New Mains of Guynd Solar Park: Ecological Appraisal

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Non-Technical Summary

Caledonian Conservation Ltd was commissioned by BWE Partnership to carry out baseline field surveys and an appraisal of the potential effects of the proposed New Mains of Guynd Solar Park. The site is approximately 6.8km east-south-east of Arbroath, Angus.

An Extended Phase 1 Habitat Survey was completed. As well as mapping habitats, the survey included searches for signs of protected mammals. In addition, a desk-study was also completed, which involved formal data searches with organisations which hold biodiversity data.

The site consists primarily of arable agriculture, and no habitats of conservation importance were found. After construction, the site will be used for grazing, which will benefit a number of species. Although a small area (0.12ha) of poor quality mixed-plantation will be lost, a species-rich hedge (comprising native species also of local provenance wherever possible) will be planted to maintain this linear edge feature, which will benefit local biodiversity. Therefore no significant negative effects are predicted for habitats.

No observations or signs of protected mammals were recorded during the survey onsite or within 250m. The site does not offer suitable habitat for water vole, and no signs of otter or badger were observed. However, it is possible that otters and badgers move through the area on occasion while foraging and both species are known historically from the wider area. It is possible that both species may travel through the site with a risk of increased mortality during construction. Therefore preconstruction surveys will be undertaken and management plans implemented if necessary. With this mitigation in place no significant impact is predicted. Construction activities will be confined to relatively small areas and will avoid suitable habitat, which was found unoccupied, therefore no direct effect on habitat is predicted. During the operational phase the access to the site will be prevented by stock-proof fencing. However, the habitat will remain poor for foraging and places of shelter, with ample habitat of higher quality in the surrounding area. Therefore no significant negative effects are predicted for otter or badger.

All bat species are listed under Annex IV of the Habitats Directive and Schedule 5 of the Wildlife and Countryside Act. However, the site was not found to offer suitable roost habitats. However, an area of mixed plantation will be lost which bats may use as a commuting route. Therefore, a species-rich hedge will be planted to retain a linear feature at this location, which will allow bats to continue to commute here. Bats may also confuse smooth surfaces such as solar PV panels for water, using echolocation. However, only limited drinking attempts are made before leaving in search of another water source. On rare occasions collisions have been recorded between bats and vertical reflective surfaces mistaken for water. However, the solar panels at this site will be horizontal. Therefore any risk of collision will be very low. Therefore no significant negative effects are predicted for bats.

Pink-footed geese, greylag geese and whooper swans have been recorded in the wider area during winter months. Pink-footed geese may be associated with Firth of Tay and Eden Estuary SPA and Montrose Basin SPA, while greylag geese may be associated with Montrose Basin SPA. Whooper swans are likely to visit an SPA during their stay in the UK. Wildfowl may use the site for foraging in winter, depending on the suitability of the crops present. These species will also use grazing fields for foraging. Therefore, no effect is predicted on wildfowl, and the creation of foraging habitat that will be present consistently may benefit these birds.

Peregrine, hen harrier, kestrel and barn owl have been recorded in the wider area. Peregrine, hen harrier and barn owl are listed under Schedule 1 of the Wildlife and Countryside Act, while kestrel is included on the Amber List of Birds of Conservation Concern. The site does not offer suitable breeding habitat for peregrine, hen harrier or barn owl. Larch trees in the area of mixed plantation that will be lost may offer suitable breeding habitat for kestrel, although no evidence of this species was found here during surveys and there are ample areas of higher quality habitat in the area. Preconstruction surveys will be undertaken to determine whether any nesting birds are present within the construction footprint if works are scheduled during the breeding season. If kestrel are found to breed, they will be monitored and felling of trees will not commence until breeding has ended. Furthermore, appropriate buffers will be applied to limit disturbance until breeding is shown to have ended. A watching brief will be maintained by the Ecological Clerk of Works. Furthermore, with the exception of field margins, the site offers only poor foraging habitat. Field margins will be retained and the change of landuse to grazing will improve foraging opportunities. Therefore no significant negative effects are predicted, and the development may benefit raptors and owls.

Grey partridge and common quail have been recorded in the wider area. Common quail is listed under Schedule 1 of the Wildlife and Countryside Act, while grey partridge is included on the Red List of Birds of Conservation Concern. Both species may breed in grass, field margins or dense vegetation such as arable crops. Therefore the site does offer suitable habitat for these birds. However, the surrounding area offers ample alternative suitable habitat. Preconstruction surveys will be undertaken to determine whether any nesting birds are present within the construction footprint if works are scheduled during the breeding season. If grey partridge or common quail are found to breed, they will be monitored and appropriate buffers will be applied to limit disturbance until breeding is shown to have ended. A watching brief will be maintained by the Ecological Clerk of Works. Field margins will be retained and the new species-rich hedge that will be created will provide new breeding habitat. In addition, the stock-proof security fence will reduce medium-sized predators, which will benefit ground nesting birds. Therefore no significant negative effects are predicted.

Lapwing, woodcock and curlew have all been recorded in the wider area. Lapwing is included on the Red List of Birds of Conservation Concern, while woodcock and curlew are both Amber Listed. All three species are included on the Scottish Biodiversity List. The site does not offer suitable breeding habitat for woodcock. With the exception of field margins, the site does not offer suitable breeding habitat for other wader species. Preconstruction surveys will be undertaken to determine whether any nesting birds are present within the construction footprint if works are scheduled during the breeding season. If waders are found to breed, they will be monitored and appropriate buffers will be applied to limit disturbance until breeding is shown to have ended. A watching brief will be maintained by the Ecological Clerk of Works. Field margins will be retained, and the change of landuse to grazing will improve breeding opportunities onsite. In addition, the stock-proof security fence will reduce medium-sized predators, which will benefit ground nesting birds. Therefore no significant negative effects are predicted, and the development may benefit waders.

Crossbill, skylark and meadow pipit have all been recorded in the wider area. Crossbill is listed under Schedule 1 of the Wildlife and Countryside Act. Skylark is included on the Red List of Birds of Conservation Concern, while meadow pipit is Amber Listed. Skylark is also included on the Scottish Biodiversity List. Conifer trees in the thin band of mixed plantation woodland that will be lost may offer breeding habitat for crossbill, although there is ample habitat of higher quality in the

surrounding area. Preconstruction surveys will be undertaken to determine whether any nesting birds are present within the construction footprint if works are scheduled during the breeding season. Checks will be made for crossbill regardless of season, as they may breed throughout the year. If crossbill are found to breed, they will be monitored and felling of trees will not commence until breeding has ended. Furthermore, appropriate buffers will be applied to limit disturbance until breeding is shown to have ended. A watching brief will be maintained by the Ecological Clerk of Works. With the exception of the trees and field margins, the site offers only poor breeding or foraging habitat for other passerines. The field margins will be retained and the change of landuse to grazing will improve foraging and breeding opportunities for meadow pipit and skylark, while the creation of a new species-rich hedge will benefit other passerines. Furthermore, the stock-proof security fence will reduce medium-sized predators, which will benefit ground nesting birds. Therefore, no significant negative effects are predicted and the development will have positive effects for passerines.

The site offers limited suitable habitat for amphibians and reptiles. However, stone walls may offer potential hibernacula sites, and field margins offer potential foraging habitat. These features will be retained and so no effect is predicted. Increased vehicle traffic during construction may present an increased risk of mortality. Reckless or intentional harm or killing to all reptiles is prohibited under Schedule 5 of the Wildlife and Countryside Act. Therefore preconstruction surveys will be undertaken of suitable habitat within the development footprint. Where populations of reptiles are found, specific mitigation measures will be considered to avoid injury or mortality, including reptile exclusion fencing. Should any hibernacula be found these will be marked and development microsited to avoid destruction of these features and injury to the occupying reptiles. It is also recommended that excavations are covered up overnight and/or ramps provided in trenches to avoid reptiles becoming trapped. A suitably experienced and qualified Ecological Clerk of Works will be appointed to oversee construction activities. However, the development will involve regrading fields to create a south-facing slope. The landuse will also change from arable to grazing. This represents an improvement in reptile and amphibian habitat, although the site will remain largely sub-optimal. It should also be noted that despite the short-term negative impacts, the works will create a mosaic of vegetation structure and heights that is essential for reptile populations to thrive. Vegetation structure is of utmost importance for reptiles, especially the availability of basking places, and ecotones where vegetation height changes. Therefore, it can be reported that the construction works will ultimately have significant positive benefits for reptiles if present in the area, and no significant negative effects are predicted.

The site does not offer high quality habitats known to support important communities of invertebrates of conservation concern. In addition, there are no important aquatic habitats onsite. However, insects which lay their eggs in water have also been found to confuse certain surfaces with similar polarized light reflective properties with water. Insects do confuse solar PV with water, as well as other artificial materials such as glass buildings, asphalt, car paint etc. There is therefore a risk that invertebrates may attempt to lay eggs on the dry solar PV panels, particularly where there are high quality aquatic habitats nearby. Studies have shown that the use of white borders on solar PV panels reduces the risk of invertebrates with an aquatic phase attempting to lay eggs on these unsuitable surfaces. White borders will be used at this site in order to reduce this risk. Therefore no significant negative effects are predicted for invertebrates. An area of species-rich hedge (comprising of native species and of local provenance wherever possible) will be created which will benefit local invertebrate communities.

No significant negative effects are predicted on habitats or species as a result of the proposed development. The change of landuse from arable to grazing and the creation of a species-rich hedge (consisting of native plants and of local provenance wherever possible) will have positive effects on local biodiversity.

1 Introduction

Caledonian Conservation Ltd was commissioned by BWE Partnership to carry out baseline field surveys and an appraisal of the potential effects of the proposed New Mains of Guynd Solar Park. This document describes the baseline conditions and an appraisal of potential ecological effects which may be associated with this development.

Field surveys were completed by Glenn Norris (Ecologist), and this appraisal was undertaken by Chris Cathrine (Director). Mapping was undertaken using ArcGIS 10, and was completed by Glenn Norris and Chris Cathrine.

This document includes the following sections:

- The Development;
- Policy and Guidance;
- Methodology;
- Baseline Results;
- Data Limitations;
- Ecological Appraisal;
- Summary and Conclusions; and
- References.

This Ecological Appraisal should be read alongside the following additional documents:

- Planning Application; and
- Ramsay & Chalmers drawings, which accompany the Planning Application.
- H+M figure NMG:LV12 Vikinglea Mitigation, which accompanies the Planning Application.

2 The Development

The development involves the installation of solar PV arrays in four fields at New Mains of Guynd, located approximately 6.8km east-south-east of Arbroath, Angus. The four fields are also shown in Figure 1, alongside the wider landownership boundary. These fields are currently used for arable agriculture, small unmanaged margins.

The project will require the regrading of the fields, creating a slight (2.5º) south-facing slope, and the grid connection at the east of the site. A stock-proof security fence will also be installed. After installation, the four fields will be used for improved grazing. Solar arrays will be spaced by 5.8m, allowing continued access to the field by wildlife.

Details of the development, including components, are shown in the following figures which accompany the planning application:

- Ramsay & Chalmers Drawing 002: Site Layout Plan
- Ramsay & Chalmers Drawing 003: Typical Site Details
- Ramsay & Chalmers Drawing 006: Section 1-1

3 Policy and Guidance

The appraisal approach was designed with reference to various relevant legislation, policy and guidance, and involved a number of stages. Following best practice, a preliminary ecological appraisal was completed to scope in the main issues, and scope out issues which did not require further consideration (Benatt 2012). Targeted novel baseline surveys were then undertaken where necessary to provide a baseline to inform this appraisal. Finally an ecological appraisal was completed.

Note that although in this case a full Ecological Impact Assessment (EcIA) has not been deemed necessary, due to the low sensitivity of the site and low impact of the development, EcIA guidance has been referred to, ensuring a rigorous approach to this appraisal.

The following legislation, policy and guidance documents have been considered in undertaking this ecological appraisal:

- Council Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Flora and Fauna (*Habitats Directive*);
- Directive 2009/147/EC on the Conservation of Wild Birds (the codified version of Council Directive 79/409/EEC as amended) (*Birds Directive*);
- The Conservation (Natural Habitats, &c.) Regulations 1994;
- Wildlife and Countryside Act 1981 (as amended);
- Nature conservation (Scotland) Act 2004;
- The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2007;
- Wildlife and Natural Environment (Scotland) Act 2011;
- The Protection of Badgers Act 1992;
- Angus Local Plan;
- Tayside Biodiversity Action Plan;
- Scottish Government Large Photovoltaic Arrays Guidance 2011;
- Cornwall Council Renewable Energy Planning Guidance Note 2: The Development of Large Scale (>50kW) Solar PV Arrays 2012[1];
- Scottish Government Planning Advice Note 1/2013: Environmental Impact Assessment;
- Scottish Planning Policy 2010;
- Scottish Executive National Planning Policy Guideline 6 (revised 2000): Renewable Energy Development;
- Scottish Planning Policy 6: Renewable Energy;
- Guidelines for Ecological Impact Assessment in the United Kingdom (Institute of Ecology and Environmental Management [IEEM] 2006);
- Guidelines for Preliminary Ecological Appraisal (Benatt 2012);

[1] Referenced in Scottish Government guidance.

