

## CHAPTER 7: ECOLOGY

### INTRODUCTION

- 7.1 This chapter concerns the flora, fauna and habitats potentially affected by the proposed construction of the Heckington Fen Wind Park.
- 7.2 An assessment of the nature conservation value of the site has been made and this chapter explains the ways in which habitats and species may be affected by the development and the significance of any potential impact identified. It sets out any mitigation measures required to reduce the significance of any negative impacts and describes biodiversity enhancements that will be implemented as part of this development. It complements the assessment of ornithological effects in **Chapter 8**.
- 7.3 The ecological assessment follows the approach set out in the Institute of Ecology and Environmental Management (IEEM) Guidelines for Impact Assessment (2006)<sup>1</sup>. These guidelines are based upon the baseline description of the ecological characteristics of the survey area, the evaluation of the habitats and species present (ecological receptors), the identification of ecological impacts, the assessment of the significance of the identified ecological impacts and the identification of mitigation and other measures required to address any identified impacts.
- 7.4 The technical reports, which were prepared following these surveys, can be found in **Appendices 7.1 to 7.4** of this Environmental Statement. The ecological surveys for the proposed wind turbine site at Heckington Fen focuses on the area defined as the 'developable area'; i.e., that area of the site within which the turbines and access roads will be located. The developable area is defined by a number of relevant constraints, restricting where the turbines can be located on the site (see **Chapter 3: Site Selection and Design**). The area surveyed is shown in **Appendix 7.1 Figure 1**.

### LEGISLATION

#### International Legislation

- 7.5 The European Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC)<sup>2</sup> was instigated to schedule important wildlife sites through the EU as Special Areas of Conservation (SACs), and to give protection to habitats and species listed in the Directive as being threatened or of community interest to ensure they are maintained at a favourable conservation status. Annex I of 92/43/EEC lists habitat types which are regarded as being of European importance. Annex II lists individual species that are considered to be of European importance. Annex IVa lists animal species of community interest and in need of strict protection.
- 7.6 SAC designation requires Member States to take appropriate steps to avoid deterioration of the natural habitats of species, as well as significant disturbance of species, for which the site is

designated (Article 6.2). This includes an appropriate assessment of the implications of any plans or projects that, alone or in combination, are likely to have a significant effect on the site in view of the site's conservation objectives (Article 6.3). If a negative assessment is concluded, a plan or project can only proceed if it is for imperative reasons of overriding public interest and no alternative solutions are possible. The Member State must also take compensatory measures to ensure the overall coherence of the Natura 2000 network (Article 6.4). This European law was transposed into UK legislation by the Conservation (Natural Habitats) & Regulations 1994<sup>3</sup> and replaced by the Conservation of Habitat and Species regulation 2010<sup>4</sup> which consolidates all the many amendments which have been made to the Regulations since they were first made in 1994.

- 7.7 Other European legislation, placing certain obligations on member states, includes the Bern Convention<sup>5</sup>. Appendix I of the Bern Convention lists strictly protected flora and Appendix II similarly protected fauna, for which the Convention's contracting parties are required to take appropriate and necessary administrative measures, ensuring their special protection. Particularly prohibited activity with regard to Appendix II species includes the deliberate disturbance of wild fauna, particularly during the periods of breeding, rearing and hibernation. Appendix III of the Bern Convention lists protected fauna and regulates certain activities to ensure that populations of the named species remain out of danger.

#### National Legislation

- 7.8 National wildlife legislation relevant to the proposed development includes the Wildlife and Countryside Act 1981<sup>6</sup> (as amended). This Act provides protection for Britain's flora and fauna. Particular protection is afforded to certain species listed in Schedules to the Act, although the degree and nature of the protection varies.
- 7.9 Schedule 5 of the Wildlife and Countryside Act lists animals that are afforded special protection. Relevant to development plans, this Schedule makes it an offence to damage, destroy or obstruct access to any structure or place which any Schedule 5 animal inhabits. It is also an offence to disturb any such animal while it is occupying a structure or place, which it uses for that purpose. For certain species, different levels of protection are afforded.
- 7.10 Schedule 8 of the Wildlife and Countryside Act lists species of plants which are afforded special protection. Whilst the protection afforded to plants is less complex than for birds or animals, the underlying protection is basically the same. Specifically, it is an offence to pick, uproot or destroy any species listed on Schedule 8 without prior authorisation.
- 7.11 Conservation of Habitat and Species Regulation 2010 is the means by which the European Habitats Directive is implemented in the UK (see paragraphs 7.5 and 7.6) which includes a requirement for competent authorities to consider or review planning permission, applied for or granted, affecting a European site, and, subject to certain exceptions, restrict or revoke permission where the integrity of the site would be adversely affected.

<sup>3</sup> Statutory Instrument 1994 No. 2716 *The Conservation (Natural Habitats, &c.) Regulations 1994*

<sup>4</sup> Statutory Instrument 2010 No.490. *The Conservation of Habitats and Species Regulation 2010*

<sup>5</sup> *Conservation of European Wildlife and Natural Habitats, 1979*

<sup>6</sup> *Wildlife and Countryside Act 1981( as amended)*

<sup>1</sup> IEEM (February 2006). *Guidelines for Ecological Impact Assessment (Final Draft)*. IEEM

<sup>2</sup> Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora 1992

- 7.12 Conservation of Habitat and Species Regulation 2010 makes it an offence to deliberately capture, injure or kill, the animals listed in Schedule 2, or damage or destroy a breeding or resting place of these species. The regulations also prohibited certain methods of capturing or killing of species listed in Schedule 4.
- 7.13 Schedule 5 of the Conservation of Habitat and Species Regulation 2010 lists those plant species of European importance for which it is an offence to deliberately pick, collect, cut, uproot or destroy.

## Protected Species

### Badgers

- 7.14 Badgers (*Meles meles*) and their setts are protected under the Protection of Badgers Act 1992<sup>7</sup>. This means that it is unlawful to knowingly kill, capture, disturb or injure an individual, or intentionally damage, destroy or obstruct an area used for breeding, resting or sheltering by badgers.

### Water Voles

- 7.15 Water voles (*Arvicola terrestris*) are protected in accordance with Schedule 5 (Section 9) of the Wildlife and Countryside Act 1981 (as amended). The legal protection makes it an offence to: intentionally damage, destroy or obstruct access to any structure or place which water voles use for shelter or protection; to disturb water voles whilst they are using such a place; and, to intentionally kill, injure, or take water voles.

### Dormice, Otters and all Bat species

- 7.16 The hazel dormouse (*Muscardinus avellanarius*), otters (*Lutra lutra*) and all bat species are protected under both European and national legislation by virtue of being listed on Annex IV of the European Habitats Directive 1992, Schedule 2 of the Conservation of Habitat and Species Regulation 2010 and Schedule 5 of the Wildlife and Countryside Act 1981 (see Paragraph 5.3 to 5.11).
- 7.17 Otters and four UK bat species are also listed on Annex II of the European Habitats Directive 1992, making them 'strictly protected'. These are Bechstein's (*Myotis bechsteinii*), barbastelle (*Barbastella barbastellus*), greater horseshoe (*Rhinolophus ferrumequinum*) and lesser horseshoe (*R. hipposideros*) bats.

### Amphibians and Reptiles

- 7.18 All native reptiles are listed on Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and are afforded different levels of protection. For the four most commonly occurring species: adder (*Vipera berus*), grass snake (*Natrix natrix*), slow-worm (*Anguis fragilis*) and common lizard (*Lacerta vivipara*) the protection extends to prohibit killing and injury, although does not include habitat protection. In practice, when the presence of reptiles is confirmed, the legislative protection requires that a mitigation programme is undertaken to make 'reasonable effort' to remove animals prior to the commencement of any site preparation or development.

- 7.19 Great crested newt (*Triturus cristatus*) is fully protected in accordance with both national and international legislation. Specifically, the species is listed on Schedule 5 of the Wildlife and Countryside Act 1981 (as amended), making it an offence to knowingly kill, injure, disturb, handle or sell the animal. The protection is afforded to all life stages and includes both the terrestrial and aquatic components of its habitat. The species is also listed under Annexes II and IV(a) of the Habitats Directive and schedule 2 of the Conservation of Habitat and Species Regulation 2010.

## Hedgerows and Trees

### Hedgerows

- 7.20 The Hedgerow Regulations (Defra 1997) provide arrangements for Local Planning Authorities in England and Wales to protect important hedgerows, by controlling their removal through a system of notification. To be 'important', as defined under the Regulations, all or part of the hedgerow must have existed for 30 years or more, and meet at least one of the criteria in Part II of Schedule 1, which is divided into 'Archaeology and history' and 'Wildlife and landscape'. The removal of any hedgerow to which the Regulations apply is permitted if it is required for carrying out development for which planning permission has been granted (and in other circumstances as set out under Regulation 6). The notification system does not apply to many of the situations in which EIAs are carried out. Nevertheless, the Regulations can be useful for valuing hedgerows within the context of EIAs

### Trees

- 7.21 Tree Preservation Orders (TPOs) are made under the Town and Country Planning Act 1990 and the Town and Country Planning (Trees) Regulations 1999. A TPO is made by the local planning authority to protect specific trees or particular woodland from deliberate damage and destruction.

## UK Biodiversity Action Plan

- 7.22 The Biodiversity Action Plan (BAP) is the UK Government's response to the Convention on Biological Diversity signed in Rio in 1992 (JNCC 2006)<sup>8</sup>. This has established a detailed approach for the protection of biological resources and is comprised of Species Action Plans and Habitat Action Plans at both national and local levels. Consequently, consideration will also be given to species identified locally as of conservation concern within the Local Biodiversity Action Plan.
- 7.23 Consideration for the biodiversity action planning process is incorporated into UK law under Part III of the Countryside and Rights of Way (CROW) Act 2000 (amended 2010), which makes it a statutory duty of any authority to have regard to the purpose of conserving biological diversity in accordance with the Rio Convention.
- 7.24 A revised UK list of priority species and habitats received approval from all four UK administrations in 2007. This list, a result of the most comprehensive analysis ever undertaken in the UK, contains 1149 species and 65 habitats which have been listed as priorities for conservation action.

<sup>7</sup> The Protection of Badgers Act 1992

<sup>8</sup> Joint Nature Conservation Committee (2006) UK Biodiversity Action Plan [www.ukbap.org.uk](http://www.ukbap.org.uk)

Local Biodiversity Action Plan

7.25 National biodiversity action plan targets are delivered at a local level through county, local or area biodiversity action plans. At this location this is delivered through the Lincolnshire Biodiversity Action Plan which has been developed and implemented by Lincolnshire Biodiversity Partnership (LBP). The habitats and species listed within the Lincolnshire BAP are listed below:

Table 7.1: Lincolnshire Biodiversity Action Plan Targets

Environment	Habitat Action Plans	Species Action Plans
Coastal and Marine	Coastal Sand Dunes	<b>Amphibians</b>  Natterjack Toad <i>Bufo calamita</i>
	Saline Lagoons	
	Saltmarsh	
Farmland and Grassland	Arable Field Margins	<b>Farmland birds</b>  Grey partridge <i>Perdix perdix</i> , lapwing <i>Vanellus vanellus</i> , curlew <i>Numenius arquata</i> , redshank <i>Tringa totanus</i> , snipe <i>Gallinago gallinago</i> , barn owl <i>Tyto alba</i> , turtle dove <i>Streptopelia turtur</i> , skylark <i>Alauda arvensis</i> , yellow wagtail <i>Motacilla flava</i> , linnet <i>Carduelis cannabina</i> , bullfinch <i>Pyrrhulla pyrrhula</i> , tree sparrow <i>Passer montanus</i> , starling <i>Sturnus vulgaris</i> , reed bunting <i>Emberiza schoeniclus</i> , corn bunting <i>Miliaria calandra</i> , yellowhammer <i>Emberiza citrinella</i> ,  <b>Bats</b>  Daubenton's <i>Myotis daubentonii</i> , Brandt's <i>Myotis brandti</i> , whiskered <i>Myotis mystacinus</i> , Natterer's <i>Myotis nattereri</i> , pipistrelle species <i>Pipistrellus pipistrellus</i> and <i>Pipistrellus pygmaeus</i> , noctule <i>Nyctalus noctula</i> , Leisler's <i>Nyctalus leisleri</i> , Nathusius' pipistrelle <i>Pipistrellus nathusii</i> , barbastelle <i>Barbastella barbastellus</i> , brown long-eared <i>Plecotus auritus</i> , serotine <i>Eptesicus serotinus</i>  Brown hare <i>Lepus europaeus</i>
	Calcareous Grassland	
	Grazing Marsh	
	Hedgerow and Hedgerow Trees	
	Meadows and Pasture	
	Road Verges	
Heathland and Peatland	Heathland and Peatland	
Rivers and Wetlands	Chalk Streams (including Blow Wells)	<b>Plants</b>  Greater Water-parsnip <i>Sium latifolium</i>
	Fens, Swamps and Wet Reedbeds	<b>Invertebrates</b>  River mussel species Witham orb mussel <i>Sphaerium</i>

Environment	Habitat Action Plans	Species Action Plans
	Ponds, Lakes and Reservoirs	<i>solidum</i> , compressed river mussel <i>Pseudanodonta complanata</i>
	Rivers, Canals and Drains	White-clawed crayfish <i>Austropotamobius pallipes</i>  <b>Birds</b>  Bittern <i>Botaurus stellaris</i>
	Springs and Flushes	<b>Mammals</b>  Water vole <i>Arvicola amphibius</i>  Otter <i>Lutra lutra</i>
Trees and Woodland	Ancient Semi-natural Woodland	
	Wet Woodland	
Urban	Churchyards and Cemeteries	<b>Amphibians</b>  Great crested newt <i>Triturus cristatus</i>
	Gardens and Allotments	<b>Urban Birds</b>
	Parks and Open Spaces	Swift <i>Apus apus</i> , song thrush <i>Turdus philomelos</i> , house sparrow <i>Passer domesticus</i>

POLICY

7.26 The following national and local planning policies are of relevance to the ecology assessment. A brief overview of these policies is provided below.

Planning Policy Statements

7.27 Planning Policy Statements (PPS) set out the Government's national policies on various aspects of planning in England. PPS9 (ODPM 2005)<sup>9</sup> sets out planning policies on the protection of biodiversity and geological conservation through the planning system. These policies complement, but do not replace or override, other national planning policies.

<sup>9</sup> Office of Deputy Prime Minister (2005) Planning Policy Statement 9 (PPS9): Biodiversity and Geological Conservation. HMSO, Norwich.

- 7.28 Planning authorities are now required to actively seek in development proposal; measures that aim to promote appropriate priority habitats and species listed in the UK Biodiversity Action Plans and treat these as 'material considerations'. PPS9, states that:

*“Development proposals provide many opportunities for building-in beneficial biodiversity or geological features as part of good design. When considering proposals, local planning authorities should maximise such opportunities in and around developments, using planning obligations where appropriate.”*

- 7.29 Enhancement is therefore a key element of the mitigation strategy outlined in this chapter, which is aimed at securing net biodiversity gain.
- 7.30 The aim of planning decisions should be to prevent harm to biodiversity and geological conservation interests. Where granting planning permission would result in significant harm to those interests, local planning authorities will need to be satisfied that the development cannot reasonably be located on any alternative sites that would result in less or no harm. In the absence of any such alternatives, local planning authorities should ensure that, before planning permission is granted, adequate mitigation measures are put in place. Where a planning decision would result in significant harm to biodiversity and geological interests which cannot be prevented or adequately mitigated against, appropriate compensation measures should be sought. If significant harm cannot be prevented, adequately mitigated against, or compensated for, then planning permission should be refused.

## Regional and Local Plan Policies

### East Midlands Regional Plan (2009)

- 7.31 The Planning and Compulsory Purchase Act 2004 replaced the old system of Structure Plans and Local Plans with a new system of Regional Plans and Local Development Documents making up a Local Development Framework.
- 7.32 The Lincolnshire Structure Plan (adopted September 2006) was replaced by the East Midlands Regional Plan in March 2009. The Schedule of Further Changes published with the Regional Plan lists all Lincolnshire Structure Plan policies alongside the Regional Plan policies which replace them.
- 7.33 The East Midlands Regional Plan provides a broad development strategy for the East Midlands up to 2026. It also represents the spatial element of the East Midlands Integrated Regional Strategy. Policies relevant to Ecology include:

### Policy 4 Development in the Eastern Sub Area

- 7.34 Development in the Eastern Sub-area should:

*Protect and enhance the natural and historic environment of the coastal margin including the Wash and Humber Estuary Special Protection Areas, and the Saltfleetby-Theddlethorpe Dunes Special Area of Conservation;*

*Protect and enhance the Rutland Water Special Protection Area and Grimsthorpe and Baston Fen Special Areas of Conservation.*

## Policy 26: Protecting and Enhancing the Region's Natural and Cultural Heritage

- 7.35 Sustainable development should ensure the protection, appropriate management and enhancement of the Region's natural and cultural heritage. As a result, the following principles should be applied:
- i) *the Region's internationally and nationally designated natural and historic assets should receive the highest level of protection;*
  - ii) *neither direct nor indirect damage to EU designated Natura 2000 sites will be permitted;*
  - iii) *damage to natural and historic assets of their settings should be avoided wherever and as far as possible. Recognising that such assets are irreplaceable;*
  - iv) *unavoidable damage must be minimised and clearly justified by a need for development in that location which outweighs the damage that would result;*
  - v) *unavoidable damage which cannot be mitigated should be compensated for, preferably in a relevant local context, and were possible in ways which also contribute to social and economic objectives;*
  - vi) *there should be a net increase in the quality and active management of natural and historic assets across the region in ways that promote adaptation to climate change, and an increase in the quantity of environmental assets generally; and*
  - vii) *the Region's best and most versatile agricultural land should be protected from permanent loss or damage.*

## Policy 28 Regional Priorities for Environmental and Green Infrastructure

- 7.36 Local Authorities, statutory environmental bodies and developers should work with the voluntary sector, landowners and local communities to ensure the delivery, protection and enhancement of Environmental Infrastructure across the Region. Such infrastructure should contribute to a high quality natural and built environment and to the delivery of sustainable communities.
- 7.37 Local Authorities and those responsible for the planning and delivery of growth and environmental management across the Region should work together to:
- i) *assess the capacity of existing Environment Infrastructure to accommodate change in order to inform decisions on the scale, location and phasing of new development. Account should be taken of current deficits and likely future demands, including those likely to result from climate change, to identify any further needs or constraints;*
  - ii) *select appropriate indicators and targets to monitor the condition of Environmental Infrastructure and to ensure that its capacity to accommodate change is not breached;*
  - iii) *ensure that the provision and design of new Environmental Infrastructure is considered and its delivery planned through environmental capacity analysis at the same time as other infrastructure requirements;*
  - iv) *within Local Development Frameworks develop 'green infrastructure plans' based on character assessments of existing natural, cultural and landscape assets and the identification of new assets required to meet the needs of existing and expanding communities;*



- v) *increase access to green space that can be used for formal and informal recreation, educational purposes and to promote healthy lifestyles, without increasing pressures on sensitive sites, especially those designated under the European Habitats Directive; and identify delivery and funding mechanisms for the creation and future management of Green*
- vi) *Infrastructure, including from the planning system and other funding sources such as EU funded Environmental Stewardship Schemes.*

### Policy 29: Priorities for Enhancing the Region's Biodiversity

- 7.38 Local Authorities, statutory environmental bodies and developers should work with the voluntary sector, landowners and local communities to implement the Regional Biodiversity Strategy, and to deliver a major step change increase in the level of biodiversity across the East Midlands. Measures should include the:
- i) *achievement of the East Midlands regional contribution towards the UK Biodiversity Action Plan targets.*
  - ii) *establishment of large scale habitat creation projects in the biodiversity conservation and enhancement areas*
  - iii) *Establishment of a regional project to promote the re-creation of key wildlife habitats in each Natural Area in the East Midlands;*
  - iv) *Creating, protecting and enhancing networks of semi-natural green spaces in urban areas;*
  - v) *Creating, protecting and enhancing features of the landscape which act as corridors and 'stepping stones', essential for the migration and dispersal of wildlife*
  - vi) *Development and implementation of mechanisms to ensure that development results in no net loss of BAP habitats and species, particularly for restricted habitats with special environmental requirements, and that net gain is achieved; and*
  - vii) *Development and maintenance of appropriate data to monitor and report on regional targets, BAPs and BCAs/BEAs.*

### North Kesteven Local Plan

- 7.39 The North Kesteven Local Plan was adopted in 2007. Under the provisions of the Planning and Compulsory Purchase Act 2004, the North Kesteven Local Plan expired 21 September 2010. However following North Kesteven District Council's application, the Secretary of State has directed that all policies of the North Kesteven are saved beyond the expiry of the plan. Policies relevant to ecology include;
- 7.40 Policy C17 - Renewable Energy Planning permission will be granted for development providing for, or associated with, the generation and distribution of energy from renewable sources provided that:
- (Text omitted)...*
- i. where the proposal would have an adverse effect on a site of international importance for nature and heritage conservation, there is no alternative solution and there are imperative reasons of overriding public interest;

- ii. where the proposal is in a nationally designated area, the objectives of the designation of the area will not be compromised, and any adverse effects on the qualities of the area are outweighed by the environmental, social and economic benefits.

### Policy LW5 - Sites of Special Scientific Interest

- 7.41 Planning permission will be granted for proposals that will directly or indirectly adversely affect a Site of Special Scientific Interest (as shown on the Proposals Map) only if:
1. *The benefits of the development, on the site, clearly outweigh the likely impacts on the features of the site that make it of special scientific interest and any broader impacts on the national network of SSSIs;*
  2. *The proposed development could not feasibly be located in a less sensitive location; and*
  3. *Where appropriate, the implementation of measures to minimise, mitigate or compensate for the harm, or to ensure the future management and enhancement of the site's interest, is assured by means of an agreement between the developer and the Council or by means of a condition upon the permission.*

### Policy LW6 - County Wildlife Sites and Local Nature Reserves

- 7.42 Planning permission will be granted for proposals that will directly or indirectly adversely affect a County Wildlife Site or a Local Nature Reserve (as shown on the Proposals Map), only if:
1. *There is a need for the development which clearly overrides the importance of the Site or Reserve;*
  2. *The proposed development could not feasibly be located in a less sensitive location; and*
  3. *Where appropriate, the implementation of measures to minimise, mitigate or compensate for the harm, or to ensure the future management and enhancement of the Site's interest, is assured by means of an agreement between the developer and the Council or by means of a condition upon the permission.*

### Policy LW7 - Features of importance for wildlife

- 7.43 Planning permission will be granted for proposals that will directly or indirectly adversely affect any habitat listed as a priority in the Lincolnshire Biodiversity Action Plan or an existing landscape feature (such as a pond, reservoir, lake, gravel pit, disused railway, road verge, river, canal or drain or their banks, building traditional field boundary (such as a hedgerow or stone wall), linear tree belt/shelter, plantation or small woodland, larger semi-natural or ancient woodland, heathland, parkland, semi-natural grassland or unimproved pasture) that is important for wild flora or fauna, only if:
1. *The need for the development clearly override the importance of the feature; and*
  2. *Where appropriate, the implementation of measures to minimise, mitigate or compensate for the harm, or to ensure the future management and enhancement of the feature's value, is assured by means of an agreement between the developer and the Council, or by means of a condition upon the permission.*

### Policy LW8 - Protected species

- 7.44 Planning permission will be granted for proposals that will adversely affect protected species or their habitat, only if:
1. *The need for the development clearly override the importance of the protected species;*
  2. *The proposed development could not feasibly be located in a less sensitive location; and*

3. *An agreement between the developer and the Council or a condition upon the permission will:*
- Facilitate the survival of individual members of the species;*
  - Reduce disturbance to the minimum;*
  - Provide adequate alternative habitats to sustain at least the current levels of population of the species.*

## Methodology

### Scope of the Ecological Survey

- 7.45 The scope of this ecological impact assessment is restricted to the potential direct and indirect impacts to selected ecological receptors found on the site due to the construction, operation, and decommissioning of a proposed wind park. Selected ecological receptors are those that have been awarded statutory and/or non-statutory conservation status.
- 7.46 This proposed development comprises the erection of up to 22 wind turbines and associated infrastructure, including access tracks, sub-station building and underground cabling within the Heckington Fen Site. The proposed turbines have maximum dimensions of 80m to hub, 45m blade lengths with a blade sweep from between 35m to 125m above the ground. Full project description details are provided in **Chapter 4: Project Description**.

### Desk Study Methodology

- 7.47 The desk-based study methodology was to consult with both statutory and non-statutory bodies pre-application in order to determine the ecological interests (both the confirmed and potential) within the site and the area adjacent to the site.
- 7.48 Data searches were requested for protected species from Lincolnshire Environmental Records Centre (LERC) in January 2011. Records of all protected plant and animal species (excluding birds) were requested within a five kilometre radius of the proposed development site centre. The search distance was increased to 15km for bat species. The National Biodiversity Gateway website (<http://data.nbn.org.uk/>) was also used to search for species records.
- 7.49 Any existing records of designated nature conservation sites (e.g. Sites of Special Scientific Interest (SSSI), and Local Wildlife Sites (LWS)) on the site and up to 5km away were obtained by a search of the MAGIC Database and a request for a data search to Lincolnshire Environmental Records Centre (LERC).

### Field Survey Methodology

#### Extended Phase I

- 7.50 An extended Phase 1 habitat survey was conducted during site visits on the 30th July, 15th, 19th, and 20th of August 2009. The area surveyed for the extended Phase 1 habitat survey was an area encompassing the developable area and a buffer extending to 500m from the proposed development where access was permitted. Target notes were used to identify areas suitable for particular species. In addition, a badger survey and a water vole survey were undertaken on the 19th October. See **Appendix 7.1: Extended Phase 1 Habitat Survey** for full report details including methodology.

- 7.51 The habitat types were recorded during the extended Phase 1 habitat survey using the standard methodology as outlined in the Nature Conservancy Council Handbook (1990) (**Figure 7.1: Phase 1 Habitat Survey**). This method provides a broad overview of the habitat resource and aims to describe the character, distribution and importance of habitat types in the survey area. However, it does not provide an assessment of the botanical composition of each habitat type surveyed; this requires a Phase 2 or National Vegetation Classification Survey.
- 7.52 The survey involved searching for indications and/or signs of the following Protected Species:
- Amphibians - water bodies and terrestrial habitat were assessed as to their potential to support amphibians;
  - Reptiles – the site was assessed for suitability for use by reptiles, and surveyors looked for casual reptile observations. In addition, suitable refuges and resting places (old carpets, sheets of metal, plastic or wood) were, where possible, lifted up to check for the presence of reptiles;
  - Water voles - the water courses and ditches found on the site were searched for evidence of water voles including latrines, nests in vegetation, sounds of voles entering water, tunnel entrances, cropped 'lawns' around tunnel entrances and feeding stations of chopped vegetation;
  - Hazel dormice – the land was searched for suitable dormouse habitat;
  - Badgers - the land was searched for evidence of setts, latrines, scratches on trees, badger hair on barbed wire across animal trails, snuffle holes or feeding activity; and
  - Otters – the watercourses within and adjacent to the site were checked for signs of otter including 'spraint' deposited on prominent rocks, stones, logs or branches within watercourses and tracks and slides in soft mud adjacent to the watercourses.

#### Great Crested Newts

- 7.53 There is one pond within the study area along with a network of drains, some of which were identified during the extended Phase 1 survey as having the potential to support great crested newts. 11 points (including the pond) were surveyed for great crested newts, with areas likely to be used as crossing points for the access roads targeted.
- 7.54 Four surveys were undertaken on the 5th, 10th, 20th and 24th May 2010 and included bottle trapping, torching, netting and egg searches. **Appendix 7.4: Great Crested Newt Survey** details the methodology used to carry out the assessment.

#### Bats

- 7.55 An assessment of potential foraging habitat and roost sites within the land holding was conducted during the extended Phase 1 surveys in 2009. **Appendix 7.1: Extended Phase 1 Habitat Survey** details the methodology used to carry out the assessment.
- 7.56 A total of seven activity surveys were conducted on four transect routes, with four surveys undertaken during 2009 and three surveys during 2010. Four surveys were carried out on a further two transects during 2009; these were not repeated during 2010 as this part of the site was removed from the developable area.

7.57 Bat activity surveys were conducted in summer and autumn 2009. Six transect routes were walked to cover the whole site, routes (A) to (F). The Transect surveys for route (A) and (B) were conducted from just after dusk for approximately 3 hours on 28th July, 11th August, 17th August and 1st September, 2009; routes (C) and (D) were surveyed on 30th July, 15th August, 18th August and 3rd September, 2009; routes (E) and (F) were surveyed on 31st July, 16th August, 19th August and 4th September, 2009. See **Appendix 7.2 Bat Activity Surveys 2009** for details.

7.58 Further bat activity surveys were conducted in spring and early summer 2010. **Appendix 7.3 Bat Activity Surveys 2010** details methods used. The Transect surveys for route (A) and (B) were conducted from just after dusk for approximately 3 hours on 19th April, 14th May and 17th June, 2010; routes (C) and (D) were surveyed on 22nd April, 21st May, and 28th June, 2010.

7.59 Roost emergence and dawn swarming surveys were undertaken of the 11 buildings and two trees on the site considered potentially suitable for use by roosting bats during 2009 and 2010. Buildings B1 to B8, B11, B12, B14, T15 and T22 were surveyed, with between one and six surveys undertaken depending on the suitability of the building. See **Appendix 7.2 Bat Activity Surveys 2009** and **Appendix 7.3 Bat Activity Surveys** for details.

#### **Further Surveys**

7.60 A further ecological visit was undertaken on the 17th February 2011 by an Ecotricity ecologist, to update the Phase 1 survey map and to check for any changes to habitats and/or species which may have occurred on the site.

#### **Assessment of significance**

7.61 This section describes the methodology used to assess the significance of effects of the proposed development upon the non-avian ecological resources of the site. The methodology uses professional judgement to do the following:

- i) Identify and value the nature conservation interest of the site in a systematic manner, establishing levels of interest for its main ecological features;
- ii) Assess the likely magnitude of impact of the development on each feature of nature conservation interest; and,
- iii) Assess the significance of ecological effects in relation to the level of ecological interest and impact magnitude.

7.62 This approach follows guidelines on ecological assessments that have been produced by the Institute of Ecology and Environmental Management (IEEM).

#### **Receptor value**

7.63 In an environmental impact assessment context, features of nature conservation interest are considered to be the ecological receptors. These are populations, species, communities, habitats and sites selected as likely to be affected (in a positive or negative way) by the environmental changes created by a proposed development.

7.64 The important ecological receptors define the nature conservation interest of the development site and must be valued to provide a basis for assessing the impacts of a development. Valuation

usually seeks to assign a geographical frame of reference for the importance of an ecological receptor. Those used are as follows:

**Table 7.2: Determining factors for nature conservation importance**

Designation	Importance
<b>International</b>	Sites of international importance on the basis of their habitats or species are designated under the EU Habitats Directive and include Special Areas of Conservation (SACs). Candidate or potential sites for these designations are also considered to be of international importance. Species protected under Annex II of the Habitats Directive and given UK protected status by Schedule 2 of the Conservation of Habitats and Species Regulation 2010.
<b>National</b> (i.e. England, Wales, Scotland or Northern Ireland)	Special Scientific Interest (SSSIs) are of national importance and are designated under the Wildlife and Countryside Act 1981 using guidelines on their selection (JNCC, 1998), as well as the presence of species listed in Schedule 5 of the Act .
<b>Regional</b>	Local authorities and County Wildlife Trusts may have designated sites of regional importance, designation criteria being published locally. This may include areas, habitats or species identified in regional Biodiversity Action Plans .
<b>County (or Metropolitan)</b>	Local authorities and County Wildlife Trusts may have designated sites at regional, county or district levels (e.g. Sites of Importance for Nature Conservation – SINC) and the designation criteria may be published locally.
<b>District (or Unitary Authority, City or Borough)</b>	In some local authority areas there is a 2 tier system of designation of local sites with sites of District or Borough importance in addition to those of County or Metropolitan importance.  Local Nature Reserve (or LNR) is a statutory designation made under Section 21 of the National Parks and Access to the Countryside Act 1949 by principal local authorities ,Parish and Town Councils
<b>Local or Parish</b>	Habitats within a parish of local importance which may be designated as Local Nature Reserves or local designations such as pocket parks or village greens
<b>Within zone of influence only (site or study area).</b>	Habitats of ecological importance within the site such as hedgerows providing ecological connectivity

7.65 Sites worthy of designation with habitat and/or species interest at any level must have a 'viable area' of habitat. Viability means that the area should be sufficient to maintain the habitat interest in adequate condition through appropriate management (which might involve some form of rotational manipulation of vegetation), as well as providing sufficient territory and suitable habitat for the breeding and wintering populations of species of interest.

7.66 It is more difficult to judge a level of importance for study areas/sites with no designation. Ecological resources contributing to the biodiversity or nature conservation importance of a study area may include:

1. Internationally, nationally or locally rare or uncommon species, subspecies or varieties;
2. Ecosystems or their parts supplying the requirements of populations of the above species
3. Habitat rarity, diversity and connectivity;
4. Communities typical of valued natural or semi-natural vegetation types
5. Large populations of uncommon or threatened species;
6. Species-rich assemblages;
7. Species on the edge of their range; and,
8. Typical faunal assemblages of homogenous habitats.

7.67 Establishment of the level of importance relating to the ecological features found by the baseline surveys firstly involves applying the criteria for designation of international, national and sub-national (where available) sites to the feature set. The approach should be to consider the ecologically coherent unit(s) of the study area and to establish as well as possible the extent of equivalent ecologically coherent units at the local, regional, national and international scales in order that the study area can be placed in context.

7.68 Reference to national and local Biodiversity Action Plans is necessary, although the biodiversity importance of a particular species must be judged in relation to its rarity, distribution (national and international, including consideration of its mobility), population size, status (e.g. population stable or declining) and priority according to biodiversity action plans.

7.69 Other aspects that may be important in the valuation of habitats and species include potential value (e.g. the potential for habitat enhancement or creation), social value (e.g. the value of the study area to local people for recreation and the enjoyment of wildlife), economic value (e.g. hunting and fishing interests or the value of the ecological interest as a tourist attraction), and secondary ecological value (e.g. buffer zones to areas of greater importance or areas that are important in ecological networks or corridors).

7.70 Legal protection must be considered and may apply to habitats and species that are rare and declining and are covered by statutory instruments such as the Conservation (Natural Habitats) & Regulations 1994, the Countryside and Rights of Way Act (CROW Act) 2000 and the Wildlife and Countryside Act 1981. Species may be protected under legislation (e.g. parts of the Wildlife and Countryside Act 1981, the Protection of Badgers Act 1992 and the Wild Mammals (Protection) Act 1996) for reasons other than rarity. In these cases the ecological importance of the species concerned must be judged in their local context.

#### **Potential Risk to Bats**

7.71 Based on available information Natural England (in guidance note TIN051) have made a preliminary assessment of species of bat and bat populations likely to be at risk from wind farms (Tables 7.3 and 7.4).

**Table 7.3: UK bat species likely to be at risk from wind turbines**

Low Risk	Medium risk	High risk
<i>Myotis</i> species	Serotine	Noctule
Long-eared bats	Barbastelle	Leisler's
Horseshoe bats	Common pipistrelle	Nathusius pipistrelle
	Soprano pipistrelle	

**Table 7.4: UK bat populations likely to be threatened due to impacts from wind turbines**

Low Risk	Medium risk	High risk
<i>Myotis</i> Species	Serotine	Noctule
Long-eared bats	Barbastelle	Leisler's
Horseshoe bats		Nathusius pipistrelle
Common pipistrelle		
Soprano pipistrelle		

#### **Predicting and characterising impacts**

7.72 Following the identification of the activities likely to cause significant impacts, it is necessary to predict and characterise the resultant changes and to assess the impact on the valued ecological resource.

