no upward tilt.
- Any external security lighting should be set on motion-sensors and short (1min) timers.
- As a last resort, accessories such as baffles, hoods or louvres can be used to reduce light spill and direct it only to where it is needed.

Internal lighting mitigation options



- Taller buildings may be best located toward the centre of the site or sufficiently set back from key habitats to minimise light spill.
- Street lights can be located so that the rear shields are adjacent to habitats or optics selected that stop back light thereby directing light into the task area where needed.

Sensitive site configuration

The location, orientation and height of newly built structures and hard standing can have a considerable impact on light spill (see figure above for examples of good internal lighting design). Small changes in terms of the placement of footpaths, open space and the number and size of windows can all achieve a good outcome in terms of minimising light spill on to key habitats and features.

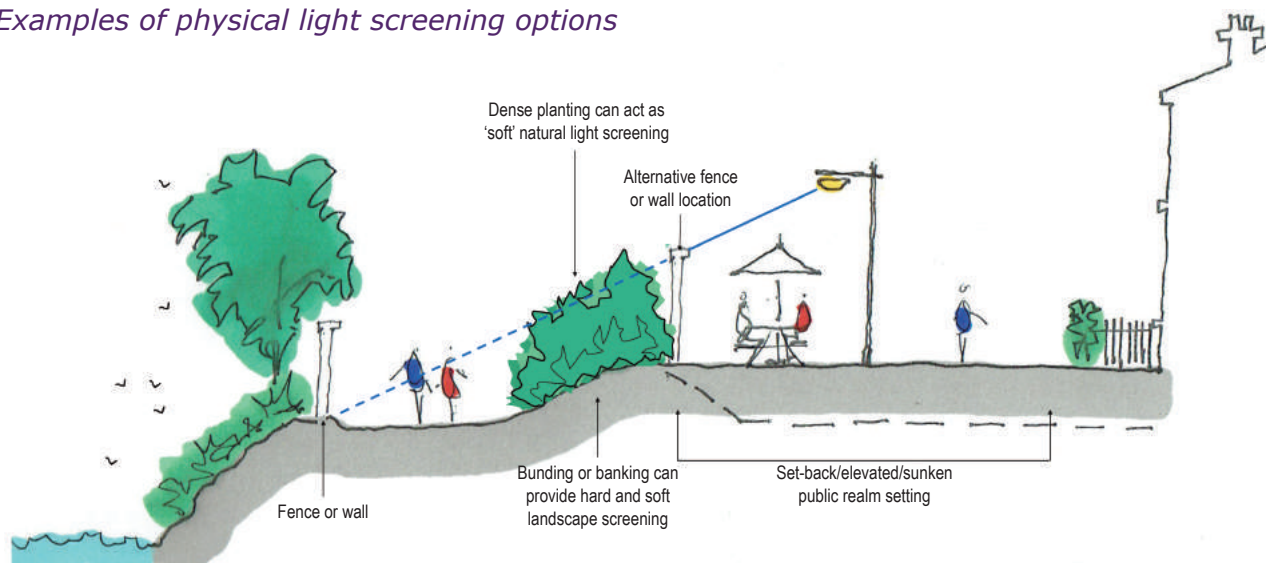
- It may be possible to include key habitats and features into unlit public open space such as parks and gardens.
- Buildings, walls and hard landscaping may be sited and designed so as to block light spill from reaching habitats and features.

Screening

Light spill can be successfully screened through soft landscaping and the installation of walls, fences and bunding (see figure overleaf for example of physical light-screening options). In order to ensure that fencing makes a long-term contribution, it is recommended that it is supported on concrete or metal posts. Fencing can also be over planted with hedgerow species or climbing plants to soften its appearance and provide a vegetated feature which bats can use for navigation or foraging.

The planting of substantial landscape features integrated to the wider network of green corridors such as hedgerows, woodland and scrub is encouraged by

Examples of physical light screening options



planning policy and would make a long-term positive contribution to the overall bat habitat connectivity and light attenuation. A landscape architect can be appointed to collaborate with your ecologist on maximising these natural light screening opportunities.

It should be noted that newly planted vegetation (trees, shrubs and scrub) is unlikely to adequately contribute to light attenuation on key habitats for a number of years until it is well established. Sufficient maintenance to achieve this is also likely to be required. Consequently, this approach is best suited to the planting of 'instant hedgerows' or other similarly dense or mature planting, including translocated vegetation. In some cases, it is appropriate to install temporary fencing or other barrier to provide the desired physical screening effects until the vegetation is determined to be sufficiently established.

Given the fact that planting may be removed, die back, or be inadequately replaced over time it should never be relied on as the sole means of attenuating light spill.