- Bat Conservation Trust Bat Surveys Good Practice Guidelines 2nd Edition (Bat Conservation Trust [BCT] 2012);
- Birds of Conservation Concern 2009 (Eaton *et al.* 2009); and
- Handbook of Biodiversity Methods (Hill *et al.* 2005).

In addition, the pre-application advice letter provided by Angus Council (reference 14/00041/PREAPP/LW.02/ID) has also been considered.

4 Methodology

An Extended Phase 1 habitat survey was conducted within the site and wider area (Figure 1). This survey involved searching for signs of protected species (particularly mammals) and mapping the habitats in this area to a Phase 1 level. Any other ecological receptors that would warrant additional surveys were also to be noted.

In addition, a desk-study was also completed to identify potential sensitivities and to provide a wider context.

4.1 Desk-based Study

Data requests for information were made with Leisure and Culture Dundee (LCD) (local records centre), Royal Society for the Protection of Birds (RSPB), Tayside Raptor Study Group (TRSG), British Trust for Ornithology (BTO), Tayside Bat Group (TBG), Scottish Badgers (SB), Saving Scotland's Red Squirrels (SSRS) and Amphibian and Reptile Conservation Trust (ARC).

4.2 Extended Phase 1 Survey

An Extended Phase 1 habitat survey was conducted within the proposed development site on 25th April 2014. This survey involved searching for signs of protected species (particularly mammals) and mapping the habitats in this area to a Phase 1 level.

The protected species survey targeted bats, otter, water vole and badger. All signs and sightings were recorded on large scale maps, and locations marked using hand held GPS devices.

4.2.1 Phase 1 Habitat Mapping

Standard Phase 1 Habitat Mapping methodology was used to identify habitat areas of ecological importance, as outlined in the Handbook for Phase 1 habitat survey published by the Joint Nature Conservancy Council (JNCC) (2007). The survey included the site and a wider area to provide context.

4.2.2 Protected Species Survey

A protected species survey was undertaken within the site and 250m buffer area. This survey targeted otter (*Lutra lutra*), water vole (*Arvicola amphibius*) and badger (*Meles meles*). Signs of other protected species such as red squirrel (*Sciurus vulgaris*), polecat (*Mustela putorius*) and pine marten (*Martes martes*) were also to be noted. All signs and sightings were recorded on large scale maps, and locations marked using hand held GPS devices.

Suitable habitat was also noted for birds, bats, amphibians and reptiles and invertebrates so as to identify the need for further targeted survey work before to inform an ecological assessment or appraisal.

Target notes were made during the Phase 1 survey regarding field signs and habitat features of note.

Further information regarding specific protected mammal survey methods are provided below.

4.2.2.1 Otter

A full otter survey was conducted following standard methodology and using an appropriate field guide (Bang and Dahlstrøm 2006; Chanin 2003a; Chanin 2003b). Field signs included:

- Holts – below ground resting places;
- Couches – above ground resting places;
- Prints; and
- Spraints – faeces used as territorial markers, with a characteristic sweet odour.

4.2.2.2 Water Vole

Areas of potentially suitable habitat were surveyed following standard methodology and using an appropriate field guide (Bang and Dahlstrøm 2006; Strachan *et al.* 2011). This involved recording the following field signs:

- Faeces – recognisable by their size, shape, and content, and also distinguishable from rat droppings by their smell, if not desiccated;
- Latrines – faeces are often deposited at discrete locations known as latrines;
- Feeding stations – food items are often brought to feeding stations along pathways and haul out platforms, indicated by neat piles of chewed vegetation up to 10cm long;
- Burrows – appear as a series of holes along the water's edge distinguishable from rat burrows by size and position;
- Lawns – may appear as grazed areas around burrows;
- Nests – where the water table is high, above ground woven nests may be found;
- Footprints – tracks may occur at the water's edge leading into vegetation cover, and may be distinguishable from rat footprints by size; and
- Runways – low tunnels pushed through vegetation near the water's edge, which are less obvious than rat runs.

4.2.2.3 Badger

A full badger survey was conducted, following standard methodology and using appropriate field reference guides and SNH guidance (Roper 2010; Bang and Dahlstrøm 2006; SNH 2001). Badger field signs include:

- Setts – burrows indicating badger setts (level of activity and other signs may allow determination of sett type, *i.e.* main sett, annexe sett, subsidiary sett or outlying sett);
- Prints;
- Latrines (and dung pits used as territorial markers);
- Hairs – highly distinctive, and often become snagged on fences;
- Feeding signs – snuffle holes (small scrapes where badgers have searched for earthworms, insects or tubers); and
- Paths.

5 Results

The baseline results are discussed in detail below. Each potential Valued Ecological Receptor (VER) is discussed in turn to allow these results to more easily inform a full Ecological Appraisal (EA) or Ecological Impact Assessment (EcIA) to accompany a planning application. A structured and robust assessment of potential effects has not been undertaken as part of this report.

5.1 Desk-based Study

5.1.1 Designated Sites

A search of digital datasets indicates that there are no statutory designations of European importance, national importance or local importance within the site boundary. Table 1 provides information on Special Protection Areas (SPA) and Special Areas of Conservation (SAC) within a 20km buffer and Sites of Special Scientific Interest (SSSIs) within a 5km buffer.

Table 1. Designated sites.

Designation	Site name	Distance (km)	Comments
Site of Special Scientific Interest (SSSI)	Dilty Moss	3.5km W	Supports nationally important raised bog habitat. As the development will have no direct or indirect impact on the site or adjacent habitat, there is no pathway for effect as identified in this appraisal.
Special Area of Conservation (SAC)	Barry Links	9.2km S	Supports internationally important habitats listed under Annex I of the Habitats Directive including: - Shifting dunes. - Humid dune slacks. - Shifting dunes with marram. - Coastal dune heathland. - Dune grassland. As the development will have no direct or indirect impact on the site or adjacent habitat, there is no pathway for effect as identified in this appraisal.

Designation	Site name	Distance (km)	Comments
SAC	Firth of Tay and Eden Estuary	9.2km S	Supports internationally important habitats listed under Annex I of the Habitats Directive including: - Subtidal sandbanks. - Estuaries. - Intertidal mudflats and sandflats. In addition, the site supports internationally important populations of harbour seal (*Phoca vitulina*) (listed under Annex II of the Habitats Directive). The development will have no direct or indirect impact on the site or adjacent habitat. Furthermore, the site does not offer suitable habitat for harour seal. Therefore there is no pathway for effect as identified in this appraisal.
Special Protection Area (SPA)	Firth of Tay and Eden Estuary	9.2km S	Supports internationally important breeding populations of breeding birds including: - Marsh harrier (*Circus aeruginosus*). - Little tern (*Sternula albifrons*). Also supports internationally important wintering waterfowl assemblage, and internationally important wintering populations of the following bird species: - Common scoter (*Melanitta nigra*). - Cormorant (*Phalacrocorax carbo*). - Eider (*Somateria mollissima*). - Goosander (*Mergus merganser*). - Grey plover (*Pluvialis squatarola*).

Designation	Site name	Distance (km)	Comments
			- Long-tailed duck (*Clangula hyemalis*). - Red-breasted merganser (*Mergus serrator*). - Sanderling (*Calidris alba*). - Velvet scoter (*Melanitta fusca*). - Dunlin (*Caladris alpina alpina*). - Greylag goose (*Anser anser*). - Redshank (*Tringa tetanus*). - Oystercatcher (*Haematopus ostralegus*). - Bar-tailed godwit (*Limosa lapponica*). - Goldeneye (*Bucephala clangula*). - Icelandic black-tailed godwit (*Limosa limosa islandica*). - Pink-footed goose (*Anser brachyrhynchus*). - Shelduck (*Tadorna tadorna*). The development site offers potentially suitable foraging habitat for wintering waders and wildfowl. The site does not offer suitable or important habitat for any of the other species.
SAC	River Tay	10.0km N	Supports internationally important habitats listed under Annex I of the Habitats Directive including: - Clear-water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels.

Designation	Site name	Distance (km)	Comments
			In addition, the site supports internationally important populations of species listed under Annex II of the Habitats Directive including: - Brook lamprey (*Lampetra planeri*). - Sea lamprey (*Petromyzon marinus*). - River lamprey (*Lampetra fluviatilis*). - Atlantic salmon (*Salmo salar*). - Otter (*Lutra lutra*). The development will have no direct or indirect impact on the site or adjacent habitat. Therefore, no pathway for effect has been identified for the habitat and fish features of this SAC. However, although the site offers poor habitat, otter associated with this SAC may occasionally forage or travel through.
SAC	River South Esk	14.5km N	Supports internationally important populations of species listed under Annex II of the Habitats Directive including: - Atlantic salmon (*Salmo salar*). - Freshwater pearl mussel (*Margeritifera margeritifera*). The development will have no direct or indirect impact on the site or adjacent habitat. Therefore, no pathway for effect has been identified in this appraisal.
SPA	Montrose Basin	17.0km NE	Supports internationally important wintering waterfowl assemblage, and internationally important wintering populations of the following bird species:

Designation	Site name	Distance (km)	Comments
			- Dunlin (*Calidris alpina*). - Eider (*Somateria mollissima*). - Knot (*Calidris canuta*). - Shelduck (*Tadorna tadorna*). - Wigeon (*Anas Penelope*). - Pink-footed goose (*Anser brachyrhynchus*). - Greylag goose (*Anser anser*). - Redshank (*Tringa totanus*). - Oystercatcher (*Haematopus ostralegus*) (non-breeding). The development site offers potentially suitable foraging habitat for wintering waders and wildfowl. The site does not offer suitable or important habitat for any of the other species.

5.1.2 Data Search Results

To date, data has been supplied by:

- RSPB;
- BTO;
- TBG;
- SSRS; and
- ARC.

Neither TBG nor ARC held any detailed data.

SSRS indicated that there were no survey boxes in the immediate vicinity of the site, and so could not draw upon the national dataset. Data regarding red squirrel sightings has not yet been provided.

Data has not yet been provided by LCD, TRSG or SB.

BTO provided data from the 2007-11 Bird Atlas for the 10km square NO54. The methods employed for this survey mean that the distribution data is only representative at a 10km resolution, but this provides useful context when considered alongside the habitats identified during the Extended Phase 1 survey.

A search of the National Biodiversity Network Gateway (NBN Gateway) was also completed. There were no records of protected species on the site although records for otter, badger, bats (Chiroptera), amphibians and reptiles were found in the same 10km square. While this information has limited value compared with records provided by formal data searches with detailed metadata, it does provide general context.

Results of data searches are considered alongside novel survey results in the baseline descriptions below.

5.2 Weather

Timings and weather conditions during the Extended Phase 1 habitat survey are provided in Table 2 below. The site had been dry the day before the survey with light showers two days previously. Therefore, the survey was completed under optimal conditions.

Table 2. Extended Phase 1 Habitat Survey Weather Conditions

Date	Surveyor	Start Time	Hour	Visibility	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Frost	Snow
25/04/2014	GN	1030	1	0	1	SE	1	8	0	0	0
			2	0	2	SE	1	8	0	0	0
			3	0	2	SE	1	8	0	0	0
			4	0	2	SE	1	8	0	0	0

Visibility; 0 = <1km; 1 = 1-2km; 2 = ≥2km

Wind direction: according to 16-point compass

Wind strength: according to the Beaufort scale

Cloud cover: in eighths of sky

Cloud height: 0 = <150m; 1 = 150-500m; 2 = >500m

Rain: 0 = None; 1 = Drizzle/Mist; 2 = Light showers; 3 = Heavy showers; 4 = Heavy rain

Frost: 0 = None; 1 = Ground; 2 = All day

Snow: 0 = None; 1 = Onsite; 2 = On high ground only

Surveyor: GN = Glenn Norris

5.3 Phase 1 Habitats

Overall, nine habitats were identified and mapped during the Phase 1 habitat survey. A summary of habitats is found in Table 3. Target notes are listed in Table 4 and their locations shown in Figure 2.