7.73 In order to do this, it is necessary to take into account the effects the following parameters would have on the ecological structure and function of the relevant feature.

#### **Likelihood**

7.74 A level of likelihood should be attached to both the occurrence of a predicted impact and the assessment of its ecological effect:

Table 7.5: Likelihood of occurrence

Likelihood	Definition
<b>Certain/near-Certain:</b>	Probability estimated at 95% chance or higher.
<b>Probable</b>	Probability estimated above 50% but below 95%.
<b>Unlikely</b>	Probability estimated above 5% but less than 50%.
<b>Extremely Unlikely</b>	Probability estimated at less than 5%.

**Positive or Negative impact**

- 7.75 In addition, a description of any potential impact also needs to address whether that impact will have a positive or negative effect on the population level of a particular species or habitat.

**Magnitude**

- 7.76 The size or amount of an impact e.g. a small increase in the population of a rare species is displaced, or a total loss of the structure and function of semi natural grassland. Broad categories of spatial magnitude can be defined as below:

Table 7.6: Spatial magnitude criteria

Magnitude	Definition
<b>Very High</b>	Total loss or very major alteration to key elements/features of the baseline (pre-development) conditions such that the post development attributes would be fundamentally changed and may be lost altogether. Guide: >80% of population lost (or gained).
<b>High</b>	Major loss or major alteration to key elements/features of the baseline conditions such that the post development attributes would be fundamentally changed. Guide: 21-80% of population lost (or gained).
<b>Moderate</b>	Loss or alteration to one or more key elements/features of the baseline conditions such that post development attributes would be partially changed. Guide: 6-20% of population lost (or gained).
<b>Minor</b>	Shift away from baseline conditions. Change arising from the loss/alteration would be discernible but the underlying attributes would be similar to pre-development circumstances/patterns. Guide: 1-5% of population lost (or gained).
<b>Negligible</b>	Very slight change from baseline conditions. Change barely distinguishable, approximating to the "no change" situation. Guide: < 1% population lost (or gained).

**Duration and Reversibility**

- 7.77 The period over which the impact is expected to last prior to recovery and replacement of the feature is considered. An irreversible (permanent) impact is one from which recovery is not possible. A reversible (temporary) impact is one from which recovery is possible.

Table 7.7: Temporal magnitude criteria

Magnitude	Definition
<b>Permanent</b>	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).
<b>Temporary</b>	Long term (15 - 25 years or longer)
	Medium term (5 – 15 years).
	Short term (up to 5 years).

**Timing and frequency**

- 7.78 Some changes may only cause an impact if they happen to coincide with critical life stages or seasons, such as the bird nesting season. The frequency of an activity should also be considered.

**Effect significance**

- 7.79 Having identified the ecologically important features likely to be affected by the development, the current IEEM guidance moves away from the use of a matrix in which ecological value and magnitude of impact are combined to determine different grades of significance based on subjective assessment.

- 7.80 Instead, a transparent approach is promoted in which an impact is determined to be significant or not on the basis of an evaluation of the factors that categorise it.

- 7.81 The IEEM (2006) guidance defines a significant effect as an effect:

*"(negative or positive) on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a defined geographical area"<sup>10</sup>.*

- 7.82 The concept of integrity is defined as follows:

<sup>10</sup> IEEM (February 2006). *Guidelines for Ecological Impact Assessment (Final Draft)*. IEEM

*“The integrity of a site is the coherence of its ecological structure and function, across its whole area, which enables it to sustain the habitat, complex of habitats and/or the levels of populations of species for which it was classified” (HMSO, 2005).*

7.83 A site that achieves this coherence is said to be in favourable condition. Effects on the integrity of a site/ecosystem will move it towards (positive) or away from (negative) favourable condition by, for instance, changing or removing ecosystem processes; changing the nature, extent, structure and function of component habitats; or by changing the average population size or viability of component species.

7.84 Sites with international designations (SACs, SPAs) frequently have conservation objectives (or similar) against which likely changes (and hence potential effects on the site's integrity) should be assessed. SSSIs may also have similar criteria.

7.85 The IEEM guidance also recommends that the concept of conservation status is used to determine whether effects are likely to be ecologically significant, using the following definitions:

*“for habitats, conservation status is determined by the sum of the influences acting on the habitat and its typical species, that may affect its long-term distribution, structure and functions as well as the long-term survival of its typical species within a given geographical area;*

*“for species, conservation status is determined by the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within a given geographical area”.*

7.86 In order to determine whether there is likely to be an effect on the integrity of a site or the conservation status of a habitat or species, the following points should be considered:

*Will any site / ecosystem processes be removed or changed;*

*What will be the effect on the nature, extent, structure and function of habitats; and*

*What will be the effect on the average population size and viability of species.*

7.87 The importance level of the ecological feature concerned then defines the geographical level at which the effect is significant, although it may be the case that the effect could be considered significant at a lower geographical level than that at which the feature is important, depending on the magnitude of the effects.

### Limitations of assessment

7.88 It is neither possible nor intended to cover the entire ecology of a site during a survey such as this. This report will nonetheless identify the probable value of the site in nature conservation terms, based upon the survey data gathered. It does not attempt to describe the total ecological composition of the study area.

7.89 Although best practice was followed for the faunal field surveys, the species in question are secretive animals and it is quite possible that some field signs were overlooked. In addition, usage of a site by many mammal species for foraging, shelter and as a transit route varies with season, and the surveys carried out therefore represent only ‘snapshots’ of activity on the site. It should also be noted that absence of recorded field signs is not necessarily evidence that a particular species is

not utilising an area. However, this report will identify the probable value of the site for the pertinent species, based upon the survey data gathered.

## BASELINE CONDITIONS

7.90 This section provides a summary of available desk-based information, and the results of field surveys and consultations.

### Desk Studies

#### Statutory designed sites

7.91 There are no European (Ramsars, SAC & SPA) or national (SSSI, NNR, LNR) statutory designated sites within 10km of the site. The nearest SSSI is Horbling Fen SSSI located 11.5km to the southwest of the site, designated for its geological interest. The Wash, situated approximately 17km to the southeast of the site at its nearest point, is the nearest SAC, SPA and Ramsar site. See **Figure 7.1** for locations of statutory designated sites surrounding the site.

#### Non-Statutory designated sites

7.92 Cole's Lane Ponds LWS is located 6km southeast of the site. The site consists of two ponds surrounded by bankside trees and scrub. There is an area of wet grassland to the west and north of the smaller pond.

7.93 South Forty Foot Drain LWS is located approximately 1km to the south of the site. This is a man-made watercourse with bankside vegetation comprising rough neutral grassland, scrub and trees. The site is a good corridor linking the centre of Boston with the River Witham.

7.94 Heckington Grassland SNCI is located approximately 5km to the east of the site. This site consists of grassland bordered by hedgerows and is used by a variety of breeding and over-wintering birds

7.95 Old Wood South Kyme SNCI is located approximately 5km to the north of the site, and is an area of woodland with Ash coppice, scrub, Elm and tall herbs.

7.96 See **Figure 7.1** for locations of non-statutory designated sites surrounding the site.

### Protected Species

#### Amphibians

7.97 One great-crested newt record was revealed, from the 1km grid square to the west of the site. This record dated from 1977. Several common amphibian records were revealed from the area surrounding the site, including common frog, common toad and smooth newt. Figure 7.2 shows the location of protected species records.

#### Reptiles

7.98 Two historical grass snake records were revealed from the 1km grid square north of the site, dating from 1977. No further reptile records were provided for the area. Figure 7.2 shows the location of protected species records.

### Mammals

- 7.99 Numerous (150) water vole records were revealed from the surrounding 5km. The nearest of these was at East Heckington, immediately southwest of the site, dating from 2006.
- 7.100 Numerous (74) hare records were revealed from around the site, including historical (1977) records from the 1km squares within the site.
- 7.101 Numerous (79) brown long-eared bat records were revealed from within 15km of the site, including a roost at South Kyme approximately 3.5km to the northeast of the site. Numerous (112) common pipistrelle (*Pipistrellus pipistrellus*) records were revealed from the area, the nearest of which was 2.9km to the east of the site. One soprano pipistrelle (*Pipistrellus pygmaeus*) record was revealed from 6.4km to the west of the site. One barbastelle record was revealed from 6.5km to the west of the site, dating from 2001. The nearest noctule (*Nyctalus noctula*) record is from Tatershall 11.8km to the north of the site. The nearest Leisler's (*N. Leisleri*) record is from Kirkby Moor in the 1km grid square 15km to the north of the site. The nearest serotine (*Eptesicus serotinus*) record is from Cowbridge, 12.5km to the east of the site, dating from 2003.
- 7.102 There are 36 records of badgers including several setts within 5km of the site. The exact location of these was not provided but the closer setts are present at East Heckington immediately south of the site, Bicker Fen and Great Hale Fen North Drain.
- 7.103 Two otter records were revealed from the area, dating from 2010. These were a fresh spraint at Skerth Drain approximately one kilometre to the east of the site, and a dead individual on the road at South Forty Foot Drain approximately two kilometres to the southeast of the site. **Figure 7.2** shows the location of protected species records.

### Habitat Surveys

#### General site location

- 7.104 This site is made up of 604 hectares of farmland situated in the Fens Natural Area. Due to the presence of high quality agricultural soils, arable farmland comprises a major proportion of the habitats currently present within the Natural Area. This widespread habitat includes ecologically important features such as hedgerows and mature trees, ditches and ponds, drains and small watercourses and rough grassland such as is found alongside tracks and on road verges. These habitats give much of the character to the Natural Area and support a wide range of species, including some that have undergone dramatic recent declines such as skylark and grey partridge.
- 7.105 The site is located some 11km west of Boston at Heckington Fen, in Lincolnshire. The survey area is diamond shaped being approximately 2.5 km by 2.2 km centred on grid reference TF 208 457. The area comprises largely of Six Hundreds Farm situated to the south and west of the main Head Dyke-Skerth Drain and north of the A17 trunk road. The farm consists of arable farmland with large open fields growing winter wheat, winter barley and winter sown oilseed rape. The habitats identified on the site can be seen in the Phase 1 habitats map **Appendix 7.1 Figure 1**.

### Habitat within the site

*Hedges, woodland and individual trees.*

- 7.106 There are three young plantations of mainly small young deciduous trees within the site, largely to provide pheasant cover. These are located to the north, northwest and west of Six Hundreds Farm. The plantation south of Six Hundreds Farm is more mature and contains some standard Ash and Oak trees. There are two short lengths (in total approximately 380m) of species-poor hedgerows on the site, to the south of Six Hundreds Farm, with Hawthorn, Blackthorn, Ash, Dog Rose and Bramble; and there are a number of standard trees and areas of scattered scrub.

#### Drainage Ditches

- 7.107 The land is drained by a network of drainage ditches which also act as field boundaries; many of these are less than 1 metre in depth and 1.5m in width. Some of these hold water on a permanent basis and others were only seasonally wet ditches. Many of the dry ditches were choked with vegetation including *Typha*, sedges, rank grasses and some bramble. Some of the major drains present were more than 2.0m in depth and up to 3.5m in width and permanently held water and contained plants such as Frogbit *Hydrocharis morsus-ranae* and Broad-leaved Pondweed *Potamogeton natans* as well as *Phragmites* and other riparian vegetation.
- 7.108 Head Dyke-Skerth Drain is an Environment Agency main river which runs along the northern edge of Six Hundreds farm before passing in a north-west to south-eastern direction separating Six Hundreds Farm from Spinney Farm. Head Dyke-Skerth Drain is a large, deep, canalised permanently wet drain approximately 5m wide with steep sides. There are two pumping stations on the site which allow the water level of the drains across the site to be regulated by moving water into the Head Dyke-Skerth Drain. Permanently wet drains approximately 2m wide run parallel to the Head Dyke-Skerth Drain on each side. Holland Dyke forms the eastern boundary of the site. This is also a permanently wet drain which drains into Head Dyke-Skerth Drain at Trinity College Pumping Station.

#### Grassland

- 7.109 The arable fields were generally cultivated right up to the field margins resulting in very few areas of botanical or ecological importance. A few of the intensively farmed arable fields were bordered on headlands by rough grassland (see **Appendix 7.1: Extended Phase 1 Habitat Survey**). Head Dyke-Skerth Drain runs between two built-up earth banks, with smaller drains on either side. These banks are grassed and used for grazing sheep and cattle.

#### Buildings

- 7.110 There were twelve buildings on the site. At Six Hundreds Farm buildings there were four modern agricultural barns, a single storey barn/stables, a two storey barn, an open-fronted barn, a small electricity building and a row of two semi-detached disused two storey houses. The houses had an overgrown mature garden with fruit trees, surrounded by tall hedges.
- 7.111 In addition to the farm buildings there are two pumping stations present on Head Dyke-Skerth Drain, and two concrete bridges which span the Head Dyke-Skerth Drain. At Spinney Farm to the northeast of the site there was a single storey barn which was included in some of the surveys.



## Species surveys

### Flora

- 7.112 None of the plant species recorded during the survey are specifically protected by the Wildlife and Countryside Act (WCA) 1981 (as amended) or considered rare nationally or locally (e.g. Preston et al. 2002). Also, none are listed as Species of Principal Biological Importance on Section 41 of the NERC Act 2006 or as Priority Species listed on the national BAP (UK BAP 2007). Further details of the species present are provided in **Appendix 7.1: Extended Phase 1 Habitat Survey**.

### Amphibians

- 7.113 Amphibian surveys did not reveal the presence of great crested newts. Common frog, common toad and smooth newt were recorded in several of the sections of drains surveyed (see **Appendix 7.3: Great Crested Newt Survey**).

### Reptiles

- 7.114 The site is largely unsuitable for reptiles due to the lack of suitable rough grassy areas for foraging or breeding. No casual observations of basking reptiles were made at the site during the Phase 1 visits (see **Appendix 7.1: Extended Phase 1 Habitat Survey**). The grassy banks adjacent to the canalised Head Dyke-Skerth Drain may possibly support a relict population of reptiles. However, this area is beyond the development footprint and will not be affected by the wind farm construction.

### Water vole

- 7.115 No evidence of water voles was observed at the site. However, some of the ditches on the site which permanently hold water appeared to provide potentially suitable habitat for water voles (see **Appendix 7.1: Extended Phase 1 Habitat Survey**). American mink (*Neovison vison*), a major predator of water voles, were recorded on the site. Mink presence can cause the extinction of water voles populations. Their presence, along with the fact that large parts of the ditch network are only seasonally wet, may explain the lack of water voles.

### Hazel dormouse

- 7.116 There is no habitat suitable for hazel dormice within the site; and no historic evidence of the presence of hazel dormice in the area (see **Appendix 7.1: Extended Phase 1 Habitat Survey**).

### Bats

- 7.117 A low number of common pipistrelle bats use the site, with activity concentrated around Holland Dike and Head Dyke-Skerth Drain, the larger woodland block and the buildings. Records of small numbers of myotis bats (likely to be Daubentons (*Myotis daubentonii*)) and a possible brown long-eared bat were observed on the site. The highest concentration of bats was along the banks of Head Dyke-Skerth Drain to the north of the site, with a total count of six bats recorded at Wait Point 14 on Transect B on 7 surveys over the season's recording, and a total of 23-24 records of Common Pipistrelle bats on the walk between Wait Points 13 and 14 on Transect B on seven activity surveys (up to 5 on one survey). The wait points and walks between wait points on the remainder of the site each had 5 or less bat passes over the season of surveys, with a large number having no bat passes at all. Out of a total of 97 hours of bat transect surveys only 212 bats

were recorded on the site. A diagram presenting the bat transect survey results can be found in Appendix 7.3 Figure 1.

**Table 7.8 Bat activity transect survey total results**

Transect	Dates surveyed	Total survey time hours	Total records of bats
A (6km)	28th July 2009	21	36
	11th August 2009		
	17th August 2009		
	1st September 2009		
	19th April 2010		
	14th May 2010		
	17th June 2010		
B (6.6km)	28th July 2009	21	83
	11th August 2009		
	17th August 2009		
	1st September 2009		
	19th April 2010		
	14th May 2010		
	17th June 2010		
C (5.8km)	30th July 2009	21	25
	15th August 2009		
	18th August 2009		
	3rd September 2009		
	22nd April 2010		
	21st May 2010		

Transect	Dates surveyed	Total survey time hours	Total records of bats
	28th June 2010		
D (4km)	30th July 2009	21	5
	15th August 2009		
	18th August 2009		
	3rd September 2009		
	22nd April 2010		
	21st May 2010		
	28th June 2010		
E (3.5km)	31st July 2009	12	40
	16th August 2009		
	19th August 2009		
	4th September 2009		
F (4.6km)	31st July 2009	12	23
	16th August 2009		
	19th August 2009		
	4th September 2009		
Total		97	212

7.118 Two buildings used by roosting bats were identified on the site. Building B6 (disused workshop/hay storage barn) had up to 5 bats roosting separately in different locations on one night, and Building B7 (disused cottage) had one bat roosting within it. Building B14 (barn at Sedlands Farm to the northeast beyond the boundary of the site) had two common pipistrelles roosting within it. There was no evidence of a maternity roost on the site. No tree roosts were identified (see **Appendix 7.2: Bat Activity Surveys 2009** and **Appendix 7.3: Bat Activity Surveys 2010**).

Table 7.9 Bat emergence survey results

Buildings	Date	Results
B1-B4	dawn 16th August, 2009	0
B5	30th July, 2009	0
	15th August, 2009	0
	dawn 16th August, 2009	0
	19th April, 2010	0
	21st May, 2010	0
	28th June, 2010	0
B6	30th July, 2009	1 x common pipistrelles
	15th August, 2009	5 x common pipistrelles
	dawn 16th August, 2009	4
	19th April, 2010	0
	21st May, 2010	4
	28th June, 2010	0
B7	11th August, 2009	1 x common pipistrelles
	15th August, 2009	2 possible common pipistrelles
	dawn 18th August, 2009	0
	19th April, 2010	1 possible common pipistrelles
	21st May, 2010	0
	28th June, 2010	0
B8	dawn 18th August, 2009	0
B11	11th August, 2009	0

Buildings	Date	Results
B12	16th August, 2009	0
	dawn 17th August, 2009	0
B14	31st July, 2009	2 x common pipistrelles
	16th August, 2009	2 x common pipistrelles
	dawn 17th August, 2009	0
B15	dawn 17th August, 2009	0
T15	dawn 19th August, 2009	0
T22	dawn 20th August, 2009	0

**Badger**

- 7.119 No badger setts or evidence of badgers was found during the initial surveys within the land ownership boundary of the site or around the periphery of the site (see **Appendix 7.1: Extended Phase 1 Habitat Survey**). A small number of badger footprints were identified during the February 2011 survey to the northeast of the site at Six Hundreds Drove close to the Holland Dike, indicating that badgers make occasional use of the site for foraging. No further evidence of badger activity was recorded.

**Otter**

- 7.120 No evidence of otters was observed at the site; however, some of the main drains and ditches on the site appeared potentially suitable for occasional use by otters (see **Appendix 7.1: Extended Phase 1 Habitat Survey**).

**ASSESSMENT OF EFFECTS****Effects to be assessed****Construction impacts**

- 7.121 A range of construction activities would be required for the various elements of the project. These include a temporary construction compound, storage of construction materials, temporary access routes on and within the site, vegetation clearance, soil removal, ground and excavation works, routing of connections to the grid, assembly areas for components of the turbine, construction of the concrete foundations and construction traffic.
- 7.122 The total landholding of the site is 604ha, however, the actual area to be developed (turbine foundations, hard standing areas, access tracks, construction compound and substation) totals approximately 9.98ha (1.65% of landholding). Post construction this area will reduce further to

9.62ha (1.6% of landholding) as the foundation area is allowed to grass over. Each standard turbine foundation has a maximum diameter of 16.2m and depth of 2.1m (see **Figure 4.2: Proposed Site Plan**).

- 7.123 Construction effects are defined in **Table 7.8** as those caused by general construction activities and cabling. The impacts amount to disturbance followed by restoration of vegetation, and temporary disturbance to fauna. The construction of the wind farm will take place over a period of approximately 12 months, although there will be a construction break of 4 weeks during this period for each turbine as detailed in **Table 4.5 of Chapter 4: Project Description**.

**Table 7.9: Construction effects to be assessed**

Construction Effects	Impact	Potential Effects on Receptors
General	Temporary, noise, vibration, movement and physical disturbance of vegetation	Loss or disturbance of habitat and fauna
Cable laying	Temporary, noise, vibration, movement and physical disturbance of vegetation	Loss or disturbance of habitat and fauna
Foundations	Removal or alteration of habitat	Loss of habitat
Tracks	Removal or overlaying of vegetation	Loss of habitat
Sub-station / control building	Removal of vegetation	Loss of habitat
Crane pads / lay down areas	Removal / overlaying of vegetation	Loss of habitat

**Operational impacts**

- 7.124 Ongoing and operational effects are defined in **Table 7.10** as habitat or species loss due to site infrastructure.

**Table 7.10: Operating effects to be assessed**

Operating Effects	Impact	Potential Effects on Receptors
Foundations	Removal or alteration of habitat	Loss of habitat
Tracks	Removal or overlaying of vegetation	Loss of habitat

Operating Effects	Impact	Potential Effects on Receptors
Sub-station / control building	Removal of vegetation	Loss of habitat
Service and Maintenance	Vehicle movements / personnel on site	Disturbance of species
Turbines	Noise and movement, medium intensity obstacle lighting	Disturbance / Collision risk to species

### Decommissioning impacts

- 7.125 Due to the fact that the decommissioning process will not take place for 25 years, after the turbines become operational, it is difficult to predict the ecological impacts the decommissioning process particularly as current climate change models predict significant changes in average seasonal temperatures and rainfall which may results in significant changes in flora and fauna using the area. Agricultural practices in the area may also change over the next 25 years. However, decommissioning is likely to have similar impacts to those given above for construction, although over a much shorter period of time.
- 7.126 It is standard practice for the turbine towers and blades to be removed from the site by the same means as they arrive, but for the foundations and access tracks to remain on the site, but be covered with topsoil, enabling green cover to establish over the turbine site. Underground cables, disconnected from the local grid, could also remain in the ground. This minimises the level of disturbance to the area and allows for any vegetation which has established itself over the lifetime of the proposed development to remain undisturbed.
- 7.127 Prior to removal, an ecological assessment will be carried out in the year prior to removal and a full Environmental Management Plan will be prepared. Decommissioning should avoid the bird breeding season. At the time of the decommissioning the developer will consult with Natural England (or the appropriate contemporaneous authority) to check whether any specific measures are required to protect any ecological interests on, or near to, the site.

### Ecological Receptors to be considered

- 7.128 The ecological receptors (habitats and species) found on or adjacent to the site are considered in this section.
- 7.129 The extended Phase 1 survey did not identify any suitable habitat for hazel dormice and the further surveys did not find any evidence for great crested newts and reptiles. Although it was considered possible that small remnant populations of reptiles could be present, the areas that could be used by these species will remain unaffected by the development. Reptiles and great crested newts are, therefore, not considered further in this section.

### Construction

#### **Statutory designated sites**

##### *Evaluation*

- 7.130 There are no international or national statutory designated sites within the developable area or within 10km of the site.

##### *Characterisation of impacts and significance*

- 7.131 Prior to mitigation it is certain that there will be **no** impact on statutory designated sites.

##### *Mitigation*

- 7.132 None required.

#### **Non Statutory Designated site**

##### *Evaluation*

- 7.133 Cole's Lane Ponds LWS and South Forty Foot Drain LWS are both located within 1km of the site. Heckington Grassland and Old Wood Kyme SNCI's are both approximately 5km away. These are of county importance.

##### *Characterisation of impacts and significance*

- 7.134 There will be no development within any non statutory designated site and there will be no direct or indirect effects on them. Therefore it is certain that, prior to mitigation, there will be **no negative impact** on these non statutory designated sites.

##### *Mitigation*

- 7.135 None required.

#### **Habitats – Trees and woodland**

##### *Ecological evaluation and assessment*

- 7.136 There are three young plantations of mainly small deciduous trees scattered around Six Hundreds Farm, and one mature plantation. These are of site interest.
- 7.137 There are seven small mature trees located within the site, within the deciduous plantations and along the drains. These are of site interest.

##### *Characterisation of impacts and significance*

- 7.138 There will be at least 160m between the deciduous plantation north of Six Hundreds Farm and the nearest turbine, and 170m between the small plantation west of Six Hundreds Farm and the nearest turbine. The plantations will not be removed during the works, and it is extremely unlikely that there will be any significant disturbance to them. Prior to mitigation it is therefore probable that there will be **no negative impact on the plantations**.

- 7.139 No mature trees will be removed during the construction of the turbines or access tracks. Therefore, prior to mitigation it is certain there will be no negative impact on the mature trees.

#### *Mitigation*

- 7.140 None required.

#### **Habitats – hedgerows**

##### *Ecological evaluation and assessment*

- 7.141 There are two small sections of intact species-poor hedgerows, totalling approximately 380m. These are remnant sections of hedge and do not form links between habitat features. They are of low (site) conservation significance.

##### *Characterisation of impacts and significance*

- 7.142 There will be no construction of turbines or access tracks within 100m of any of the sections of hedgerow. Therefore prior to mitigation it is certain there will be **no negative impact** on hedgerow habitat of local importance.

#### *Mitigation*

- 7.143 None required.

#### **Habitat –Standing water**

##### *Evaluation*

- 7.144 The site is divided by a network of drainage ditches and drains, several of which hold water permanently. These have not been found to support great crested newts, but are used by common frogs, common toads and smooth newts, as well as fish species. Dragonfly and damselfly larvae were found in sweep netting surveys, along with other invertebrates indicating that water quality in ditches across the site was generally good. These are of site interest.

##### *Characterisation of impacts and significance*

- 7.145 Construction of the turbine access tracks will involve crossing 11 dry and one wet ditch. This will involve inserting pipe culverts into the ditches, which will cause some damage to the ditches and may potentially cause damage to the species using it.
- 7.146 There is a potential risk of damage to the remainder of the ditches and species using the drainage ditches if construction occurs close to the bank of ditches. If during construction there is a period of heavy rain there is a small risk of increased silt run-off. Prior to mitigation it is therefore probable there will be a **negligible negative impact**.

#### *Mitigation*

- 7.147 An engineering solution and associated pollution prevention plan (PPP) will be employed as part of the construction method statement to ensure that contaminated or silt laden run-off is prevented from reaching any water bodies or water courses.

#### *Residual Significance*

- 7.148 It is certain that after mitigation there will be **no significant negative impact** on watercourses during the construction phase.

#### **Protected Species - Badgers**

##### *Evaluation*

- 7.149 There are no setts within the developable area and few signs of badger activity were recorded on the site. The site is suitable for use by foraging badgers and it is likely that badgers in the surrounding area make occasional use of the site for foraging. These populations would be of no more than local importance.

##### *Characterisation of impacts and significance*

- 7.150 No setts were identified within the developable areas, therefore construction work will not cause sett disturbance. There will be a minor loss of foraging habitat although this will be less than 0.1% of the land holding. Therefore it is certain there will be **no negative impact** on badgers.

#### *Mitigation*

- 7.151 None required.

#### **Protected Species - Otters**

##### *Evaluation*

- 7.152 The permanently wet drains (Head Dyke-Skerth Drain, Holland Dike and several of the smaller drains) are considered suitable for use by occasional foraging and commuting otters. No otters or signs of otters were recorded on the site during the surveys. The otter population in the area is considered to be of regional importance.

##### *Characterisation of impacts and significance*

- 7.153 Construction of the access tracks will involve inserting short sections of pipe culvert into only one of the smaller wet drains, to the north of Six Hundreds Farm. The large main drains (Head Dyke-Skerth Drain, Labour in Vain Drain, the unnamed drain running north-south through the site and Holland Dike) will not be affected by the development. There are approximately 5450m of permanently wet drain on the site, of which approximately 10m will be affected (0.18 %). It is extremely unlikely that any otters which may make occasional use of the smaller wet drains would be disturbed by this. It is therefore considered likely that there will be **no negative impact** on otters.

*Further surveys*

- 7.154 As the habitat was suitable for use by otters and because they are known to be present in the surrounding areas, a precautionary approach will be necessary. Further otter surveys will be carried out along the wet drains prior to construction, and should they reveal the presence of otters it may be necessary to undertake the work under licence and with a suitably experienced ecologist overseeing the work.

**Protected Species –Water Voles***Evaluation*

- 7.155 Although the drains were considered to contain suitable habitat for use by water voles, no water voles were recorded on the site during targeted surveys, and no historical records of water voles on the site were revealed. The absence of water voles on the site may be explained by the presence of mink and the fact that many of the drains are only seasonally wet. Water vole populations in the wider area which could potentially make use of the site in the future are considered to be of no more than local importance.

*Characterisation of impacts and significance*

- 7.156 Construction of the access tracks will involve inserting short sections of pipe culverts into one of the smaller wet drains, to the north of Six Hundreds Farm. The large main drains (Head Dyke-Skerth Drain, Labour in Vain Drain, the unnamed drain running north-south through the site and Holland Dike) will not be affected by the development. As water voles are not currently present within the developable area, prior to mitigation it is certain there will be **no negative impact** on water voles. Should water voles become present on the network of drains, it is possible the construction of these access tracks could cause a minor negative impact on water voles.

*Mitigation and further surveys*

- 7.157 Although this species was not found to be present at the time of the surveys, as the habitat was suitable for use and water voles are known to be present in the surrounding areas, a precautionary approach will be necessary. In the season prior to construction all wet drain crossing points will be re-surveyed for water voles. Should water voles be found to be present sections of bank 20m either side of each proposed crossing will be kept bare of vegetation from March for at least 6 months prior to culvert construction to dissuade water vole use and colonisation of that section of bank, therefore avoiding risk of damage to any burrows or individual water voles.

**Protected Species – Bats***Evaluation*

- 7.158 There was a low level of common pipistrelle bat activity over the site. A high proportion (25%) of the total number of foraging bats were recorded along the Head Dyke-Skerth Drain and Holland Dike, with the remainder largely associated with sheltered linear features, smaller drains and close to buildings. Several (mostly individual) myotis bats (likely to be Daubenton's) were recorded over the site, largely associated with Head Dyke-Skerth Drain, and a single probable brown long-eared bat was recorded at the northeast part of the site. No bat species considered to be at high risk from wind turbines were recorded. Small number of roost sites in the farm buildings were identified, used by individual common pipistrelle bats, located away from any proposed turbines. Maximum

counts of five individuals at Barn B6 and one at the house B7 were recorded roosting at Six Hundreds Farm, and two at barn B14 at Sedland Farm. **See Appendix 7.3: Bat Activity Surveys 2009 and Appendix 7.4: Bat Activity Surveys 2010.** The small population of bats present in the site is considered to be of local importance

*Characterisation of impacts and significance*

- 7.159 No roost sites or potential roost sites will be damaged during construction of turbines or associated infrastructure, and there will be no construction of turbines within 200m of any roost sites.
- 7.160 There will be no loss of foraging habitat due to the construction of the turbines and therefore prior to mitigation there will be **no significant negative** impacts.
- 7.161 Safety lighting may be used in the construction compound. While some lighting can sometimes disrupt commuting flight paths of some bat species, the species of bat recorded on site are not disturbed by lighting, unless close to a roost and they may even be attracted to feed on insects around bright white lighting<sup>11</sup>.

*Mitigation*

- 7.162 Any lighting required for safe working would be limited to winter use when bats are inactive. If security lighting is required during the summer this will be of low intensity and only be used within the construction compound and directed away from the buildings and any important bat features.

*Residual Significance*

- 7.163 It is certain that after mitigation there will be **no significant impact** on bat populations during the construction phase.

**Operation****Statutory and Non Statutory designated sites and Habitats***Evaluation*

- 7.164 There will be **no operational impact** of the proposed wind turbines on any habitat or designated site.

*Characterisation of impacts and significance*

- 7.165 Not significant

*Mitigation*

- 7.166 None required.

<sup>11</sup> Rydell J & Racey, P A (1993) Street lamps and the feeding ecology of insectivorous bats. *Recent Advances in Bat Biology* Zool Soc Lond Symposium abstracts

**Protected Species – Badgers***Evaluation*

- 7.167 No setts are present on or surrounding the site and badgers are likely to make limited use of the site for foraging.

*Characterisation of impacts and significance*

- 7.168 Access for maintenance of turbines will be by van along the access tracks. The frequency of movement by maintenance vehicles each year will be significantly less than the typical annual vehicle movements associated with agricultural practice on the site. It is certain that there will be **no significant** impact on badgers during the operational phase.

*Mitigation*

- 7.169 None required.

**Protected Species – Bats***Evaluation*

- 7.170 There was a low level of bat activity over the site with a large proportion of foraging common pipistrelles recorded close to Head Dyke-Skerth Drain and Holland Dike, The closest turbine is over 250m to the south of this dyke. There was a lower level of activity along the smaller drains, at the woodland and around the buildings. Several recordings of probable Daubenton's and one brown long-eared bat were made. No noctules or other high-flying, high-risk, bats were recorded on the site. A small number (up to six) of individual common pipistrelles were roosting in farm buildings at Six Hundreds Farm. These buildings are over 200m from the closest turbines.
- 7.171 There is concern, particularly in mainland Europe and America that onshore and offshore wind turbines in certain locations can be a collision or barotrauma<sup>12</sup> hazard to bats if they fly close to moving turbines. The most serious incidents have involved migratory tree-dwelling bat species that fly very high and for long journeys across North America. The latest interim guidance from Natural England<sup>12</sup> states:

*“that most bat species in the UK are unlikely to come into contact with the blades during their normal movements, because, to the best of our knowledge, these bats do not migrate at high altitude and rarely fly at heights that intersect with the blades”.*

<sup>12</sup> Baerwald E,F, D'Amours G, H, Klug,B, J and Barclay R M R 2008 Current Biology, Volume 18, Issue 16, R695-R696, 26 August 2008

*Characterisation of impacts and significance – Bat flight*

- 7.172 Common pipistrelle, brown long-eared bat and Myotis populations are considered by Natural England to be at low risk from wind turbines (**see Table 4**). Direct observations on this site combined with the low level of activity and the location of foraging indicates that these animals are very unlikely to come into direct contact with any wind turbines erected on this site. Therefore it is considered that prior to mitigation there will be **a negligible negative impact** on these populations.

*Mitigation*

- 7.173 The turbines will be located in the centre of the site and the blade sweep will be over 50m from Head Dyke-Skerth Drain and Holland Dike, the area of highest activity.
- 7.174 The location of turbines has been designed to ensure the sweep of the blades is at least 50m from hedgerows, trees and wet drains likely to be used by foraging bats in accordance with natural England guidance TIN051. The turbines are at least 200m from any buildings used by small numbers of roosting bats. These roosts will be monitored following the construction of the turbines to ensure their continued use.
- 7.175 All hedgerows within the site will be managed so that they are tight and low which makes them less attractive for foraging bats (Barndt et al 2007)<sup>13</sup>.

*Residual Significance*

- 7.176 It is certain that after mitigation there will be **no significant impact** on bat populations during the operational phase.

**DECOMMISSIONING**

- 7.177 Decommissioning is likely to have similar impacts as to those in construction, although over a much shorter period of time. However, there may well have been significant changes in habitat and species present on the site due to predicted changes in climate and associated changes in any use of the surrounding area. Therefore, further surveys will be required prior to the assessment of any impacts on particular species or habitats. The turbine towers and blades will be removed from the site by the same means as they arrive, but the foundations will remain on the site unless otherwise specified. This minimises the level of disturbance to the area and allows for any vegetation which has established itself over the lifetime of the proposed development to remain undisturbed. Therefore the impact of decommissioning is likely to be significantly less than that of construction.