Glazing treatments

Glazing should be restricted or redesigned wherever the ecologist and lighting professional determine there is a likely significant effect upon key bat habitat and features. Where windows and glass

facades etc cannot be avoided, low transmission glazing treatments may be a suitable option in achieving reduced illuminance targets.

Products available include retrofit window films and factory-tinted glazing. 'Smart glass', which can be set to automatically obscure on a timer during the hours of darkness, and automatic blinds can also be used but their longevity depends on regular maintenance and successful routine operation by the occupant, and should not be solely relied upon.

Depending on the height of the building and windows, and therefore predicted light spill, such glazing treatments may not be required on all storeys. This effect can be more accurately determined by a lighting professional.

Creation of alternative valuable bat habitat on site

The provision of new, additional or alternative bat flightpaths, commuting habitat or foraging habitat could result in appropriate compensation for any such habitat being lost to the development. Your ecologist will be able to suggest and design such alternative habitats although particular consideration as to its connectivity to other features, the species to be used, the lag time required for a habitat to sufficiently establish, and the provision for its ongoing protection and maintenance should be given.

Dimming and part-night lighting

Depending on the pattern of bat activity across the key features identified on site by your ecologist, it may be appropriate for an element of on-site lighting to be controlled either diurnally, seasonally or according to human activity. A control management system can be used to dim (typically to 25% or less) or turn off groups of lights when not in use.

It should be noted that these systems depend on regular maintenance and a long-term commitment for them to be successful. Additionally, part-night lighting should be designed with input from an ecologist as they may still produce unacceptably high light levels when active or dimmed. Part-night lighting is not usually appropriate where lights are undimmed during key bat activity times as derived from bat survey data. Research has indicated that impacts upon commuting bats are still prevalent where lighting is dimmed during the middle of the night at a time when illumination for human use is less necessary (Azam et al, 2015). Thus this approach should not always be seen as a solution unless backed up by robust ecological survey and assessment of nightly bat activity.

Step 5: Demonstrate compliance with illuminance limits and buffers

Design and pre-planning phase

It may be necessary to demonstrate that the proposed lighting will comply with any agreed light-limitation or screening measures set as a result of your ecologist's recommendations and evaluation. This is especially likely to be requested if planning permission is required.

A horizontal illuminance contour plan can be prepared by a suitably experienced and competent lighting professional (member of the Chartered Institution of Building Services Engineers (CIBSE), Society of Light and Lighting (SLL), Institution of

Lighting Professionals (ILP) or similar to ensure competency) using an appropriate software package to model the extent of light spill from the proposed and, possibly, existing luminaires. The various buffer zone widths and illuminance limits which may have been agreed can then be overlaid to determine if any further mitigation is necessary. In some circumstances, a vertical illuminance contour plot may be necessary to demonstrate the light in sensitive areas such as entrances to roosts.

Such calculations and documentation would need to be prepared in advance of submission for planning permission to enable the LPA ecologist to fully assess impacts and compliance.

Because illuminance contour plots and plans may need to be understood and examined by non-lighting professionals such as architects and local planning authority ecologists, the following should be observed when producing or assessing illuminance contour plans to ensure the correct information is displayed.

- A horizontal calculation plane representing ground level should always be used.
- Vertical calculation planes should be used wherever appropriate, for example along the site-facing aspects of a hedgerow or façade of buildings containing roosts to show the illumination directly upon the vertical faces of the feature. Vertical planes can also show a cross-sectional view within open space. Vertical planes will enable a visualisation of the effects of illumination at the various heights at which different bat species fly.
- Models should include light from all luminaires and each should be set to the maximum output anticipated to be used in normal operation on site (ie no dimming where dimming is not anticipated during normal operation).
- A calculation showing output of luminaires to be expected at 'day 1' of operation should be included, where the luminaire and/or scheme Maintenance Factor is set to one.

- Where dimming, PIR or variable illuminance states are to be used, an individual set of calculation results should accompany each of these states.
- The contours (and/or coloured numbers) for 0.2, 0.5, 1, 5, and 10 lux must be clearly shown as well as appropriate contours for values above these.
- Each contour plan should be accompanied by a table showing their minimum and maximum lux values.
- Where buildings are proposed in proximity to key features or habitats, plots should also model the contribution of light spill through nearby windows, making assumptions as to internal luminaire specification and transmissivity of windows. It should be assumed that blinds or curtains are absent or fully open although low-transmittance glazing treatments may be appropriate. Assumptions will need to be made as to the internal luminaire specification and levels of illuminance likely to occur on 'day 1' of operation. These assumptions should be clearly stated and guided by the building/room type and discussions between architect, client and lighting professional. It is acknowledged that in many circumstances, only a 'best effort' can be made in terms of accuracy of these calculations.
- Modelled plots should not include any light attenuation factor from new or existing planting due to the lag time between planting and establishment and the risk of damage, removal or failure of vegetation. This may result in difficulties in the long term achievement of the screening effect and hamper any post-construction compliance surveys.
- The illuminance contour plots should be accompanied by an explanatory note from the lighting professional to list where, in their opinion, sources of glare acting upon the key habitats and features may occur and what has been done/can be done to reduce their impacts.