Table 3. Phase 1 habitat survey summary (see Figure 2 for map)

Phase 1 Code	Description
A1.3.2	Mixed plantation woodland
A2.1	Continuous scrub
A2.2	Scattered scrub
B4	Improved grassland
C1.1	Continuous bracken
G2	Running water
J1.1	Arable fields
J1.2	Amenity grassland
J2.2.2	Defunct species-poor hedge
J2.4	Fence
J2.5	Wall
J2.7	Boundary removed
J3.6	Building
J5	Other (track)

Table 4. Phase 1 habitat survey target notes (shown in Figure 2)

TN	Grid Reference	Details
1	NO5672042889	Large beech trees (Photo 14) as well as scots pine and oak present in the mixed woodland may have hidden fissures potentially serving as roosts for bats.
2	NO5664743184	More large trees present amongst the northern part of the mixed plantation woodland.
3	NO5607142525	A small strip of land along the westernmost landownership boundary contains small stands of horse chestnut (*Aesculus hippocastanum*).
4	NO5628142176	Field margin of three metres left containing false oat-grass (*Arrhenatherum elatius*) and cocksfoot (*Dactylis glomerata*).
5	NO5707442850	Large beech trees that offer bat roost potential.
6	NO5728042781	Shallow rocky stream that could potentially act as an otter transit route. The rocky banks and bed leave no potential habitat for water voles.
7	NO5728042801	Large overhanging roots formed by the current eroding the bank provide excellent temporary cover for travelling otters.

5.3.1 A1.3.2 Mixed Plantation Woodland

As with much of the surrounding area, the predominant land use of New Mains of Guynd is arable farming, with large fields covering the majority of the landholding. The field margins provide the only viable habitats for small mammals, birds and reptiles to inhabit. A well-established mixed plantation woodland remains in a compartment to the north of the landholding between two arable fields.

The wood comprises of beech (*Fagus sylvatica*), oak (*Quercus* sp.), sitka spruce (*Picea stichensis*), scots pine (*Pinus sylvestris*) and rowan (*Sorbus aucuparia*) (photo 1). The understorey is composed of gorse (*Ulex europaea*) and broom (*Cytisus scoparius*) (Photo 2) with grasses between these such as Yorkshire fog (*Holcus lanatus*), cocksfoot (*Dactylis glomerata*) and false oat-grass (*Arrhenatherum elatius*). Cocksfoot and false oat-grass were often found towards the edges of the woodland with Yorkshire fog dominant within. Averis (2013) describes the dominance of this grass within habitats as a sign of nitrogen enrichment, which is likely to have occurred on this site.

The woodland continues for the entirety of its compartment until the far west where it gives way to raspberry (*Rubus idaeus*) (Photo 3) and a stand of bracken (*Pteridium aquilinum*). However, the site boundary includes a small section of woodland (0.12ha), although this is particularly and thin as most of the sitka spruce and larch has been felled by wind leaving only a few thin trees remaining (Photo 4). These

trees offer poor habitat compared to the immediately adjacent woodland, and offer poor bat roost potential.

A slim stand of mixed plantation woodland is present on the south east border of the site consisting of horse chestnut (*Aesculus hippocastanum*), oak, rowan and birch (*Betula* spp.).

5.3.2 A2.1 Continuous Scrub

Patches of continuous scrub were small or linear, often replacing hedgerows along the disturbed soils of field boundaries as in Photo 5. The dominant species in these habitats are gorse and broom. However, one patch exists near the mixed plantation woodland that consists solely of raspberry clearly free from grazing pressure from deer (Photo 3).

5.3.3 A2.2 Scattered Scrub

Individual stands of gorse and broom occur along the disturbed soils of field margins. Over time these will form the continuous stands along fence-lines and previously described in section 5.3.2.

5.3.4 B4 Improved Grassland

Grasslands adjacent to arable fields are at risk of agricultural enrichment and this is the case on New Mains of Guynd. Photo 6 shows a small patch of grassland lying to the far west of the site surrounded by three arable fields and the vegetation present represents the high nutrient content of the soils. Running through this grassland was a dried up stream banked by tuberous comfrey (*Symphytum tuberosum*) and butterbur (*Petasites hybridus*), the latter a species of fertile soils (Photo 7). The dominant species within the grassland was Yorkshire fog, a species known to thrive in nutrient-rich soils. Amongst this small area of grassland were individual trees reaching, at most, three metres in height including *Laburnum* sp., beech and oak.

5.3.5 C1.1 Continuous Bracken

In the far west of the woodland compartment raspberry gives way to a continuous cover of bracken allowing very little diversity within this small patch.

5.3.6 G2 Running Water

Most of the sinks marked on the map are dried ditches (Photos 7 and 8), however one channel does still flow at the south of the site. Most of the water from the site drains in to this channel (Photo 9). The channel is deep in places with steep banks as high as two metres, with a rocky riverbed. There are very few aquatic plants present, perhaps due to the inconsistent flow of the channel. It is banked by plants that thrive on fertile soils apparent in the arable landscape such as butterbur, Yorkshire fog and tuberous comfrey, suggesting that the water will include nutrient enriched agricultural runoff.

There is a wider stream to the east of the site that flows through the woodland (Photo 10). This stream offers a potential route for otters moving between the coast and the pond north east of the site, which is likely to support toads, as anecdotal records indicate these amphibians have been observed crossing the road between Redford and The Steading (Pete Minting, pers comm.). There are plentiful opportunities for hovers and couches provided by excavated root systems and undercut banks. The lower banks are unlikely to provide permanent holts for otters due to the risk flooding.

5.3.7 J1.1 Arable

Arable farming is the primary use of land on site (Photo 11) and in the surrounding area leaving only strands of woodland, scrub and grassland. In total, arable land covers 89% (86.5 ha) of the landholding and 96% (18.9 ha) of the proposed site boundary. In some areas a field margin of three metres is kept unsown where rank grasses such as false oat-grass and cocksfoot can grow unchecked, although the majority of sowing occurs immediately adjacent to the fence-line.

5.3.8 J1.2 Amenity Grassland

Houses within the landowner boundary have gardens of mown lawn and flowerbeds.

5.3.9 J2.2.2 Defunct Species-poor Hedge

Remains of hedges used as field margins before the construction of walls and fences are found throughout the site. However none but the continuous stand of gorse and broom are stock-proof. The old defunct hedges consist mostly of hawthorn (*Cretaegus monogyna*) and have either been continuously pruned on the top and sides or left to grow out in the more inaccessible areas. Poor maintenance of the hawthorn hedges has left them top heavy, with much bushy growth on top and very little below, leaving holes that could allow stock to pass through, while offering only very little cover for nesting birds and small mammals (Photo 12).

Within the hedgerows, large oaks have been planted evenly amongst them creating long corridors of a single tree width throughout the site (Photo 12).

5.3.10 J2.4 Fence

Fences are found throughout the site and are marked on the map for completeness rather than their contribution to habitats.

5.3.11 J2.5 Wall

Un-mortared stone walls provide the division for the landowner boundary and for the woodland compartment. These may offer hibernacula to amphibians and reptiles.

5.3.12 J2.7 Boundary Removed

A boundary outwith the landholding north of the westernmost compartment of woodland has been removed.

5.3.13 J3.6 Building

There are agricultural buildings on site consisting of a barn, garages and storerooms as well as the houses inhabited by the landowners and tenants. Some of these buildings may offer roost potential for bats and nesting habitat for barn owls.

5.3.14 J5 Other (Track)

A gravel track runs through the centre of the site and ends at the house within the woodland in the north.

5.4 Protected Mammals

The following sections describe the findings of the protected species survey.

5.4.1 Otter (Lutra lutra)

One otter record exists from the Black Burn within the landowner boundary that runs through woodland to the east of the site, however this survey is only as recent as 1994 (NBN Gateway). It is likely that otters use the burn as a route between the small loch upstream and Elliot Water and ultimately the coast.

No field signs of otters were discovered but the burn does offer temporary cover in the form of undercut banks and visible root systems (Photo 13). It is unlikely that otters would remain on site or venture near the proposed site boundary due to the unsuitable habitat.

5.4.2 Water Vole (Arvicola amphibius)

No field signs of water vole were found during the survey. There are no water vole records within 10 km of the site and the unsuitable habitat, in the form of streams with rocky substrates, offered means that it is unlikely that they exist on site (Photos 7, 8 and 9).

5.4.3 Red Squirrel (Sciurus vulgaris)

The development site does not offer suitable habitat for this species. Optimal habitat for red squirrels is offered by blocks of conifers over 200ha in area, with a varied age structure (Red Squirrels in South Scotland, Unknown Date). Areas of mixed woodland are likely to be colonised by grey squirrels (*Sciurus carolinensis*), resulting in the loss of red squirrels through disease. The limited area of mixed-plantation woodland that will be lost (0.12ha) does not offer suitable habitat for red squirrels.

5.4.4 Badger (Meles meles)

No field signs of badger were found during the survey. There are no previous records of badgers on site however they have been found within 10 km (NBN).

There is potential habitat within the landownership, however it is limited and distant from the proposed site boundary. Badgers are therefore unlikely to be disturbed by construction. It is possible that badgers may wander on to the site from territories outside the site boundary, when foraging. However, the site itself offers very limited foraging opportunities.

5.4.5 Bats (Chiroptera)

There are no bat records for the site or landholding, however there is suitable habitat and there have been sightings of bats flying over the farm by the landowner (pers. comm.). There are large old trees throughout the landholding and several may offer potential for roosting bats, however, none of these are present within the site boundary (Photo 14). The site itself offers only limited foraging potential, and no roost potential. The field margins are often lined with trees, and these as well as the thin strands of woodland in the north east of the site could act as bat transit routes between roosts and foraging areas (Photo 5).

5.5 Ornithology

The following sections describe the potential ornithological sensitivities based on habitats and desk-study results.

5.5.1 Wildfowl

Small numbers of whooper swan (*Cygnus cygnus*), greylag goose (*Anser anser*) and pink-footed goose (*Anser brachyrhynchus*) have been recorded in the same 10km square as the site according to BTO data

5.5.2 Raptors

Hen harrier (*Circus cyaneus*) and peregrine (*Falco peregrinus*) have been recorded in the same 10km square as the site according to BTO data. RSPB and BTO data both include records of possible breeding kestrel (*Falco tinnunculus*) in the same 10km square as the site. However, the site does not offer suitable breeding habitat for hen harrier or peregrine. However, the thin band of mixed woodland could offer potential breeding habitat for kestrel, although no evidence of kestrel was found in this area during the Extended Phase 1 survey.

5.5.3 Barn Owl

RSPB and BTO data both include records of possible breeding of barn owl (*Tyto alba*) in the same 10km square as the site. The disturbance distance for barn owls is considered to be 100m (Ruddock and Whitfield 2007; Whitfield *et al.* 2008). No buildings within this distance are suitable to support nesting barn owls. All buildings within this area are modern and subject to high levels of human disturbance. The site itself offers only limited foraging habitat for barn owl.

5.5.4 Gamebirds

Records provided by the BTO show that grey partridge (*Perdix perdix*) has been observed within 2km of the site during breeding season. The site offers potentially suitable breeding and foraging habitat for this species. Grey partridge has suffered declines of 39% between 1994 and 2007 in the UK (Riseley *et al*. 2008).

Common quail (*Coturnix coturnix*) has been recorded to breed within 2km of the proposed development site, based on BTO data. Quail is a migratory game bird whose number fluctuates each summer depending on weather conditions. The site does offer potentially suitable breeding and foraging habitat for this species.

5.5.5 Waders

Waders including lapwing (*Vanellus vanellus*), woodcock (*Scolopax rusticola*) and curlew (*Numenius arquata*) have been recorded to breed and overwinter within the same 10km square as the site, based on BTO data. BTO data also indicates that oystercatchers have been recorded to breed within 2km of the site.

5.5.6 Passerines

BTO data also indicates that a number of species of passerines are known to breeding in the 10km square, including skylark and meadow pipit which may be

affected by this development. However, the arable fields which comprise the majority of the site are of limited value for these birds.

Crossbill were also recorded in winter, although this bird may breed throughout winter as it relies upon availability of conifer seeds (Forrester *et al.* 2007). The small area of poor quality woodland onsite offers very limited habitat for these birds.

5.6 Amphibians and Reptiles

The site itself does not offer any suitable breeding habitat for amphibians, only very limited terrestrial habitat along field margins. Stone walls offer potential hibernacula sites for amphibians present in the area. Anecdotal observations on the road between Redford and The Steading indicate that common toads (*Bufo bufo*) are present in the wider area, and likely use the large ponds to the north-east of the site. It is therefore possible that toads may commute over the largely unsuitable terrestrial habitat onsite.

The site offers only limited suitable habitat for reptiles. Potentially suitable habitat is restricted to field margins and stone walls.