<sup>13</sup> Brandt, G. Blows, L. Linton, D. Plaing, N. and Prescott, C. Habitat associations of British bat species on lowland farmland within the Upper Thames catchment area. Centre for Wildlife Assessment and Conservation E journal (2007) 1 10-19



## MITIGATION

### Design mitigation

- 7.178 Access track routes and turbine locations have been selected to ensure that there is no loss of existing hedgerows.
- 7.179 The location of turbines has been designed to ensure that the sweep of the blades is at least 50m from hedgerows, trees and wet drains likely to be used by foraging bats in accordance with natural England guidance TIN051. They are also at least 200m from any roosts used by individual bats.
- 7.180 Access routes and turbine locations have been designed so there will be no construction within 9m of any water courses except to provide new crossings.
- 7.181 An engineering solution and associated pollution prevention plan (PPP) will be employed as part of the construction method statement to ensure that contaminated or silt laden run-off is prevented from reaching any water bodies or water courses.

### Construction mitigation

- 7.182 Other measures involving avoidance, reduction and enhancement, will be implemented during construction in order to offset effects identified in the previous section. These include:
- 1) The use of noisy earth-moving machinery which will be restricted to normal working hours, to reduce levels of disturbance generally to wildlife in the area;
  - 2) Any lighting used for the construction process will be installed in such a way as to avoid excessive illumination of areas of scrub, hedge, trees or woodland. Directional lights will be used, in keeping with considerations of human safety, to reduce light pollution to areas important for wildlife. Lighting the working areas at night during the summer will be avoided;
  - 3) Preparation and implementation of an overall Environmental Management Plan (EMP) to ensure best environmental working practice, proper implementation of mitigation measures and to minimise the potentially adverse effects of construction activity;
  - 4) In the season prior to construction all potential crossing points of water courses will be re-surveyed for water voles. Should they be found to be present, sections of bank 20m either side of each proposed crossings will be kept bare of vegetation for at least 6 months prior to bridge construction to dissuade water vole use and colonisation of that section of bank, therefore avoiding risk of damage to any burrows or individual water voles; and
  - 5) Should further surveys prior to construction reveal the presence of otters using the drains it may be necessary to undertake the work under licence and with a suitably experienced ecologist overseeing the work.

### Post-construction mitigation

- 7.183 Other measures, involving avoidance, reduction and enhancement, will be implemented post-construction in order to offset effects identified in the previous section. These include ongoing hedgerow management to ensure all hedgerow on site are kept low and tight.

- 7.184 The location of turbines has been designed to ensure the sweep of the blades is at least 200m from any buildings used by individual roosting bats. These roosts will be monitored following the construction of the turbines to ensure their continued use.

### Decommissioning Mitigation

- 7.185 Due to the fact that the decommissioning process will not take place for over 25 years after the turbines become operational, it is very difficult to predict the ecological impacts the decommissioning process will have. However, decommissioning is likely to replicate the impacts given above for construction. Therefore a full Environmental Management Plan should again be prepared and decommissioning should avoid the bird breeding season.
- 7.186 At the time of the decommissioning the developer will, if requested, consult with Natural England (or the appropriate contemporaneous authority) to check whether any specific measures are required to protect any ecological interests on, or near to, the site.
- 7.187 As a current baseline, all the mitigation measures which are undertaken for construction should be implemented, unless otherwise deemed unnecessary by the appropriate authority.

## STATEMENT OF RESIDUAL SIGNIFICANCE

- 7.188 This section considers the effect of the development after mitigation. The potential residual significance of the proposed development is summarised in **Tables 7.10, 7.11 and 7.12**.

### Proposed Additional Monitoring

- 7.189 This section provides a summary of additional monitoring which will be undertaken when the development has obtained planning permission.
- 7.190 The bat transect surveys and dusk emergence/dawn re-entrance surveys will be repeated following the construction of the wind park to assess the impact of the turbines on the existing bat populations. These will be undertaken in July, August and September in the first two seasons after the beginning of operation Transects A, B and C (the transects with most bat activity) will be re-surveyed.

## BIODIVERSITY ENHANCEMENTS

- 7.191 Planning authorities are now required under the guidance set out in *PPS9: Biodiversity and Geological Conservation* to actively seek in development proposals measures that aim to promote appropriate priority habitats and species listed in the UK and Local Biodiversity Action Plans.
- 7.192 An Environmental Management Plan will be drawn up identifying key management policies. These will be implemented following construction of the turbines for the duration of the operational phase. This will include details of management and cutting/clearing regimes for the remnant sections of hedgerow, the ditch network, and the areas of grassland.

- 7.193 The habitat on site, outside the developable area but inside the land ownership boundary, will be improved, specifically for birds but also to the benefit of other wildlife. This will include:
- 1) Creating skylark scrapes (small areas of ground left bare) in the crops within fields away from the developable area. Two plots per hectare (at least 16m<sup>2</sup> each) in fields larger than five hectares can boost productivity by almost 50%<sup>14</sup>. These will also benefit corn buntings and will be of benefit to invertebrates including bees;
  - 2) Create beetle banks as over-wintering habitat for beneficial insects. Beetle banks are two-metre grass strips through the middle of arable fields;
  - 3) Nest boxes for house sparrows, tree sparrows, barn owls and starlings, on buildings within the farm complexes;
  - 4) Allowing weeds to grow up on non-cropped areas such as access tracks and the field boundaries, to encourage invertebrates which are an important food source for birds such as corn bunting, and are of biodiversity value in their own right; and
  - 5) Improving existing/creating new hedgerows surrounding the farm away from the turbines (specifically to the south adjacent to the A17). This will be done by adding whips of an appropriate mix of hedgerow species to any gaps, and cutting and laying appropriate sections.

## SUMMARY

- 7.194 An extended Phase 1 habitat and protected species survey and additional surveys for great crested newts and bats were conducted. Using species and habitat information provided by these surveys and additional desk study information, this ecology chapter has considered the impacts and provisional mitigation requirements for a range of protected species which may potentially be present on the site.
- 7.195 This assessment has determined that an unmitigated development strategy is unlikely to have a significant negative impact on habitats present on the site.
- 7.196 This assessment has determined that an unmitigated development strategy is unlikely to have a significant negative impact on protected species present on the site.
- 7.197 Following analysis of available survey work and background data searches, it is considered that there is no evidence to suggest that the proposed development would lead to a significant impact on any known protected species or ecological features of value at the national, county or local level provided appropriate safeguards are set in place and compensatory measures provided as outlined in this chapter.

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<sup>14</sup> RSPB (2008) - Advice for farmers: Skylark. Available online: [www.rspb.org.uk](http://www.rspb.org.uk)

**Table 7.11: Summary table of Construction Impacts on Habitats**

Habitat	Indicative importance	Nature of impact	Potential unmitigated impact on the feature	Likely occurrence	Magnitude	Significance without mitigation	Mitigation and Enhancement	Residual significance
Trees and woodland	Site	Removal or alteration of habitat	Loss of habitat	Extremely Unlikely	Negligible	Not significant	None required	N/A
Hedgerows	Site	Removal or alteration of habitat	Loss of habitat	Extremely Unlikely	Negligible	Not significant	None required	N/A
Standing water	Site	Heavy rain during construction could increase risk of silt run-off. Damage to banks during construction of new crossing points (culverts)	Degradation of habitat downstream of site through increased turbidity, nutrient load and smothering habitats. Loss of small sections of habitat, disturbance or risk of injury to protected species	Probable	Negligible	Potential for temporary significant impacts downstream of site	An engineering solution and associated pollution prevention plan (PPP) will be employed as part of the construction method statement to ensure that contaminated or silt laden run-off is prevented from reaching any water bodies or water courses	Not significant

Table 7.12 Summary of Construction Impacts on protected species

Species	Indicative Importance of populations	Nature of impact	Potential Effect	Likely occurrence	Magnitude	Significance without mitigation	Mitigation & Enhancement	Residual significance
Badger	Local	Removal or alteration of foraging habitat	Construction of access tracks and turbines will result in the loss of a very small area of possible feeding habitat	Likely	Negligible	Not significant	None required	N/A
Otter	Regional (where present)	Removal or alteration of habitat	Construction of access tracks and turbines will result in the loss of small sections of possible feeding habitat along the ditches and possible disturbance	Unlikely	Negligible	Not significant	None required. Should further surveys prior to construction reveal the presence of otters using the drains it may be necessary to implement a mitigation plan including undertaking the work under licence and with a suitably experienced ecologist overseeing the work	Not significant
Water voles	Local (where present)	Removal or alteration of habitat	Construction of access tracks and turbines will result in the loss of small sections of possible habitat along the ditches and possible disturbance	Unlikely	Negligible	Not significant	None required. Should further surveys prior to construction reveal the presence of water voles using the drains it may be necessary to implement a mitigation plan including undertaking the work under licence and with a suitably experienced ecologist overseeing the work	Not significant
Bats (largely pipistrelles)	Local	Temporary, lights, noise, vibration, movement and physical disturbance	Disruption of foraging pattern	Extremely Unlikely	Negligible	There will be no construction in identified feeding areas, no construction at night during the summer and any lighting would be limited to winter only and directed away from important feature for bats. There will be no negative impact and therefore this is not significant	None required	N/A

Table 7.13: Summary of Operational Impacts on Protected Species

Species	Indicative Importance of populations	Potential impact on population of wind farm based on NE Guidance	Nature of impact	Potential Effect	Likely occurrence	Magnitude	Significance without mitigation	Mitigation & Enhancements	Residual significance
Badger	Local	N/A	Vehicle access for turbine maintenance	Disturbance to foraging individuals	Maintenance vehicle activity will be significantly less than typical agricultural practices, therefore disturbance to badgers is extremely unlikely.	Negligible	Not significant	None required	N/A
Common Pipistrelle	Local	Low	Movement of blades	Disturbance  Collision resulting in injury or death	Due to low numbers using the site and foraging patterns of species it is considered to be extremely unlikely	Negligible	Not significant	The sweep of the blades is at least 50m from hedgerows or trees likely to be used by foraging bats, and at least 200m from any buildings used by roosting bats.  All hedgerows within the site will be managed tight and low which are less attractive for foraging bats	Not significant
Myotis sp. and brown long-eared	Local	Low	Movement of blades	Disturbance  Collision resulting in injury or death	Due to low numbers using the site and foraging patterns of species it is considered to be extremely unlikely	Negligible	Not significant	The sweep of the blades is at least 50m from hedgerows or trees likely to be used by foraging bats, and at least 200m from any buildings used by roosting bats.  All hedgerows within the site will be managed tight and low which are less attractive for foraging bats	Not significant



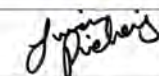


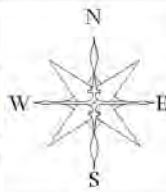
**Legend**

- Site Boundary
- 10km Distance Band
- Ancient Semi-Natural Woodland
- Replanted Ancient Woodland
- Site of Special Scientific Interest
- Local Nature Reserve
- National Nature Reserve
- Ramsar Site
- Special Protection Area
- Special Area of Conservation
- RSPB Site
- Important Bird Area
- County Wildlife Site
- Site of Nature Conservation Interest
- Lincolnshire Wildlife Trust Reserve

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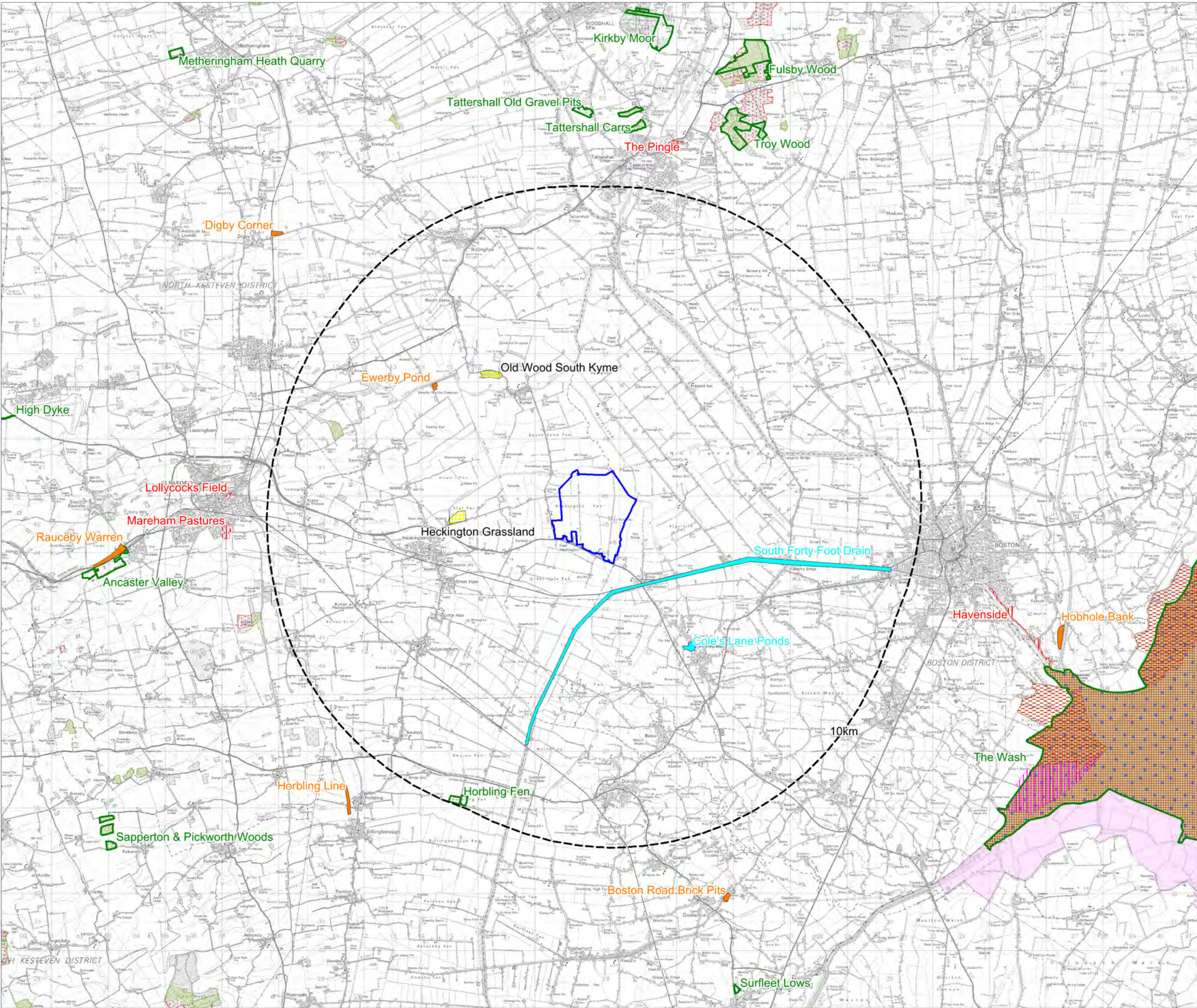
Document Number: 4038\_T0286\_01

Date: June 2011

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Figure: 7.1  
Title: Statutory and Non-Statutory  
Designated Sites Around Heckington Fen

Heckington Fen Wind Park  
Environmental Statement



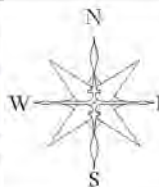


Legend

- Site Boundary
- 5km Distance Bands
- Brown Hare (74)
- Otter (2)
- European Water Vole (151)

Map produced from data provided by  
Lincolnshire Environmental Records Centre 2011

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Checked by *R. Apple*  
Approved by *J. Pichard*



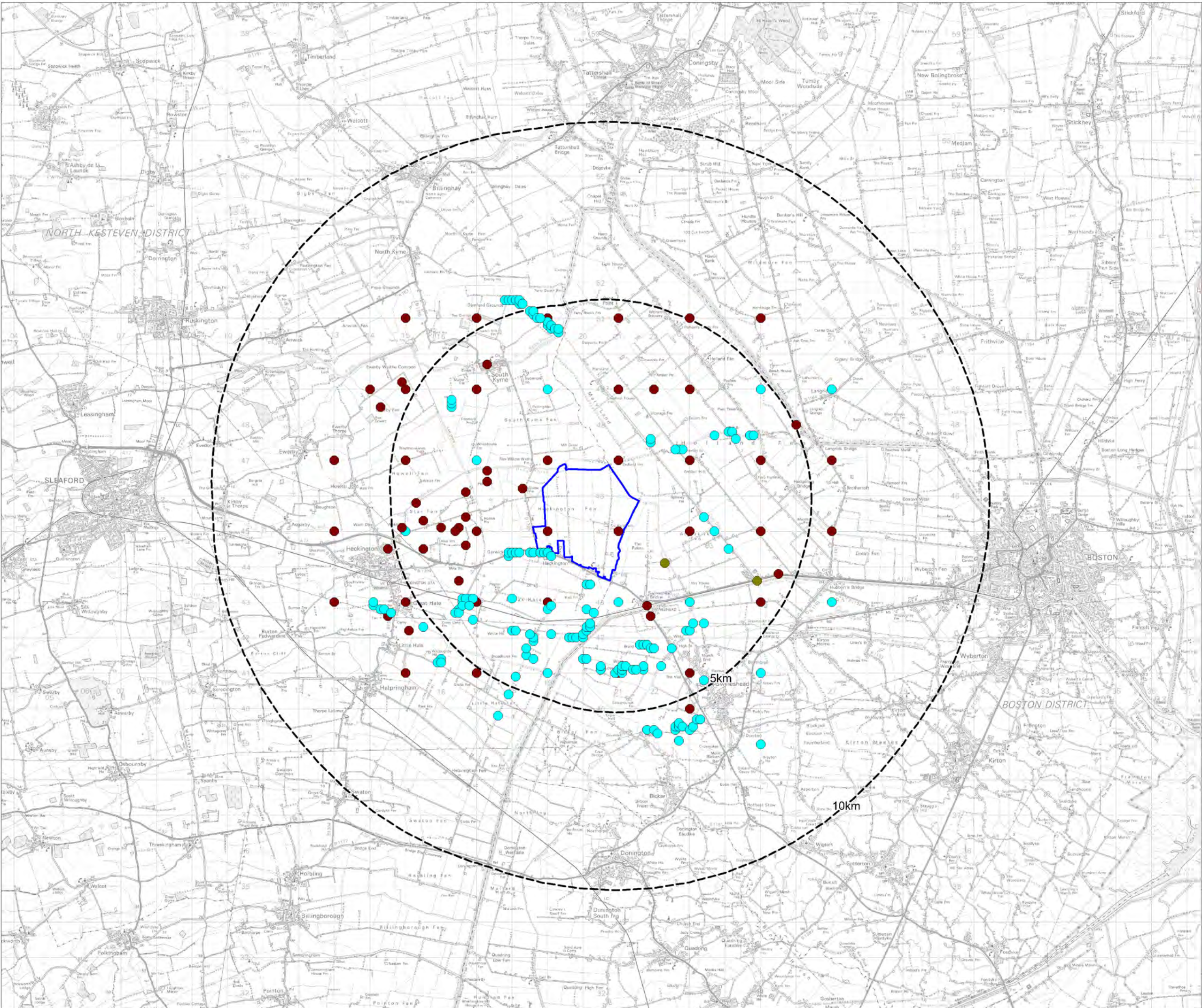
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Date: June 2011

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Figure: 7.2a  
Title: Desk Study Records of Protected  
Species - Mammals

Heckington Fen Wind Park  
Environmental Statement





Legend

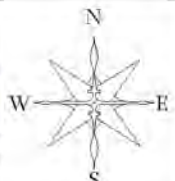
- Site Boundary
- 5km Distance Bands
- Daubenton's bat (27)
- Soprano Pipistrelle (31)
- Brown long-eared bat (79)
- Leisler's (2)
- Myotis sp. (22)
- Natterer's bat (6)
- Noctule bat (25)
- Serotine (1)
- Whiskered bat (2)
- Barbastelle (1)
- Pipistrelle Species (272)
- Unknown Bat Species (989)

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Checked by *R. Apple*

Approved by *J. Pickers*



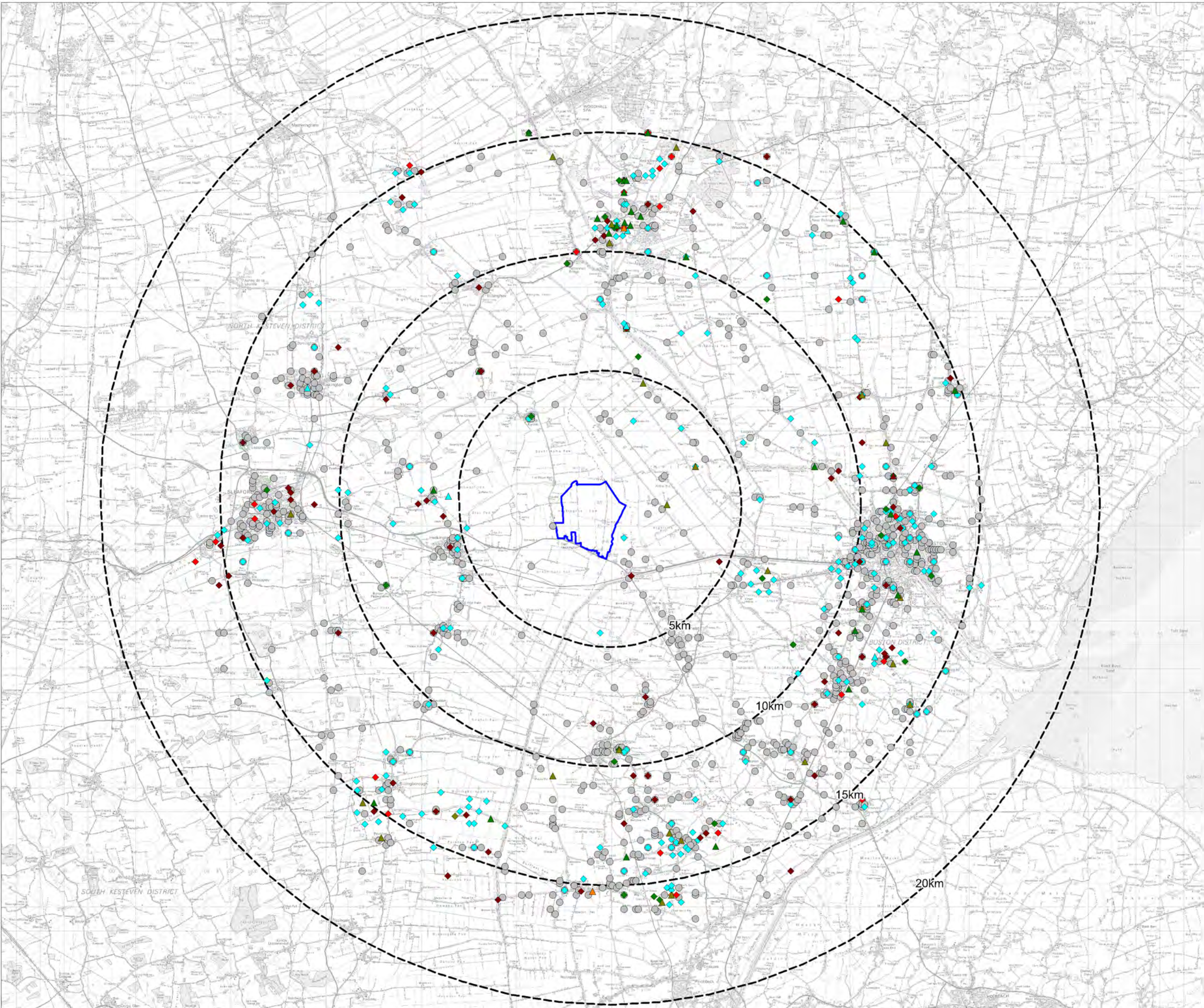
Document Number: 4038\_T0306\_01

Date: June 2011

Scale: 1: 150,000 @ A3

Figure: 7.2b  
Title: Desk Study Records of Protected  
Species - Bats

Heckington Fen Wind Park  
Environmental Statement





Legend

- Site Boundary
- 5km Distance Bands
- Brown long-eared bat (32)
- Daubenton's bat (3)
- Myotis species (8)
- Noctule bat (1)
- Soprano pipistrelle (5)
- Whiskered bat (1)
- Natterer's bat (2)
- Pipistrelle Species (93)
- Unknown Bat Species (4)

Map produced from data provided by  
Lincolnshire Environmental Records Centre 2011

Drawn by	<i>M. Smith</i>	
Checked by	<i>R. Apple</i>	
Approved by	<i>J. Pickers</i>	

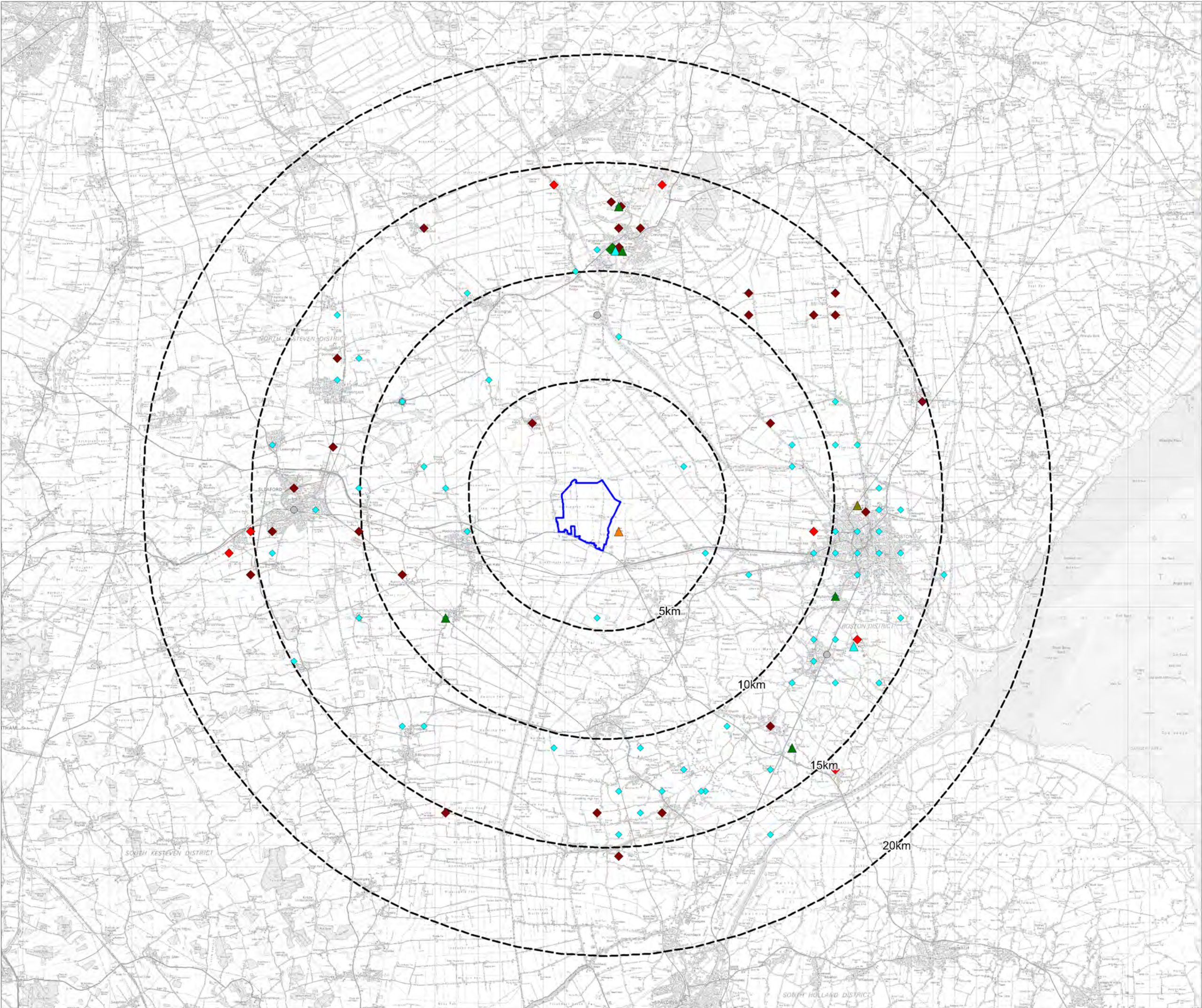
Document Number: 4038\_T0308\_01

Date: June 2011

Scale: 1: 150,000 @ A3

Figure: 7.2c  
Title: Desk Study Records of Protected  
Species - Bat Roosts

Heckington Fen Wind Park  
Environmental Statement





## APPENDIX 7.1: PHASE 1 SURVEY

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REPORT ON A PHASE 1 HABITAT SURVEY  
CONDUCTED IN CONNECTION WITH THE SITE OF  
THE PROPOSED WIND FARM DEVELOPMENT AT  
HECKINGTON FEN, SOUTH OF BOSTON,  
LINCOLNSHIRE.

5<sup>th</sup> November, 2009

This copy includes appendices

I the undersigned, hereby declare that the work was performed according to the procedures herein described and that this Report is an accurate and faithful record of the results obtained.

NEIL BOSTOCK BSc Hons

This document is an account of work carried out by NEIL BOSTOCK on behalf of ECOTRICITY Ltd.  
NEIL BOSTOCK cannot accept responsibility for decisions made or actions taken on the basis of this Report.

SUB-CONTRACTOR:NEIL BOSTOCK

CONTRACTOR:ECOTRICITY LTD.

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## 2. SUMMARY

- There are proposals for a wind farm to be constructed by Ecotricity on land at Heckington Fen, west of Boston, in Lincolnshire. As part of the ecological assessment of the site Natural England has requested that a pre-construction Phase 1 habitat survey be undertaken in order to assess the ecological value of the area and to identify areas where ecological mitigation may be required during the construction stage. The survey was conducted adopting the methods outlined in the Handbook for Phase 1 habitat survey published by the Nature Conservancy Council (1990). The area which was examined was that which was nominated on a map which encompassed the land within 500m of the development footprint. Aspects which were considered on the Phase 1 Survey map were wooded shelter belts, deciduous plantations, significant standard trees, hedgerows, drains and ditches together with a categorisation of the land use.
- In addition, specific aspects of ecological importance such as trees with holes or cracks which had bat roost potential, main drainages or ditches which may hold a Great Crested Newt population, Badger setts, or evidence of populations of Otter, Water Vole or reptiles were target noted. Each target note was identified with a specific number. Generally, these target-noted features were also photographed.
- The survey was carried out on behalf of Ecotricity by Ecologists Neil Bostock MIEEM and in part by Juliette Banwell. The survey was conducted on four dates between 30<sup>th</sup> July and 20<sup>th</sup> August, 2009. The survey also incorporated ecological assessment of the site for Great Crested Newt (*Triturus cristatus*), Otter (*Lutra lutra*), Badger (*Meles meles*), Water Vole (*Arvicola terrestris*) and reptiles. In addition, a Water Vole Survey was conducted and the Badger Survey completed on 19<sup>th</sup> October, 2009.
- The Phase 1 habitat survey showed the development area to consist of intensively farmed arable fields, a few of which were bordered on headlands by rough grassland. The arable fields were generally cultivated right up to the field margins resulting in very few areas of botanical or ecological importance. The most valuable aspects of the site were the main drainages and ditches which bordered most of the fields and which formed a network of drainage channels which lowered the water table across the site. There were a few small plantation woodlands comprising young trees; however just south of Six Hundreds Farm a mature plantation woodland held some standard Oak and Ash trees which contained holes and cracks which may provide potential roosting sites for bats. However, in general, these plantations were of low ecological significance. To the south of Six hundreds Farm is a small section of intact, species-poor hedgerow comprising Hawthorn, Blackthorn, Ash, Dog Rose and Bramble which provides shelter for foraging bats in windy conditions. The potential of causing botanical damage to the site due to the construction and operation of the proposed windfarm is likely to be minimal.
- The survey results show that the development site has suitable habitat for Water Voles, although no evidence of Water Voles was found during the survey. There was no evidence of Badger activity found within 500m radius of the development footprint. Although some areas beyond the land ownership boundary were not searched, no evidence of Badger activity was found along the entire edge of the land ownership area indicating that Badgers are not moving onto the site from an external sett. It is unlikely that there will be any impact on any Badger population due to the construction phase or production phase of the windfarm development.
- No evidence of Otter was observed at the site; however, some of the main drainages and ditches on the site appeared potentially suitable for Otters.
- Although no evidence of Great Crested Newt was found during the survey as the time of year was unsuitable to conduct bottle-trapping or torch surveys; the Phase 1 survey results show that the development site has some main drainages and ditches with suitable habitat for breeding Great Crested Newts (*Triturus cristatus*). Any ditches with suitable habitat are only likely to be impacted during the construction phase if a 'crossing point' has to be constructed in order to move the wind turbines into their proposed positions. Prior to the construction of any 'crossing points' a 50 metre length of ditch either side each 'crossing point' should be bottle-trapped and torch-surveyed during late February to June to confirm the absence or presence of Great Crested Newt. As the only affect of the windfarm site would be the minimal affect of any alterations to the ditch structure at the 'crossing points' and minimal habitat loss (of an area of intensive arable farmland) caused by the 'footprint' of the base of the turbine tower; it was considered that any affect on any Great Crested Newt population potentially occurring within or beyond the land boundary (where no search was conducted) would be negligible.

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- Although no specific survey for Hazel Dormouse (*Muscardinus avellanarius*) was conducted there appears to be no suitable habitat within the site; and no historic evidence of the presence of Hazel Dormouse in the area.
- Whilst the presence or absence of viable reptile populations is not confirmed, the development area appeared generally unsuitable to sustain reptile populations and the construction of the windfarm is likely to have a minimal affect on any relict populations of reptiles which may occur at the Heckington Fen site. Any reptile populations could be protected by minimising the removal of hedgerows or woodland during the construction phase.
- The construction of the windfarm at the Heckington Fen site would be very unlikely to affect any populations of protected species such as Otter, Water Vole, Great Crested Newt or Badger. Similarly, Hazel Dormouse or any populations of reptiles are unlikely to be affected by the development proposal.
- The season at which the Phase 1 Habitat Survey was conducted limits the results obtained from the survey work. The effectiveness of the survey to confirm the presence of Great Crested Newt or to determine the diversity of flowering plants at the site was reduced because the survey work was conducted from mid August until mid October. However, Water Vole, Otter and Badger activity is perhaps easier to monitor at this season.
- Proposed Mitigation:
- Wherever possible any hedgerows currently found on the development site should be retained; any sections of hedgerow which have to be removed during the construction process should be replaced by a section of at least an equivalent length and quality.
- Planting of areas of native tree species on areas away from the windfarm development would benefit wildlife across the farm, particularly insects and birds.
- Wherever possible the standard trees which are present on the site should be retained as they provide a wide range of nesting habitat for hole-nesting birds, for roosting bats and other wildlife such as beetles and moths.
- Although no evidence of Otter was observed at the site, the main drainages and ditches on the site appeared potentially suitable for Otters; it is suggested that *wherever possible* the construction or access roadways should avoid crossing main drainages or ditches. Similarly, care should be taken to avoid pollution of any watercourses during the construction phase as this would impact strongly on any Otter population present.
- As the construction phase of the windfarm may occur perhaps a few years into the future when the water table level is different, prior to the construction of the 'crossing points', surveys should be conducted for 50 metres either side of the proposed 'crossing points' in order to re-affirm the absence of Water Vole. If Water Voles are found to be present then appropriate mitigation should be put in place to protect the Water Vole population during the construction and post construction phases of the development. This may include restoration of the ditch habitat and prevention of pollution by preventing water run off from the development into the watercourses on the site.
- Although no evidence of Great Crested Newt was found during the survey as the time of year was unsuitable to conduct bottle-trapping or torch surveys; the Phase 1 survey results show that the development site has some main drainages and ditches with suitable habitat for breeding Great Crested Newts (*Triturus cristatus*). Prior to the construction of any 'crossing points' a 50 metre length of ditch either side each 'crossing point' should be bottle-trapped and torch-surveyed during late February to June to confirm the absence or presence of Great Crested Newt. If GCN are found to be present then appropriate mitigation should be put in place to protect the population during the construction and post construction phases of the development. This may include restoration of the ditch habitat and prevention of pollution by preventing water run off from the development into the watercourses on the site.