N.B. It is acknowledged that, especially for vertical calculation planes, very low

levels of light (<0.5 lux) may occur even at considerable distances from the source if there is little intervening attenuation. It is therefore very difficult to demonstrate 'complete darkness' or a 'complete absence of illumination' on vertical planes where some form of lighting is proposed on site despite efforts to reduce them as far as possible and where horizontal plane illuminance levels are zero. Consequently, where 'complete darkness' on a feature or buffer is required, it may be appropriate to consider this to be where illuminance is below 0.2 lux on the horizontal plane and below 0.4 lux on the vertical plane. These figures are still lower than what may be expected on a moonlit night and are in line with research findings for the illuminance found at hedgerows used by lesser horseshoe bats, a species well known for its light averse behaviour (Stone, 2012).

Baseline and post-completion light monitoring surveys

Baseline, pre-development lighting surveys may be useful where existing on- or off-site lighting is suspected to be acting on key habitats and features and so may prevent the agreed or modelled illuminance limits being achieved. This data can then be used to help isolate which luminaires might need to be removed, where screening should be implemented or establish a new illuminance limit reduced below existing levels. For example, where baseline surveys establish that on- and off-site lighting illuminates potential key habitat, improvements could be made by installing a tall perimeter fence adjacent to the habitat and alterations to the siting and specification of new lighting to avoid further illumination. Further information and techniques to deal with modeling pre-development lighting can be found in ILP publication PLG04 *Lighting Impact Assessments* due to be published late 2018.

Baseline lighting surveys must be carried out by a suitably qualified competent person. As a minimum, readings should be

taken at ground level on the horizontal plane (to give illuminance hitting the ground), and in at least one direction on the vertical plane at, for example, 1.5m or 2m above ground (to replicate the likely location of bats using the feature or site). The orientation should be perpendicular to the dominant light sources or perpendicular to the surface/edge of the feature in question (such as a wall or hedgerow) in order to produce a 'worst case' reading. Further measurements at other orientations may prove beneficial in capturing influence of all luminaires in proximity to the feature or principal directions of flight used by bats. This should be discussed with the ecologist.

Baseline measurements should be taken systematically across the site or features in question. That is, they will need to be repeated at intervals to sample across the site or feature, either in a grid or linear transect as appropriate. The lighting professional will be able to recommend the most appropriate grid spacing.

Measurements should always be taken in the absence of moonlight, either on nights of a new moon or heavy cloud to avoid artificially raising the baseline. As an alternative, moonlight can be measured at a place where no artificial light is likely to affect the reading.

As all proposed illuminance level contours will be produced from modelled luminaires at 100% output, baseline measurements need to be taken with all lights on and undimmed, with blinds or screens over windows removed. Cowls and other fittings on luminaires can remain in place.

Where possible, measurements should be taken during the spring and summer when vegetation is mostly in leaf, in order to accurately represent the baseline during

the principal active season for bats and to avoid artificially raising the baseline.

The topography of the immediate surrounding landscape should be considered in order to determine the potential for increased or decreased light spill beyond the site.

Post-construction/operational phase compliance-checking

Post-completion lighting surveys are often required where planning permission has been obtained on the condition that the proposed lighting levels are checked to confirm they are in fact achieved on site and that the lighting specification (including luminaire heights, design and presence of shielding etc) is as proposed.

All lighting surveys should be conducted by a suitably qualified competent person and should be conducted using the same measurement criteria and lighting states used in the preparation of the illuminance contour plots and/or baseline surveys as discussed above. It may be necessary to conduct multiple repeats over different illumination states or other conditions specific to the project.

Results should always be reported to the LPA as per any such planning condition. A report should be prepared in order to provide an assessment of compliance by the lighting professional and a discussion of any remedial measures which are likely to be required in order to achieve compliance. Any limitations or notable conditions such as deviation from the desired lighting state or use of blinds/barriers should be clearly reported. Ongoing monitoring schedules can also be set, especially where compliance is contingent on automated lighting and dimming systems or on physical screening solutions.

4. References

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