5.7 Invertebrates

The site does not offer any habitats known to support important invertebrate communities (such as semi-natural ancient woodland, brownfield, or species-rich grassland). There are also very limited examples of aquatic habitat on site. Therefore, it is considered unlikely that the development site supports important invertebrate populations or communities of conservation concern.

6 Data Limitations

The Extended Phase 1 survey was completed during harr conditions, reducing visibility to between 100m and 1km. However, all areas of the site and at least a 250m buffer were visited, and so these conditions will not have interfered with survey results. Otherwise, the survey was completed under ideal conditions.

Novel ornithology surveys were not completed, as the development area is of poor value to birds. With the exception of the thin band of small trees which will be felled for the grid connection installation, the site offers only very limited nesting habitat for Schedule 1 birds or other species of conservation concern. Data search results provide a good indication of rare species which are likely to be present in this area, and pre-construction surveys and Ecological Clerk of Works presence will prevent contravention of the Wildlife and Countryside Act 1981 (as amended). Therefore, more detailed ornithology surveys are not considered necessary.

Therefore, there are no significant data limitations as identified in this appraisal.

7 Ecological Appraisal

The following section considers the potential effects of the development on ecology.

7.1 Ecological Appraisal Methodology

The approach taken to the appraisal of ecological impacts follows the Ecological Impact Assessment guidance produced by the Institute of Ecology and Environmental Management (IEEM 2006). These guidelines set out the process for assessment through the following stages:

- Identification of Valued Ecological Receptors (VERs) (the ecological components of highest value present at a site);
- Determining the nature conservation value (sensitivity) of the VERs present within the zone of influence that may be affected by the development;
- Identifying the potential effects based on the nature of the construction, operation and decommissioning of the proposed development;
- Determining the magnitude of the impacts including consideration of the sensitivity of the receptor and the duration and reversibility of the effect;
- Determining the significance of the impacts based on the interaction between the effect magnitude/duration, and the nature conservation value and the likelihood of the effect occurring;
- Identifying mitigation measures required to address significant adverse effects;
- Determining the residual impact significance after the effects of mitigation have been considered, including a description of any legal and policy consequences; and
- Identification of any monitoring requirements.

7.1.1 Identification of Valued Ecological Receptors

The assessment process involves identifying VERs. These ecological receptors and their conservation concern, or 'Sensitivity', are determined by the criteria defined in Table 5. It should be noted that these criteria are intended as a guide and are not definitive. Attributing a value to a receptor is generally straightforward in the case of designated sites, as the designations themselves are normally indicative of a value level. For example a site designated as a Special Area of Conservation under the Habitats Directive is implicitly of European (i.e. international) importance – and so classified as of 'Very high' sensitivity. Professional judgement is important when attributing a value level to a particular species or individual habitat. In these cases, reference has also been made to national guidelines for the selection of Sites of Special Scientific Interest (SSSI) in order to determine which level of significance should be applied (Nature Conservancy Council, 1989). Social and economic factors are also considered when valuing receptors, if appropriate.

Table 5. Approach to Identifying Sensitivity for Ecological Receptors.

Sensitivity Level	Examples
Very high	An internationally designated site, candidate site, or an area meeting the criteria for an international designation (e.g. Special Area of Conservation [SAC]). Large areas of priority habitat listed under Annex I of the Habitats Directive, and smaller areas of such a habitat that are essential to maintain the viability of that ecological resource. A regularly occurring, nationally significant population of any internationally important species, listed under Annex II or Annex IV of the Habitats Directive or Annex I of the Birds Directive. A regularly occurring migratory species listed under Annex II/2 of the Birds Directive connected to an SPA designated for this species.
High	A nationally designated site, or area meeting criteria for national level designations (e.g. Site of Special Scientific Interest [SSSI]). Significant extents of a priority habitat identified in the Scottish Biodiversity List, or smaller areas which are essential to maintain the viability of that ecological resource. A regularly occurring, regionally significant population of any nationally important species listed as a Scottish Biodiversity List priority species and Species listed under Schedule 1 or Schedule 5 of the Wildlife and Countryside Act, Annex II or Annex IV of the Habitats Directive or Annex I of the Birds Directive.
Medium	Viable areas of key semi-natural habitat identified in the Scottish Biodiversity List. A regularly occurring, locally significant population of any nationally important species listed as a Scottish Biodiversity List priority species and Species listed under Schedule 1 or Schedule 5 of the Wildlife and Countryside Act, Annex II or Annex IV of the Habitats Directive or Annex I of the Birds Directive. Sites which exceed the local authority-level designations but fall short of SSSI selection guidelines, including areas of semi-natural woodland exceeding 0.25ha.
Low	Areas of semi-natural ancient woodland smaller than 0.25ha. Sites of Importance for Nature Conservation or equivalent sites selected on local authority criteria. Local Nature Reserves. Other species of conservation concern, including species included under the Birds of Conservation Concern Red List (Eaton *et al.* 2009) or Local BAP (LBAP). Areas of habitat or species considered to appreciably enrich the ecological resource within the local context e.g. species-rich flushes or hedgerows.

Sensitivity Level	Examples
Negligible	All other species and habitats that are widespread and common and which are not present in locally, regionally or nationally important numbers or habitats which are considered to be of poor ecological value (e.g. commercial forestry).

7.1.2 Assessment of Effects

Effects on VERs are judged in terms of magnitude and duration, or 'reversibility' (Regini 2000).

Magnitude is determined on a quantitative basis where possible. This may relate to the area of habitat lost to the development footprint in the case of a habitat receptor, or predicted loss of individuals in the case of a population of a particular species of animal. Magnitude is assessed using the five categories detailed in Table 6.

Table 6. Criteria for Describing Magnitude (adapted from Percival 2007)

Magnitude	Description
Severe	Total loss or very major alteration to key elements/features of the baseline (pre-development) conditions such that the post development character / composition / attributes would be fundamentally changed and may be lost from the site altogether. Guide: <20% of population/habitat remains
Major	Major loss or major alteration to key elements / features of the baseline conditions such that the post development character / composition/attributes would be fundamentally changed. Guide: 20-80% of population/habitat lost
Moderate	Loss or alteration to one or more key elements / features of the baseline conditions such that post development character / composition / attributes would be partially changed. Guide: 5-20% of population/habitat lost
Minor	Minor shift away from baseline conditions. Change arising from the loss / alteration would be discernible but the underlying character/composition/attributes would be similar to pre-development circumstances/patterns. Guide: 1-5% of population/habitat lost
Negligible	Very slight change from baseline condition. Change barely distinguishable, approximating to the "no change" situation. Guide: < 1% population/habitat lost

In the case of designated sites, spatial magnitude is assessed in respect of the area within the designated site boundary. For non-designated sites, spatial magnitude is assessed in respect of an appropriate scale depending on the value of the receptor.

Reversibility is defined by considering the duration of the impact. This is the time for which the impact is expected to last before recovery – i.e. return to pre-construction baseline conditions (see Table 7).

Table 7. Criteria for Describing Reversibility of Effects

Reversibility	Definition
Irreversible	Effects continuing indefinitely beyond the span of one human generation (taken as approximately 25 years), except where there is likely to be substantial improvement after this period (e.g. the replacement of mature trees by young trees which need >25 years to reach maturity, or restoration of ground after removal of a development. Such exceptions can be termed very long-term effects).
Reversible	Effects that recover over the lifetime of the development, either naturally or as a result of mitigation or compensation. Duration of reversible effects can be categorised as below: Long-term (15 - 25 years) Medium-term (5 – 15 years) Short-term (up to 5 years)

Knowledge of how rapidly the population or performance of a species is likely to recover following loss or disturbance (e.g. by individuals being recruited from other populations elsewhere) is used to assess reversibility, where such information is available.

Magnitude, reversibility and sensitivity are then considered alongside proposed mitigation, and the consequence of the effect determined. The nature of any effect on a VER is assessed as negative or positive based upon IEEM guidelines. While a negative change is one that is likely to cause an adverse effect on the integrity of a VER, a positive will result in a beneficial change. The concept of 'integrity' in this context refers to sustained coherence of ecological structure and function of a VER, and includes consideration of both temporal and spatial factors.

Magnitude, reversibility and sensitivity are then considered alongside proposed mitigation, and the consequence of the effect determined. The nature of any effect on a VER is assessed as being either negative or positive, which is based upon IEEM guidelines. The concept of 'integrity' in this context refers to sustained coherence of ecological structure and function of a VER, and includes consideration of both temporal and spatial factors.

The combined assessment of the magnitude of the effect and the sensitivity of ecological receptors have been used to determine whether or not an effect is significant with respect of the EIA Regulations. Table 8 shows how these criteria are considered to determine the overall level of significance of an effect. Effects with significance levels of moderate, high and very high are considered to be significant in terms of EIA Regulations.

Table 8. Significance Level of Ecological Effects

	Sensitivity of VER				
Magnitude of effect	**Very High**	**High**	**Medium**	**Low**	**Negligible**
Severe	**Very High**	**Very High**	**High**	**Medium**	**Low**
High	**Very High**	**Very High**	**Medium**	**Low**	**Very Low**
Moderate	**Very High**	**High**	**Low**	**Very Low**	**Very Low**
Minor	**Medium**	**Low**	**Low**	**Very Low**	**Very Low**
Negligible	**Low**	**Very Low**	**Very Low**	**Very Low**	**Very Low**

Red = SIGNIFICANT in terms of EIA Regulations
Green = NOT SIGNIFICANT in terms of EIA Regulations

7.1.3 Potential Effects on Ecological Receptors

Overall, solar PV parks are relatively benign, with low or no negative ecological impacts (Tsoutsos *et al.* 2005; RSPB 2011). This is particularly the case when installed in agricultural environments with poor biodiversity value. When installed in areas of intensive agriculture there may even be positive effects that benefit local wildlife through landuse change (RSPB 2011).

There are four ways in which a solar park may affect ecological receptors:

- Habitat loss;
- Disturbance;
- Confusion with water; and
- Collision.

Each of these forms of potential effect are discussed in turn below, and are considered in greater detail when relevant to individual receptor assessments.

7.1.3.1 Habitat Loss

During the construction phase the potential effects of associated noise and visual disturbance could lead to the temporary displacement of animals. Potential effects are likely to be greatest during the bird breeding season (mainly between March and August, depending on species) and behavioural sensitivity to the effects will vary between species. Disturbance to birds is becoming increasingly well understood, although it depends heavily on the individuals involved. However, larger bird species, those higher up the food chain or those that feed in flocks in the open tend to be more vulnerable to disturbance than small birds living in structurally complex or closed habitats such as woodland (Hill *et al*. 1997). The potential effects associated with construction activities are only likely to occur for as long as the construction phase continues. The exception to this would be if an adverse effect on a receptor were such that the local population becomes extinct and replacement through recruitment or recolonisation does not occur.

7.1.3.2 Disturbance

The operation of solar parks and associated human activities for maintenance purposes also has the potential to cause disturbance and displace species from the development site. Disturbance effects during the operational phase will be less than during the construction phase, as there will be a much lower level of human activity of a less intrusive nature. In this case, the level of human disturbance during operation will be equivalent to current disturbance levels under the current agricultural landuse. During the operational life of the solar park animals are unlikely to be disturbed by the infrastructure itself, and birds have been observed to nest on solar PV structures (Hernandez *et al.* 2014).

7.1.3.3 Confusion with water

Bats possess an innate ability to detect water through echolocation, and can confuse smooth surfaces, such as solar PV, with water (Greif and Siemers 2010; Russo *et al.* 2012). Bats have been found to approach smooth surfaces and attempt to drink from these (Russo *et al.* 2012). On rare occasions, collisions have been recorded between bats and vertical reflective surfaces when mistaken for water, which is discussed in more detail in the section below (Natural England 2011). No feeding buzzes have been recorded associated with approaches to reflective surfaces

(Russo *et al.* 2012). However, bats soon learn that the smooth surfaces are not water, and leave.

Insects which lay their eggs in water have also been found to confuse certain surfaces with similar polarized light reflective properties with water. Insects do confuse solar PV with water, as well as other artificial materials such as glass buildings, asphalt, car paint etc (Kirska *et al.* 1998; Kriska *et al.* 2006; Kriska *et al.* 2008; Horváth and Kriska 2008; Horváth *et al.* 2010). There is therefore a risk that invertebrates may attempt to lay eggs on the dry solar PV panels, particularly where there are high quality aquatic habitats nearby (Horváth *et al.* 2010; RSPB 2011).

7.1.3.4 Collision

Unlike wind turbines, there is not a high risk of collision with birds or bats associated with solar PV developments. Although there is an inherent possibility with any structure in the landscape, there is no increased risk with solar PV (RSPB 2011). There have been suggestions that bats (particularly juveniles) may be at a small increased risk of collision, when confusing vertical solar PV panels with water (Natural England 2011).