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### 3. INTRODUCTION

- 3.1 There are proposals for a wind farm to be constructed by Ecotricity on land at Heckington Fen, west of Boston, in Lincolnshire. As part of the ecological assessment of the site Natural England has requested that a pre-construction Phase 1 habitat survey be undertaken in order to assess the ecological value of the area and to identify areas where ecological mitigation may be required during the construction stage.
- 3.2 The survey was carried out on behalf of Ecotricity by Ecologists Neil Bostock MIEEM and in part by Juliette Banwell. The survey was conducted on four dates between 30<sup>th</sup> July and 20<sup>th</sup> August, 2009. The survey also incorporated ecological assessment of the site for Great Crested Newt (*Triturus cristatus*), Otter (*Lutra lutra*), Badger (*Meles meles*), Water Vole (*Arvicola terrestris*) and reptiles. In addition, a Water Vole Survey was conducted and the Badger Survey completed on 19<sup>th</sup> October, 2009.
- 3.3 This report describes the area surveyed, the survey methods, the results and the conclusions drawn. The habitat types were marked onto survey maps using standard methodology outlined in the Handbook for Phase 1 habitat survey published by the Nature Conservancy Council (1990); in addition target notes were used to identify areas of ecological significance.

### 4. SITE DESCRIPTION

The site is located some 11.0 km west of Boston at Heckington Fen, in Lincolnshire. The survey area is diamond shaped being approximately 3.8 km by 2.8 km centred on grid reference TF 208 457. The area comprises largely of the two farms of Spinney Farm situated to the north of the Skirt Drain and Six Hundreds Farm situated to the south of the Skirt Drain and north of the A17 trunk road. Both farms consist of arable farmland with large open fields growing winter wheat, winter and spring sown oilseed rape and sugar beet. The majority of the fields are separated by drainage ditches; many of these are less than 1 metre in depth and 1.5m in width and were dry during the survey period. These dry ditches were often choked with vegetation including *Typha*, sedges, rank grasses and some bramble and offer no habitat for Water Voles and very limited foraging for bats; the large windswept open arable fields are also poor foraging habitat for bats. However, some major drains were also present being more than 2.0m in depth and up to 3.5m in width which permanently held water and contained plants such as Frogbit *Hydrocharis morsus-ranae* and Broad-leaved Pondweed *Potamogeton natans* as well as *Phragmites* and other riparian vegetation. These may provide habitat for Water Voles (*Arvicola terrestris*), potential habitat for Otter (*Lutra lutra*), potential sites for Great Crested Newt (*Triturus cristatus*) and foraging opportunities for bats and reptiles such as Grass Snake (*Natrix natrix*). A major drainage the Skirt Drain runs along the northern edge of Six Hundreds farm before passing in a north-west to south-eastern direction separating Six Hundreds Farm from Spinney Farm. On the Skirt Drain are two Pumping Stations which allow the water level of the drains across the site to be regulated by moving water into the Skirt Drain. This major drainage is canalised and runs between two built-up earth banks which are grassed and used for grazing sheep and cattle. At the outer base of the earth banks is a further deep drain formed from the removal of earth to build up the banks. As with the larger drainage ditches on the site the Skirt Drain provides potential habitat for Water Vole, Otter and Grass Snake as well as sheltered foraging opportunities for bats and offer potential corridors for bats to commute onto the site. The grassed banks which canalise the Skirt Drain could also potentially provide habitat for reptiles such as Slow-worm (*Anguis fragilis*) or Common Lizard (*Lacerta vivipara*). There are a few young plantations of mainly small deciduous trees scattered around Six Hundreds Farm largely to provide Pheasant cover, these do not provide roosting opportunities for bats but may provide sheltered foraging in windy conditions. The plantation south of Six Hundreds Farm is more mature and contains some standard Ash and Oak trees which could offer roosting sites for bats. In particular an Ash tree (T15) has splits, cracks and holes offering low to moderate bat roosting potential (BRP 2-3); whilst an Oak tree (T16) has some splits and flaking bark and may offer low bat roosting potential (BRP 3). On Spinney Farm a small plantation also contains some Ash trees (T11), (T12) and (T13) which have broken limbs, flaking bark or splits which offer low to moderate bat roosting potential. Within the open field landscape just east of the Gas Valve Compound there was also a small dead Alder (T21) with flaking bark offering low bat roost potential (BRP 3) and an isolated Ash (T22) with holes at its base offering low bat roost potential (BRP 3). Potentially the plantations could support cover to harbour a Badger (*Meles meles*) sett. To the south of Six hundreds Farm is a small section of intact species-poor hedgerow comprising Hawthorn, Blackthorn, Ash, Dog Rose and Bramble which provides shelter for foraging bats in windy conditions.

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Throughout the site were several buildings which could provide suitable roost sites for bats; these buildings were assessed using features of age, method of construction and location to identify which had the greatest potential for bats. At Six Hundreds Farm buildings with bat roost potential included: B5 (T17) a single storey cowshed with low to medium bat roosting potential (BRP 3-2); B6 (T17) a two storey barn with medium to high bat roosting potential (BRP 2-1); B7 (T18) two semi-detached disused two storey houses with medium to high bat roosting potential (BRP 2-1); and B9 (T20) a single storey barn with low bat roosting potential (BRP 3). Other buildings identified as B1-4 and B10 which were modern barns and B8 (T19) a small single storey open-fronted brick barn with a chimney were considered to have limited or no bat roosting potential. At Spinney Farm B14 (T3) a single storey barn with cavities and gaps in its fabric offered medium to high bat roosting potential (BRP 2-1). The pumping station B11 (T4) and the Trinity College Pumping Station B12 (T9) were largely sealed single storey buildings but may offer low to medium bat roosting potential (BRP 3-2), if gaps exist under the pump-house buildings. The black corrugated iron barn with an asbestos roof (T8) was considered to have no Bat Roost potential.

The bridges which spanned the Skirt Drain, Skirt Drain No 1 (B13) and Skirt Drain No 2 (B15) were of concrete construction and were considered to offer negligible roosting potential for bats. Observations of the bridges showed no evidence of bats and few features that might accommodate roosting bats.

The houses B7 (T18) had an overgrown mature garden with fruit trees, surrounded by tall hedges offering good potential for insects and foraging bats.

In several of the buildings raptor nest boxes for Barn Owl (*Tyto alba*) and Common Kestrel (*Falco tinnunculus*) had been erected; together with other Barn Owl and Common Kestrel nest boxes positioned on posts or on trees within the site. Several of these were being used successfully by these species to rear their young. The areas of grassland on the headlands of some fields together with the often grassy field edges adjacent to the ditches provide ideal hunting areas for these birds which feed on mice and voles.

### 5. METHODS

#### 5.1 Survey Conduct

##### Phase 1 Habitat Survey

An examination of the site was carried out in order to identify habitat areas with the greatest ecological importance adopting the methods outlined in the Handbook for Phase 1 habitat survey published by the Nature Conservancy Council (1990). The area which was examined was that which was nominated on the map which encompassed all of the land within 500m of the proposed development footprint, except where this extended beyond the land ownership boundaries so that surveyors had no right of access. Aspects which were considered on the Phase 1 Survey map were wooded shelter belts, deciduous plantations, significant standard trees, hedgerows, drains and ditches together with a categorisation of the land use.

In addition, specific aspects of ecological importance such as buildings or trees with holes or cracks which had bat roost potential or ponds which may hold a Great Crested Newt population were target noted. Each target note was identified with a specific number. Generally, these target-noted features were also photographed. The Phase 1 Habitat survey was conducted on four dates between 30<sup>th</sup> July and 20<sup>th</sup> August, 2009. Additionally, a Water Vole Survey was conducted and the Badger Survey was completed on 19<sup>th</sup> October, 2009.

##### Otter Survey

All the watercourses on the site were searched for evidence of Otter (*Lutra lutra*). Signs used to establish the presence of Otters included actual observations of animals, 'spraint' latrines deposited on prominent rocks, stones or logs or branches within watercourses (these spraints often contain fish bones and scales and have a sweet odour similar to jasmine tea) and Otter tracks in soft mud adjacent to the watercourses. No evidence of Otter was observed at the site; however, the Skirt Drain as well as some of the deeper ditches which permanently held water present on the proposed development site appeared suitable for Otters.

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Badger Survey

A survey for Badger sets and evidence of Badger activity was conducted. This survey was conducted within a 500m radius of the development footprint (although areas beyond the land ownership boundary of the site were not searched). However, the entire edges of the land ownership boundaries and the land area within were searched for evidence of setts, latrines, scratches on trees, Badger hair on barbed wire across animal trails, snuffle holes or feeding activity. Areas such as the 'grassed banks' of the Skirt Drain and other major drainages, woodland plantations and old hedge-banks received particular attention. No evidence of Badger was observed at the site

Water Vole

The ditches and watercourses which permanently held water found on the site were searched for evidence of Water Voles. Signs used to establish the presence of Water Voles included actual observations of animals, sounds of voles entering the water, latrines showing discrete piles of droppings, tunnel entrances (above and below the water), cropped 'lawn' around tunnel entrances and feeding stations of chopped vegetation. No evidence of Water Vole was observed at the site; however, several main drainages and ditches found on site appeared suitable for Water Voles.

Great Crested Newt

No bottle-trapping surveys or torch-surveys were conducted at the site as the time of year was unsuitable to determine if a breeding population of Great Crested Newt (*Triturus cristatus*) was present. However, the Phase 1 survey results show that several of the main drainages and ditches on the site, which permanently hold water, may provide suitable habitat for breeding Great Crested Newts.

Hazel Dormouse

Although no specific survey for Hazel Dormouse (*Muscardus avellanarius*) was conducted there appears to be no suitable habitat within the site for this species. The site is in an area of England where Hazel Dormouse has been extinct (or never present) since at least 1885.

Reptile Survey

The Phase 1 survey was conducted at an suitable time of year to produce casual observations of basking Common Lizard (*Lacerta vivipara*), Slow-worm (*Anguis fragilis*), Adder (*Vipera berus*) or Grass snake (*Matrix natrix*); and no specific surveys were undertaken at the site to determine reptile populations. The site appeared largely unsuitable to sustain reptile populations apart from perhaps Grass Snake due to the paucity of suitable areas for foraging or breeding. This is to be expected as the area consists largely of intensively farmed arable fields (albeit some edged or with headlands planted with rough grassland) which are generally cultivated right up to the field margins resulting in very few areas suitable for reptiles to forage. However, the grassy banks which contain the canalised Skirt Drain may possibly support a relict population of Slow Worm or Common Lizard. However, this area is beyond the development footprint and will not be affected by the wind farm construction. The potential for significant reptile populations at the site of the proposed windfarm is minimal.

**5.2 Area Encompassed by the Survey**

The area surveyed for Phase 1 Habitat Survey was an area encompassing the development footprint of the proposed windfarm situated at Heckington Fen, west of Boston, Lincolnshire. The area surveyed for evidence of Badger was up to 500m radius from the turbine positions or to the land ownership boundary. Suitable ditches for Great Crested Newts were noted within 500m of the turbine positions, or to the land ownership boundary. Areas of suitable habitat for Otters and Water Voles were examined within 200m of the turbine positions or construction roadways and to the land ownership boundary; whilst areas of suitable habitat for Water Voles were examined within 50m either side of any proposed 'crossing points' which allowed the turbines to be moved across ditches to be positioned.

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**5.3 Survey Visit Timings and Weather Conditions**

Details of survey visit dates; start and finish times and weather conditions during the survey are presented in Table 1.

**Table 1 - Visit Schedule and Weather Conditions during Survey**

Visit	Visit date	Start Time	Weather conditions (at start)	Finish time	Weather conditions (at finish)
A	30 July 09	08:30 am	10% cloud cover Wind SW 1-2. Dry, sunny, warm. Air Temp 15.5° C	16:15 pm	10% cloud cover Wind SW 1-2. Dry, sunny, warm. Air Temp 17.5° C
B	15 Aug 09	08:30 am	30% cloud cover Wind SW 2-3 Dry, high humidity. Air Temp 19.0° C	17:30 pm	30% cloud cover Wind SW 2-3 Dry, high humidity. Air Temp 24.0° C
C	19 Aug 09	10:30 am	10% cloud cover No Wind. Dry, sunny warm, Air Temp 22.0° C	18:30 pm	15% cloud cover No Wind. Dry, warm, sunny Air Temp 23.0° C
D	20 Aug 09	10:30 am	0% cloud cover No Wind. Dry, warm, sunny Air Temp 21.0° C	17:30 pm	0% cloud cover No Wind. Dry, warm, sunny Air Temp 23.0° C
E	19 Nov 09	08:30 am	30% cloud cover Wind SE 1 Dry, sunny, warm	17:30 pm	40% cloud cover Wind SE 1 Dry, sunny, warm

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## 6. RESULTS

### 6.1 Phase 1 Habitat Survey

The results of the Phase 1 Habitat Survey were expressed pictorially on a map (see Figure 1).

From the survey the key habitat features present at the site were a network of ditches which bounded the majority of the large arable fields on the site. Many of these ditches were less than 1 metre in depth and 1.5m in width and were dry during the survey period. These dry ditches were often choked with vegetation including *Typha*, sedges, rank grasses and some bramble and offer no habitat for Water Voles and very limited foraging for bats; the large windswept open arable fields are also poor foraging habitat for bats. However, some major drains were also present being 2.0m in depth and up to 3.5m in width which permanently held water and contained plants such as Frogbit *Hydrocharis morsus-ranae* and Broad-leaved Pondweed *Potamogeton natans* as well as *Phragmites* and other riparian vegetation. These ditches may provide habitat for Water Voles (*Arvicola terrestris*), potential habitat for Otter (*Lutra lutra*), potential breeding sites for Great Crested Newt (*Triturus cristatus*) and foraging opportunities for bats and reptiles such as Grass Snake (*Natrix natrix*). A major drainage the Skirt Drain runs along the northern edge of Six Hundreds farm before passing in a north-west to south-eastern direction separating Six Hundreds Farm from Spinney Farm. On the Skirt Drain are two Pumping Stations which allow the water level of the drains across the site to be regulated by moving water into the Skirt Drain. This major drainage is canalised and runs between two built-up earth banks which are grassed and used for grazing sheep and cattle. At the outer base of the earth banks is a further deep drain formed from the removal of earth to build up the banks. As with the larger drainage ditches on the site the Skirt Drain provides potential habitat for Water Vole, Otter and Grass Snake as well as sheltered foraging opportunities for bats and offer potential corridors for bats to commute onto the site. The grassed banks which canalise the Skirt Drain could also potentially provide habitat for reptiles such as Slow-worm (*Anguis fragilis*) or Common Lizard (*Lacerta vivipara*); however, these banks are unlikely to be affected during the construction of the windfarm. A few of the arable fields had planted rough grassland headlands or edges; otherwise they were cultivated right up to the field margins, leaving little room for wildlife.

There are a few young plantations of mainly small deciduous trees scattered around Six Hundreds Farm largely to provide Pheasant cover, these do not provide roosting opportunities for bats but may provide sheltered foraging in windy conditions. The plantation south of Six Hundreds Farm is more mature and contains some standard Ash and Oak trees which could offer roosting sites for bats. In particular an Ash tree (T15) has splits, cracks and holes offering low to moderate bat roosting potential (BRP 2-3); whilst an Oak tree (T16) has some splits and flaking bark and may offer low bat roosting potential (BRP 3). On Spinney Farm a small plantation also contains some Ash trees (T11), (T12) and (T13) which have broken limbs, flaking bark or splits which offer low to moderate or low bat roosting potential respectively. Within the open field landscape just east of the Gas Valve Compound there was also a small dead Alder (T21) with flaking bark offering low bat roost potential (BRP 3) and an isolated Ash (T22) with holes at its base offering low bat roost potential (BRP 3). Potentially the plantations could support cover to harbour a Badger (*Meles meles*) sett. To the south of Six hundreds Farm is a small section of intact, species-poor hedgerow, comprising Hawthorn, Blackthorn, Ash, Dog Rose and Bramble which provides shelter for foraging bats in windy conditions.

Throughout the site were several buildings which could provide suitable roost sites for bats; these buildings were assessed using features of age, method of construction and location to identify which had the greatest potential for bats. At Six Hundreds Farm buildings with bat roost potential included: B5 (T17) an old single storey barn with a pan-tiled roof offering low to medium bat roosting potential (BRP 3-2); B6 (T17) a two storey barn with holes in the gables offering medium to high bat roosting potential (BRP 2-1); B7 (T18) two semi-detached disused two storey houses with medium to high bat roosting potential (BRP 2-1); and B9 (T20) a single storey barn with low bat roosting potential (BRP 3). Other buildings identified as B1-4 and B10 which were modern barns and B8 (19) a small single storey open-fronted brick barn with a chimney were considered to have limited or no bat roosting potential. At Spinney Farm B14 (T3) a single storey barn with cavities and gaps in its fabric offered medium to high bat roosting potential (BRP 2-1). The pumping station B11 (T4) and the Trinity College Pumping Station B12 (T9) were largely sealed single storey buildings but may offer low to medium bat roosting potential (BRP 3-2), if gaps exist under the pump-house buildings. The black corrugated iron barn with an asbestos roof (T6) was considered to have no Bat Roost potential. The houses B7 (T18) had an overgrown mature garden with fruit trees, surrounded by tall hedges offering good potential for insects and foraging bats.

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In several of the buildings raptor nest boxes for Barn Owl (*Tyto alba*) and Common Kestrel (*Falco tinnunculus*) had been erected; together with other Barn Owl and Common Kestrel nest boxes positioned on posts or on trees within the site. Several of these were being used successfully by these species to rear their young. The areas of grassland on the headlands of some fields together with the often grassy field edges adjacent to the ditches provide ideal hunting areas for these birds which feed on mice and voles.

### Target Notes

The following target notes of ecological interest were specified during the Phase 1 Habitat Survey.

Target Note	
T1 – Typical permanently wet ditch providing suitable habitat for Water Vole	T2 – New Cut Drain Ditch looking east to church; a typical major dyke on the site
	
T3 – Sedland Farm Barn B14 with holes and crevices offering medium to high Bat Roost Potential (BRP 1-2).	T4 – Pumping Station B11; a sealed building offering little Bat Roost Potential apart from any potential holes or crevices beneath the building.
	
T5 – Skirt Drain looking west from pumping station B11	T6 – Corrugated Black Barn with asbestos roof; unsuitable for roosting bats but with Barn Owl nest box.
	

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T7 – Barn Owl nest box on post and brick built bridge over drain at southern edge of Skirt Drain bank.	T8 – Holland Dyke looking south from Skirt Drain Bridge number 2. A seasonally dry ditch, with Phragmites and riparian plants.
	
T9 – Trinity College Pumping Station B12; a sealed building offering little Bat Roost Potential apart from any potential holes or crevices beneath the building.	T10 – Skirt Drain looking south from bend to the east of pumping station B12
	
T11 – Hollow broken-off Ash tree edge of plantation offering low to moderate Bat Roost Potential (BRP 2-3)	T12 – Broken limb of Ash tree with some flaking bark offering low Bat Roost Potential (BRP 3)
	

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T13 – Broken limb of Ash tree with some flaking bark offering low Bat Roost Potential (BRP 3)	T14 – Church beyond 500m boundary with crevices in doorway and eaves offering moderate to high Bat Roosting Potential (BRP 1-2).
	
T15 – Ash tree with splits, cracks and holes offering low to moderate bat roost potential. (BRP 2-3)	T15b – Close up of section of the trunk
	

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T16 – Oak tree with splits, cracks and flaking barks offering, low bat roost potential. (BRP 3)	T17 – double storey barn B6 offering medium to high bat roosting potential (BRP 2-1) and single storey cowshed B5 offering low to medium bat roosting potential (BRP 3-2)
	
T18 – double storey disused houses B7 offering medium to high bat roosting potential (BRP 2-1)	T19 – a small single storey open-fronted brick barn with a chimney B8 offering limited bat roosting potential.
	
T20 – a single storey electrical shed B9 offering low Bat Roost Potential (BRP 3)	T21 – dead Alder tree with flaking barks offering low bat roost potential. (BRP 3)
	

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T22 – isolated Ash tree with splits at its base offering low bat roost potential (BRP 3)	T22b – isolated Ash tree showing close up of base
	
T23 and T24 – isolated plantations of small trees planted for pheasant cover; with some but limited potential for Badger setts.	T25 – Typical seasonally dry ditch unsuitable for Water Vole
	

## 6.2 Badger Survey

No evidence of Badger (*Meles meles*) was found within the land ownership boundary of the site. Due to land ownership issues some areas within 500m of the proposed turbine positions were not searched; however there was no evidence of Badger activity along the periphery of the land ownership boundary indicating that Badgers are not moving onto the site from beyond the land ownership boundary. It is unlikely that there will be any impact on a Badger population due to the construction phase or production phase of the windfarm development.

## 6.3 Otter Survey

The course of the main drainages and ditches across the site were searched for evidence of Otter (*Lutra lutra*). Signs used to establish the presence of Otters included actual observations of animals, Otter spraint on rocks or other prominent places close to water courses, droppings which contained fish bones and scales and had a pleasant odour similar to jasmine tea.

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No evidence of Otter was observed at the site; however, some of the main drains and ditches on the site appeared potentially suitable for Otters. The introduced alien species American Mink (*Neovison vison*) were observed on three occasions in daylight during wintering and breeding bird surveys in the main Skirt Drain, the Holland Dyke and the main drain which leads north from Rectory Farm. Otter are known to be highly antagonistic towards American Mink and this is further evidence that Otter use or visit the site only very rarely. However, it is suggested that *wherever possible* the construction or access roadways should avoid crossing or being constructed within 10m of suitable main drains or ditches. Similarly, care should be taken to avoid pollution of any watercourses during the construction phase as this would impact strongly on any Otter population present.

#### 6.4 Water Vole Survey

The course of the main drains (apart from the Skirt Drain which will not be affected by the windfarm construction) and all other ditches which permanently contain water on site were searched for evidence of Water Voles (*Arvicola terrestris*) within 50 metres either side of any currently proposed 'crossing points' where bridges may be constructed to transport the wind turbines into position. Signs used to establish the presence of water voles included actual observations of animals, sounds of voles entering the water, latrines showing discrete piles of droppings, tunnel entrances (above and below the water), cropped 'lawn' around tunnel entrances and feeding stations of chopped vegetation.

No evidence of Water Vole was observed at the site; however, some of the ditches on the site which permanently hold water appeared to provide potentially suitable habitat for Water Voles. These can be seen in Table 2 below.

Table 2: Water vole survey results

Crossing point number	Status of ditch	Results
1	Dry	No signs
2	Dry	No signs
3	Dry	No signs
4	Dry	No signs
5	Dry	No signs
6	Dry	No signs
7	Dry	No signs
8	Dry	No signs
9	Dry	No signs
10a	Wet – good habitat	No signs
10b	Wet – densely vegetated	No signs
10c	Dry	No signs
10d	Dry	No signs
11	Dry	No signs
12a	Wet – good habitat	No signs
12b	Wet – good habitat	No signs
13a	Wet – good habitat	No signs
13b	Wet – good habitat	No signs
13c	Wet – good habitat	No signs

As the windfarm construction may occur at a period further in the future, when the water table may be higher, it is suggested that in areas where the construction or access roadways cross potentially suitable habitat that the absence of Water Voles is re-affirmed prior to the construction of the 'crossing points'. This can be achieved by physical examination of the habitat (as was conducted in October 2009) or by placing floating platforms baited with apple within the watercourse; the droppings of any animals visiting the apple bait can then be examined to determine whether Water Voles are present.

The introduced alien species American Mink (*Neovison vison*) were observed on three occasions in daylight during wintering and breeding bird surveys in the main Skirt Drain, the Holland Dyke and the main drain which leads north from Rectory Farm. Mink are known to be highly predatory and antagonistic towards Water Voles and this is further evidence that there are no Water Vole populations on the site or that the populations are likely to be very small.

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If the presence of Water Voles is confirmed then appropriate mitigation should be put in place to protect the Water Vole population during the construction and post construction phases of the development. This may include restoration of the streamside habitat and prevention of pollution by preventing water run off from the development into the watercourses on the site.

#### 6.5 Great Crested Newt Survey

Some of the ditches on site appeared suitable for breeding Great Crested Newts (*Triturus cristatus*); however, these are unlikely to be impacted during the construction phase or operational phase of the proposed wind farm development except by the construction of 'crossing points' in which the water level and flow of the ditch is maintained by a piped conduit. No evidence of Great Crested Newt was found during the extended Phase 1 survey as the time of year was unsuitable to conduct bottle-trapping or torch surveys. Although areas beyond the land ownership boundary of the site were not searched, the Great Crested Newt populations which occurred within any suitable ditches or ponds beyond the 500m radius of the development footprint would not be affected by the construction phase or operational phase of the windfarm development.

As the only affect of the windfarm site would be the minimal affect of any small alterations to the ditch structure at the 'crossing points' and minimal habitat loss (of an area of intensively farmed arable farmland) caused by the 'footprint' of the base of the turbine tower, it was considered that any affect on any Great Crested Newt population potentially occurring within or beyond the land boundary (where no search was conducted) would be negligible.

#### 6.6 Hazel Dormouse Survey

Although no specific survey for Hazel Dormouse (*Muscardardus avellanarius*) was conducted there appears to be no suitable habitat within the site; and no historic evidence of the presence of Hazel Dormouse in the area.

#### 6.7 Reptile Survey

No specific surveys were undertaken at the site to determine reptile populations; however, the site appeared largely unsuitable to sustain reptile populations due to the lack of suitable unimproved grassy areas for foraging or breeding. This may indicate that the site has very low or is lacking reptile populations. During the period that the Phase 1 survey was conducted no casual observations of basking Common Lizard (*Lacerta vivipara*), Slow-worm (*Anguis fragilis*), Adder (*Vipera berus*) or Grass snake (*Natrix natrix*) were made at the site during the visits.

The development area appeared generally unsuitable to sustain reptile populations as it consists of intensively farmed arable land with only small areas of rough grassland. The arable land is generally cultivated right up to the field edges leaving few areas for reptiles to forage or breed. The potential for significant reptile populations at the site of the proposed windfarm is minimal and the presence of viable reptile populations is unlikely.

However, the 'Skirt Drain banks' which act as a watercourse for the major drainage on the site were grass covered and could possibly support relict reptile populations by providing reptiles with foraging and breeding sites. However, the Skirt Drain is unlikely to be impacted by the construction or operational phase of the windfarm with subsequently no detrimental effects to any reptile populations.

### 7. ANALYSIS AND CONCLUSIONS

#### 7.1 Conclusions

- 1) The Phase 1 habitat survey showed the development area to consist of intensively farmed arable fields, a few of which were bordered on headlands by rough grassland. The arable fields were generally cultivated right up to the field margins resulting in very few areas of botanical or ecological importance. The most valuable aspects of the site were the main drainages and ditches which bordered most of the fields and which formed a network of drainage channels which lowered the water table across the site. There were a few small plantation woodlands comprising young trees; however just south of Six Hundreds Farm a mature plantation woodland held some standard Oak and Ash trees which contained holes and cracks which may provide potential roosting sites for bats;

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however in general these plantations were of low ecological significance. To the south of Six Hundreds Farm is a small section of intact, species-poor hedgerow comprising Hawthorn, Blackthorn, Ash, Dog Rose and Bramble which provides shelter for foraging bats in windy conditions. The potential of causing botanical damage to the site due to the construction and operation of the proposed windfarm is likely to be minimal.

- 2) The construction of the windfarm at the Heckington Fen site would be very unlikely to affect any populations of protected species such as Otter, Water Vole or Great Crested Newt which are dependant on riparian habitats. During a thorough investigation of the ditches and main drains on the site no evidence of Otter or Water Vole was found. Whilst the period of the year precluded an accurate assessment for Great Crested Newts, several of the drains appeared to provide suitable potential habitat for this species as well as Otter and Water Voles. For the construction of the wind turbines on the site it will be necessary to construct bridges across some of the ditches in order to move the wind turbines into their proposed positions. These proposed 'crossing points' were examined for a distance of 50 metres either side the 'crossing point' for the presence of Water Vole and Otter during October, 2009. However, the water table at this period was low and it is suggested that this work is repeated in the future immediately prior to the construction of the 'crossing points' in order to re-affirm the absence of Water Vole. This can be achieved by physical examination of the habitat (as was conducted in October 2009) or by placing floating platforms baited with apple within the watercourse; the droppings of any animals visiting the apple bait can then be examined to determine whether Water Voles are present. If the presence of Water Voles is confirmed then appropriate mitigation should be put in place to protect the Water Vole population during the construction and post construction phases of the development. This may include restoration of the streamside habitat and prevention of pollution by preventing water run off from the development into the watercourses on the site. The prevention of pollution of any watercourses on site is imperative to protect populations of Water Vole or Otter or Great Crested Newt.
- 3) Although no evidence of Great Crested Newt (*Triturus cristatus*) was found during the survey as the time of year was unsuitable to conduct bottle-trapping or torch surveys; the Phase 1 survey results show that the development site has some main drainages and ditches with suitable habitat for breeding Great Crested Newts. Prior to the construction of any 'crossing points' a 50 metre length of ditch either side each 'crossing point' should be bottle-trapped and torch-surveyed during late February to June to confirm the absence or presence of Great Crested Newt. If GCN are found to be present then appropriate mitigation should be put in place to protect the population during the construction and post construction phases of the development. This may include restoration of the ditch habitat and prevention of pollution by preventing water run off from the development into the watercourses on the site. As the only affect of the windfarm site would be the minimal affect of any alterations to the ditch structure at the 'crossing points' and minimal habitat loss (of an area of intensive arable farmland) caused by the 'footprint' of the base of the turbine tower; it was considered that any affect on any Great Crested Newt population potentially occurring within or beyond the land boundary (where no search was conducted) would be negligible.
- 4) No evidence of Badger (*Meles meles*) was found at the site; although areas beyond the land ownership boundary were not searched there was no evidence of Badger activity along the periphery of the land ownership boundary indicating that Badgers are not moving onto the site from a sett beyond the land ownership boundary. It is unlikely that there will be any impact on any Badger population due to the construction phase or production phase of the windfarm development.
- 5) Although no specific survey for Hazel Dormouse (*Muscardus avellanarius*) was conducted there appears to be no suitable habitat within the site; and no historic evidence of the presence of Hazel Dormouse in the area
- 6) Whilst the presence or absence of viable reptile populations is not confirmed, the development area appeared generally unsuitable to sustain reptile populations and the construction of the windfarm is likely to have a minimal affect on any relict populations of reptiles which may occur at the Heckington Fen site. Any reptile populations could be protected by minimising the removal of hedgerows, woodland during the construction phase.
- 7) The season at which the Phase 1 Habitat Survey was conducted limits the results obtained from the survey work. The effectiveness of the survey to confirm the presence of Great Crested Newt or to determine the diversity of flowering plants at the site was reduced because the survey work was conducted from mid August until mid October. However, Water Vole, Otter and Badger activity is perhaps easier to monitor at this season.

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## 8. PROPOSED MITIGATION

1. Wherever possible any hedgerows currently found on the development site should be retained; any sections of hedgerow which have to be removed during the construction process should be replaced by a section of at least an equivalent length and quality.
2. Planting of areas of native tree species on areas away from the windfarm development would benefit wildlife across the farm, particularly insects and birds.
3. Wherever possible the standard trees which are present on the site should be retained as they provide a wide range of nesting habitat for hole-nesting birds, for roosting bats and other wildlife such as beetles and moths.
4. Although no evidence of Otter was observed at the site, the main drainages and ditches on the site appeared potentially suitable for Otters; it is suggested that wherever possible the construction or access roadways should avoid crossing main drainages or ditches *wherever possible*. Similarly, care should be taken to avoid pollution of any watercourses during the construction phase as this would impact strongly on any Otter population present.
5. As the construction phase of the windfarm may occur perhaps a few years into the future when the water table level is different, prior to the construction of the 'crossing points', surveys should be conducted for 50 metres either side of the proposed 'crossing points' in order to re-affirm the absence of Water Vole. If Water Voles are found to be present then appropriate mitigation should be put in place to protect the Water Vole population during the construction and post construction phases of the development. This may include restoration of the streamside habitat and prevention of pollution by preventing water run off from the development into the watercourses on the site.
6. Although no evidence of Great Crested Newt was found during the survey as the time of year was unsuitable to conduct bottle-trapping or torch surveys; the Phase 1 survey results show that the development site has some main drainages and ditches with suitable habitat for breeding Great Crested Newts (*Triturus cristatus*). Prior to the construction of any 'crossing points' a 50 metre length of ditch either side each 'crossing point' should be bottle-trapped and torch-surveyed during late February to June to confirm the absence or presence of Great Crested Newt. If GCN are found to be present then appropriate mitigation should be put in place to protect the population during the construction and post construction phases of the development. This may include restoration of the ditch habitat and prevention of pollution by preventing water run off from the development into the watercourses on the site.

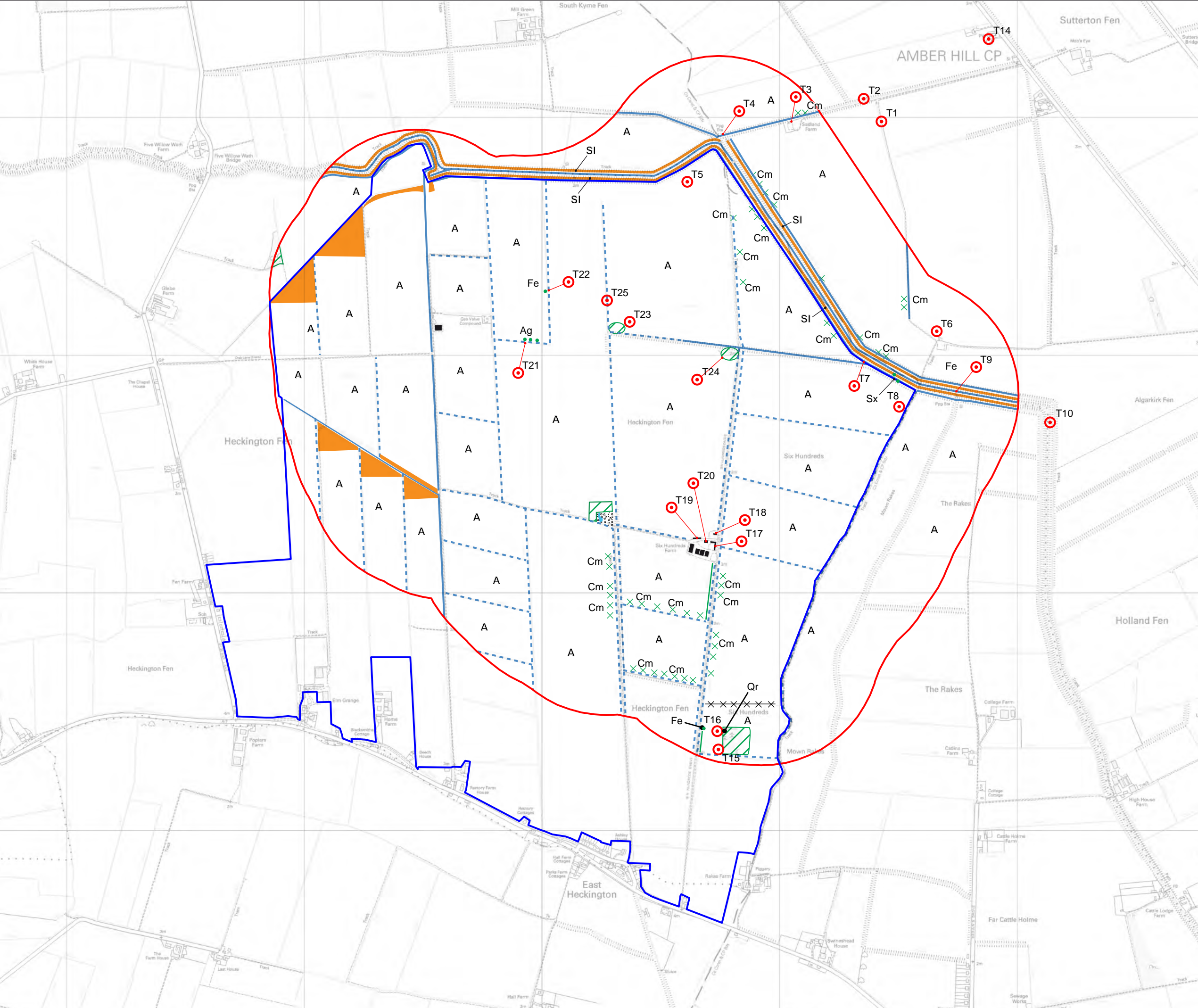
## 9. REFERENCES

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Water Vole Conservation Handbook published jointly by English Nature, the Environment Agency and the Wildlife Conservation Research Unit (1998).

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**Legend**

- Site Boundary
- Survey Area
- Target Note
- Deciduous Plantation
- Standard Trees
- Intact Species Poor Hedge
- Unimproved Neutral Grassland
- Semi-Improved Neutral Grassland
- Arable
- Scattered Scrub
- Bare Ground
- Building
- Permanent Water
- Seasonally Wet Ditch
- Pond
- Boundary Removed
- Ash
- Alder
- Hawthorn
- Oak
- Willow Species

Note:  
Target notes 11-13 are not shown as they fall outside of the study area.

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Date: July 2011

Scale: 1: 15,000 @ A3

Appendix 7.1: Figure 1

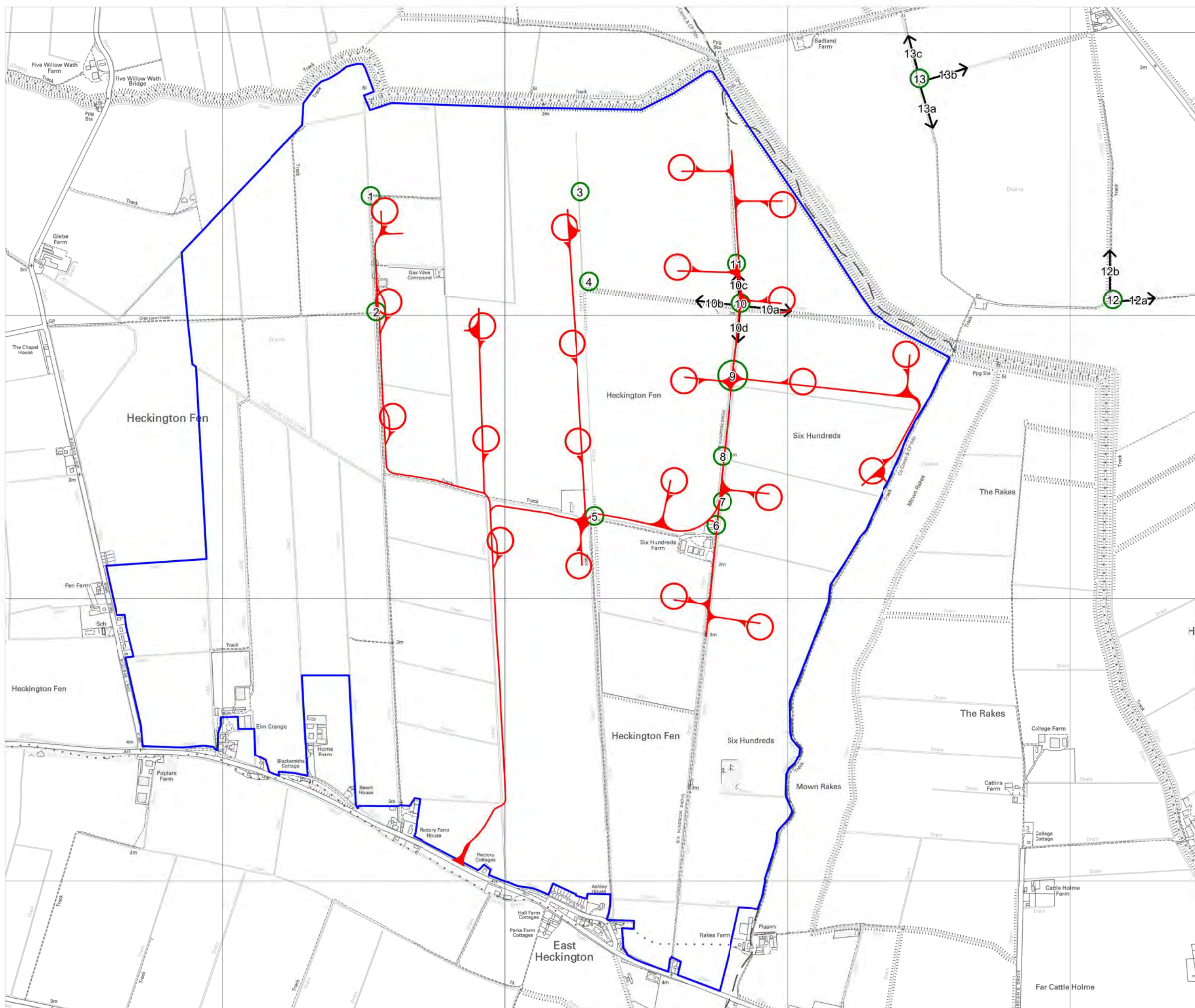
Title: Phase 1 Habitat Survey


Heckington Fen Wind Park  
Environmental Statement

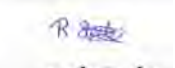


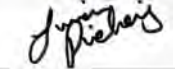
## Legend

- Site Boundary
- Proposed Access Tracks Including Turbine Overhang
- Crossing Points Targeted for Water Vole Surveys
- Extended Survey Areas Searched for Water Vole Evidence



Drawn by 

Checked by 

Approved by 



Document Number: 4038\_T0298\_02

Date: June 2011

Scale: 1: 12,500 @ A3

Appendix 7.1: Figure 2

Title: Water Vole Survey Locations 2009

Heckington Fen Wind Park  
Environmental Statement



APPENDIX 7.2 BAT SURVEY

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REPORT ON A BAT SURVEY CONDUCTED IN  
CONNECTION WITH THE SITE OF THE PROPOSED  
WIND TURBINE DEVELOPMENT AT HECKINGTON  
FEN, WEST OF BOSTON, IN LINCOLNSHIRE.

5<sup>th</sup> November, 2009

This copy includes appendices

I the undersigned, hereby declare that the work was performed according to the procedures herein described and that this Report is an accurate and faithful record of the results obtained.

NEIL BOSTOCK BSc Hons

This document is an account of work carried out by NEIL BOSTOCK on behalf of ECOTRICITY Ltd.  
NEIL BOSTOCK cannot accept responsibility for decisions made or actions taken on the basis of this Report

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### APPENDICES

Appendix A Building Assessment Survey Results

### FIGURES

Figure 1 Bat Activity Transect Routes

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## 2. SUMMARY

- There are proposals for a wind turbine to be constructed by Ecotricity on land at Heckington Fen, west of Boston, in Lincolnshire. As part of the ecological assessment of the site Natural England has requested that a pre-construction and operation night-time bat survey be undertaken in order to assess the actual use made by bats of the area, for roosting, foraging and feeding, and/or for commuting from off-site roosts to preferred feeding areas elsewhere. This study is designed to generate quantitative data which could be used to measure the impact of the proposed wind farm on bat movements and activity when taken in conjunction with data from surveys in the post-construction and operational phase.
- The surveys were carried out on behalf of Ecotricity by Ecologists Louise Brown MIEEM, Shaun Baker MIEEM, Neil Bostock MIEEM and Juliette Banwell, Keith Miller and Lee Rudd all of who are experienced in bat transect and roost surveys. As the proposed wind farm is large the area was split into six survey routes, termed (A) to (F) in order to survey the whole area in blocks which would take approximately 3 hours to cover so that the routes were surveyed at peak times of bat activity. The whole area was surveyed once in July, twice in August and once in September, 2009. The Transect surveys for route (A) and (B) were conducted from just after dusk for approximately 3 hours on 28<sup>th</sup> July, 11<sup>th</sup> August, 17<sup>th</sup> August and 1<sup>st</sup> September, 2009; routes (C) and (D) were surveyed on 30<sup>th</sup> July, 15<sup>th</sup> August, 18<sup>th</sup> August and 3<sup>rd</sup> September, 2009; routes (E) and (F) were surveyed on 31<sup>st</sup> July, 16<sup>th</sup> August, 19<sup>th</sup> August and 4<sup>th</sup> September, 2009; with the route being reversed on each alternate transect. Emergence and roosting surveys were conducted prior to the transect surveys for approximately 60 minutes each evening commencing 30 minutes before dusk; and for 105 minutes in the morning commencing 90 minutes before dawn. During the surveys a Duet II Bat Detector set at 40-45 kHz was used to detect Pipistrelle and Myotis bats; in addition a Peterson 240DX Bat Detector set at 25 kHz was used to determine the presence of Noctule bats in conjunction with an Anabat SD 1 which recorded all bat activity during the surveys.
- The bat roost swarming and emergence surveys were carried from just before dusk and prior to dawn at sites which had been identified during the Phase 1 habitat survey as localities (trees or buildings) which could potentially support a bat roost and they followed standard survey methods. In addition, an assessment of all the potential buildings and structures (such as bridges) was made to determine their potential and suitability for bat roosting sites. A day-time site visit was made to look at each building or structure for bat droppings (on walls of buildings) or holes or cavities which allowed a bat to access to find a dry secure roost site. Any suitable holes were examined for evidence of roosting bats such as absence of spider webs and the presence of any scratches or slightly darkened greasy marks which often occur when bats squeeze into a roosting site and were examined internally with an endoscope for the presence of roosting bats. The following buildings (as identified in the buildings and structures survey) were examined thoroughly for bat emergence or swarming activity: B5 (T17) an old single storey cowshed/barn with low to medium bat roosting potential (BRP 3-2); B6 (T17) a two storey barn with medium to high bat roosting potential (BRP 2-1); B7 (T18) two semi-detached two storey houses with medium to high bat roosting potential (BRP 2-1); B8 (T19) a single storey barn with a chimney with limited bat roosting potential; B9 (T20) a single storey electric shed/barn with low bat roosting potential (BRP 3); B11 (T4) pump-house and B12 (T9) Trinity pump-house single storey buildings with, if gaps exist under the pump-house building, low to medium bat roosting potential (BRP 3-2); B14 (T3) a single storey barn with medium to high bat roosting potential (BRP 2-1). Other buildings and structures were examined jointly or on just one occasion as these were considered to have limited potential for roosting bats; these were buildings B1-4 which were modern barns and the bridge B15. Several trees on were identified which may have potential for roosting bats on the site; an Ash tree (T11) a hollow broken off tree at the edge of the plantation on Spinney Farm which had cracks and splits in the bark offering low to moderate potential for roosting bats (BRP 2-3); an Ash tree (T12) with a broken limb and some cracks and flaking bark offering low potential for roosting bats (BRP 3); an Ash tree (T13) with a broken limb and flaking bark offering low bat roost potential (BRP 3); an Ash tree (T15) with large splits and flaking bark offering low to moderate bat roost potential (BRP 2-3); an Oak tree (T16) with some splits and flaking bark offering low bat roost potential (BRP 3); an alder (T21) with flaking bark offering low bat roost potential (BRP 3); and an isolated Ash (T22) with splits at its base offering low bat roost potential (BRP 3). Only the trees (T15) and (T22) were surveyed at dawn for swarming activity and for roosting bats. Any potential roost sites were generally observed by two people from a position where all suitable emergence points could be seen at each survey period. The survey periods were generally selected when the weather conditions were optimum for bat activity i.e. dry and with calm conditions; however, the emergence survey conducted at B7 and B8 on 18<sup>th</sup> August occurred in cooler conditions than was hoped (ranging down to 9.5° C). The air temperature, wind speed and direction and weather conditions were recorded on each visit.

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- The night-time transect bat surveys were carried out after dusk between 28<sup>th</sup> July and 4<sup>th</sup> September, 2009 and they followed standard survey methods. As the proposed wind farm is large the area was split into six survey routes, termed (A) to (F) in order to survey the whole area in blocks which would take approximately 3 hours to cover so that each route could be surveyed at peak times of bat activity. A day-time site visit enabled the proposed turbine positions and physical features on each route most likely to support bat activity to be identified and these were used to set fixed recording points on each transect route which was followed by observers using bat detectors. Recording points encompassed both natural and man made features and the majority of the area (subject to land ownership) within 500m radius of the proposed development area was walked during the transect surveys; the survey route also took into account the position of the proposed turbines on the site. On each night, the same survey method was used. The survey nights were generally selected when the weather conditions were optimum for bat activity i.e. warm, dry and with calm conditions. Survey nights were as far as possible spaced evenly apart at a period when weather conditions would optimise bat activity; however, on 30<sup>th</sup> July clear, cool conditions caused the temperature to drop to 8.5° C by the end of the transect survey; whilst the September surveys were conducted in slightly windier conditions than was generally hoped for. The air temperature, wind speed and direction and weather conditions were recorded on each visit. During the first visit, the survey route selected generally moved chronologically from recording points 1 to either 16, 17, 13, 12 or 8 (depending on the survey route A-F) ; whilst during the alternate visit the route taken was reversed in order to ascertain different bat activity at different points at different periods of the night.
- The survey results show that the site is used by relatively small numbers of 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) with between 0 and 20 individuals foraging on the survey transects, depending on the survey route, the time of year and weather conditions during the survey. Numbers were lowest during the surveys conducted on routes (A), (C) and (D) which comprise a transect route along the small ditches and field boundaries of the open arable farmland. The numbers of bats were generally highest on survey routes (B), (E) and (F) which ran alongside long sections the Skirt Drain which was a major drainage channel situated between Six Hundreds Farm and Spinney Farm. The Skirt Drain consisted of two high banks separated by a broad gently flowing watercourse; the physical structure of the Skirt Drain which provided shelter from most winds and the slightly vegetated banks concentrated insect activity which in turn provided ideal foraging opportunities and concentrated the number of bats. The Skirt Drain also formed a linear feature which ran right across the site from west to east acting as a commuting corridor for bats moving onto the site from beyond the 500m boundary. During September the levels of bat activity on the survey routes were generally lower due to moderately windy weather conditions reducing the level of bat activity on what is an exposed site; however on route (B) the level of bat activity was maintained as bats concentrated foraging within the Skirt Drain. Conversely, routes (C) and (D) which traversed open farmland registered no bats. In late July total numbers were relatively low with 34 bats being recorded; bat numbers gradually increased in August reaching a peak on surveys conducted from 17<sup>th</sup> to 19<sup>th</sup> August when the adult bat population was augmented by juvenile bats. In September the bat population across the site began to decline as bats began to desert their summer roosting areas and move to their wintering roosting areas. No Noctule Bats (*Nyctalus noctula*) were recorded during the surveys; similarly no 55 kHz Pipistrelle bats (*Pipistrellus pygmaeus*) were recorded. A few *Myotis* spp bat was found during the surveys; these were particularly associated with the Skirt Drain with most individuals being recorded on transect route (B). Generally, numbers were low with just one individual being recorded during most survey visits; however during surveys conducted from 17<sup>th</sup> to 19<sup>th</sup> August 3 *Myotis* spp bats were recorded perhaps indicating the additional presence of juveniles or perhaps dispersal through the site by these species. It is likely that the *Myotis* spp bats were Daubenton's Bats (*Myotis daubentonii*); this species was specifically identified on 28<sup>th</sup> July and the foraging activity and habitat being used (foraging low over the water of the Skirt Drain) strongly indicates this species. The results are considered to be within the range of the typical kind of "background" bat activity expected for a site of this nature, which consists mainly of exposed, open arable farmland with small pockets of grassland, very few mature hedgerows and a few small deciduous wooded plantations. The Skirt Drain forms the major bat habitat both for foraging in a range of weather conditions and as a linear corridor to commute onto the site. Although the majority of trees are young and do not provide bats with many roosting opportunities; the small grassland areas at the arable site potentially provides bats with good foraging areas. The mature woodland plantations and mature hedgerows also provide bats with limited foraging potential.
- The bat activity recorded by the surveys generally involves relatively low numbers of the commonest bat species and is believed to be not significant given that there is a large amount of similar habitat in the vicinity. The level of bat activity which occurred in the open exposed arable areas in which the most prevalent features were the small field boundary ditches and isolated small plantations mostly with small trees was very low. This is the area of the site where any proposed turbine development will be situated. Most bat foraging and commuting activity was associated with the Skirt Drain which will

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- not be impacted by the wind farm development on either Six Hundreds Farm or Spinney Farm. Overall the potential for significant bat activity at the site of the proposed wind turbine appears to be minimal.
- The construction and operation of the wind turbines at the site is unlikely to affect the activity of feeding or commuting bats as revealed by the night-time surveys undertaken in the period end July to early September, 2009. The majority of the bats using the site are 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) which are known to fly quite low to the ground and are unlikely, even when foraging in the vicinity of the windfarm, to be affected by the operation of the turbines. It is therefore considered that no mitigation measures with respect to foraging, feeding or commuting bats of this species are required at this site. No 55 kHz Pipistrelle bats (*Pipistrellus pygmaeus*) were recorded; whilst a one to three *Myotis* spp bat (likely to be Daubenton's bat [*Myotis daubentonii*]) were recorded foraging on the Skirt Drain throughout the survey. These are also generally a low flying species which are unlikely to be affected by the wind turbines and they foraged and probably commuted onto the site using an area which will not be affected by the wind turbine development. No Noctule Bats (*Nyctalus noctula*) which are a species which can fly high and may forage at altitude and are perceived as being at risk from collision from wind turbines were observed during the surveys.
- An examination of the numbers of bats recorded at the waiting Stations and en route between the Stations during each survey visit indicates that generally very low numbers of 45 KHz Pipistrelle bats (*Pipistrellus pipistrellus*) were foraging along corridors formed by the ditches in open arable farmland. Whilst the few hedgerows situated south and west of Six Hundreds Farm and the mature plantation situated south of Six Hundreds Farm provided sheltered foraging habitat for a few bats depending on wind direction the numbers of bats using the open arable areas overall was low. The Skirt Drain provided the major bat habitat on the site; on route (B) waiting Stations adjacent to the Skirt Drain produced 75% of the bats recorded on the survey route; on route (E) waiting Stations adjacent to the Skirt Drain produced 78% of the bats recorded on the survey route whilst on route (F) waiting Stations adjacent to the Skirt Drain produced 76% of the bats recorded on the survey route. The buildings on site also provided shelter and concentrated insects which in turn concentrated foraging bats; on route (C) 50% of the bats recorded on the transect occurred around the buildings at Six hundreds Farm. However, as survey route (C) largely comprised open arable areas the number of bats recorded on each survey visit was low ranging from 0 to 8. Only twenty-one 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were found at or en route between all wait Stations within 200m of the proposed turbine positions across all survey routes during the entire survey period. This represents only 13% of the bats which were recorded across all survey routes during the entire survey period. No *Myotis* spp bats were found within 200m of the proposed turbine position. No Noctule Bats (*Nyctalus noctula*) were recorded during the surveys. This indicates that the bat activity within 200m of the turbine is generally very low. The greatest bat activity occurred adjacent to the Skirt Drain which is 350m from the proposed turbine positions.
- At end July to mid August, in comparable weather conditions, the number of bats recorded in each of the surveys appeared to be quite consistent. Indeed, the positions and foraging localities where bats were found over this period also appeared to be consistent indicating that some of the same bats may be involved in some of the records. This is further evidence that the population of bats using the site is not large.
- Small differences in the number of bats using the site are likely to be due to weather related factors; as small and large differences in survey conditions, including temperature, wind strength and direction and cloud cover, may have a greater bearing on bat activity than could be perceived by humans. Still conditions with high temperatures and high humidity are likely to make insect food more abundant; the phase of the moon may also influence insect and bat activity.
- There are several opportunities for bats to roost within the area within 500m radius of the proposed development footprint which forms the survey area. The older brick-built farm buildings at Six Hundreds Farm and Sedlands Farm were assessed to have suitable structures and construction to have Bat Roost Potential. In particular the buildings B5 and B11 were considered to have low to medium Bat Roost Potential (BRP 2-3); whilst buildings B6, B7 and B14 were considered to have medium to high Bat roost Potential (BRP 1-2). By contrast, the modern asbestos barn buildings B1-4, B10 and the brick-built barn B8 and store B9 were considered to have low or very limited potential for roosting bats. The pumping stations B11 and B12 were well-sealed buildings where the only bat roost potential was if there were any gaps underneath the building in the concrete structure adjacent to the watercourse. The Skirt Drain bridges B13 and B15 were not suitable for roosting bats. During emergence and swarming surveys conducted between 30<sup>th</sup> July and 18<sup>th</sup> August; 5 roosting 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) each roosting singly, using 5 separate roosts were found in the gables of building B6; one roosting 45 kHz Pipistrelle bat was using the chimney stack of building B7;

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<p>two roosting 45 kHz Pipistrelle bats each roosting singly were using the gable and interior of building B14 and a 45 kHz Pipistrelle bat possibly roosted in building B4. Several trees across the site were identified as having low to moderate Bat Roosting Potential (BRP 2-3); of these an Ash tree (T15) and an isolated Ash tree (T22) were examined during swarming surveys conducted on 19<sup>th</sup> and 20<sup>th</sup> August. No bats were found to be roosting in these trees; although it is possible bats may have been using other trees within 500m of the development footprint for roosting. The majority of bats which were observed foraging on the surveys were most likely commuting to the site to feed from roost sites beyond the 500m boundary from the turbine positions. The Skirt Drain is an important linear foraging and commuting corridor for bat activity on the site.</p> <ul style="list-style-type: none"><li>• The construction and operation of the wind turbine is unlikely to destroy any bat roost sites or affect the bats which are currently foraging at the site.</li><li>• <u>Proposed Mitigation:</u></li><li>• As this survey was only commenced in late July it is important that further transect surveys should be conducted to confirm the use of the site from April, when bats first become active, until June in order to have a complete assessment of how bats use the site. The emergence and swarming surveys should be conducted again in June on buildings B5, B6, B7 and B14 in order to confirm that the roosts located are still active and that no maternity roosts are present at the site.</li><li>• The buildings on the site in particular buildings B6 at Six Hundreds Farm and building B14 termed Sedlands Farm hold roosting bats. In addition, the houses B7 may sporadically also hold roosting bats. If any of these buildings were to be structurally altered or demolished during the construction of the wind farm further surveys would be required to assess whether these roosts comprised maternity or hibernation roosts or single bats. Prior to demolition an alternative specifically constructed 'bat house' should be erected to provide an alternative roosting site for these animals. Before demolition of any building the effective transfer and use of the 'bat house' for roosting should be demonstrated.</li><li>• Wherever possible the mature standard trees which are present within 500m of the site should be retained as they potentially provide a wide range of bat roosting habitat such as holes, flaking bark, or cracks in the trunk.</li></ul>	
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<p><b>3. INTRODUCTION</b></p> <p><b>3.1</b> There are proposals for a wind turbine to be constructed by Ecotricity on land at Heckington Fen, west of Boston, in Lincolnshire. As part of the ecological assessment of the site Natural England has requested that a pre-construction and operation night-time bat survey be undertaken in order to assess the actual use made by bats of the area, for roosting, foraging and feeding, and/or for commuting from off-site roosts to preferred feeding areas elsewhere. This study is designed to generate quantitative data which could be used to measure the impact of the proposed wind farm on bat movements and activity when taken in conjunction with data from surveys in the post-construction and operational phase.</p> <p><b>3.2</b> The surveys were carried out on behalf of Ecotricity by Ecologists Louise Brown MIEEM, Shaun Baker MIEEM, Neil Bostock MIEEM and Juliette Banwell, Keith Miller and Lee Rudd all of who are experienced in bat transect and roost surveys. As the proposed wind farm is large the area was split into six survey routes, termed (A) to (F) in order to survey the whole area in blocks which would take approximately 3 hours to cover so that the routes were surveyed at peak times of bat activity. The whole area was surveyed once in July, twice in August and once in September, 2009. The Transect surveys for route (A) and (B) were conducted from just after dusk for approximately 3 hours on 28<sup>th</sup> July, 11<sup>th</sup> August, 17<sup>th</sup> August and 1<sup>st</sup> September, 2009; routes (C) and (D) were surveyed on 30<sup>th</sup> July, 15<sup>th</sup> August, 18<sup>th</sup> August and 3<sup>rd</sup> September, 2009; routes (E) and (F) were surveyed on 31<sup>st</sup> July, 16<sup>th</sup> August, 19<sup>th</sup> August and 4<sup>th</sup> September, 2009; with the route being reversed on each alternate transect. Emergence and roosting surveys were conducted prior to the transect surveys for approximately 60 minutes each evening commencing 30 minutes before dusk; and for 105 minutes on the morning commencing 90 minutes before dawn. During the surveys a Duet II Bat Detector set at 40-45 kHz was used to detect Pipistrelle and Myotis bats; in addition a Peterson 240DX Bat Detector set at 25 kHz was used to determine the presence of Noctule bats in conjunction with an Anabat SD 1 which recorded all bat activity during the surveys.</p> <p><b>3.3</b> This report describes the area surveyed, the survey methods, the results and the conclusions drawn. The locations and flight lines of all the bats encountered were marked onto survey maps along with details of any deviations from standard methodology, conditions at the time of survey and a brief summary of the results.</p> <p><b>4. SITE DESCRIPTION</b></p> <p>The site is located some 11.0 km west of Boston at Heckington Fen, in Lincolnshire. The survey area is diamond shaped being approximately 3.8 km by 2.8 km centred on grid reference TF 208 457. The area comprises largely of the two farms of Spinney Farm situated to the north of the Skirt Drain and Six Hundreds Farm situated to the south of the main Skirt Drain and north of the A17 trunk road. Both farms consist of arable farmland with large open fields growing winter wheat, winter and spring sown oilseed rape and sugar beet. The majority of the fields are separated by drainage ditches; many of these are less than 1 metre in depth and 1.5m in width and were dry during the survey period. These dry ditches were often choked with vegetation including <i>Typha</i>, sedges, rank grasses and some bramble and offer very limited foraging for bats; the large windswept open arable fields are also poor foraging habitat for bats. However, some major drains were also present being 2.0m in depth and up to 3.0m in width which permanently held water and contained plants such as Frogbit <i>Hydrocharis morsus-ranae</i> and Broad-leaved Pondweed <i>Potamogeton natans</i> as well as <i>Phragmites</i> and other riparian vegetation. A major drainage the Skirt Drain runs along the northern edge of Six Hundreds farm before passing in a north-west to south-eastern direction separating Six Hundreds Farm from Spinney Farm. On the Skirt Drain are two Pumping Stations which allow the water level of the drains across the site to be regulated by moving water into the Skirt Drain. This major drainage is canalised and runs between two built-up earth banks which are grassed and used for grazing sheep and cattle. At the outer base of the earth banks is a further deep drain formed from the removal of earth to build up the banks. The Skirt Drain and the larger drainage ditches on the site provide sheltered foraging opportunities for bats and offer potential corridors for bats to commute onto the site. There are a few young plantations of mainly small deciduous trees scattered around Six Hundreds Farm largely to provide Pheasant cover, these do not provide roosting opportunities for bats but may provide sheltered foraging in windy conditions. The plantation south of Six Hundreds Farm is more mature and contains some standard Ash and Oak trees which could offer roosting sites for bats. In particular an Ash tree (T15) has splits, cracks and holes offering low to moderate bat roosting potential (BRP 2-3); whilst an Oak tree (T16) has some splits and flaking bark and may offer low bat roosting potential (BRP 3). On Spinney Farm a small plantation also contains some Ash trees (T11), (T12) and (T13) which have broken limbs, flaking bark or splits which offer low to</p> <p>SUB-CONTRACTOR: NEIL BOSTOCK</p> <p>CONTRACTOR: ECOTRICITY LTD.</p>	



moderate or low bat roosting potential respectively. Within the open field landscape just east of the Gas Valve Compound there was also a small dead Alder (T21) with flaking bark offering low bat roost potential (BRP 3) and an isolated Ash (T22) with splits at its base offering low bat roost potential (BRP 3).

Throughout the site were several buildings which could provide suitable roost sites for bats; these buildings were assessed using features of age, method of construction and location to identify which had the greatest potential for bats. At Six Hundreds Farm buildings with bat roost potential included: B5 (T17) an old single storey cowshed/barn with low to medium bat roosting potential (BRP 3-2); B6 (T17) a two storey barn with medium to high bat roosting potential (BRP 2-1); B7 (T18) two semi-detached disused two storey houses with medium to high bat roosting potential (BRP 2-1); and B9 (T20) a single storey electric shed/barn with low bat roosting potential (BRP 3). Other buildings identified as B1-4 and B10 which were modern barns and B8 (T19) a small single storey open-fronted brick barn with a chimney were considered to have no or limited bat roosting potential. At Spinney Farm B14 (T3) a single storey barn with cavities and gaps in its fabric offered medium to high bat roosting potential (BRP 2-1). The pumping station B11 (T4) and the Trinity College Pumping Station B12 (T9) were largely sealed single storey buildings but may offer low to medium bat roosting potential (BRP 3-2), if gaps exist under the pump-house buildings.

The bridges which spanned the Skirt Drain, Skirt Drain No 1 (B13) and Skirt Drain No 2 (B15) were of concrete construction and were considered to offer negligible roosting potential for bats. Observations of the bridges showed no evidence of bats and few features that might accommodate roosting bats.

The houses B7 (T18) had an overgrown mature garden with fruit trees, surrounded by tall hedges offering good potential for insects and foraging bats.

The fields immediately south of Six Hundreds Farm were surrounded by mature dense intact hedges which may offer sheltered foraging for bats in windy conditions. Elsewhere on the site there is very little shelter apart from the Skirt Drain which is sheltered by the high banks which produce the watercourse channel. The ends of many of the fields at the western section of the site are substantial areas seeded with rough grassland, these areas have abundant insect populations and may provide significant foraging areas for bats.

## 5. METHODS

### 5.1 Survey Conduct

#### a) Transect Surveys

As the proposed wind farm is large, the area was split into six survey routes, termed (A) to (F) in order to survey the whole area in blocks which would take approximately 3 hours to cover, so that the routes were surveyed at peak times of bat activity. A day-time examination of the site was carried out for each survey route in order to identify areas most likely to support bat activity, such as sheltered places provided by ditches or rivers, or the lee of buildings or hedgerows or adjacent to ponds or plantations or within woodland. The proposed turbine positions together with these physical features on each route were used to set fixed designated recording points on each transect route which were walked by observers using bat detectors. Recording points encompassed both natural and man made features and covered the majority of the area (subject to land ownership) within 500m radius of the proposed development area; the survey route also took into account the position of the proposed turbines on the site. A survey route was devised with defined start and end points and which took the observers to each recording point via the site's field boundaries.

The surveyors walked along each route recording and mapping bat activity along the route using hand-held bat detectors. At the designated recording points the surveyors remained still for three minutes, and noted and mapped bat activity in the surrounding area using hand-held bat detectors. During the surveys a Duet II Bat Detector set at 40-45 kHz was used to detect Pipistrelle and *Myotis* bats; in addition a Peterson 240DX Bat Detector set at 25 kHz was used to determine the presence of Noctule bats in conjunction with an Anabat SD 1 which recorded all bat activity during the surveys. If necessary the Duet frequency was then changed in order to detect other bat species. Whenever bats were encountered in between designated recording points their activity was noted to determine if they were feeding actively or commuting and a target note was put on the maps to record the species, position and activity of the bat. The direction of flight of any commuting bats was noted if this could be determined.

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On each night, the same survey method was used. The survey nights were generally selected when the weather conditions were optimum for bat activity i.e. warm, dry and with generally calm conditions. Survey nights were as far as possible spaced equally throughout the recording period from end July to early September, 2009. The air temperature, wind speed and direction and weather conditions were recorded on each visit. During the first visits for each survey route made between 28<sup>th</sup> and 31<sup>st</sup> July the survey routes selected moved chronologically from recording points 1-16 for route (A); from 1-17 for route (B); from 1-13 for route (C); from 1-12 for route (D); from 1-8 for route (E); and from 1-8 for route (F). However, during the second visit between 11<sup>th</sup> August and 16<sup>th</sup> August the routes taken were each reversed in order to ascertain different bat activity at different recording points at different periods of the night. Thereafter the route was reversed on the subsequent visits between 17<sup>th</sup> and 19<sup>th</sup> August and between 1<sup>st</sup> and 4<sup>th</sup> September, 2009.

The survey method was based on information given in the Bat Workers Manual (Mitchell-Jones, T & McLeish, AP; 2004; Bat Workers' Manual 3<sup>rd</sup> Edition, JNCC) for the undertaking of bat detector surveys, where the peak of bat activity which occurs after dusk for around 2 hours is used as the main window for survey.

The survey method allows for exact repetition at any stage in the future. Details of route, time spent recording (in total and at selected points), the location of the selected recording points, the work undertaken at these points, and start and end times were noted.

The conduct of the fieldwork was commensurate with 'Good Ecological Practice', with due attention being given to parameters which may affect the activity of bats i.e. period in the year, time of night and weather conditions. Where land ownership or footpath access allowed, the majority of the field boundaries and woodland blocks were walked; the survey route also took into account the position of the proposed turbines on the site.

#### b) Building Assessment Surveys

An assessment of the suitability of the buildings (and other structures such as bridges) on the site was made in order to determine which buildings were likely to offer potential for roosting bats and to determine if any buildings could support a maternity roost or be suitable for hibernating bats. The assessment incorporated various factors including the age and height of the building, its current use, the roof structure and construction, the fabric material of the walls, the structural features of the building including gables, barge boards, flashing, roof voids or under-felting. Any features which would allow potential access for bats or would act as a feature which would allow a bat to roost were identified for each building. Using this assessment the level of potential for roosting bats was identified as none or limited, low, medium or high. The suitability of any of the buildings to act as a maternity roost or for bats to use as a hibernation site was also assessed. The day-time site visit enabled surveyors to look at each building for bat droppings (on walls, beams and floors) or holes or cavities in the fabric which allowed a bat to move upwards to find a dry secure roost site. Any holes were examined for evidence of roosting bats such as absence of spider webs and the presence of any scratches or slightly darkened greasy marks which often occur when bats squeeze into a roosting site. Photographs were taken of buildings and the locations of all the buildings on the site were mapped. The results of these surveys are presented in Appendix B.