There have also been high profile reports of birds and other animals being burned or colliding with heliostat solar plants in America (McCrary *et al.* 1986; Pimentel *et al.* 1994). Heliostat solar is highly reflective and concentrates light towards central receivers, whereas solar PV absorbs light and is not reflective nor uses central receivers (RSPB 2011). Therefore, the higher risk of collision and heat related injury or mortality associated with heliostat technology does not apply to solar PV (Pimentel *et al.* 1994; RSPB 2011).

7.2 Receptor Assessments

A summary of identified Valued Ecological Receptors (VERS) is provided in Table 9 below.

Table 9. Summary of identified Valued Ecological Receptors

Sensitivity	VER
VERY HIGH	Otter Greylag goose Pink-footed goose Whooper swan
HIGH	Barn owl Common quail
MEDIUM	Bats Hen harrier Peregrine Crossbill Common toad Reptiles
LOW	Badger Kestrel Grey partridge Lapwing Woodcock Curlew Skylark Meadow pipit Invertebrates
NEGLIGIBLE	Mixed-plantation woodland

Receptors of negligible conservation importance are not considered further in this assessment as they were not recorded in important numbers or areas. These receptors are generally common and widespread species or habitats.

Other VERs are discussed as groups or individual receptor accounts as appropriate. Potential construction and operational effects are also considered for each receptor.

Mitigation is then discussed where appropriate. However, it should be considered that the principle mitigation measure adopted to minimise the ecological impact of the development has been the use of an iterative design process. Use has been made of ecological constraints plans and ecological issues have been taken into account

throughout the design process. This means that most mitigation measures are embedded within the overall design, allowing the opportunity to microsite infrastructure away from the most sensitive habitats or species. This section presents specific measures adopted through the different phases of the development. An Ecological Clerk of Works (ECoW) will be appointed to oversee mitigation measures, and ensure best practise during the construction and decommissioning phases.

Potential decommissioning effects are considered to be of the same nature as construction effects, with the exception that habitat is likely to be restored and displaced species able to return to abandoned areas.

7.2.1 Otter

The otter population in Tayside is thought to be at or near carrying capacity, and has demonstrated a sustained improvement (Strachan 2007; Chanin 2013). Otters are a qualifying feature of the River Tay SAC, for which the otter population is considered to be in favourable condition, and at or near carrying capacity (Strachan 2007). In addition otters are listed under Annex IV and of the Habitats Directive and Schedule 5 of the Wildlife and Countryside Act. They are therefore considered to be of **very high sensitivity.**

7.2.1.1 Potential Construction Effects

Although no evidence of otters or holts (for which the habitat was found to be sub-optimal) was found within the survey area, they may move through the site on occasion while foraging or commuting. However, this is likely to be infrequent as the site does not offer good foraging habitat for this species.

Increased noise, increased ground vibrations and vehicle traffic may result in disturbance to otters, if they forage in this area during construction activities.

Increased vehicle traffic during the construction phase may also present an increased risk of mortality to otters.

There is also a risk that otters may become trapped in trenches required during construction activities which may result in mortality.

Therefore, there is a small possibility of disturbance and increased mortality risk during construction. It is highly unlikely that there would be any noticeable impact on the local population. Furthermore, the population would certainly be able to recover in the unlikely event of any mortality through natural recruitment.

As there is a risk of an impact on the local otter population through mortality, mitigation is required to reduce this to an acceptable level. Preconstruction surveys should be undertaken to ascertain current local status and use of the development footprint. Should any holts or couches be identified, and disturbance considered likely, an application for a European Protected Species licence will be made. If a license is required, implementation of an otter management plan may be necessary. Where there is a potential risk of fatality through collision with construction traffic, specific mitigation measures will be considered including otter fencing and wildlife reflectors. It is also recommended that excavations are either covered up overnight and/or ramps provided in trenches to avoid otter, or other mammals, becoming trapped during the construction phase. A suitably experienced and qualified Ecological Clerk of Works will be appointed to oversee construction activities.

Following implementation of mitigation measures outlined above, any potential impact would be of **negligible magnitude**, **reversible in the short- to medium-**

term, and of a **low significance** level. Therefore **no significant negative effect is predicted.**

7.2.1.2 Potential Operation Effects

There will be no increase in human disturbance after installation. However, stock-proof security fencing will prevent access to fields by otters. The existing arable landuse does not offer suitable foraging habitat for otters. The sheep grazing habitat that will replace the arable habitat after construction will also be of poor value to foraging otters. Therefore there will be no loss of important habitat. Fencing off of the four fields will not limit otter distribution, as many alternative dispersal routes of greater value (e.g. water courses) exist in the area. It is likely that otters will arrive in the area during toad breeding season if they have learned to tackle these toxic amphibians, targeting the pond to the north-east of the site (Chanin 2013). However, otters coming from the south are likely to follow the Elliot Water and Black Burn, which offer excellent commuting corridors unlike the poor agricultural habitat onsite. Therefore, **no significant effect is predicted.**

7.2.1.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects, with the exception that fences are likely to be removed and so otters could pass through the fields again. The habitat will remain unsuitable for otters regardless of whether the landuse returns to arable or remains sheep grazing. Relevant mitigation described under Construction Effects will also be applied during Decommissioning.

7.2.2 Badger

Badgers are protected under the Protection of Badgers Act 1992, however they are now a common and widespread species in Scotland and the UK as a whole. Badgers are therefore considered to be of **low sensitivity**.

7.2.2.1 Potential Construction Effects

No badger setts or evidence of badgers were recorded within 250m of the development site. Furthermore, the habitat throughout the site does not provide cover and slopes for the establishment of setts, which is required by badgers (Roper 2010).

Although no evidence of badgers or setts (for which the habitat was found to be sub-optimal) was found within the survey area, they may on occasion forage on site. However, this is likely to be infrequent as the site does not offer good foraging habitat for this species.

Increased noise, increased ground vibrations and vehicle traffic may result in disturbance to badgers, if they forage in this area during construction activities.

Increased vehicle traffic during the construction phase may also present an increased risk of mortality to badgers.

There is also a risk that badgers may become trapped in trenches required during construction activities which may result in mortality.

Therefore, there is a small possibility of disturbance and increased mortality risk during construction. It is highly unlikely that there would be any noticeable impact on the local population. Furthermore, the population would certainly be able to recover in the unlikely event of any mortality through natural recruitment.

Although any impact on badgers is considered highly unlikely, mitigation is recommended as a precaution. Preconstruction surveys should be undertaken to ascertain current local status and use of the development footprint. Should any setts be identified, and disturbance considered likely, an application will be made to SNH for a licence. If a license is required, implementation of a badger management plan may be necessary. Where there is a potential risk of fatality through collision with construction traffic, specific mitigation measures will be considered including badger fencing and wildlife reflectors. It is also recommended that excavations are either covered up overnight and/or ramps provided in trenches to avoid badgers, or other mammals, becoming trapped during the construction phase. A suitably experienced and qualified Ecological Clerk of Works will be appointed to oversee construction activities.

Following implementation of mitigation measures outlined above, any potential impact would be of **negligible magnitude**, **reversible in the short- to medium-term**, and of a **very low significance** level. Therefore **no significant negative effect is predicted.**

7.2.2.2 Potential Operation Effects

There will be no increase in human disturbance after installation. However, stock-proof security fencing will prevent access to fields by badgers. The existing arable landuse does not offer suitable foraging habitat for badgers. The sheep grazing habitat that will replace the arable habitat after construction will also be of poor value to foraging badgers. Therefore there will be no loss of important habitat. Fencing off of the four fields will not limit badger distribution, as many alternative dispersal routes of greater value (e.g. areas of dense scrub and vegetation) exist in the area. Therefore, **no significant effect is predicted.**

7.2.2.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects, with the exception that fences are likely to be removed and so badgers could pass through the fields again. The habitat will remain unsuitable for badgers regardless of whether the landuse returns to arable or remains sheep grazing. Relevant mitigation described under Construction Effects will also be applied during Decommissioning.

7.2.3 Bats

All bat species are listed under Annex IV of the Habitats Directive and Schedule 5 of the Wildlife and Countryside Act. As such, bats are considered to be of **medium sensitivity.**

7.2.3.1 Potential Construction Effects

The majority of the site consists of arable fields, which cannot support bat roosts. Although some of the field margins and boundaries may offer commuting routes or foraging habitat, these will be almost completely retained. The only area of habitat which may be used by bats that will be affected by the development is an area of mixed plantation woodland at the east of the site. This woodland will be removed in order to install grid connection. However, the trees present here are unsuitable to support bat roosts, lacking any cracks, crevices or other features which could be used for this purpose. Therefore, the only potential effect is the fragmentation of a linear feature which may be used as a commuting route. In order to mitigate for this effect, a species-rich hedge (consisting of native species also of local provenance where possible) will be planted to ensure the retention of a linear feature at this

location (Figure 3). Following implementation of mitigation measures outlined above, any potential impact would be of **negligible magnitude**, **reversible in the short-term**, and of a **very low significance** level. Therefore **no significant negative effect is predicted.**

7.2.3.2 Potential Operation Effects

Bats possess an innate ability to detect water through echolocation (Greif and Siemers 2010). Bats can confuse smooth reflective surfaces, such as solar PV panels, for water, using echolocation (Greif and Siemers 2010; Russo *et al.* 2012). However, only drinking attempts have been found to be made when bats approach smooth surfaces which appear to be analogous to water when identified through echolocation (Russo *et al.* 2012). Furthermore, these attempts are limited, and the bat soon leaves in search of another water source. On rare occasions, collisions have been recorded between bats and vertical reflective surfaces when mistaken for water (Natural England 2011). Such collisions are thought to be more likely to occur with juvenile bats (Natural England 2011). However, the solar arrays that will be installed at this site will be horizontal. In addition, no feeding buzzes have been recorded associated with approaches to reflective surfaces (Russo *et al.* 2012). Therefore, the risk of collision at this site is extremely low, as would be any associated mortality. It is highly unlikely that there would be any noticeable impact on the local population. Furthermore, the population would certainly be able to recover in the unlikely event of any mortality through natural recruitment.

Therefore, any potential impact would be of **negligible magnitude**, **reversible in the short-term**, and of a **very low significance** level. Therefore **no significant negative effect is predicted.**

7.2.3.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects, with the exception that solar arrays are likely to be removed.

7.2.4 Wildfowl

Pink-footed geese may be associated with Firth of Tay and Eden Estuary SPA and Montrose Basin SPA. Greylag geese may be associated with Montrose Basin SPA. There are no SPAs designated for whooper swans within the maximum 20km connectivity distance (Pendlebury *et al.* 2011; SNH 2012). However, as the majority of all migratory wildfowl will at some point visit an SPA in the UK, pink-footed geese, greylag geese and whooper swans are considered to be of **high sensitivity** for the purposes of this assessment.

7.2.4.1 Potential Construction Effects

Pink-footed geese, greylag geese and whooper swans are known to occur within the same 10km square as the site during winter months. Although the site is a considerable distance from SPA roost locations, it is within the connectivity distance for both Firth of Tay and Eden Estuary SPA and Montrose Basin SPA. These species do use some arable agricultural fields for foraging, and this site may offer suitable crops in some years. Therefore, it is possible that geese and swans may use the site for foraging on occasion. Although the landuse will change from arable to grazing, these birds also use improved grassland as foraging habitat. Therefore, **no effect is predicted**.

7.2.4.2 Potential Operation Effects

The site will still be available for foraging geese during operation. Furthermore, the change to grazing will provide consistently suitable habitat, whereas the current arable landuse provides variable suitable habitat for foraging geese depending upon crop rotation. Therefore, **no effect is predicted**.

7.2.4.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects. The habitat will remain suitable for foraging geese whether it remains as grazing or is returned to arable (depending on crop type). Therefore, **no effect is predicted**.

7.2.5 Raptors

There are records of peregrine, hen harrier and kestrel in the wider area. As peregrine and hen harrier are listed under Schedule 1 of the Wildlife and Countryside Act, they are considered to be of **high sensitivity.** Kestrel is included on the Amber List, and so is considered to be of **low sensitivity**.

7.2.5.1 Potential Construction Effects

As there is no potential breeding habitat for peregrine or hen harrier **no effects are predicted** on these species as a result of construction.

Larch trees in the thin band of woodland that will be lost to construction offers potential breeding habitat for kestrel (Figure 3). However, no evidence of kestrel was found here during surveys and there are ample areas of potential breeding habitat of higher quality in the wider area. A preconstruction survey will be undertaken to determine whether any nesting birds are present within the construction footprint, if works are scheduled during the breeding season. If kestrel are found to breed, they will be monitored and felling of trees will not commence until breeding has ended. Furthermore, appropriate buffers will be applied in accordance with best practice and available literature. Construction activities are restricted or prohibited within buffer areas as appropriate until breeding is shown to have ended. A watching brief will be maintained by the Ecological Clerk of Works. Any effect on breeding kestrel is considered highly unlikely with mitigation in place. Any effect would be of **negligible magnitude, reversible in the short-term,** and of a **very low level of significance.** Therefore **no significant effect is predicted.**

Furthermore, with the exception of the field margins, the site offers only poor foraging habitat for raptors. The field margins will be retained, and the change of landuse to grazing will improve foraging opportunities onsite, as will the creation of a new species-rich hedge to the east of the site (Figure 3). Hedges of similar species composition will also be planted as part of the Vikinglea mitigation (see H+M Figure NMG:LV12). As such, a **long-term positive effect** of **negligible magnitude** and so **very low level of significance** is predicted.

7.2.5.2 Potential Operation Effects

The change of landuse to grazing and creation of a species-rich hedge to the east of the site will continue to benefit raptors throughout operation.

No negative effects are predicted.

7.2.5.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects, although the habitat may return to its current less-suitable condition if arable farming is resumed.

7.2.6 Barn owl

As barn owls are listed under Schedule 1 of the Wildlife and Countryside Act, they are considered to be of **high sensitivity.**

7.2.6.1 Potential Construction Effects

There are no potential barn owl nest sites within the recommended 100m buffer distance to avoid disturbance to this species (Ruddock and Whitfield 2007; Whitfield *et al.* 2008). Therefore **no effects are predicted** on breeding barn owl as a result of disturbance during construction.

Furthermore, with the exception of the field margins, the site offers only poor foraging habitat for barn owl. The field margins will be retained, and the change of landuse to grazing will improve foraging opportunities onsite, as will the creation of a new species-rich hedge to the east of the site (Figure 3). Hedges of similar species composition will also be planted as part of the Vikinglea mitigation (see H+M Figure NMG:LV12). As such, a **long-term positive effect** of **negligible magnitude** and so **very low level of significance** is predicted.

7.2.6.2 Potential Operation Effects

The change of landuse to grazing and creation of a species-rich hedge to the east of the site will continue to benefit barn owls throughout operation.

Therefore, **no negative effects are predicted**.

7.2.6.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects, although the habitat may return to its current less-suitable condition if arable farming is resumed.

7.2.7 Gamebirds

There are records of common quail and grey partridge breeding in the wider area, and the site does offer suitable habitat for these species. As common quail is listed under Schedule 1 of the Wildlife and Countryside Act, they are considered to be of **high sensitivity.** Grey partridge is included on the Red List and Scottish Biodiversity List, and so is considered to be of **low sensitivity**.

7.2.7.1 Potential Construction Effects

The site offers potentially suitable breeding habitat for both common quail and grey partridge, which may both breed in grass such as at field margins or in dense vegetation such as arable crops (Forrester *et al.* 2007; Balmer *et al.* 2013). Angus and the farmland of the north-east is a stronghold for both species. Common quail is a migratory bird, and populations vary between years, with occasional influxes such as in 2011 when over 100 calling males were recorded in Angus and Dundee (Balmer *et al.* 2013). Grey partridge, conversely, are resident. Both species are present in the highest densities in areas of arable farming (Forrester *et al.* 2007).

There will be disturbance and a temporary loss of potential breeding and foraging habitat during construction. However, the surrounding areas offers ample alternative breeding and foraging habitat. A preconstruction survey will be undertaken to determine whether any nesting birds are present within the construction footprint, if works are scheduled during the breeding season. If quail or partridge are found to breed, appropriate buffers will be applied in accordance with best practice and available literature. Construction activities are restricted or prohibited within buffer areas as appropriate until breeding is shown to have ended. A watching brief will be maintained by the Ecological Clerk of Works. Any effect on either common quail or grey partridge is considered highly unlikely with mitigation in place. Any effect would be of **negligible magnitude, reversible in the short-term,** and of a **very low level of significance.** Therefore **no significant effect is predicted.**

The field margins will be retained, and the change of landuse to grazing will continue to offer potential foraging opportunities onsite. The creation of a new species-rich hedge to the east of the site will also provide new breeding habitat (Figure 3). Hedges of similar species composition will also be planted as part of the Vikinglea mitigation (see H+M Figure NMG:LV12). Considering this mitigation, a **long-term negative effect** of **negligible magnitude** and so **very low level of significance** is predicted. Therefore **no significant effect is predicted.**

7.2.7.2 Potential Operation Effects

The level of disturbance to gamebirds will remain the same after construction as it is under the current arable land use.

In addition, stock-proof security fencing will limit access to the site by medium-sized predators. It has been shown that removing predators from an area can have beneficial effects on ground nesting birds (Smith *et al.* 2010). Therefore, a **long-term positive effect** of **negligible magnitude** and so **very low level of significance** is predicted.

Therefore **no significant negative effects are predicted.**

7.2.7.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects, although the habitat may return to its current more-suitable condition if arable farming is resumed.

7.2.8 Waders

Lapwing, woodcock and curlew have all been recorded in the wider area. Lapwing is Red Listed, while woodcock and curlew are both included on the Amber List. All three species are included on the Scottish Biodiversity List. Although populations of wintering waders are included on SPA citations within 20km, the distances (7.2km to Firth of Tay and Eden Estuary SPA and 17km to Montrose Basin SPA) mean that it is extremely unlikely that birds associated with these sites will regularly forage at New Mains of Guynd.

As such they are considered to be of **low sensitivity.**

7.2.8.1 Potential Construction Effects

The site does not offer suitable breeding habitat for woodcock, and so **no effect is predicted** on this species.

With the exception of the field margins, the site does not offer suitable breeding habitat for other wader species. The field margins will be retained, and the change of

landuse to grazing will improve breeding opportunities onsite. As such, a **long-term positive effect** of **negligible magnitude** and so **very low level of significance** is predicted.

A preconstruction survey will be undertaken to determine whether any nesting birds are present within the construction footprint if works are scheduled during the breeding season. If waders are found to breed, appropriate buffers will be applied in accordance with best practice and available literature. Construction activities are restricted or prohibited within buffer areas as appropriate until breeding is shown to have ended. A watching brief will be maintained by the Ecological Clerk of Works. Any effect on waders is considered highly unlikely with mitigation in place. Any effect would be of **negligible magnitude, reversible in the short-term,** and of a **very low level of significance.** Therefore **no significant effect is predicted.**

7.2.8.2 Potential Operation Effects

The level of disturbance to waders will remain the same after construction as it is under the current arable land use.

In addition, stock-proof security fencing will limit access to the site by medium-sized predators. It has been shown that removing predators from an area can have beneficial effects on ground nesting birds (Smith *et al.* 2010). Therefore, a **long-term positive effect** of **negligible magnitude** and so **very low level of significance** is predicted.

Therefore **no significant negative effects are predicted.**

7.2.8.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects, although the habitat may return to its current less-suitable condition if arable farming is resumed.

7.2.9 Passerines

Crossbills are listed under Schedule 1 of the Wildlife and Countryside Act, and are therefore considered to be of **high sensitivity.**

Skylark is included on the Red List, while meadow pipit is Amber Listed. Skylark is also included on the Scottish Biodiversity List. Therefore, these species are considered to be of **low sensitivity.**

7.2.9.1 Potential Construction Effects

Conifer trees in the thin band of woodland that will be lost to construction offers potential breeding habitat for crossbill (Figure 3). However, crossbills were neither seen nor heard during surveys and there are ample areas of potential breeding habitat of higher quality in the wider area. A preconstruction survey will be undertaken to determine whether any breeding crossbills are present within the construction footprint, regardless of when works are scheduled. If crossbills are found to breed, they will be monitored and felling of trees will not commence until breeding has ended. Furthermore, appropriate buffers will be applied in accordance with best practice and available literature. Construction activities are restricted or prohibited within buffer areas as appropriate until breeding is shown to have ended. A watching brief will be maintained by the Ecological Clerk of Works. Any effect on breeding crossbill is considered highly unlikely with mitigation in place. Any effect

would be of **negligible magnitude, reversible in the short-term,** and of a **very low level of significance.** Therefore **no significant effect is predicted.**

Nesting bird checks will also be undertaken for all other species if works are scheduled for the breeding season. If nests are found, appropriate buffers will be applied in accordance with best practice and available literature. Construction activities are restricted or prohibited in buffer areas as appropriate until breeding is shown to have ended. A watching brief will be maintained by the ecological clerk of works. Any effect would be of **negligible magnitude, reversible in the short-term,** and of a **very low level of significance.** Therefore **no significant effect is predicted.**

With the exception of the trees, field margins, the site offers only poor breeding or foraging habitat for other passerines. The field margins will be retained, and the change of landuse to grazing will improve breeding and foraging opportunities onsite for skylark and meadow pipit, while the creation of a new species-rich hedge to the east of the site will benefit other passerine species (Figure 3). Hedges of similar species composition will also be planted as part of the Vikinglea mitigation (see H+M Figure NMG:LV12). As such, a **long-term positive effect** of **negligible magnitude** and so **very low level of significance** is predicted.

7.2.9.2 Potential Operation Effects

The level of disturbance to passerines will remain the same after construction as it is under the current arable land use.

In addition, stock-proof security fencing will limit access to the site by medium-sized predators. It has been shown that removing predators from an area can have beneficial effects on ground nesting birds (Smith *et al.* 2010). Therefore, a **long-term positive effect** of **negligible magnitude** and so **very low level of significance** is predicted.

Therefore **no significant negative effects are predicted.**

7.2.9.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects, although the habitat may return to its current less-suitable condition if arable farming is resumed.

7.2.10 Reptiles

The site offers limited suitable habitat for reptiles. However, stone walls may offer potential hibernacula sites, and the field margins offer potential foraging habitat.

Adders, common lizards and slow-worms are all protected from intentional or reckless killing or injury under the Wildlife and Countryside Act, and are also Scottish Biodiversity List species. They are therefore considered to be of **medium sensitivity.**

7.2.10.1 Potential Construction Effects

The development has been designed so as to retain field margins, and the stone walls will also be retained. Therefore, there will be no loss of potential reptile habitat.

Increased noise, increased ground vibrations and vehicle traffic may result in disturbance to reptiles if they are present within the site boundary during construction activities.

Increased vehicle traffic during the construction phase may also present an increased risk of mortality to reptiles. It is also possible that reptiles may be directly killed or injured by construction activities and there is a risk that reptiles may become trapped in trenches which may result in mortality.

Preconstruction surveys should be undertaken of suitable habitat within the development footprint to identify presence of reptiles. Where populations of reptiles are found to be present specific mitigation measures will be considered to avoid injury or mortality, including reptile exclusion fencing. Should any hibernacula be identified, these will be marked and development should be microsited to avoid destruction of these features and injury to the occupying reptiles. It is also recommended that excavations are either covered up overnight and/or ramps provided in trenches to avoid reptiles becoming trapped during the construction phase. A suitably experienced and qualified Ecological Clerk of Works will be appointed to oversee construction activities.

Therefore, there is a possibility of disturbance and increased mortality risk to reptiles during construction. It is highly unlikely that there would be any noticeable impact on the local population. Furthermore, the population would certainly be able to recover in the unlikely event of any mortality through natural recruitment. The proposed mitigation also minimises any risk of injury or mortality to individual reptiles. Therefore, any predicted negative impact would be of **negligible magnitude** and reversible in the **short-term**, and so of a **very low significance level.** Therefore **no significant negative effect is predicted.**

However, the development will involve regrading fields to create a south-facing slope. The landuse will also change from arable to grazing. This represents an improvement in reptile habitat, although the site will remain largely sub-optimal. It should also be noted that despite the short-term negative impacts, the works will create a mosaic of vegetation structure and heights that is essential for reptile populations to thrive. Vegetation structure is of utmost importance for reptiles, especially the availability of basking places, and ecotones where vegetation height changes (Edgar *et al.* 2010). Therefore, it can be reported that the construction works will ultimately have significant positive benefits for reptiles if present in the area.

The development will therefore have a **positive effect** of **negligible magnitude** over the **long-term** on reptiles.

7.2.10.2 Potential Operation Effects

The level of disturbance to reptiles will remain the same after construction as it is under the current arable land use. However, the site will be marginally more suitable for these species during operation.

Stock-proof security fencing will have a gap at the bottom and wide enough spacing to allow reptiles to access the site without presenting a barrier.

Therefore **no negative effects are predicted**.

7.2.10.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects, although the habitat may return to its current less-suitable condition if arable farming is resumed. Relevant mitigation described under Construction Effects will also be applied during Decommissioning.