#### c) Emergence and Roosting Surveys

The bat roost and emergence surveys were carried from just before dusk and prior to dawn at buildings which had been identified during the Buildings Assessment Survey and at trees identified during the Phase 1 habitat survey as localities (trees or buildings) which could potentially support a bat roost and they followed standard survey methods. The following buildings (as identified in the buildings and structures survey) were examined thoroughly for bat emergence or swarming activity: B5 an old single storey cowshed/barn with low to medium bat roosting potential (BRP 3-2); B6 a two storey barn with medium to high bat roosting potential (BRP 2-1); B7 two semi-detached two storey houses with medium to high bat roosting potential (BRP 2-1); B8 a single storey barn with a chimney with limited bat roosting potential; B9 a single storey electric shed/barn with low bat roosting potential (BRP 3); B11 pump-house and B12 Trinity pump-house single storey buildings with, if gaps exist under the pump-house building, low to medium bat roosting potential (BRP 3-2); B14 a single storey barn with medium to high bat roosting potential (BRP 2-1). Other buildings and structures were examined jointly or on just one occasion as these were considered to have limited potential for roosting bats; these were buildings B1-4 which were modern barns and the bridge B15. Any potential roost sites were generally observed by two people from a position where all suitable

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emergence points could be seen at each survey period. Several trees across the site were identified as having low to moderate Bat Roosting Potential (BRP 2-3); of these an Ash tree (T15) and an isolated Ash tree (T22) were examined during swarming surveys conducted on 19<sup>th</sup> and 20<sup>th</sup> August. No bats were found to be roosting in these trees; although it is possible bats may have been using other trees within 500m of the development footprint for roosting. The survey periods were generally selected when the weather conditions were optimum for bat activity i.e. dry and with calm conditions; however, the dawn swarming survey conducted at B7 and B8 on 18<sup>th</sup> August occurred in cooler conditions than was hoped (ranging down to 9.5° C). The air temperature, wind speed and direction and weather conditions were recorded on each visit.

The emergence surveys were conducted for approximately for 45 minutes each evening commencing from 15 minutes before dusk and for 105 minutes each morning commencing from 90 minutes before sunrise and continuing for 15 minutes after sunrise. During the surveys a Duet II Bat Detector set at 40-45 kHz was used to detect Pipistrelle and *Myotis* bats; in addition a Peterson 240DX Bat Detector set at 25 kHz was used to determine the presence of Noctule bats in conjunction with an Anabat SD 1 which recorded all bat activity during the surveys. Each surveyor stood at a fixed position which allowed good visibility of the building or tree to be surveyed; visual observation was augmented by a hand-held bat detector. At dusk, the point from where any emerging bats came from was pin-pointed, together with their species, the time of first emergence and number of bats emerging and the activity (period of foraging around roost, direction of flight away from roost) was determined if possible. At dawn the location of roost sites was determined by swarming behaviour of any bats prior to roosting and intense observation used to determine the location of the roost. The species and numbers of roosting bats were recorded.

The survey method allows for exact repetition at any stage in the future. Details of emergence/roost survey positions, time spent recording, the work undertaken at these points, and survey start and end times were noted.

Locations where bat roosts were found and the bat species and numbers of bats using the roosts were registered using references to the Buildings Assessment Survey (see Appendix A).

A day-time site visit was made to look at each site for bat droppings (on walls of buildings) or holes in trees which allowed a bat to move upwards to find a dry secure roost site. Any holes were examined for evidence of roosting bats such as absence of spider webs and the presence of any scratches or slightly darkened greasy marks which often occur when bats squeeze into a roosting site.

## 5.2 Area Encompassed by the Survey

The area surveyed was an area encompassing 500m radius from the proposed development footprint of the proposed windfarm situated at Heckington Fen, 11.0 km west of Boston, in Lincolnshire. The survey route took into account the topography of the site and natural features of the site which may affect bat foraging or commuting activity as well as assessing bat activity adjacent to the proposed turbine positions. The emergence survey was conducted at trees or buildings with bat roosting potential identified during the Buildings Assessment Survey and the Phase 1 habitat survey.

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## 5.3 Survey Visit Timings and Weather Conditions

Details of survey visit dates; start and finish times and weather conditions during the survey are presented in Table 1.

**Table 1 - Visit Schedule and Weather Conditions during Surveys**

Visit	Visit date	Start Time	Weather conditions (at start)	Finish time	Weather conditions (at finish)
<b>Building Assessment Surveys</b>					
D day	11 Aug 09 On buildings at Six Hundreds Farm, pumping station and Skirt Drain Bridge No. 1	13:30 pm	40% cloud cover Wind W 1. Dry, sunny. Air Temp 20.0° C	17:30 pm	60% clouds cover Wind W 2-3. Dry, sunny. Air Temp 19.0° C
F day	16 Aug 09 On buildings at Spinney Farm, Trinity College pumping station and Skirt Drain Bridge No. 2	18:30 pm	80% cloud cover Wind W 2-3 Dry, high humidity, Air Temp 20.5° C	20:00 pm	90% cloud cover Wind W 2-3 Dry, high humidity, Air Temp 19.5° C
<b>Emergence Surveys</b>					
B pm	30 July 09 On barns B5 and B6 Sunset 20:55 pm	21:07 pm	10% cloud cover Wind SW 1-2. Dry, cool. Moon 4/8. Air Temp 12.5° C	21:45 pm	10% cloud cover Wind SW 1-2. Dry, cool. Moon 4/8. Air Temp 12.5° C
C pm	31 July 09 On barn B14 Sunset 20:53 pm	20:45 pm	100% clouds cover Wind SSW 1-2. Dry, humid. No moon. Air Temp 18.5° C	21:45 pm	100% clouds cover Wind SSW 1-2. Dry, humid. No moon. Air Temp 17.5° C
D pm	11 Aug 09 On pumping station B11 Sunset 20:33 pm	20:55 pm	70% cloud cover Wind W 2-3 Dry, high humidity, Air Temp 20.5° C	21:30 pm	70% cloud cover Wind W 2-3 Dry, high humidity, Air Temp 20.5° C
D pm	11 Aug 09 On houses B7 Sunset 20:33 pm	20:55 pm	70% cloud cover Wind W 2-3 Dry, high humidity, Air Temp 20.5° C	21:30 pm	70% cloud cover Wind W 2-3 Dry, high humidity, Air Temp 20.5° C
E pm	15 Aug 09 On barns B5 and B6 Sunset 20:27 pm	20:19 pm	30% cloud cover Wind SW 3 Dry, high humidity, Air Temp 23.0° C	21:15 pm	30% cloud cover Wind SW 3 Dry, high humidity, Air Temp 23.0° C

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Visit	Visit date	Start Time	Weather conditions (at start)	Finish time	Weather conditions (at finish)
Emergence Surveys					
E pm	15 Aug 09 On houses B7 Sunset 20:27 pm	20:15 pm	30% cloud cover Wind SW 3 Dry, high humidity, Air Temp 23.0° C	21:14 pm	30% cloud cover Wind SW 3 Dry, high humidity, Air Temp 23.0° C
F pm	16 Aug 09 On Trinity college pumping station B12 Sunset 20:26 pm	20:25 pm	90% cloud cover Wind W 2-3 Dry, high humidity, Air Temp 19.5° C	21:15 pm	90% cloud cover Wind W 2-3 Dry, high humidity, Air Temp 19.5° C
F pm	16 Aug 09 On barn B14 Sunset 20:26 pm	20:35 pm	90% cloud cover Wind W 2-3 Dry, high humidity, Air Temp 19.5° C	21:15 pm	90% cloud cover Wind W 2-3 Dry, high humidity, Air Temp 19.5° C
Swarming and Roosting Surveys					
F am	16 Aug 09 On barns B5, B6 and B9 Sunrise 05:39 am	03:55 am	0% cloud cover Wind SW 1. Moon 1/8 Dry, high humidity, Air Temp 13.5° C	05:45 am	10% cloud cover Wind SW 1 cooler, light rain, Air Temp 13.5° C
F am	16 Aug 09 On barns B1 to B4 Sunrise 05:39 am	04:00 am	0% cloud cover Wind SW 1. Moon 1/8 Dry, high humidity, Air Temp 13.5° C	05:45 am	10% cloud cover Wind SW 1 cooler, light rain, Air Temp 13.5° C
G am	17 Aug 09 On Pumping Station B12 & bridge B15 Sunrise 05:41 am	03:54 am	85% cloud cover Wind SW 1-2. Dry, high humidity, Air Temp 12.0° C	06:00 am	100% cloud cover Wind SW 2 cooler, no rain, Air Temp 12.5° C
G am	17 Aug 09 On barn B14 Sunrise 05:41 am	04:05 am	85% cloud cover Wind SW 1-2. Dry, high humidity, Air Temp 12.0° C	05:49 am	100% cloud cover Wind SW 2 cooler, no rain, Air Temp 12.5° C
H am	18 Aug 09 On houses B7 Sunrise 05:43 am	04:00 am	0% cloud cover No Wind. Dry, cool, Moon 1/8 Air Temp 9.5° C	06:00 am	60% cloud cover Wind SW 1 Dry, cool, Air Temp 11.0° C
H am	18 Aug 09 On barn B8 Sunrise 05:43 am	03:55 am	0% cloud cover No Wind. Dry, cool, Moon 1/8 Air Temp 9.5° C	06:00 am	60% cloud cover Wind SW 1 Dry, cool, Air Temp 11.0° C

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Visit	Visit date	Start Time	Weather conditions (at start)	Finish time	Weather conditions (at finish)
Swarming Surveys					
I	19 Aug 09 On Ash T15 Sunrise 05:44 am	03:55 am	10% cloud cover No Wind. Dry, cool, Moon 1/8 Air Temp 10.0° C	06:00 am	10% cloud cover Wind SW 1 Dry, cool, Air Temp 11.0° C
J	20 Aug 09 On Ash T22 Sunrise 05:46 am	04:00 am	0% cloud cover No Wind. Dry, cool, Moon 1/8 Air Temp 10.0° C	06:00 am	0% cloud cover Wind SW 1 Dry, cool, Air Temp 11.0° C
Transect Surveys					
A	28 July 09 Route (A) Sunset 20:55	21:00 pm	100% clouds cover Wind SSW 2-3. Dry, humid. No moon. Air Temp 17.0° C	00:15 am	100% cloud cover Wind SSW 1-2. Dry, cool. No Moon. Air Temp 16.0° C
A	28 July 09 Route (B) Sunset 20:55	21:11 pm	100% clouds cover Wind SSW 2-3. Dry, humid. No moon. Air Temp 17.0° C	23:52 pm	100% cloud cover Wind SSW 1-2. Dry, cool. No Moon. Air Temp 16.0° C
B	30 July 09 Route (C) Sunset 20:54	21:11 pm	0% cloud cover Wind SW 1-2 Dry, humid. Moon 4/8. Air Temp 12.5° C	23:52 pm	0% cloud cover Wind SW 1. Dry, cool, high humidity. Air Temp 8.5° C
B	30 July 09 Route (D) Sunset 20:54	22:02 pm	0% cloud cover Wind SW 1-2. Dry, humid. Moon 4/8. Air Temp 12.5° C	23:53 pm	0% cloud cover Wind SW 1. Dry, cool, high humidity. Air Temp 8.5° C
C	31 July 09 Route (E) Sunset 20:53	21:57 pm	100% clouds cover Wind SSW 1-2. Dry, humid. No moon. Air Temp 18.5° C	23:52 pm	100% cloud cover Wind SSW 1-2. Dry, humid. No Moon. Air Temp 16.5° C
C	31 July 09 Route (F) Sunset 20:53	21:05 pm	100% clouds cover Wind SSW 1-2. Dry, humid. No moon. Air Temp 18.5° C	22:45 pm	100% cloud cover Wind SSW 1-2. Dry, humid. No Moon. Air Temp 16.5° C
D	11 Aug 09 Route (A) Sunset 20:33	21:33 pm	70% cloud cover Wind W 2-3. No Moon. Dry, warm and humid. Air Temp 20.5° C	00:05 am	40% cloud cover Wind W 2. Moon 3/8. Dry, warm and humid. Air Temp 18.0° C
D	11 Aug 09 Route (B) Sunset 20:33	20:48 pm	70% cloud cover Wind W 2-3. No Moon. Dry, warm and humid. Air Temp 20.5° C	00:01 am	40% cloud cover Wind W 2. Moon 3/8. Dry, warm and humid. Air Temp 18.0° C
E	15 Aug 09 Route (C) Sunset 20:27	21:52 pm	30% cloud cover Wind SW 3-4. No Moon. Dry, warm and humid. Air Temp 23.0° C	23:45 am	15% cloud cover Wind SW 1-2. No moon. Dry, warm and humid. Air Temp 21.0° C

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Visit	Visit date	Start Time	Weather conditions (at start)	Finish time	Weather conditions (at finish)
Transect Surveys					
E	15 Aug 09 Route (D) Sunset 20:27	21:44 pm	30% cloud cover Wind SW 3-4. No Moon. Dry, warm and humid. Air Temp 23.0° C	23:10 am	15% cloud cover Wind SW 1-2. No moon. Dry, warm and humid. Air Temp 21.0° C
F	16 Aug 09 Route (E) Sunset 20:26	21:21 pm	90% cloud cover Wind W 3. No Moon. Dry, warm and humid. Air Temp 19.5° C	22:39 pm	70% cloud cover Wind W 2-3. No moon. Dry, warm and humid. Air Temp 14.0° C
F	16 Aug 09 Route (F) Sunset 20:26	21:22 pm	90% cloud cover Wind W 3. No Moon. Dry, warm and humid. Air Temp 19.5° C	22:36 pm	70% cloud cover Wind W 2-3. No moon. Dry, warm and humid. Air Temp 14.0° C
G	17 Aug 09 Route (A) Sunset 20:25	20:43 pm	5% cloud cover Wind SW 1-2. No Moon. Dry, warm moderate humidity. Air Temp 15.0° C	23:05 pm	0% cloud cover No wind. No moon. Dry, warm moderate humidity. Air Temp 12.5° C
G	17 Aug 09 Route (B) Sunset 20:25	20:48 pm	5% cloud cover Wind W 3. No Moon. Dry, warm moderate humidity. Air Temp 15.0° C	23:46 pm	0% cloud cover Wind W 2-3. No moon. Dry, warm moderate humidity. Air Temp 12.5° C
H	18 Aug 09 Route (C) Sunset 20:23	20:38 pm	15% cloud cover Wind SW 1. No Moon. Dry, warm moderate humidity. Air Temp 16.5° C	22:51 pm	0% cloud cover Wind SW 1 No moon. Dry, warm moderate humidity. Air Temp 12.5° C
H	18 Aug 09 Route (D) Sunset 20:23	20:46 pm	15% cloud cover Wind SW 1. No Moon. Dry, warm moderate humidity. Air Temp 16.5° C	22:19 pm	0% cloud cover Wind SW 1 No moon. Dry, warm moderate humidity. Air Temp 12.5° C
I	19 Aug 09 Route (E) Sunset 20:21	20:50 pm	10% cloud cover Wind SW 1-2. No Moon. Dry, warm moderate humidity. Air Temp 21.5° C	22:07 pm	20% cloud cover Wind SW 2 No moon. Dry, warm moderate humidity. Air Temp 21.5° C
I	19 Aug 09 Route (F) Sunset 20:21	20:45 pm	10% cloud cover Wind SW 1-2. No Moon. Dry, warm moderate humidity. Air Temp 21.5° C	22:17 pm	20% cloud cover Wind SW 2 No moon. Dry, warm moderate humidity. Air Temp 21.5° C
K	1 Sept 09 Route (A) Sunset 19:52	20:02 pm	50% cloud cover Wind SSW 3-4. Moon 8/8. Dry, warm moderate humidity. Air Temp 13.5° C	22:30 pm	10% cloud cover Wind SW 2 Moon 8/8. Dry, warm moderate humidity. Air Temp 12.0° C

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Visit	Visit date	Start Time	Weather conditions (at start)	Finish time	Weather conditions (at finish)
Transect Surveys					
K	1 Sept 09 Route (B) Sunset 19:52	20:12 pm	50% cloud cover Wind SSW 3-4. Moon 8/8. Dry, warm moderate humidity. Air Temp 13.5° C	22:36 pm	10% cloud cover Wind SSW 2. Moon 8/8. light rain 20:35 to 20:45pm, warm moderate humidity. Air Temp 12.0° C
L	3 Sept 09 Route (C) Sunset 19:47	20:09 pm	65% cloud cover Wind WNW 3-4. Moon 8/8. Dry, warm moderate humidity. Air Temp 13.5° C	21:54 pm	5% cloud cover Wind WNW 3-4. Dry, warm moderate humidity. Moon 8/8. Air Temp 11.5° C
L	3 Sept 09 Route (D) Sunset 19:47	20:07 pm	65% cloud cover Wind WNW 3-4. Moon 8/8. Dry, warm moderate humidity. Air Temp 13.5° C	21:39 pm	5% cloud cover Wind WNW 3-4. Dry, warm moderate humidity. Moon 8/8. Air Temp 11.5° C
M	4 Sept 09 Route (E) Sunset 19:45	20:18 pm	40% cloud cover Wind WSW 3-4. Moon 8/8. Dry, warm moderate humidity. Air Temp 14.0° C	21:23 pm	30% cloud cover Wind WSW 3-4. Dry, warm moderate humidity. Moon 8/8. Air Temp 12.5° C
M	4 Sept 09 Route (F) Sunset 19:45	20:13 pm	40% cloud cover Wind WSW 3-4. Moon 8/8. Dry, warm moderate humidity. Air Temp 14.0° C	21:30 pm	30% cloud cover Wind WSW 3-4. Dry, warm moderate humidity. Moon 8/8. Air Temp 12.5° C

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## 6. RESULTS

### Transect Surveys

#### 6.1 Dusk of 28<sup>th</sup> July, 2009 route (A) visit (A)

- No bats were recorded adjacent to the north-western corner of the tall plantation at (Station 1).
- No bats were recorded along the county boundary drainage at (Station 2).
- No bats were recorded further north along the county boundary drainage at (Station 3).
- No bats were recorded further north along the county boundary drainage directly east of Six Hundreds Farm at (Station 4).
- No bats were recorded halfway along the first drainage ditch north and east of Six Hundreds Farm at (Station 5).
- No bats were recorded alongside the main track north of Six Hundreds Farm at (Station 6).
- No bats were recorded halfway along the second drainage ditch north and east of Six Hundreds Farm at (Station 7).
- No bats were recorded at the eastern end of the second drainage ditch north and east of Six Hundreds Farm at (Station 8).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes along the county boundary drainage south of the second drainage ditch north and east of Six Hundreds Farm at (Station 9).
- One *Myotis* spp bat, probably Daubenton's Bat (*Myotis daubentonii*) was recorded foraging over the broad drain adjacent to the Skirt Drain immediately north of Station 10).
- No bats were recorded along the county boundary drainage directly west of the Trinity College Pumping Station just south of the Skirt Drain at (Station 10).
- No bats were recorded alongside ditch adjacent to the brick-built bridge and sluice just west of the Skirt Drain at (Station 11).
- No bats were recorded feeding along the drainage ditch just east of the plantation on the main track at (Station 12).
- No bats were recorded feeding along the main track and drainage ditches just south of the plantation on the main track at (Station 13).
- One 45 kHz Pipistrelle was recorded making continuous foraging passes around the derelict houses at Six Hundreds Farm between Station 13 and Station 14.
- No bats were recorded feeding along the main track and drainage ditches directly east of the derelict houses at Six Hundreds Farm at (Station 14).
- No bats were recorded feeding along the drainage ditch directly east of the modern barns at Six Hundreds Farm at (Station 15).
- No bats were recorded feeding along the main track and adjacent hedgerows south of Six Hundreds Farm at (Station 16).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 2

Total number of *Myotis* spp bats (*Myotis spp*) [probably Daubenton's Bat] recorded on the route = 1

#### 6.2 Dusk of 28<sup>th</sup> July, 2009 route (B) visit (A)

- No bats were recorded immediately north of the plantation adjacent to the main track at (Station 1).
- No bats were recorded further west of Station 1, adjacent to the ditch and just east of the other small plantation (T?) at (Station 2).
- No bats were recorded further north of the small plantation (T?) adjacent to the ditch at (Station 3).
- No bats were recorded adjacent to the ditch immediately south of the Skirt Drain at (Station 4).
- Two 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were recorded feeding around the top of the isolated Ash tree (T21), north-east of the Gas Valve Compound at (Station 5).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass, further south of Station 5 slightly north of a small line of trees adjacent to a drainage ditch at (Station 6).
- No bats were recorded further south of the small line of trees (including the dead Alder tree (T20)) at (Station 7).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass, just west of the small line of trees between Station 7 and Station 8.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass, just north of Station 8, between Station 7 and Station 8.
- No bats were recorded at the eastern end of the second ditch south of the Gas Valve Compound at (Station 8).

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- No bats were recorded at the western end of the farm track which runs east to west from Six Hundreds Farm to join the track which runs north from Rectory Farm at (Station 9).
- No bats were recorded feeding along the main track and adjacent ditches which run north from rectory farm just south of the barn at (Station 10).
- No bats were recorded just north of the barn adjacent to the track to the Gas Valve Compound at Station (11).
- No bats were recorded adjacent to the western end of the second ditch north of the Gas Valve Compound at Station (12).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass, just north of Station 12, between Station 12 and Station 13.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass further north adjacent to the bridge to the bank of the Skirt Drain at (Station 13).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making continuous foraging passes on the bend of the Skirt Drain between Station 13 and Station 14.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass further east on the Skirt Drain between Station 13 and Station 14.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass further east on the Skirt Drain close to Station 14.
- No bats were recorded east along the southern bank of the Skirt Drain at (Station 14).
- No bats were recorded east along the southern bank of the Skirt Drain adjacent to the bend in the watercourse at (Station 15).
- No bats were recorded east along the southern bank of the Skirt Drain adjacent to the pumping station at (Station 16A).
- No bats were recorded just south of the Skirt Drain Bridge number 1 within the arable field at (Station 16).
- No bats were recorded just south of the Skirt Drain Bridge number 1 and north of the small plantation where there is an access across the ditch at (Station 17).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 10

#### 6.3 Dusk of 30<sup>th</sup> July, 2009 route (C), visit (B)

- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making continual foraging passes along the east side of the buildings (B5) and (B6) adjacent to (Station 1).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) emerged from (B6) and commuted northwards towards the derelict house (B7) adjacent to (Station 1).
- No bats were recorded between (B6) and (B7) at (Station 1).
- No bats were recorded along the track and adjacent ditch west of Six Hundreds Farm at (Station 2).
- No bats were recorded along the ditch north of the copse, west of Six Hundreds Farm at (Station 3).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 feeding pass over the ditch between Station 3 and Station 4.
- No bats were recorded around the copse, west of Six Hundreds Farm at (Station 4).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 feeding passes over the ditch and raised bank between Station 4 and Station 5.
- No bats were recorded along the ditch and raised bank west of Six Hundreds Farm at (Station 5).
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass over the ditch and raised bank south of Station 5, between Station 5 and Station 6.
- No bats were recorded along the first ditch and hedgerow south-west of Six Hundreds Farm at (Station 6).
- No bats were recorded along the second ditch and hedgerow south-west of Six Hundreds Farm at (Station 7).
- No bats were recorded along the ditch and raised bank, south of the second ditch and hedgerow south-west of Six Hundreds Farm at (Station 8).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded foraging continually within the open barn (B4) just east of Station 9.
- No bats were recorded alongside the modern barns (B1) and (B2) at Six Hundreds Farm at (Station 9).
- No bats were recorded along the ditch west of the raised bank, south of the small copse at (Station 10).
- No bats were recorded along the ditch west of the raised bank, south of Station 10 at (Station 11).
- No bats were recorded along the ditch south-west of the small copse at (Station 12).
- No bats were recorded further south along the ditch from Station 12 at (Station 13).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 5.

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**6.4 Dusk of 30<sup>th</sup> July, 2009 route (D), visit (B)**

- No bats were recorded along the track north of Rectory Farm and adjacent ditch at (Station 1).
- No bats were recorded alongside the Labour in Vain Drain just east of the track north of Rectory Farm at (Station 2).
- No bats were recorded north of the Labour in Vain Drain at (Station 3).
- No bats were recorded adjacent to the gravel track running west of the main track from Rectory Farm at (Station 4).
- No bats were recorded west of the barn at (Station 5).
- No bats were recorded north-west of the barn, adjacent to an area of grassland and a large ditch at (Station 6).
- No bats were recorded north-west of the barn, adjacent to a ditch on the periphery of the 500m boundary at (Station 7).
- No bats were recorded just south of Crab Lane, on the periphery of the 500m boundary at (Station 8).
- No bats were recorded just south of the Labour in Vain Drain adjacent to the track to Elm Grange at (Station 9).
- No bats were recorded one ditch further east of Station 9 and south of the Labour in Vain Drain at (Station 10).
- No bats were recorded one ditch further east of Station 9 and further south of the Labour in Vain Drain at (Station 11).
- No bats were recorded one ditch further east of Station 11 and further south of the Labour in Vain Drain at (Station 12).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 0.

**6.5 Dusk of 31<sup>st</sup> July, 2009 route (E), visit (C)**

- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass across the track between the black barn and the Skirt Drain en route to Station 1.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making continuous foraging passes around the willow trees adjacent to the Skirt Drain en route to Station 1.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making five foraging passes adjacent to the Skirt Drain at the bend at (Station 1).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass adjacent to the Skirt Drain between Station 1 and Station 2.
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 4 foraging pass adjacent to the Skirt Drain at (Station 2).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass adjacent to the Skirt Drain between Station 2 and Station 3.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass adjacent to the Skirt Drain between Station 2 and Station 3.
- No bats were recorded adjacent to the Skirt Drain, south of the pumping station at (Station 3).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass east of the pumping station between Station 3 and Station 4.
- No bats were recorded between the pumping station and Sedland Farm at (Station 4).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes just east of Sedland Farm between Station 4 and Station 5.
- Two 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were recorded making continuous foraging passes just east of Sedland Farm at (Station 5).
- Two, probably the same, 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were recorded making continuous foraging passes along the ditch just east of Station 5.
- No bats were recorded along the track and ditch south Sedland Farm at (Station 6).
- No bats were recorded east of Station 6 in an arable field at (Station 7).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass close to Station 8.
- No bats were recorded along the track and ditch south Sedland Farm to the north-west of the black barn at (Station 8).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes along the ditch just south of Station 8.

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 12.

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**6.6 Dusk of 31<sup>st</sup> July, 2009 route (F), visit (C)**

- No bats were recorded along the hedgerow north of the Skirt Drain just west of the Trinity College pumping station at (Station 1).
- No bats were recorded along the Skirt Drain east of the Trinity College pumping station just before the bend in the Skirt Drain at (Station 2).
- No bats were recorded along the Skirt Drain just south the bend in the Skirt Drain at (Station 3).
- No bats were recorded along the Skirt Drain further south the bend in the Skirt Drain at a junction of ditches at (Station 4).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 5 foraging passes along the hedgerow north of the Skirt Drain just west of the Trinity College pumping station en route to (Station 5).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 3 foraging passes across the track between the black barn and the Skirt Drain, en route to Station 5.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded briefly making 1 commuting pass across the track east of the black barn at (Station 5).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass along the ditch south of Station 6 between Station 5 and Station 6.
- No bats were recorded along around the bridge across the Skerth Drain ditch at (Station 6).
- No bats were recorded along the ditch adjacent to the track west of Spinney farm and the end of the Skerth Drain at (Station 7).
- No bats were recorded around the black barn at (Station 8).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 4.

**6.7 Dusk of 11<sup>th</sup> August, 2009 reverse route (A) visit (D)**

- No bats were recorded feeding along the drainage ditch directly east of the modern barns at Six Hundreds Farm at (Station 15).
- No bats were recorded feeding along the main track and drainage ditches directly east of the derelict houses at Six Hundreds Farm at (Station 14).
- No bats were recorded feeding along the main track and drainage ditches just south of the plantation on the main track at (Station 13).
- No bats were recorded feeding along the drainage ditch just east of the plantation on the main track at (Station 12).
- No bats were recorded alongside ditch adjacent to the brick-built bridge and sluice just west of the Skirt Drain at (Station 11).
- No bats were recorded along the county boundary drainage directly west of the Trinity College Pumping Station just south of the Skirt Drain at (Station 10).
- No bats were recorded along the county boundary drainage south of the second drainage ditch north and east of Six Hundreds Farm at (Station 9).
- No bats were recorded at the eastern end of the second drainage ditch north and east of Six Hundreds Farm at (Station 8).
- No bats were recorded halfway along the second drainage ditch north and east of Six Hundreds Farm at (Station 7).
- No bats were recorded alongside the main track north of Six Hundreds Farm at (Station 6).
- No bats were recorded halfway along the first drainage ditch north and east of Six Hundreds Farm at (Station 5).
- No bats were recorded further north along the county boundary drainage directly east of Six Hundreds Farm at (Station 4).
- One 45 kHz Pipistrelle (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass just south of Station 4 along the county boundary drainage directly east of Six Hundreds Farm.
- No bats were recorded further north along the county boundary drainage at (Station 3).
- No bats were recorded along the county boundary drainage at (Station 2).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass over the ditch just south of the tall plantation south west of Station 2.
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass along the east side of tall plantation south west of Station 2.
- Two 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were recorded making continuous foraging passes along the edge of the north-western corner of the tall plantation at (Station 1).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass along the main track and adjacent hedgerows south of Six Hundreds Farm at (Station 16).

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- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass along the main track and adjacent hedgerows south of Six Hundreds Farm between Station 16 and Station 15.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass along the main track and adjacent hedgerows just south of Six Hundreds Farm between Station 16 and Station 15.

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 7

#### 6.8 Dusk of 11<sup>th</sup> August, 2009 reverse route (B) visit (D)

- No bats were recorded just south of the Skirt Drain Bridge number 1 within the arable field at (Station 16).
- No bats were recorded east along the southern bank of the Skirt Drain adjacent to the pumping station at (Station 16A).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass east along the southern bank of the Skirt Drain adjacent to the pumping station at (Station 16A).
- Two 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were recorded making 2 foraging passes west along the southern bank of the Skirt Drain between the pumping station at Station 16A and Station 15.
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass west along the southern bank of the Skirt Drain towards Station 15.
- At least two 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were recorded making twelve foraging passes along the southern bank of the Skirt Drain adjacent to the bend in the watercourse at (Station 15).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass west along the southern bank of the Skirt Drain west of Station 15.
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass along the southern bank of the Skirt Drain west of Station 15.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 3 foraging passes along the southern bank of the Skirt Drain between Station 15 and Station 14.
- No bats were recorded east along the southern bank of the Skirt Drain at (Station 14).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 4 foraging passes further west on the Skirt Drain close to Station 14.
- One Myotis spp bat, probably Daubenton's Bat (*Myotis daubentoni*) was recorded making 1 commuting pass between Station 14 and Station 13.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass further west on the Skirt Drain between Station 14 and Station 13.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making continuous foraging passes for c30 seconds on the bend of the Skirt Drain between Station 13 and Station 14.
- No bats were recorded further west adjacent to the bridge to the bank of the Skirt Drain at (Station 13).
- No bats were recorded adjacent to the western end of the second ditch north of the Gas Valve Compound at Station (12).
- No bats were recorded just north of the barn adjacent to the track to the Gas Valve Compound at Station (11).
- No bats were recorded feeding along the main track and adjacent ditches which run north from rectory farm just south of the barn at (Station 10).
- No bats were recorded at the western end of the farm track which runs east to west from Six Hundreds Farm to join the track which runs north from Rectory Farm at (Station 9).
- No bats were recorded at the eastern end of the second ditch south of the Gas Valve Compound at (Station 8).
- No bats were recorded further south of the small line of trees (including the dead Alder tree (T20)) at (Station 7).
- No bats were recorded north of Station 7, slightly north of a small line of trees adjacent to a drainage ditch at (Station 6).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded feeding around the top of the isolated Ash tree (T21), north-east of the Gas Valve Compound at (Station 5).
- No bats were recorded adjacent to the ditch immediately south of the Skirt Drain at (Station 4).
- No bats were recorded further north of the small plantation (T?) adjacent to the ditch at (Station 3).
- No bats were recorded further west of Station 1, adjacent to the ditch and just east of the other small plantation (T?) at (Station 2).
- No bats were recorded immediately north of the plantation adjacent to the main track at (Station 1).

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- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass just north of the plantation adjacent to the main track midway between Station 1 and Station 17.
- No bats were recorded just south of the Skirt Drain Bridge number 1 and north of the small plantation where there is an access across the ditch at (Station 17).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 12+

Total number of Myotis spp bats (*Myotis spp*) [probably Daubenton's Bat] recorded on the route = 1

#### 6.9 Dusk of 15<sup>th</sup> August, 2009 reversed route (C), visit (E)

- No bats were recorded along the ditch south-west of the small copse at (Station 12).
- No bats were recorded further south along the ditch from Station 12 at (Station 13).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass north of Station 12 en route to Station 10.
- No bats were recorded along the ditch west of the raised bank, south of the small copse at (Station 10).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making one commuting pass along the ditch west of the raised bank, south of Station 10 at (Station 11).
- No bats were recorded alongside the modern barns (B1) and (B2) at Six Hundreds Farm at (Station 9).
- Two 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) were recorded foraging continually within the open barn (B4) just east of Station 9.
- No bats were recorded along the ditch and raised bank, south of the second ditch and hedgerow south-west of Six Hundreds Farm at (Station 8).
- No bats were recorded along the second ditch and hedgerow south-west of Six Hundreds Farm at (Station 7).
- No bats were recorded along the first ditch and hedgerow south-west of Six Hundreds Farm at (Station 6).
- No bats were recorded along the ditch and raised bank west of Six Hundreds Farm at (Station 5).
- No bats were recorded around the copse, west of Six Hundreds Farm at (Station 4).
- No bats were recorded along the ditch north of the copse, west of Six Hundreds Farm at (Station 3).
- No bats were recorded along the track and adjacent ditch west of Six Hundreds Farm at (Station 2).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass between (B6) and (B7) at (Station 1).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 5.

#### 6.10 Dusk of 15<sup>th</sup> August, 2009 reversed route (D), visit (E)

- No bats were recorded one ditch further east of Station 11 and further south of the Labour in Vain Drain at (Station 12).
- No bats were recorded one ditch further east of Station 9 and further south of the Labour in Vain Drain at (Station 11).
- No bats were recorded one ditch further east of Station 9 and south of the Labour in Vain Drain at (Station 10).
- No bats were recorded just south of the Labour in Vain Drain adjacent to the track to Elm Grange at (Station 9).
- No bats were recorded just south of Crab Lane, on the periphery of the 500m boundary at (Station 8).
- No bats were recorded north-west of the barn, adjacent to a ditch on the periphery of the 500m boundary at (Station 7).
- No bats were recorded north-west of the barn, adjacent to an area of grassland and a large ditch at (Station 6).
- No bats were recorded west of the barn at (Station 5).
- No bats were recorded adjacent to the gravel track running west of the main track from Rectory Farm at (Station 4).
- No bats were recorded north of the Labour in Vain Drain at (Station 3).
- No bats were recorded alongside the Labour in Vain Drain just east of the track north of Rectory Farm at (Station 2).
- No bats were recorded along the track north of Rectory Farm and adjacent ditch at (Station 1).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 0.

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**6.11 Dusk of 16<sup>th</sup> August, 2009 reversed route (E), visit (F)**

- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass just west of Sedland Farm between Station 4 and Station 5.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 4 foraging passes between the pumping station and Sedland Farm at (Station 4).
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass just west of Station 4.
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 3 foraging passes just east of the pumping station, slightly further west of Station 4.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making a foraging pass just south-west of the pumping station, between Station 4 and Station 3.
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass just south-west of the pumping station, between Station 4 and Station 3.
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass just south-west of the pumping station, between Station 4 and Station 3.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 3 foraging passes adjacent to the Skirt Drain, south of the pumping station at (Station 3).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 3 foraging passes adjacent to the Skirt Drain at (Station 2).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes adjacent to the Skirt Drain between Station 2 and Station 1.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes adjacent to the Skirt Drain at the bend at (Station 1).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass along the ditch on the bend between the black barn and Station 8.

- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass along the ditch just south of Station 8.
- No bats were recorded along the track and ditch south Sedland Farm to the north-west of the black barn at (Station 8).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass in an arable field east of Station 6 at (Station 7).
- No bats were recorded along the track and ditch south Sedland Farm at (Station 6).
- No bats were recorded just east of Sedland Farm at (Station 5).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 10.

**6.12 Dusk of 16<sup>th</sup> August, 2009 reversed route (F), visit (F)**

- No bats were recorded around the black barn at (Station 8).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 3 foraging passes along the ditch adjacent to the track west of Spinney farm and the end of the Skerth Drain at (Station 7).
- No bats were recorded along around the bridge across the Skerth Drain ditch at (Station 6).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded briefly making 1 commuting pass across the track east of the black barn at (Station 5).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass across the track between the black barn and the Skirt Drain, to the west of Station 5.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes along the hedgerow north of the Skirt Drain just west of the Trinity College pumping station en route to Station 4.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass along the Skirt Drain east of the Trinity College pumping station en route to Station 4.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass along the Skirt Drain east of the Trinity College pumping station just before the Skirt Drain bends, en route to Station 4.
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded foraging continuously along the Skirt Drain east of the Trinity College pumping station just after the Skirt Drain bends, en route to Station 4.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes along the Skirt Drain further south of the bend in the Skirt Drain at a junction of ditches at (Station 4).

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- No bats were recorded along the Skirt Drain just south the bend in the Skirt Drain at (Station 3).
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded foraging continuously along the Skirt Drain east of the Trinity College pumping station just after the Skirt Drain bends, between Station 3 and Station 2.
- No bats were recorded along the Skirt Drain east of the Trinity College pumping station just before the bend in the Skirt Drain at (Station 2).
- No bats were recorded along the hedgerow north of the Skirt Drain just west of the Trinity College pumping station at (Station 1).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 7

**6.13 Dusk of 17<sup>th</sup> August, 2009 route (A) visit (G)**

- No bats were recorded adjacent to the north-western corner of the tall plantation at (Station 1).
- No bats were recorded along the county boundary drainage at (Station 2).
- No bats were recorded further north along the county boundary drainage at (Station 3).
- No bats were recorded further north along the county boundary drainage directly east of Six Hundreds Farm at (Station 4).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was briefly recorded making 1 commuting pass halfway along the first drainage ditch north and east of Six Hundreds Farm at (Station 5).
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass just to the west of Station 5.
- No bats were recorded alongside the main track north of Six Hundreds Farm at (Station 6).
- No bats were recorded halfway along the second drainage ditch north and east of Six Hundreds Farm at (Station 7).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass just to the west of Station 8, between Station 7 and Station 8.
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass at the eastern end of the second drainage ditch north and east of Six Hundreds Farm at (Station 8).
- No bats were recorded along the county boundary drainage south of the second drainage ditch north and east of Six Hundreds Farm at (Station 9).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass along the county boundary drainage ditch just to the east of Station 8, between Station 9 and Station 10.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass along the county boundary drainage directly west of the Trinity College Pumping Station just south of the Skirt Drain at (Station 10).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass alongside ditch adjacent to the brick-built bridge and sluice just west of the Skirt Drain at (Station 11).
- No bats were recorded feeding along the drainage ditch just east of the plantation on the main track at (Station 12).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass along the main track and drainage ditches just south of the plantation on the main track at (Station 13).
- One 45 kHz Pipistrelle bat was recorded making 1 brief commuting pass just south of Station 13, between Station 13 and Station 14.
- No bats were recorded feeding along the main track and drainage ditches directly east of the derelict houses at Six Hundreds Farm at (Station 14).
- No bats were recorded feeding along the drainage ditch directly east of the modern barns at Six Hundreds Farm at (Station 15).
- No bats were recorded feeding along the main track and adjacent hedgerows south of Six Hundreds Farm at (Station 16).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 7

**6.14 Dusk of 17<sup>th</sup> August, 2009 route (B) visit (G)**

- No bats were recorded immediately north of the plantation adjacent to the main track at (Station 1).
- No bats were recorded further west of Station 1, adjacent to the ditch and just east of the other small plantation (T?) at (Station 2).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 3 foraging passes further north of the small plantation (T?) adjacent to the ditch at (Station 3).

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- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 4 foraging passes adjacent to the ditch immediately south of the Skirt Drain at (Station 4).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded feeding continuously around the top of the isolated Ash tree (T21), north-east of the Gas Valve Compound at (Station 5).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass, further south of Station 5 slightly north of a small line of trees adjacent to a drainage ditch at (Station 6).
- No bats were recorded further south of the small line of trees (including the dead Alder tree (T20)) at (Station 7).
- No bats were recorded at the eastern end of the second ditch south of the Gas Valve Compound at (Station 8).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes along the ditch just east of Station 9, between Station 8 and Station 9.
- No bats were recorded at the western end of the farm track which runs east to west from Six Hundreds Farm to join the track which runs north from Rectory Farm at (Station 9).
- No bats were recorded feeding along the main track and adjacent ditches which run north from rectory farm just south of the barn at (Station 10).
- No bats were recorded just north of the barn adjacent to the track to the Gas Valve Compound at Station (11).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass and social calls adjacent to the western end of the second ditch north of the Gas Valve Compound at Station (12).
- No bats were recorded further north adjacent to the bridge to the bank of the Skirt Drain at (Station 13).
- One Myotis bat (*Myotis spp*) was recorded making 1 foraging pass and two 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were recorded making continuous foraging passes on the bend of the Skirt Drain between Station 13 and Station 14.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 12 foraging passes further east along the southern bank of the Skirt Drain at (Station 14).
- One Myotis bat (*Myotis spp*) was recorded making 1 foraging pass and two 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were recorded making continuous foraging passes on the Skirt Drain east of Station 14, between Station 14 and Station 15.
- One Myotis bat (*Myotis spp*) was recorded making 1 commuting pass and two, probably the same, 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were recorded making continuous foraging passes on the Skirt Drain further east of Station 14, between Station 14 and Station 15.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 4 foraging passes further east along the southern bank of the Skirt Drain close to Station 15, between Station 14 and Station 15.
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded along the southern bank of the Skirt Drain adjacent to the bend in the watercourse at (Station 15).
- One unidentified bat, possibly a 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) or a Myotis bat (*Myotis spp*) was recorded briefly making 1 foraging pass between Station 15 and Station 16A.
- Two 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) were recorded foraging continuously and making social calls along the southern bank of the Skirt Drain adjacent to the pumping station at (Station 16A).
- No bats were recorded just south of the Skirt Drain Bridge number 1 within the arable field at (Station 16).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded briefly making 1 commuting pass over the ditch between Station 16 and Station 17.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass just south of the Skirt Drain Bridge number 1 and north of the small plantation where there is an access across the ditch at (Station 17).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 16

Total number of Myotis spp bats (*Myotis spp*) [probably Daubenton's Bat] recorded on the route = 3

Total number of unidentified bats (*Bat spp*) recorded on the route = 1

#### 6.15 Dusk of 18<sup>th</sup> August, 2009 route (C), visit (H)

- No bats were recorded between (B6) and (B7) at (Station 1).
- No bats were recorded along the track and adjacent ditch west of Six Hundreds Farm at (Station 2).
- No bats were recorded along the ditch north of the copse, west of Six Hundreds Farm at (Station 3).
- No bats were recorded around the copse, west of Six Hundreds Farm at (Station 4).
- No bats were recorded along the ditch and raised bank west of Six Hundreds Farm at (Station 5).

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- No bats were recorded along the first ditch and hedgerow south-west of Six Hundreds Farm at (Station 6).
- No bats were recorded along the second ditch and hedgerow south-west of Six Hundreds Farm at (Station 7).
- No bats were recorded along the ditch and raised bank, south of the second ditch and hedgerow south-west of Six Hundreds Farm at (Station 8).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass along the ditch just west of Station 7, en route between Station 8 and Station 9.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass along the hedgerow just south of Six Hundred Farm, en route between Station 8 and Station 9.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded foraging continually within the open barn (B4) just east of Station 9.
- No bats were recorded alongside the modern barns (B1) and (B2) at Six Hundreds Farm at (Station 9).
- No bats were recorded along the ditch west of the raised bank, south of the small copse at (Station 10).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass along the ditch west of the raised bank, south of Station 10 at (Station 11).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 3 foraging passes over the junction of ditches just north of Station 12, en route between Station 11 and Station 12.
- No bats were recorded along the ditch south-west of the small copse at (Station 12).
- No bats were recorded further south along the ditch from Station 12 at (Station 13).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making continuous foraging passes along the hedgerow just west of Six Hundred Farm, east of Station 2.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes along the hedgerow by the houses at Six Hundred Farm, west of Station 1.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 faint foraging passes and social calls along the west side of the buildings B5 and B6 at Six Hundred Farm, just south of Station 1.

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 8.

#### 6.16 Dusk of 18<sup>th</sup> August, 2009 route (D), visit (H)

- No bats were recorded along the track north of Rectory Farm and adjacent ditch at (Station 1).
- No bats were recorded alongside the Labour in Vain Drain just east of the track north of Rectory Farm at (Station 2).
- No bats were recorded north of the Labour in Vain Drain at (Station 3).
- No bats were recorded adjacent to the gravel track running west of the main track from Rectory Farm at (Station 4).
- No bats were recorded west of the barn at (Station 5).
- No bats were recorded north-west of the barn, adjacent to an area of grassland and a large ditch at (Station 6).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes over grassland west of Station 6, between Station 6 and Station 7.
- No bats were recorded north-west of the barn, adjacent to a ditch on the periphery of the 500m boundary at (Station 7).
- No bats were recorded just south of Crab Lane, on the periphery of the 500m boundary at (Station 8).
- No bats were recorded just south of the Labour in Vain Drain adjacent to the track to Elm Grange at (Station 9).
- No bats were recorded one ditch further east of Station 9 and south of the Labour in Vain Drain at (Station 10).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass one ditch further east of Station 9 and further south of the Labour in Vain Drain at (Station 11).
- No bats were recorded one ditch further east of Station 11 and further south of the Labour in Vain Drain at (Station 12).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass over the ditch just north of Station 12.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass over the Labour in Vain Drain just west of Station 2.
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass over the Labour in Vain Drain just east of Station 2.

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Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 4.

#### 6.17 Dusk of 19<sup>th</sup> August, 2009 route (E), visit (I)

- No bats were recorded just east of Sedland Farm at (Station 5).
- No bats were recorded along the track and ditch south Sedland Farm at (Station 6).
- No bats were recorded east of Station 6 in an arable field at (Station 7).
- No bats were recorded along the track and ditch south Sedland Farm to the north-west of the black barn at (Station 8).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass south of Station 8, close to the black barn.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 4 foraging passes over the Skirt Drain, en route to Station 1
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass over the Skirt Drain, en route to Station 1
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes adjacent to the Skirt Drain at the bend at (Station 1).
- Two 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were recorded making 4 foraging passes adjacent to the Skirt Drain at (Station 2).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes adjacent to the Skirt Drain between Station 2 and Station 3.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 5 foraging passes adjacent to the Skirt Drain, south of the pumping station at (Station 3).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass south of the pumping station between Station 3 and Station 4.
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 3 foraging passes just south of the pumping station between Station 3 and Station 4.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 4 foraging passes by the pumping station between Station 3 and Station 4.
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 4 foraging passes between the pumping station and Sedland Farm at (Station 4).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 10.

#### 6.18 Dusk of 19<sup>th</sup> August, 2009 route (F), visit (I)

- No bats were recorded along the hedgerow north of the Skirt Drain just west of the Trinity College pumping station at (Station 1).
- No bats were recorded along the Skirt Drain east of the Trinity College pumping station just before the bend in the Skirt Drain at (Station 2).
- No bats were recorded along the Skirt Drain just south the bend in the Skirt Drain at (Station 3).
- No bats were recorded along the Skirt Drain further south the bend in the Skirt Drain at a junction of ditches at (Station 4).
- Two 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were recorded foraging continuously over the Skirt Drain on the bend of the drain east of the Trinity College pumping station en route to (Station 5).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 3 foraging passes over the Skirt Drain just west of the Trinity College pumping station en route to (Station 5).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded foraging continuously along the hedgerow north of the Skirt Drain east of the Trinity College pumping station en route to (Station 5).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes around the bale stack by the black barn, en route to Station 5.
- One, possibly the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass east of the black barn, en route to Station 5
- No bats were recorded on the track east of the black barn at (Station 5).
- No bats were recorded along around the bridge across the Skerth Drain ditch at (Station 6).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded foraging continuously along the ditch adjacent to the track west of Spinney farm and the end of the Skerth Drain at (Station 7).
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes east of the black barn, en route to Station 8

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- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 3 foraging passes east of the black barn, en route to Station 8
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass around the black barn at (Station 8).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 6-7.

#### 6.19 Dusk of 1<sup>st</sup> September, 2009 reverse route (A) visit (K)

- No bats were recorded along the main track and adjacent hedgerows south of Six Hundreds Farm at (Station 16).
- No bats were recorded feeding along the drainage ditch directly east of the modern barns at Six Hundreds Farm at (Station 15).
- No bats were recorded feeding along the main track and drainage ditches directly east of the derelict houses at Six Hundreds Farm at (Station 14).
- No bats were recorded feeding along the main track and drainage ditches just south of the plantation on the main track at (Station 13).
- No bats were recorded feeding along the drainage ditch just east of the plantation on the main track at (Station 12).
- No bats were recorded alongside ditch adjacent to the brick-built bridge and sluice just west of the Skirt Drain at (Station 11).
- No bats were recorded along the county boundary drainage directly west of the Trinity College Pumping Station just south of the Skirt Drain at (Station 10).
- No bats were recorded along the county boundary drainage south of the second drainage ditch north and east of Six Hundreds Farm at (Station 9).
- No bats were recorded at the eastern end of the second drainage ditch north and east of Six Hundreds Farm at (Station 8).
- No bats were recorded halfway along the second drainage ditch north and east of Six Hundreds Farm at (Station 7).
- No bats were recorded alongside the main track north of Six Hundreds Farm at (Station 6).
- No bats were recorded halfway along the first drainage ditch north and east of Six Hundreds Farm at (Station 5).
- No bats were recorded further north along the county boundary drainage directly east of Six Hundreds Farm at (Station 4).
- No bats were recorded further north along the county boundary drainage at (Station 3).
- No bats were recorded along the county boundary drainage at (Station 2).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making continuous foraging passes along the edge of the south-eastern corner of the tall plantation between Station 1 and Station 2.
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 3 foraging passes along the edge of the north-eastern corner of the tall plantation between Station 1 and Station 2.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making continuous foraging passes adjacent to the north-western corner of the tall plantation at (Station 1).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 2

#### 6.20 Dusk of 1<sup>st</sup> September, 2009 reverse route (B) visit (K)

- No bats were recorded just south of the Skirt Drain Bridge number 1 and north of the small plantation where there is an access across the ditch at (Station 17).
- No bats were recorded just south of the Skirt Drain Bridge number 1 within the arable field at (Station 16).
- No bats were recorded east along the southern bank of the Skirt Drain adjacent to the pumping station at (Station 16A).
- At least two 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were recorded making up to 3 foraging passes each along the southern bank of the Skirt Drain adjacent to the bend in the watercourse at (Station 15).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 3 foraging passes west along the southern bank of the Skirt Drain west of Station 15, between Station 15 and Station 14.

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- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 4 foraging passes along the southern bank of the Skirt Drain between Station 15 and Station 14.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes along the southern bank of the Skirt Drain just east of Station 14, between Station 15 and Station 14.
- At least two 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were recorded foraging continuously along the southern bank of the Skirt Drain at (Station 14).
- One possible Myotis bat (*Myotis spp*) was recorded making 1 commuting pass and one 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded foraging continuously further west on the Skirt Drain west of Station 14, between Station 14 and Station 13.
- Four or five 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were recorded making continuous foraging passes on the bend of the Skirt Drain between Station 13 and Station 14.
- No bats were recorded further west adjacent to the bridge to the bank of the Skirt Drain at (Station 13).
- No bats were recorded adjacent to the western end of the second ditch north of the Gas Valve Compound at Station (12).
- No bats were recorded just north of the barn adjacent to the track to the Gas Valve Compound at Station (11).
- No bats were recorded feeding along the main track and adjacent ditches which run north from rectory farm just south of the barn at (Station 10).
- No bats were recorded at the western end of the farm track which runs east to west from Six Hundreds Farm to join the track which runs north from Rectory Farm at (Station 9).
- No bats were recorded at the eastern end of the second ditch south of the Gas Valve Compound at (Station 8).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass across the ditch just north of Station 8, between Station 8 and Station 7.
- No bats were recorded further south of the small line of trees (including the dead Alder tree (T20)) at (Station 7).
- No bats were recorded north of Station 7, slightly north of a small line of trees adjacent to a drainage ditch at (Station 6).
- No bats were recorded around the isolated Ash tree (T21), north-east of the Gas Valve Compound at (Station 5).
- No bats were recorded adjacent to the ditch immediately south of the Skirt Drain at (Station 4).
- No bats were recorded further north of the small plantation (T?) adjacent to the ditch at (Station 3).
- No bats were recorded further west of Station 1, adjacent to the ditch and just east of the other small plantation (T?) at (Station 2).
- No bats were recorded immediately north of the plantation adjacent to the main track at (Station 1).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 12-13  
 Total number of Myotis spp bats (*Myotis spp*) [probably Daubenton's Bat] recorded on the route = 1

#### 6.21 Dusk of 3<sup>rd</sup> September, 2009 reversed route (C), visit (L)

- No bats were recorded along the ditch south-west of the small copse at (Station 12).
- No bats were recorded further south along the ditch from Station 12 at (Station 13).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making one commuting pass along the ditch west of the raised bank, south of Station 10 at (Station 11).
- No bats were recorded along the ditch west of the raised bank, south of the small copse at (Station 10).
- No bats were recorded alongside the modern barns (B1) and (B2) at Six Hundreds Farm at (Station 9).
- No bats were recorded along the ditch and raised bank, south of the second ditch and hedgerow south-west of Six Hundreds Farm at (Station 8).
- No bats were recorded along the second ditch and hedgerow south-west of Six Hundreds Farm at (Station 7).
- No bats were recorded along the first ditch and hedgerow south-west of Six Hundreds Farm at (Station 6).
- No bats were recorded along the ditch and raised bank west of Six Hundreds Farm at (Station 5).
- No bats were recorded around the copse, west of Six Hundreds Farm at (Station 4).
- No bats were recorded along the ditch north of the copse, west of Six Hundreds Farm at (Station 3).
- No bats were recorded along the track and adjacent ditch west of Six Hundreds Farm at (Station 2).
- No bats were recorded between (B6) and (B7) at (Station 1).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 0.

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#### 6.22 Dusk of 3<sup>rd</sup> September, 2009 reversed route (D), visit (L)

- No bats were recorded one ditch further east of Station 11 and further south of the Labour in Vain Drain at (Station 12).
- No bats were recorded one ditch further east of Station 9 and further south of the Labour in Vain Drain at (Station 11).
- No bats were recorded one ditch further east of Station 9 and south of the Labour in Vain Drain at (Station 10).
- No bats were recorded just south of the Labour in Vain Drain adjacent to the track to Elm Grange at (Station 9).
- No bats were recorded just south of Crab Lane, on the periphery of the 500m boundary at (Station 8).
- No bats were recorded north-west of the barn, adjacent to a ditch on the periphery of the 500m boundary at (Station 7).
- No bats were recorded north-west of the barn, adjacent to an area of grassland and a large ditch at (Station 6).
- No bats were recorded west of the barn at (Station 5).
- No bats were recorded adjacent to the gravel track running west of the main track from Rectory Farm at (Station 4).
- No bats were recorded north of the Labour in Vain Drain at (Station 3).
- No bats were recorded alongside the Labour in Vain Drain just east of the track north of Rectory Farm at (Station 2).
- No bats were recorded along the track north of Rectory Farm and adjacent ditch at (Station 1).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 0.

#### 6.23 Dusk of 4<sup>th</sup> September, 2009 reversed route (E), visit (M)

- No bats were recorded adjacent to the bend in the Skirt Drain at (Station 1).
- No bats were recorded adjacent to the Skirt Drain at (Station 2).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass adjacent to the Skirt Drain between Station 2 and Station 3.
- No bats were recorded adjacent to the Skirt Drain, south of the pumping station at (Station 3).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded foraging continuously by the pumping station between Station 3 and Station 4.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass between the pumping station and Sedland Farm at (Station 4).
- No bats were recorded just east of Sedland Farm at (Station 5).
- No bats were recorded along the track and ditch south Sedland Farm at (Station 6).
- No bats were recorded east of Station 6 in an arable field at (Station 7).
- No bats were recorded along the track and ditch south Sedland Farm to the north-west of the black barn at (Station 8).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 3.

#### 6.24 Dusk of 4<sup>th</sup> September, 2009 reversed route (F), visit (M)

- No bats were recorded around the black barn at (Station 8).
- No bats were recorded along the ditch adjacent to the track west of Spinney farm and the end of the Skerth Drain at (Station 7).
- No bats were recorded along around the bridge across the Skerth Drain ditch at (Station 6).
- No bats were recorded on the track east of the black barn at (Station 5).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 brief commuting pass east of the black barn, en route to Station 4.
- No bats were recorded along the Skirt Drain further south the bend in the Skirt Drain at a junction of ditches at (Station 4).
- No bats were recorded along the Skirt Drain just south the bend in the Skirt Drain at (Station 3).
- No bats were recorded along the Skirt Drain east of the Trinity College pumping station just before the bend in the Skirt Drain at (Station 2).
- No bats were recorded along the hedgerow north of the Skirt Drain just west of the Trinity College pumping station at (Station 1).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 1

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Table 2 - Number and Species of Bats Recorded at all visits to Heckington Fen

Bat Species	Number of Bats																								Total												
	Survey Period																																				
	28-31 <sup>st</sup> July, 2009						11 <sup>th</sup> -16th Aug, 2009						17 <sup>th</sup> -19 <sup>th</sup> Aug, 2009						1 <sup>st</sup> -4 <sup>th</sup> Sept, 2009																		
	Route																																				
	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F													
45 kHz Pipistrelle	2	10	6	0	12	4	7	12	5	0	10	7	7	16	8	5	10	6-7	2	12-13	0	0	3	1	145-147+												
Myotis spp	1	-	-	-	-	-	1	-	-				3						1						6												
Unid. Bat	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1												
Total no. of bats per visit on each route	3	10	6	0	12	4	7	13+	5	0	10	7	7	20	8	5	10	6-7	2	13-14	0	0	3	1	152-154+												
Total no. of bats at site per survey	35						42+						56-57						19-20						152-154+												
	Route																																				
	A						B						C						D						E						F						
Total no. of bats on each survey route (all visits)	19						56-57+						19						5						35						18-19						152-154+

Table 3 - Summary of Total number and Species of Bats Recorded at each point on the survey transect (A) during all visits to Heckington Fen

Total Number of Bats recorded during 4 survey nights: 28 <sup>th</sup> July, 11 <sup>th</sup> August, 17 <sup>th</sup> August and 1 <sup>st</sup> September, 2009			
Station/walk	Pipistrelle 45	Myotis spp	Total No. of Bats
Station 1	2	0	2
1-2	2	0	2
Station 2	1	0	1
2-3	0	0	0
Station 3	0	0	0
3-4	1	0	1
Station 4	0	0	0
4-5	0	0	0
Station 5	1	0	1
5-6	1	0	1
Station 6	0	0	0
6-7	0	0	0
Station 7	0	0	0
7-8	1	0	1
Station 8	1	0	1
8-9	0	0	0
Station 9	1	0	1
9-10	1	1	2
Station 10	1	0	1
10-11	0	0	0
Station 11	1	0	1
11-12	0	0	0
Station 12	0	0	0
12-13	0	0	0
Station 13	1	0	1
13-14	2	0	2
Station 14	0	0	0
14-15	0	0	0
Station 15	0	0	0
15-16	2	0	2
Station 16	2	0	2
Total	21	1	22

The differences in total bat numbers of each species between Table 2 & Table 4 and Table 3 is accounted by some individual bats being recorded as 'probably the same' in Table 2 & Table 4 but being assigned to feeding or commuting at a Station or within each transect section in Table 3.

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**Table 3 (continued) - Summary of Total number and Species of Bats Recorded at each point on the survey transect (B) during all visits to Heckington Fen**

Total Number of Bats recorded during 4 survey nights: 28 <sup>th</sup> July, 11 <sup>th</sup> August, 17 <sup>th</sup> August and 1 <sup>st</sup> September, 2009				
Station/walk	Pipistrelle 45	Myotis spp	Unidentified Bat	Total No. of Bats
Station 1	0	0	0	0
1-2	0	0	0	0
Station 2	0	0	0	0
2-3	0	0	0	0
Station 3	1	0	0	1
3-4	0	0	0	0
Station 4	1	0	0	1
4-5	0	0	0	0
Station 5	4	0	0	4
5-6	0	0	0	0
Station 6	2	0	0	2
6-7	0	0	0	0
Station 7	0	0	0	0
7-8	3	0	0	3
Station 8	0	0	0	0
8-9	1	0	0	1
Station 9	0	0	0	0
9-10	0	0	0	0
Station 10	0	0	0	0
10-11	0	0	0	0
Station 11	0	0	0	0
11-12	0	0	0	0
Station 12	1	0	0	1
12-13	1	0	0	1
Station 13	1	0	0	1
13-14	13-14	3	0	16-17
Station 14	3+	0	0	3+
14-15	9	2	0	11
Station 15	4+	0	0	4+
15-16A	4	0	1	5
Station 16A	2	0	0	2
16A-16	0	0	0	0
Station 16	0	0	0	0
16-17	0	0	0	0
Station 17	1	0	0	1
17-1	1	0	0	1
<b>Total</b>	<b>53-54+</b>	<b>5</b>	<b>1</b>	<b>59-60+</b>

The differences in total bat numbers of each species between Table 2 & Table 4 and Table 3 is accounted by some individual bats being recorded as 'probably the same' in Table 2 & Table 4 but being assigned to feeding or commuting at a Station or within each transect section in Table 3.

**Table 3 (continued) - Summary of Total number and Species of Bats Recorded at each point on the survey transect (C) during all visits to Heckington Fen**

Total Number of Bats recorded during 4 survey nights: 30 <sup>th</sup> July, 11 <sup>th</sup> August, 18 <sup>th</sup> August and 3 <sup>rd</sup> September, 2009		
Station/walk	Pipistrelle 45	Total No. of Bats
Station 1	1	1
1-2	5	5
Station 2	0	0
2-3	0	0
Station 3	0	0
3-4	1	1
Station 4	0	0
4-5	1	1
Station 5	0	0
5-6	1	1
Station 6	0	0
6-7	0	0
Station 7	0	0
7-8	0	0
Station 8	0	0
8-9	6	6
Station 9	0	0
9-10	0	0
Station 10	0	0
10-11	0	0
Station 11	2	2
11-12	2	2
Station 12	0	0
12-13	0	0
Station 13	0	0
<b>Total</b>	<b>19</b>	<b>19</b>

The differences in total bat numbers of each species between Table 2 & Table 4 and Table 3 is accounted by some individual bats being recorded as 'probably the same' in Table 2 & Table 4 but being assigned to feeding or commuting at a Station or within each transect section in Table 3.



**Table 3 (continued) - Summary of Total number and Species of Bats Recorded at each point on the survey transect (D) during all visits to Heckington Fen**

Total Number of Bats recorded during 4 survey nights: 30 <sup>th</sup> July, 11 <sup>th</sup> August, 18 <sup>th</sup> August and 3 <sup>rd</sup> September, 2009		
Station/walk	Pipistrelle 45	Total No. of Bats
Station 1	0	0
1-2	0	0
Station 2	0	0
2-3	0	0
Station 3	0	0
3-4	0	0
Station 4	0	0
4-5	0	0
Station 5	0	0
5-6	0	0
Station 6	0	0
6-7	1	1
Station 7	0	0
7-8	0	0
Station 8	0	0
8-9	0	0
Station 9	0	0
9-10	0	0
Station 10	0	0
10-11	0	0
Station 11	1	1
11-12	0	0
Station 12	0	0
12-1	3	3
Total	5	5

The differences in total bat numbers of each species between Table 2 & Table 4 and Table 3 is accounted by some individual bats being recorded as 'probably the same' in Table 2 & Table 4 but being assigned to feeding or commuting at a Station or within each transect section in Table 3.

**Table 3 (continued) - Summary of Total number and Species of Bats Recorded at each point on the survey transect (E) during all visits to Heckington Fen**

Total Number of Bats recorded during 4 survey nights: 31 <sup>st</sup> July, 16 <sup>th</sup> August, 19 <sup>th</sup> August and 4 <sup>th</sup> September, 2009		
Station/walk	Pipistrelle 45	Total No. of Bats
Station 1	3	3
1-2	2	2
Station 2	4	4
2-3	4	4
Station 3	2	2
3-4	6	6
Station 4	3	3
4-5	2	2
Station 5	2	2
5-6	2	2
Station 6	0	0
6-7	0	0
Station 7	1	1
7-8	1	1
Station 8	0	0
8-1	8	8
Total	40	40

The differences in total bat numbers of each species between Table 2 & Table 4 and Table 3 is accounted by some individual bats being recorded as 'probably the same' in Table 2 & Table 4 but being assigned to feeding or commuting at a Station or within each transect section in Table 3.

**Table 3 (continued) - Summary of Total number and Species of Bats Recorded at each point on the survey transect (F) during all visits to Heckington Fen**

Total Number of Bats recorded during 4 survey nights: 31 <sup>st</sup> July, 16 <sup>th</sup> August, 19 <sup>th</sup> August and 4 <sup>th</sup> September, 2009		
Station/walk	Pipistrelle 45	Total No. of Bats
Station 1	0	0
1-2	0	0
Station 2	0	0
2-3	1	1
Station 3	0	0
3-4	0	0
Station 4	1	1
4-5	13	13
Station 5	2	2
5-6	1	1
Station 6	0	0
6-7	0	0
Station 7	2	2
7-8	2	2
Station 8	1	1
8-1	0	0
Total	23	23

The differences in total bat numbers of each species between Table 2 & Table 4 and Table 3 is accounted by some individual bats being recorded as 'probably the same' in Table 2 & Table 4 but being assigned to feeding or commuting at a Station or within each transect section in Table 3.

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Table 4 - Number and Species of Bats and number of Passes Recorded at and between wait Stations on Route (A) during all visits to Heckington Fen

Station Walk	Visit A - 28 <sup>th</sup> July, 2009				Visit D - 11 <sup>th</sup> August, 2009				Visit G - 17 <sup>th</sup> August, 2009				
	Time	45 kHz Pipistrelle	Myotis daub.	Number of Passes	Total A	Time	45 kHz Pipistrelle	Number of Passes	Total D	Time	45 kHz Pipistrelle	Number of Passes	Total G
1	21:09	0	0	0	0	21:09	2f (track 25)	continuous	2	20:49	0	0	0
1-2	-	0	0	0	0	23:39	1f (track 23)	1	1	-	0	0	0
1-2	-	0	0	0	0	23:41	1f prob same (track 24)	1	0	-	0	0	0
2	21:15	0	0	0	0	23:34	0	0	0	21:01	0	0	0
3	21:39	0	0	0	0	23:28	0	0	0	21:08	0	0	0
3-4	-	0	0	0	0	23:21	1c	1	1	-	0	0	0
4	21:56	0	0	0	0	23:20	0	0	0	21:16	0	0	0
5	22:11	0	0	0	0	23:06	0	0	0	21:27	1c (track 1)	1	1
5-6	-	0	0	0	0	-	0	0	0	21:28	1f prob same (track 2)	1	0
6	22:19	0	0	0	0	22:58	0	0	0	21:37	0	0	0
7	22:33	0	0	0	0	22:48	0	0	0	21:48	0	0	0
7-8	-	0	0	0	0	-	-	0	0	21:52	1f (track 3)	1	1
8	22:39	0	0	0	0	22:37	0	0	0	21:56	1f prob same (track 4)	1	0
9	22:49	1f (tracks 1,2)	0	2	1	22:31	0	0	0	22:02	0	0	0
9-10	23:03	0	1f (tracks 3,4)	1	1	-	0	0	0	22:05	1c (track 5)	1	1
10	23:21	0	0	0	0	22:21	0	0	0	22:10	1f (track 6)	1	1
11	23:36	0	0	0	0	22:10	0	0	0	22:17	1f (track 7)	1	1
12	23:45	0	0	0	0	22:01	0	0	0	22:30	0	0	0
13	23:51	0	0	0	0	21:54	0	0	0	22:35	1c (track 8)	1	1
13-14	23:56	1f (tracks 5,6)	0	continuous	1	-	0	0	0	22:37	1c (track 8)	1	1
14	21:59	0	0	0	0	21:44	0	0	0	22:46	0	0	0
15	00:04	0	0	0	0	21:39	0	0	0	22:52	0	0	0
16	00:10	0	0	0	0	23:56	1f	1	1	23:00	0	0	0
16-16	-	0	0	0	0	23:57	1c (track 26)	1	1	-	0	0	0
15-16	-	0	0	0	0	00:00	1c (track 27)	1	1	-	0	0	0
Total		2	1	3	3		7	6	7		7	9	7

Time is time at end of walk at station or time of observation whilst walking. f - Denotes a feeding bat. c - denotes commuting bat. social - denotes social calls

\* Time is time at end of wait at station or time of observation whilst walking; f - Denotes a feeding bat; c - denotes commuting bat; social - denotes social calls

SUB-CONTRACTOR: NEIL BOSTOCK

CONTRACTOR: ECOTRICITY LTD.

Table 4 (continued) Number and Species of Bats and number of Passes Recorded at and between wait Stations on Route (A) during all visits to Heckington Fen

Station		Visit K - 1 <sup>st</sup> September, 2009					Total	
Walk	Time	45 kHz Pipistrelle	Myotis daub.	Number of Passes	K	A, D, G, K		
1	22:25	0	0	0	0	2		
1-2	22:19	1f (track 1)	0	continuous	1	2		
1-2	22:20	1f prob same (track 2)	0	3	0			
2	22:09	1f (tracks 3+4+5)	0	continuous	1	1		
3	22:03	0	0	0	0	0		
3-4	-	0	0	0	0	1		
4	21:56	0	0	0	0	0		
4-5	-	0	0	0	0	0		
5	22:11	0	0	0	0	1		
5-6	-	0	0	0	0	0		
6	21:36	0	0	0	0	0		
7	21:29	0	0	0	0	0		
7-8	-	0	0	0	0	1		
8	21:18	0	0	0	0	0		
9	21:09	0	0	0	0	1		
9-10	-	0	0	0	0	2		
10	21:02	0	0	0	0	1		
11	20:51	0	0	0	0	1		
12	20:40	0	0	0	0	0		
13	20:34	0	0	0	0	1		
13-14	-	0	0	0	0	2		
14	20:23	0	0	0	0	0		
15	20:18	0	0	0	0	0		
16	20:05	0	0	0	0	1		
15-16	-	0	0	0	0	2		
Total		2	0	3	2	19		

Time is time at end of wait at station or time of observation whilst walking; f - Denotes a feeding bat; c - denotes commuting bat; social - denotes social calls

\* Time is time at end of wait at station or time of observation whilst walking; f - Denotes a feeding bat; c - denotes commuting bat; social - denotes social calls

SUB-CONTRACTOR: NEIL BOSTOCK

CONTRACTOR: ECOTRICITY LTD.