7.2.11 Common toad

The site offers limited suitable habitat for common toads, and no breeding habitat. However, stone walls may offer potential hibernacula sites, and field margins offer potential foraging habitat which may be used by toads breeding in ponds to the north-east of the site.

Common toads are Scottish Biodiversity List species. They are therefore considered to be of **medium sensitivity.**

7.2.11.1 Potential Construction Effects

The development has been designed so as to retain field margins, and the stone walls will also be retained. Therefore, there will be no loss of potential toad habitat.

Increased noise, increased ground vibrations and vehicle traffic may result in disturbance to toads if they are present within the site boundary during construction activities.

Increased vehicle traffic during the construction phase may also present an increased risk of mortality to toads. However, it should be noted that any migration routes from potential hibernacula would not cross the development site. It is also possible that toads may be directly killed or injured by construction activities and there is a risk that toads may become trapped in trenches which may result in mortality.

Common toads and other amphibians will benefit from reptile mitigation. Any amphibians found onsite during these works will be removed to a safe location offsite by a suitably experienced and qualified Ecological Clerk of Works.

Therefore, there is a possibility of disturbance and increased mortality risk to common toads during construction. It is highly unlikely that there would be any noticeable impact on the local population. Furthermore, the population would certainly be able to recover in the unlikely event of any mortality through natural recruitment. The proposed mitigation also minimises any risk of injury or mortality to individual reptiles. Therefore, any predicted negative impact would be of **negligible magnitude** and reversible in the **short-term**, and so of a **very low significance level.** Therefore **no significant negative effect is predicted.**

However, the development will involve regrading fields to create a south-facing slope. The landuse will also change from arable to grazing. This represents an improvement in amphibian habitat, although the site will remain largely sub-optimal. Therefore, it can be reported that the construction works will ultimately have significant positive benefits for reptiles if present in the area.

The development will therefore have a **positive effect** of **negligible magnitude** over the **long-term** on common toad.

7.2.11.2 Potential Operation Effects

The level of disturbance to common toads will remain the same after construction as it is under the current arable land use. However, the site will be marginally more suitable for these species during operation.

Stock-proof security fencing will have a gap at the bottom and wide enough spacing to allow amphibians to access the site without presenting a barrier.

Therefore **no negative effects are predicted**.

7.2.11.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects, although the habitat may return to its current less-suitable condition if arable farming is resumed. Relevant mitigation described under Construction Effects will also be applied during Decommissioning.

7.2.12 Invertebrates

The site does not offer high quality habitats known to support invertebrates of conservation concern, and there are no aquatic habitats present.

However, solar PV is can have particular effects on invertebrates that lay eggs in aquatic habitats through reflection of polarized light and it is possible that some of these species may overfly the site. Therefore these effects are considered here.

Invertebrates are considered to be of **low sensitivity** for the purposes of this appraisal.

7.2.12.1 Potential Construction Effects

The best areas of invertebrate habitat present are the field margins. As the development has been designed so as to retain field margins, and species-rich hedges will be created to the east of the site (Figure 3) and as part of the Vikinglea mitigation (see H+M Figure NMG:LV12) offering new habitat for invertebrates, a **long-term positive effect** of **negligible magnitude** and so **very low level of significance** is predicted.

Therefore, **no significant negative effects are predicted**.

7.2.12.2 Potential Operation Effects

Insects which lay their eggs in water (e.g. mayflies, caddisflies, various true-flies, water beetles etc) have been found to confuse certain surfaces with similar polarized light reflective properties with water. Insects do confuse solar PV with water, as well as other artificial materials such as glass buildings, asphalt, car paint etc (Kirska *et al.* 1998; Kriska *et al.* 2006; Kriska *et al.* 2008; Horváth and Kriska 2008; Horváth *et al.* 2010). There is therefore a risk that invertebrates may attempt to lay eggs on the dry solar PV panels (Horváth *et al.* 2010; RSPB 2011). However, research has shown that the use of white borders dramatically reduces the risk of invertebrates confusing solar PV panels for water (Horváth *et al.* 2010). Furthermore, there are no aquatic habitats onsite. However, in order to limit any potential risk to invertebrates with an aquatic phase, white borders will be used at this site. Therefore, a **long-term negative effect** of **negligible magnitude** and so **very low level of significance** is predicted.

Therefore **no significant negative effects are predicted**.

7.2.12.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects, although the habitat may return to arable farming if this is resumed, while the hedge will be retained.

8 Summary and Conclusions

No significant negative effects are predicted on any ecological receptors as a result of this development. The change of landuse from arable to grazing and the creation of a species-rich hedge (consisting of native plants and of local provenance wherever possible) will have positive effects on local biodiversity.

Table 10 details the predicted effects after mitigation has been considered. As decommissioning activities are of a similar type and intensity as construction activities, the assessment considers that likely significant effects of decommissioning will be of a similar nature to the likely significant effects of construction. In the case of this development, mitigation measures during construction would also apply to the decommissioning phase and so are not repeated. This is likely to be precautionary as in practice many of the decommissioning effects are likely to be of a smaller scale than the construction effects.

Table 10. Summary of residual effects.

VER	Sensitivity	Potential Effect	Mitigation	Magnitude (after mitigation)	Reversibility (after mitigation)	Nature (after mitigation)	Significance level (after mitigation)	Level of Certainty/ Comments and Significance (in terms of EIA regulations)
CONSTRUCTION (AND DECOMMISSIONING) EFFECTS								
Otter	Very High	Disturbance, increased mortality through construction/traffic. Entrapment in trenches	Preconstruction surveys, Otter Management Plan if otters present involving ECoW presence during construction, covering of trenches/providing escapes,	Negligible	Reversible in Short– to Medium-term	Negative	Very low	Not significant. High certainty. No evidence of badgers within 250m of site area. Management plan required if preconstruction surveys prove otter presence
Badger	Low	Disturbance, increased mortality through construction/traffic. Entrapment in trenches	Preconstruction surveys, Management Plan if badger present involving ECoW presence during construction, covering of trenches/providing escapes	Negligible	Reversible in Short to Medium-term	Negative	Very Low	Not significant. High certainty. No evidence of badgers within 250m of site. Management plan required if pre construction surveys prove badger presence.
Bats	Medium	Loss of roosts and linear	Creation of species-rich hedge	No effects predicted				Not significant. High certainty. No suitable roost

VER	Sensitivity	Potential Effect	Mitigation	Magnitude (after mitigation)	Reversibility (after mitigation)	Nature (after mitigation)	Significance level (after mitigation)	Level of Certainty/ Comments and Significance (in terms of EIA regulations)
		features used as commuting routes.	to maintain linear commuting route					habitat present. Although a thin band of trees which may be used as a commuting route will be lost, a species-rich hedge will be created to maintain a linear feature at this location.
Wildfowl (pink-footed geese, greylag geese and whooper swan)	Very High	Loss of foraging habitat, disturbance		No effects predicted				Not significant. High certainty. Site will remain suitable for foraging..
Peregrine	High	Loss of foraging habitat	Retention of field margins. Change of landuse to grazing.	Negligible	Long-term	Positive	Very low	Not significant. High certainty. Foraging habitat will be improved after construction. No suitable nesting habitat present.
Hen harrier	High	Loss of foraging habitat	Retention of field margins. Change of landuse to grazing.	Negligible	Long-term	Positive	Very low	Not significant. High certainty. Foraging habitat will be improved after construction. No suitable nesting habitat present.
Kestrel	Low	Loss of foraging or nesting habitat,	Preconstruction surveys will identify tree nesting	Negligible	Reversible in the short-term	Negative	Very low	Not significant. High certainty. Site will offer improved foraging habitat

VER	Sensitivity	Potential Effect	Mitigation	Magnitude (after mitigation)	Reversibility (after mitigation)	Nature (after mitigation)	Significance level (after mitigation)	Level of Certainty/ Comments and Significance (in terms of EIA regulations)
		disturbance	raptors. If present appropriate buffers will be implemented. Construction works will be restricted as appropriate within buffers until nesting is shown to have ended. Change of landuse to grazing.					after landuse change.
Barn owl	High	Loss of foraging habitat	Retention of field margins. Change of landuse to grazing.	Negligible	Long-term	Positive	Very low	Not significant. High certainty. Foraging habitat will be improved after construction. No suitable nesting habitat present.
Common quail	High	Loss of breeding and foraging habitat, disturbance	Preconstruction surveys will identify nesting birds. If present appropriate buffers will be implemented. Construction works will be restricted as	Negligible	Reversible in the short-term	Negative	Very low	Not significant. High certainty.

VER	Sensitivity	Potential Effect	Mitigation	Magnitude (after mitigation)	Reversibility (after mitigation)	Nature (after mitigation)	Significance level (after mitigation)	Level of Certainty/ Comments and Significance (in terms of EIA regulations)
			appropriate within buffers until nesting is shown to have ended. Retention of field margins. Creation of species-rich hedge.					
Grey partridge	Low	Loss of breeding and foraging habitat, disturbance	Preconstruction surveys will identify nesting birds. If present appropriate buffers will be implemented. Construction works will be restricted as appropriate within buffers until nesting is shown to have ended. Retention of field margins. Creation of species-rich hedge.	Negligible	Reversible in the short-term	Negative	Very low	Not significant. High certainty.

VER	Sensitivity	Potential Effect	Mitigation	Magnitude (after mitigation)	Reversibility (after mitigation)	Nature (after mitigation)	Significance level (after mitigation)	Level of Certainty/ Comments and Significance (in terms of EIA regulations)
Waders (lapwing, woodcock, curlew)	Low	Loss of habitat, disturbance	Preconstruction surveys will identify nesting birds. If present appropriate buffers will be implemented. Construction works will be restricted as appropriate within buffers until nesting is shown to have ended. Retention of field margins. Change of landuse to grazing	Negligible	Reversible in the short-term	Negative	Very low	Not significant. High certainty. Improved breeding and foraging habitat after construction for most wader species. No suitable breeding habitat for woodcock present.
Crossbill	High	Loss of habitat, disturbance	Preconstruction surveys will identify nesting birds. If present appropriate buffers will be implemented. Construction works will be restricted as appropriate within	Negligible	Reversible in the short-term	Negative	Low	Not significant. High certainty. Only poor and limited breeding habitat onsite, which ample high quality alternative habitat in surrounding area.

VER	Sensitivity	Potential Effect	Mitigation	Magnitude (after mitigation)	Reversibility (after mitigation)	Nature (after mitigation)	Significance level (after mitigation)	Level of Certainty/ Comments and Significance (in terms of EIA regulations)
			buffers until nesting is shown to have ended.					
Other passerines	Low	Loss of habitat, disturbance	Preconstruction surveys will identify nesting birds. If present appropriate buffers will be implemented. Construction works will be restricted as appropriate within buffers until nesting is shown to have ended. Retention of field margins. Creation of species-rich hedge. Change of landuse to grazing	Negligible	Long-term	Positive	Very low	Not significant. High certainty. Change in landuse will benefit skylark and meadow pipit. Creation of species-rich hedge will benefit other passerines.
Reptiles and amphibians	Medium	Loss of habitat, disturbance, increased mortality	Preconstruction surveys, Management Plan if reptiles present	Negligible	Long-term	Positive	Very low	Not significant. High certainty. Only poor habitat onsite. Habitat will be improved by development

VER	Sensitivity	Potential Effect	Mitigation	Magnitude (after mitigation)	Reversibility (after mitigation)	Nature (after mitigation)	Significance level (after mitigation)	Level of Certainty/ Comments and Significance (in terms of EIA regulations)
		through construction	involving ECoW presence during construction, covering of trenches/providing escapes. Retention of field margins and potential hibernacula sites. Change of landuse to grazing and regrading of fields to create south-facing slope will benefit these species.					but remain sub-optimal.
Invertebrates	Low	Loss of habitat, disturbance	Retention of field margins. Creation of species-rich hedge.	Negligible	Long-term	Positive	Very low	Not significant. High certainty. Only poor invertebrate habitat onsite. Development will improve habitat.

OPERATIONAL EFFECTS								
Otter	Very high	Exclusion from foraging habitat due to stock-proof fencing	None	Negligible	Long-term	Negative	Very low	Not significant. High certainty. Site currently offers poor foraging habitat for otter, and habitat after construction will remain sub-optimal. Ample alternative higher quality habitat available in surrounding area.
Badger	Low	Exclusion from foraging habitat due to stock-proof fencing	None	Negligible	Long-term	Negative	Very low	Not significant. High certainty. Site currently offers poor foraging habitat for badger, and habitat after construction will remain sub-optimal. Ample alternative higher quality habitat available in surrounding area.
Bats	Medium	Collision	None	Negligible	Reversible in short-term	Negative	Very Low	Not significant. High certainty.
Common quail	High	Reduced access to medium-sized predators	Stock-proof security fencing will reduce access to medium-sized predators, benefiting ground nesting birds.	Negligible	Long-term	Positive	Very low	Not significant. High certainty.

Grey partridge	Low	Reduced access to medium-sized predators	Stock-proof security fencing will reduce access to medium-sized predators, benefiting ground nesting birds.	Negligible	Long-term	Positive	Very low	Not significant. High certainty.
Waders	Low	Reduced access to medium-sized predators	Stock-proof security fencing will reduce access to medium-sized predators, benefiting ground nesting birds.	Negligible	Long-term	Positive	Very low	Not significant. High certainty.
Passerines	Low	Reduced access to medium-sized predators	Stock-proof security fencing will reduce access to medium-sized predators, benefiting ground nesting birds.	Negligible	Long-term	Positive	Very low	Not significant. High certainty.
Reptiles and amphibians	Medium	Reduced access to medium-sized predators	Stock-proof security fencing will reduce access to medium-sized predators, benefiting reptiles and amphibians.	Negligible	Long-term	Positive	Very low	Not significant. High certainty.
Invertebrates	Low	Egg laying on unsuitable habitat due to confusion with water	White borders on solar PV panels	Negligible	Long-term	Negative	Very low	Not significant. High certainty.

Barn owl	High	Collision	Habitat improvement through the Habitat Management Plan	Negligible	Medium-term	Negative	Very Low	Not significant. High certainty. No good habitat on site, behaviour of birds mitigates against collision.
Skylark	Low	Habitat loss, collision, disturbance		No effects predicted				Not significant. High certainty
DECOMMISSIONING EFFECTS								
Potential decommissioning effects are considered to be of the same nature as construction effects, with the exception that habitat is likely to be restored and displaced species able to return to abandoned areas. Relevant mitigation described under Construction Effects will also be applied during Decommissioning.								

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APPENDIX 1: Photographs

Photo 1: A1.3.2 Mixed plantation woodland around north east site boundary (NO5666242889). © Glenn Norris.

Photo 2: Gorse, broom and rowan understorey of the mixed plantation woodland (NO5669642889). © Glenn Norris.

Photo 3: A2.1 Continuous scrub consisting of raspberry (NO5628243078). © Glenn Norris.

Photo 4: The trees are sparse where the site boundary overlaps the woodland (NO5651242903). © Chris Cathrine.

Photo 5: Example of continuous gorse and broom replacing hawthorn hedgerows lined with large oak trees (NO5646742179). © Glenn Norris.

Photo 6: Example of B4 Improved grassland between arable fields caused by nutrient leaching (NO5592241665). © Glenn Norris.

Photo 7: Dried up drainage ditch with rocky substrate and nutrient-loving vegetation on the banks (NO5592241665). © Glenn Norris.

Photo 8: Example of a dried up sink between field margins (NO5613342729). © Glenn Norris.

Photo 9: Sink with a low flow. Rocky substrate and steep one metre high banks (NO5617642185). © Glenn Norris.

Photo 10: Black Burn running through the east of the landholding (NO5728042801). © Glenn Norris.

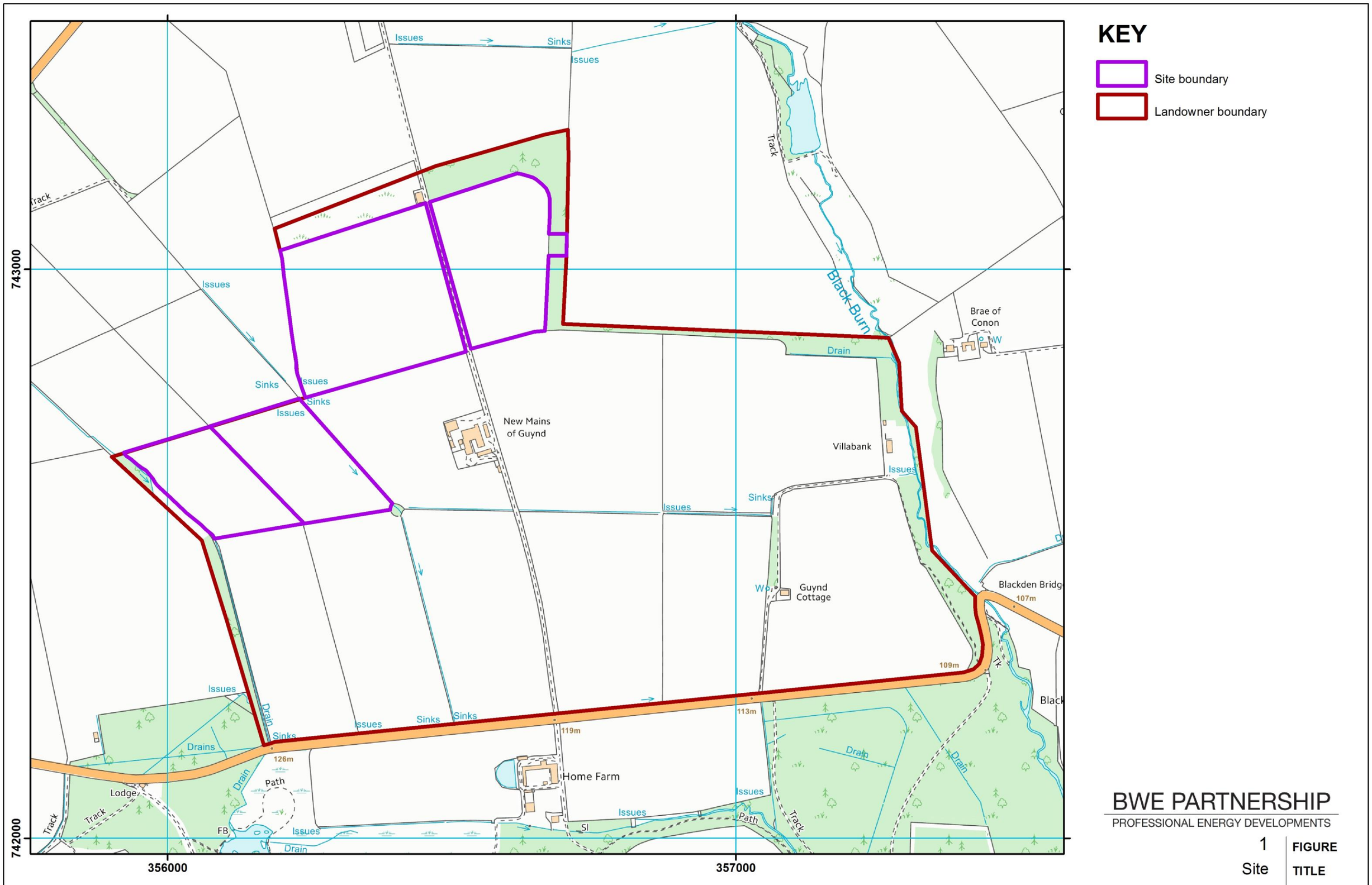
Photo 11: Example of the arable fields present on site (NO5653342851). © Glenn Norris.

Photo 12: an example of J2.2.2 Defunct species-poor hedgerows lining fields (NO5653442802). © Glenn Norris.

Photo 13: Undercut banks and exposed root systems on the bank of Black Burn (NO5728042801). © Glenn Norris.

Photo 14: Large trees with potential for harbouring bat roosts outwith the site boundary (NO5664743174). © Glenn Norris.

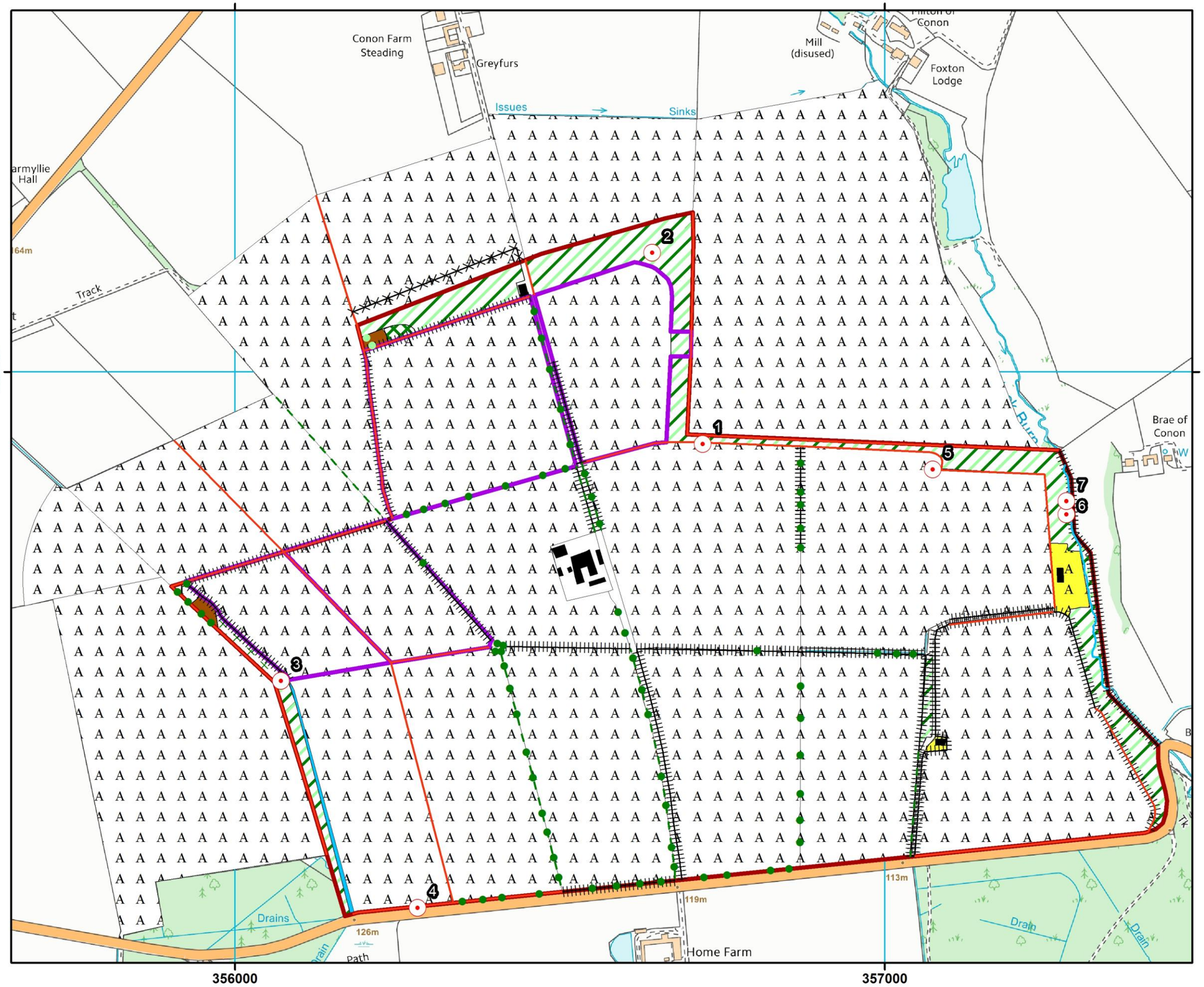
APPENDIX 2: Figures



BWE PARTNERSHIP

PROFESSIONAL ENERGY DEVELOPMENTS

1	FIGURE
Site	TITLE
1:6,000 @ A3	SCALE
CC0221-1	DWG. NO.



KEY

- Target note
- A3.1 Broad-leaved scattered trees
- A3.2 Coniferous scattered trees
- G2 Running water
- J2.2.2 Defunct species-poor hedge
- J2.4 Fence
- J2.5 Wall
- J2.7 Boundary removed
- A1.3.2 Mixed plantation woodland
- A2.1 Continuous scrub
- A2.2 Scattered scrub
- B4 Improved grassland
- C1.1 Continuous bracken
- G2 Running water
- J1.1 Arable
- J1.2 Amenity grassland
- J3.6 Buildings
- J5 Other (track)
- Site boundary
- Landowner boundary

N

BWE PARTNERSHIP
PROFESSIONAL ENERGY DEVELOPMENTS

2	FIGURE
Extended Phase 1	TITLE
1:6,000 @ A3	SCALE
CC0221-2	DWG. NO.

KEY

- Proposed species-rich hedgerow
- Area of proposed felled woodland
- Site boundary
- Landowner boundary

N

BWE PARTNERSHIP
PROFESSIONAL ENERGY DEVELOPMENTS

3	FIGURE
Habitat Loss and Creation	TITLE
1:1,000 @ A3	SCALE
CC0221-3	DWG. NO.