Table 4 Number and Species of Bats and number of Passes Recorded at and between wait Stations on Route (B) during all visits to Heckington Fen

Station /walk	Visit A - 28 <sup>th</sup> July 2009				Visit D - 11 <sup>th</sup> August 2009				Visit G - 17 <sup>th</sup> August 2009					
	Time	45 kHz Pipistrelle	Number of Passes	Total A	Time	45 kHz Pipistrelle	Myotis spp	Number of Passes	Total D	Time	45 kHz Pipistrelle	Myotis spp	Number of Passes	Total G
1	21:16	0	0	0	23:54	0	0	0	0	20:54	0	0	0	0
2	21:24	0	0	0	23:44	0	0	0	0	21:10	0	0	0	0
3	21:34	0	0	0	23:36	0	0	0	0	21:22	1f (track 2)	0	0	3
4	21:41	0	0	0	23:27	0	0	0	0	21:32	1f (tracks 3,4)	0	0	4
5	21:53	2f (track 1)	continuous	2	23:17	1f	0	continuous	1	21:42	1f ( track 5)	0	continuous	1
6	22:02	1c	1	1	23:09	0	0	0	0	21:48	1c	0	0	1
7	22:10	0	0	0	23:03	0	0	0	0	21:55	0	0	0	0
7-8	22:11	1c	1	1	-	0	0	0	0	-	0	0	0	0
7-8	22:16	1c	1	1	-	0	0	0	0	-	0	0	0	0
8	22:20	0	0	0	22:53	0	0	0	0	21:56	0	0	0	0
8-9	-	0	0	0	-	0	0	0	0	22:11	1f	0	0	2
9	22:30	0	0	0	22:44	0	0	0	0	22:16	0	0	0	0
10	22:41	0	0	0	22:32	0	0	0	0	22:28	0	0	0	0
11	22:46	0	0	0	22:22	0	0	0	0	22:36	0	0	0	0
12	22:51	0	0	0	22:15	0	0	0	0	22:41	1f social	0	0	1
12-13	22:52	1c	1	1	-	0	0	0	0	-	0	0	0	0
13	23:00	1c	1	1	22:06	0	0	0	0	22:53	0	0	0	0
13-14	-	0	0	0	21:58	1f	0	continuous	1	22:55	2f (track 6/7)	1f (track 7)	continuous (1)	3
13-14	23:02	1f	continuous	1	21:57	1f	0	1	1	-	0	0	0	0
13-14	23:07	1f	1	1	21:55	0	1c prob. dub.	1	1	-	0	0	0	0
13-14	23:12	1c	1	1	21:52	1f	0	4	1	-	0	0	0	0
14	23:17	0	0	0	21:51	0	0	0	0	23:03	1f	0	0	1
14-15	-	0	0	0	21:46	1f	0	3	1	23:05	2f (track 8)	0	continuous	3
14-15	-	0	0	0	21:41	1f prob same	0	1	0	23:09	2f prob same	1c(track 9)	0	1
14-15	-	0	0	0	21:40	1f	0	1	1	23:13	1f	0	2	1
15	23:28	0	0	0	21:29	2+f (track 5	0	continuous	2+	23:19	1f prob same	0	4	0
15-16A	-	0	0	0	21:33	1c prob same (track 4)	0	1	0	23:21	0	0	1	1
15-16A	-	0	0	0	21:31	2f (tracks 2-3)	0	2	2	-	0	0	0	0
15-16A	-	0	0	0	21:27	1c	0	1	1	-	0	0	0	0
16A	23:35	0	0	0	21:17	0	0	0	0	23:28	2f (track 10)	0	continuous	2
16	23:43	0	0	0	21:10	0	0	0	0	23:33	0	0	0	0
1-17	-	0	0	0	23:55	1c	0	1	1	23:38	1c	0	0	1
17	23:52	0	0	0	00:01	0	0	0	0	23:44	1c	0	0	1
Total		2	7	10	-	12+	1	16	13+	-	16	3	34	20

\* Time is time at end of wait at station or time of observation whilst walking, f - Denotes a feeding bat, c - denotes commuting bat, social - denotes social calls

SUB-CONTRACTOR: NEIL BOSTOCK

CONTRACTOR: ECOTRICITY LTD.

Table 4 (continued) Number and Species of Bats and number of Passes Recorded at and between wait Stations on Route (B) during all visits to Heckington Fen

Station /walk	Visit K - 1 <sup>st</sup> September 2009				Visit L - 13 <sup>th</sup> September 2009			
	Time	45 kHz Pipistrelle	Myotis spp	Number of Passes	Time	45 kHz Pipistrelle	Myotis spp	Number of Passes
1	22:33	0	0	0	12:13	0	0	0
2	22:25	0	0	0	12:14	0	0	0
3	22:18	0	0	0	12:15	0	0	0
4	22:11	0	0	0	12:16	0	0	0
5	22:03	0	0	0	12:17	0	0	0
6	21:57	0	0	0	12:18	0	0	0
7	21:51	0	0	0	12:19	0	0	0
7-8	21:43	1c	0	1	12:20	0	0	0
8	21:41	0	0	0	12:21	0	0	0
8-9	-	0	0	0	12:22	0	0	0
9	21:33	0	0	0	12:23	0	0	0
10	21:28	0	0	0	12:24	0	0	0
11	21:17	0	0	0	12:25	0	0	0
12	21:11	0	0	0	12:26	0	0	0
12-13	-	0	0	0	12:27	0	0	0
13	21:03	0	0	0	12:28	0	0	0
13-14	20:56	4-5f (track 7)	0	continuous	12:29	0	0	0
13-14	20:53	1f (track 6)	1c poss	0	12:30	0	0	0
14	20:51	2+f (track 5)	0	continuous	12:31	0	0	0
14-15	20:46	1f (track 4)	0	2	12:32	0	0	0
14-15	20:39	1f prob same	0	4	12:33	0	0	0
14-15	20:38	1f (track 3)	0	3	12:34	0	0	0
15	20:35	2f (tracks 1-2)	0	3	12:35	0	0	0
15-16A	-	0	0	0	12:36	0	0	0
16A	20:28	0	0	0	12:37	0	0	0
16	20:22	0	0	0	12:38	0	0	0
16-17	-	0	0	0	12:39	0	0	0
17	20:13	0	0	0	12:40	0	0	0
1-17	-	0	0	0	12:41	0	0	0
Total		12-13+	1	13	12-14+	56-57+		

\* Time is time at end of wait at station or time of observation whilst walking, f - Denotes a feeding bat, c - denotes commuting bat, social - denotes social calls

SUB-CONTRACTOR: NEIL BOSTOCK

CONTRACTOR: ECOTRICITY LTD.



Table 4 (continued) Number and Species of Bats and number of Passes Recorded at and between wait Stations on Route (C) during all visits to Heckington Fen

Station /walk	Visit B - 30 <sup>th</sup> July, 2009				Visit E - 15 <sup>th</sup> August, 2009				Visit H - 18 <sup>th</sup> August, 2009			
	Time	45 kHz Pipistrelle	Number of Passes	Total B	Time	45 kHz Pipistrelle	Number of Passes	Total E	Time	45 kHz Pipistrelle	Number of Passes	Total H
1	21:57	0	0	0	21:09	1f	1	1	20:41	0	0	0
1-2	21:49	1f (track 2)	continuous	1	23:39	0	0	0	22:31	1f (track 2)	continuous	1
1-2	21:52	1c	1	1	23:41	0	0	0	22:35	1f (track 3)	2	1
1-2	-	0	0	0	-	0	0	0	22:38	1f	2	1
2	22:05	0	0	0	23:39	0	0	0	20:48	0	0	0
3	22:14	0	0	0	23:28	0	0	0	20:58	0	0	0
3-4	22:16	1f	1	1	-	0	0	0	-	0	0	0
4	22:20	0	0	0	23:22	0	0	0	21:03	0	0	0
4-5	22:24	1f (track 4)	2	1	23:31	0	0	0	-	0	0	0
5	22:30	0	0	0	23:31	0	0	0	21:14	0	0	0
5-6	22:32	1f (track 2)	1	1	-	0	0	0	-	0	0	0
6	22:42	0	0	0	23:21	0	0	0	21:22	0	0	0
7	22:56	0	0	0	23:11	0	0	0	21:35	0	0	0
8	23:02	0	0	0	23:05	0	0	0	21:42	0	0	0
8-9	23:18	1f (track 6)	continuous	1	22:47	2f	continuous	2	21:47	1f	1	1
8-9	-	0	0	0	-	0	0	0	21:54	1f	1	1
8-9	-	0	0	0	-	0	0	0	21:58	1f (track 1)	continuous	1
9	23:18	0	0	0	22:46	0	0	0	22:02	0	0	0
10	23:36	0	0	0	22:27	0	0	0	22:15	0	0	0
11	23:43	0	0	0	22:32	1c	1	1	22:20	1f	1	1
11-12	-	0	0	0	22:12	1c	1	1	22:30	1f	3	1
12	00:10	0	0	0	22:02	0	0	0	22:36	0	0	0
13	00:18	0	0	0	22:08	0	0	0	22:44	0	0	0
Total		6	5	6	-	5	3	5	-	8	10	8

\* Time is time at end of wait at station or time of observation whilst walking; f - Denotes a feeding bat; c - denotes commuting bat; social - denotes social calls

SUB-CONTRACTOR: NEIL BOSTOCK

CONTRACTOR: ECOTRICITY LTD.

Table 4 (continued) Number and Species of Bats and number of Passes Recorded at and between wait Stations on Route (C) during all visits to Heckington Fen

Station /walk	Visit L - 3 <sup>rd</sup> September, 2009			
	Time	45 kHz Pipistrelle	Number of Passes	Total B, E, H, L
1	21:54	0	0	0
1-2	-	0	0	0
2	21:47	0	0	0
3	21:40	0	0	0
3-4	0	0	0	0
4	21:34	0	0	0
4-5	-	0	0	0
5	21:26	0	0	0
5-6	0	0	0	0
6	21:17	0	0	0
7	21:07	0	0	0
8	21:01	0	0	0
8-9	-	0	0	0
9	20:44	0	0	0
10	20:34	0	0	0
11	20:28	0	0	0
11-12	0	0	0	0
12	20:16	0	0	0
12-13	-	0	0	0
13	20:21	0	0	0
Total		0	0	19

\* Time is time at end of wait at station or time of observation whilst walking; f - Denotes a feeding bat; c - denotes commuting bat; social - denotes social calls

SUB-CONTRACTOR: NEIL BOSTOCK

CONTRACTOR: ECOTRICITY LTD.

Table 4 (continued) Number and Species of Bats and number of Passes Recorded at and between wait Stations on Route (D) during all visits to Heckington Fen

Station /walk	Visit B - 30 <sup>th</sup> July, 2009				Visit E - 15 <sup>th</sup> August, 2009				Visit H - 18 <sup>th</sup> August, 2009			
	Time	45 kHz Pipistrelle	Number of Passes	Total B	Time	45 kHz Pipistrelle	Number of Passes	Total E	Time	45 kHz Pipistrelle	Number of Passes	Total H
1	22:07	0	0	0	23:06	0	0	0	20:46	0	0	0
2	22:12	0	0	0	22:59	0	0	0	20:56	0	0	0
3	22:22	0	0	0	22:50	0	0	0	21:05	0	0	0
4	22:28	0	0	0	22:45	0	0	0	21:11	0	0	0
5	22:34	0	0	0	22:37	0	0	0	21:18	0	0	0
6	22:45	0	0	0	22:30	0	0	0	21:24	0	0	0
6-7	-	0	0	0	-	0	0	0	21:26	1f (track 10)	2	1
7	23:06	0	0	0	22:20	0	0	0	21:34	0	0	0
8	23:13	0	0	0	22:13	0	0	0	-	0	0	0
9	23:21	0	0	0	22:09	0	0	0	21:47	0	0	0
10	23:32	0	0	0	22:04	0	0	0	21:54	0	0	0
11	23:38	0	0	0	21:58	0	0	0	22:00	1c	1	1
12	23:48	0	0	0	21:52	0	0	0	22:09	0	0	0
12-1	-	0	0	0	-	0	0	0	22:11	1c (track 11)	1	1
12-1	-	0	0	0	-	0	0	0	22:15	1f	1	1
12-1	-	0	0	0	-	0	0	0	22:17	1c (track 12)	1	1
Total		0	0	0	-	0	0	0	-	5	6	5

\* Time is time at end of wait at station or time of observation whilst walking. f - Denotes a feeding bat, c - denotes commuting bat, social - denotes social calls

SUB-CONTRACTOR: NEIL BOSTOCK

CONTRACTOR: ECOTRICITY LTD.

Table 4 (continued) Number and Species of Bats and number of Passes Recorded at and between wait Stations on Route (D) during all visits to Heckington Fen

Station /walk	Visit L - 3 <sup>rd</sup> September, 2009				Visit M - 10 <sup>th</sup> September, 2009			
	Time	45 kHz Pipistrelle	Number of Passes	Total L	Time	45 kHz Pipistrelle	Number of Passes	Total M
1	21:35	0	0	0	21:35	0	0	0
2	21:29	0	0	0	21:29	0	0	0
3	21:18	0	0	0	21:18	0	0	0
4	21:12	0	0	0	21:12	0	0	0
5	21:05	0	0	0	21:05	0	0	0
6	20:58	0	0	0	20:58	0	0	0
6-7	-	0	0	0	-	0	0	0
7	20:49	0	0	0	20:49	0	0	0
8	20:41	0	0	0	20:41	0	0	0
8-9	-	0	0	0	-	0	0	0
9	20:36	0	0	0	20:36	0	0	0
10	20:28	0	0	0	20:28	0	0	0
11	20:23	0	0	0	20:23	0	0	0
11-12	-	0	0	0	-	0	0	0
12	20:15	0	0	0	20:15	0	0	0
12-1	-	0	0	0	-	0	0	0
Total		0	0	0		0	0	0

\* Time is time at end of wait at station or time of observation whilst walking. f - Denotes a feeding bat, c - denotes commuting bat, social - denotes social calls

SUB-CONTRACTOR: NEIL BOSTOCK

CONTRACTOR: ECOTRICITY LTD.



Table 4 (continued) Number and Species of Bats and number of Passes Recorded at and between wait Stations on Route (E) during all visits to Heckington Fen

Station /walk	Visit C – 31 <sup>st</sup> July, 2009				Visit F – 16 <sup>th</sup> August, 2009				Visit I – 19 <sup>th</sup> August, 2009			
	Time	45 kHz Pipistrelle	Number of Passes	Total C	Time	45 kHz Pipistrelle	Number of Passes	Total F	Time	45 kHz Pipistrelle	Number of Passes	Total I
8-1	21:59	1c (track 7)	1	1	22:04	1f	1	1	21:28	1f (tracks 1-3)	4	1
8-1	22:03	1f (track 8)	continuous	1	22:10	1c	1	1	21:31	1f	1	1
1	22:14	1f	5	5	21:55	1f	2	2	21:36	1f	2	1
1-2	22:18	1f	1	1	21:48	1f	2	1	-	0	0	0
2	22:22	1f prob same	4	0	21:46	1f	3	1	21:41	2f (tracks 4-5)	4	2
2-3	22:23	1f	1	1	-	0	0	0	21:42	1f	2	1
2-3	22:27	1c	1	1	-	0	0	0	-	0	0	0
3	22:32	0	0	0	21:39	1f	3	1	21:52	1f	5	1
3-4	22:38	1c	1	1	21:26	1f prob same	1	0	21:54	1f	1	1
3-4	-	0	0	0	21:28	1f prob same	3	0	21:57	1f prob same	3	0
3-4	-	0	0	0	21:31	1f	1	1	21:58	1f	4	1
3-4	-	0	0	0	21:32	1f prob same	1	0	-	0	0	0
3-4	-	0	0	0	21:34	1f prob same	1	0	-	0	0	0
4	22:42	0	0	0	21:26	1f (track 8)	4	1	22:04	1f prob same (track 6)	4	0
4-5	22:46	1f	2	1	21:22	1f (track 7)	1	1	-	0	0	0
5	22:50	2f	1	2	22:34	0	0	0	20:57	0	0	0
5-6	22:50	2f prob same	continuous	0	-	0	0	0	-	0	0	0
6	23:03	0	0	0	22:25	0	0	0	21:07	0	0	0
7	23:09	0	0	0	22:20	1c	1	1	21:12	0	0	0
7-8	23:11	1c	1	1	-	0	0	0	-	0	0	0
8	23:15	0	0	0	22:15	0	0	0	21:18	0	0	0
8-1	23:17	1f	2	1	-	0	0	0	21:23	1c	1	1
Total		12	20	12		10	24	10		10	31	10

\* Time is time at end of wait at station or time of observation whilst walking. f - Denotes a feeding bat, c - denotes commuting bat, social - denotes social calls

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Table 4 (continued) Number and Species of Bats and number of Passes Recorded at and between wait Stations on Route (E) during all visits to Heckington Fen

Station /walk	Visit M – 4 <sup>th</sup> September, 2009			
	Time	45 kHz Pipistrelle	Number of Passes	Total C, F, I, M
1	20:21	0	0	0
1-2	-	0	0	0
2	20:29	0	0	0
2-3	20:32	1c (track 1)	1	1
3	20:38	0	0	0
3-4	20:42	1f (track 2)	continuous	1
4	20:47	1c (track 3)	1	1
4-5	-	0	0	0
5	20:56	0	0	0
5-6	-	0	0	0
6	21:09	0	0	0
7	21:14	0	0	0
7-8	-	0	0	0
8	21:20	0	0	0
8-1	-	0	0	0
Total		3	0	3

\* Time is time at end of wait at station or time of observation whilst walking. f - Denotes a feeding bat, c - denotes commuting bat, social - denotes social calls

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Table 4 (continued) Number and Species of Bats and number of Passes Recorded at and between wait Stations on Route (F) during all visits to Heckington Fen

Station /walk	Visit C – 31 <sup>st</sup> July, 2009				Visit F - 16 <sup>th</sup> August, 2009				Visit I - 19 <sup>th</sup> August, 2009			
	Time	45 kHz Pipistrelle	Number of Passes	Total C	Time	45 kHz Pipistrelle	Number of Passes	Total F	Time	45 kHz Pipistrelle	Number of Passes	Total I
1	21:14	0	0	0	22:36	0	0	0	20:52	0	0	0
2	21:25	0	0	0	22:28	0	0	0	20:59	0	0	0
2-3	-	0	0	0	22:22	1f	continuous	1	-	0	0	0
3	21:31	0	0	0	22:21	0	0	0	21:05	0	0	0
4	21:38	0	0	0	22:16	1f	2	1	21:21	0	0	0
4-5	21:56	1f (track 2)	5	1	22:06	1f prob same	continuous	0	21:26	2f (track 13)	continuous	2
4-5	22:01	1f (track 3)	3	1	22:05	1f	1	1	21:31	1f (tracks 14,15,16)	3	1
4-5	-	0	0	0	22:03	1f	1	1	21:34	1f (track 17)	continuous	1
4-5	-	0	0	0	22:01	1f	2	1	21:39	1f (track 18)	2	1
4-5	-	0	0	0	21:52	1f	1	1	21:41	1f prob same	1	1?
5	22:50	1c	1	1	21:49	1c	1	1	21:47	0	0	0
5-6	22:17	1c	1	1	-	-	0	0	-	0	0	0
6	22:25	0	0	0	21:41	0	0	0	21:58	0	0	0
7	22:34	0	0	0	21:34	1f	3	1	22:02	1f (tracks 19,20)	continuous	1
7-8	-	0	0	0	-	0	0	0	22:08	1f prob same	2	0
7-8	-	0	0	0	-	0	0	0	22:12	1f prob same	3	0
8	22:45	0	0	0	21:25	0	0	0	21:18	1c prob same	1	0
Total		4	10	4	-	8	9	8	-	6-7	12	9-7

\* Time is time at end of wait at station or time of observation whilst walking, f – Denotes a feeding bat, c – denotes commuting bat, social – denotes social calls

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Table 4 (continued) Number and Species of Bats and number of Passes Recorded at and between wait Stations on Route (F) during all visits to Heckington Fen

Station /walk	Visit M – 4 <sup>th</sup> September, 2009				Visit N – 11 <sup>th</sup> September, 2009			
	Time	45 kHz Pipistrelle	Number of Passes	Total M	Time	45 kHz Pipistrelle	Number of Passes	Total N
1	21:27	0	0	0	21:27	0	0	0
1-2	-	0	0	0	21:20	0	0	0
2	21:20	0	0	0	20:32	0	0	0
2-3	20:32	0	0	0	20:38	0	0	0
3	20:38	0	0	0	-	0	0	0
3-4	-	0	0	0	21:06	0	0	0
4	21:06	0	0	0	20:47	1c	1	1
4-5	20:47	1c	1	1	20:43	0	0	0
5	20:43	0	0	0	-	0	0	0
5-6	-	0	0	0	20:35	0	0	0
6	20:35	0	0	0	20:27	0	0	0
7	20:27	0	0	0	-	0	0	0
7-8	-	0	0	0	20:16	0	0	0
8	20:16	0	0	0	-	0	0	0
Total		1	0	1	-	0	0	0

\* Time is time at end of wait at station or time of observation whilst walking, f – Denotes a feeding bat, c – denotes commuting bat, social – denotes social calls

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Emergence and Roosting Surveys**6.25 Dusk of 30<sup>th</sup> July, 2009**

The brick-built barns termed B5 and B6 at (T17) which had some gaps in the gables, raised flashing and gaps under roof and ridge tiles offering low to moderate Bat Roosting Potential (BRP 2-3) and medium to high Bat Roosting Potential (BRP 2-1) respectively were observed by four people from positions where most suitable emergence points could be seen during survey period.

A single 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded emerging from the top of the wall plate of the north-facing gable of building B6 where there was a gap in the mortar over the double door at 21:33 pm. This bat then made several foraging passes around the building and the adjacent derelict houses B7 until 21:39 pm after which it moved off South-west. It was recorded on track 1 and the species confirmed analysis on 6<sup>th</sup> August, 2009. The emergence point is shown in Photograph Roost 1. At 00:18 am during the transect survey a 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was again recorded at the southern side of the barn B5.

**6.26 Dusk of 31<sup>st</sup> July, 2009**

The brick-built barn at Sedland Farm termed B14, target noted (T3), was observed by two people from positions where most suitable emergence points could be seen during survey period.

A single 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded emerging from the outside of the east gable end at 21:22 pm. This bat then made several foraging passes around the building until 21:25 pm after which it moved off South-west. It was recorded on track 7 and the species confirmed analysis on 6<sup>th</sup> August, 2009. At 21:32 pm another 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded emerging from the inside of the northern side of the barn; this bat moved immediately northwards towards the adjacent New Cut Drain.

**6.27 Dusk of 11<sup>th</sup> August, 2009**

The brick-built pumping station building termed B11, target noted (T4), was observed by two people from positions where most suitable emergence points could be seen during survey period.

No emerging bats were observed.

**6.28 Dusk of 11<sup>th</sup> August, 2009**

The disused brick-built houses building termed B7 (T18) were observed by two people from positions where most suitable emergence points could be seen during survey period.

A single 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded emerging from the chimney stack at 21:16 pm before flying towards the barns B5 and B6. At 21:20 and 21:30 pm this or another 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded foraging inside the garden of the houses along the mature tall hedgerows on the west and south sides of the garden.

**6.29 Dusk of 15<sup>th</sup> August, 2009**

The brick-built barns termed B5 and B6 at (T17) were observed by two people from positions where most suitable emergence points on the northern and western side of the buildings could be seen during survey period.

A single 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded emerging from towards the top of the wall plate of the north-facing gable of building B6 where there was a gap in the mortar on the north-west corner of the building at 20:54 pm. This bat emerged from a slightly different point than that located on 31<sup>st</sup> July. At 20:58 pm another 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) emerged from towards the top of the south-facing gable of B6; the exact location was not seen but it may have been where the roof beams produced a gap in the fabric of the gable. Both these bats were observed making several foraging passes around the buildings B5 and B6 until 21:02 pm. An additional 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded emerging from the same roost used on 31<sup>st</sup> July at 21:07 pm; indicating that this is likely to be the same individual that was recorded in July.

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**6.30 Dusk of 15<sup>th</sup> August, 2009**

The disused brick-built houses building termed B7 (T18) were observed by two people from positions where most suitable emergence points could be seen during survey period.

A single 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded foraging around the houses at 20:56 pm and *possibly* emerged from towards the top of house. At 21:03 pm another 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded *possibly* emerging from the eaves at the western-facing side of the house, close to the north gable end. Neither of these potential roost points was confirmed as 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were recorded commuting and foraging around the house from 20:56 pm until 21:06 pm; and could easily have come from roosts sites in B5 and B6 and not from B7.

**6.31 Dusk of 16<sup>th</sup> August, 2009**

The brick-built Trinity College Pumping Station building termed B12, target noted (T9), was observed by two people from positions where most suitable emergence points could be seen during survey period.

No emerging bats were observed. However, single 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were heard or seen at 21:00, 21:07 and 21:11 pm commuting past the building from the east.

**6.32 Dusk of 16<sup>th</sup> August, 2009**

The brick-built barn at Sedland Farm termed B14, target noted (T3), was observed by two people from positions where most suitable emergence points could be seen during survey period.

A single 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded emerging from the inside of the building at 21:04 pm. This bat then made several foraging passes around the building until 21:08 pm after which it moved off. At 21:16 pm another 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded commuting east to west along the New Cut Drain towards the pumping station building B11.

**6.33 Dawn of 16<sup>th</sup> August, 2009**

The brick-built barns termed B5 and B6 at (T17) which had some gaps in the gables, raised flashing and gaps under roof and ridge tiles offering low to moderate Bat Roosting Potential (BRP 2-3) and medium to high Bat Roosting Potential (BRP 2-1) respectively were observed by three people from positions on the east, west and north sides where most suitable roosting points could be seen during survey period.

On the eastern side of the buildings B5 and B6 a single 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded flying over the ridge of building B5 towards the open barn B4 at 04:21 am; at 04:25 am a 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) made 2 passes around the southern gable end of building B6. At 04:28 am, two possibly three 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were exhibiting swarming behaviour around the southern gable point of building B6 on the eastern side; this behaviour continued until 04:31 am. At 04:33 am a 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was seen to land on the gable before flying off. At 04:40 am a 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) entered the gable on the east side into a crack adjacent to the lowest roof beam. At 04:42 am a 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) possibly entered the gable towards the roof point. From 04:51 am a 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) flew around the building 8 times before entering the gable on the eastern side adjacent to a beam position about halfway up the gable at 05:04 am.

On the northern side of building B6, 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were observed foraging or flying around the building from 04:04 am until 05:06 am. These are likely to be some of the individuals observed swarming and entering roost sites from the eastern side. However, at 04:44 am a 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was observed swarming around the northern gable end before roosting at 05:02 am in the roost first located on 30<sup>th</sup> July, 2009. Following this, another 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was observed roosting in the roost identified on 15<sup>th</sup> August, 2009. Finally, a 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was observed foraging at 05:06 am but was not seen to roost in the building B6. This is likely to be the individual noted in building B4 from 05:10 am onwards.

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On the western side of building B6, 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were observed foraging or flying around the building from 04:22 am until 05:05 am. These are likely to be the individuals observed entering roost sites from the eastern side and in the northern gable. Swarming behaviour was also observed around the southern gable point of building B6 at 04:36 am; however, no bats were seen to enter roost sites situated on the western side.

#### 6.34 Dawn of 16<sup>th</sup> August, 2009

The metal and asbestos barns and the open sided barns termed B1 to B4 which had some gaps in the gables, raised flashing and gaps under roof offering low or limited Bat Roosting Potential (BRP 3) were observed by one person moving around to identify any potential swarming activity.

At these buildings B1 to B4, 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were observed foraging or flying around buildings B1 to B3 or within the building B4 from 04:12 am until 05:02 am. These are likely to be the individuals observed entering roost sites from the eastern side of building B6. From 05:10 am until 05:13 am another 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was observed foraging just inside the open barn B4 after which time there was no contact and it is possible this individual may have roosted in the building.

#### 6.35 Dawn of 17<sup>th</sup> August, 2009

The brick-built Trinity College Pumping Station building termed B12, target noted (T9), was observed by one person from a position where most suitable roosting points could be seen during survey period. In addition the concrete Skirt Drain Number 2 Bridge termed B15 situated close-by was observed by one person from a position where most suitable roosting points could be seen during survey period.

At the Pumping Station a 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was heard distantly at 04:20 am; at 04:24 and 04:41 am single 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were observed to commute past the building. At the relatively late time of 05:00 am another 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was observed to fly three times around the pump-house but was then observed to fly eastwards along the Skirt Drain. No bats were observed to exhibit swarming behaviour or used the site to roost during the survey period.

At the bridge no bats were seen or heard.

#### 6.36 Dawn of 17<sup>th</sup> August, 2009

The brick-built barn at Sedland Farm termed B14, target noted (T3), was observed by two people from positions where most suitable roosting points could be seen during survey period.

One or two, 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were heard or observed from at 04:08 am until 05:10 am foraging or commuting past or around the building. At 05:12 am a 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was observed to enter the western-most door into the barn twice, perhaps prospecting a roost site before flying off. The Church just beyond the 500m boundary approximately 1 km further east from Sedlands Farm along the New Cut Drain is also likely to offer potential for roosting bats.

No bats were observed to exhibit swarming behaviour or used the site to roost during the survey period.

#### 6.37 Dawn of 18<sup>th</sup> August, 2009

The disused brick-built houses building termed B7 (T18) were observed by two people from positions where most suitable emergence points could be seen during survey period.

The only observation was of a single 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) which commuted in, flew around for a few seconds and then moved away. No bats were observed to exhibit swarming behaviour during the survey period.

#### 6.38 Dawn of 18<sup>th</sup> August, 2009

The brick-built barn with a chimney termed B8 (T19) had gaps in the gables and gaps under roof and ridge tiles offering low to Bat Roosting Potential (BRP 3) were observed by two people from positions where most suitable emergence points could be seen during survey period.

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No bats were observed around the building during the survey period.

#### 6.39 Dawn of 19<sup>th</sup> August, 2009

An Ash tree termed (T15) on the Phase 1 survey which had many splits, cracks and holes offering low to moderate Bat Roosting Potential (BRP 2-3) was observed by one person from a position where most suitable emergence points could be seen during survey period.

No bats were observed around the tree during the survey period.

#### 6.40 Dawn of 20<sup>th</sup> August, 2009

An Ash tree termed (T22) on the Phase 1 survey which often held a foraging 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) which had some cracks and holes at its base offering low Bat Roosting Potential (BRP 3) was observed by one person from a position where most suitable emergence points could be seen during survey period.

No bats were observed around the tree during the survey period.

#### 6.41 Bat Roosts found at the Site

The trees which were considered to have the greatest Bat Roost Potential were examined for the presence of roosting bats. Swarming surveys conducted on these trees at dusk on the 19<sup>th</sup> and 20<sup>th</sup> August failed to locate any roosting bats. However, there were a few other trees found within the 500m radius survey area which had low Bat Roost Potential but these were not all specifically examined during emergence and swarming surveys.

The brick-built double storey barn B6 was found to hold probably 5 roosting 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) which were entering the building at slightly different points and were likely to be roosting individually. Two were using the northern gable of the building [Roost 1, above the double barn door which was photographed and Roost 2 just below the roof which was not photographed], whilst another three were using the southern gable end. The locations of the three roost sites in the southern gable were also photographed. The roosts sites in the northern gable were shown to be active at dusk of 30<sup>th</sup> July, at dusk of 15<sup>th</sup> August and at dawn on 16<sup>th</sup> August. The roosts sites in the southern gable were shown to be active at dusk of 15<sup>th</sup> August and at dawn on 16<sup>th</sup> August.

The brick-built double storey houses B7 was found to hold a single roosting 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) which emerged from the eastern-most chimney stack of the building at dusk of 11<sup>th</sup> August. At dusk of 15<sup>th</sup> August a single 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded foraging around the houses at 20:56 pm and possibly emerged from towards the top of house. Also at dusk on the 15<sup>th</sup> August, at 21:03 pm, another 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded possibly emerging from the eaves at the western-facing side of the house, close to the north gable end. However, neither of these potential roost points was confirmed. During a dawn survey on 18<sup>th</sup> August only one bat was observed briefly and no bats were observed to exhibit swarming behaviour or roost in the building indicating that potential roost sites in the building B7 are only used sporadically.

The brick-built barn B14 at Sedland Farm was found to hold 2 roosting 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) which emerged individually from different locations on the building at dusk on 31<sup>st</sup> July. One emerged from the eastern gable end and the other from inside the building on the northern side. A single 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was also seen to emerge from inside the building at dusk of 16<sup>th</sup> August, perhaps indicating that at least one of these roosts is regularly used. However, a dawn of 17<sup>th</sup> August, although one or two 45 kHz Pipistrelle bats were observed foraging around the building and one 45 kHz Pipistrelle bat was seen to prospect a roost site inside the building, this bat eventually flew off and no bats roosted.

The only other potential roost site was within the open barn B4 where at dawn on 16<sup>th</sup> August a late foraging bat quickly disappeared and was likely to have roosted in the building.

None of the other buildings on the site had any indication of roosting bats.


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It is possible that other buildings or mature trees beyond the 500m radius may have cavities, cracks, holes or flaking bark which could offer bat roost potential and that the majority of bats recorded on the site are roosting at sites more than 500m from the proposed turbine position and commuting onto the survey area to forage.

Photographs of Roost sites

Roost 1	
Position of Roost 1 in hole at top of northern gable in barn B6 at Six Hundreds Farm (T17) used by a single 45 kHz Pipistrelle bat.	Close up of Roost 1 entry site
	
Roost 2	
Position of Roost 2 is situated on the gable just below the roof immediately to the right of the top of the door to the upper storey.	
	
Roost 3, Roost 4 and Roost 5	
Southern gable end of barn B6 showing view of gable and three roost sites located on the right of the gable apex.	Close up of Roost 3
	

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7. ANALYSIS AND CONCLUSIONS





7.1 Conclusions

- 1) The survey results show that the site is used by relatively small numbers of 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) with between 0 and 20 individuals foraging on the survey transects, depending on the survey route, the time of year and weather conditions during the survey. Numbers were lowest during the surveys conducted on routes (A), (C) and (D) which comprise a transect route along the small ditches and field boundaries of the open arable farmland. The numbers of bats were generally highest on survey routes (B), (E) and (F) which ran alongside long sections the Skirt Drain which was a major drainage channel situated between Six Hundreds Farm and Spinney Farm. The Skirt Drain consisted of two high banks separated by a broad gently flowing watercourse; the physical structure of the Skirt Drain which provided shelter from most winds and the slightly vegetated banks concentrated insect activity which in turn provided ideal foraging opportunities and concentrated the number of bats. The Skirt Drain also formed a linear feature which ran right across the site from west to east acting as a commuting corridor for bats moving onto the site from beyond the 500m boundary. During September the levels of bat activity on the survey routes were generally lower due to moderately windy weather conditions reducing the level of bat activity on what is an exposed site; however on route (B) the level of bat activity was maintained as bats concentrated foraging within the Skirt Drain. Conversely, routes (C) and (D) which traversed open farmland registered no bats. In late July total numbers were relatively low with 34 bats being recorded, bat numbers gradually increased in August reaching a peak on surveys conducted from 17<sup>th</sup> to 19<sup>th</sup> August when the adult bat population was augmented by juvenile bats. In September the bat population across the site began to decline as bats began to desert their summer roosting areas and move to their wintering roosting areas. No Noctule Bats (*Nyctalus noctula*) were recorded during the surveys; similarly no 55 kHz Pipistrelle bats (*Pipistrellus pygmaeus*) were recorded. A few *Myotis* spp bat was found during the surveys; these were particularly associated with the Skirt Drain with most individuals being recorded on transect route (B). Generally, numbers were low with just one individual being recorded during most survey visits; however during surveys conducted from 17<sup>th</sup> to 19<sup>th</sup> August 3 *Myotis* spp bats were recorded perhaps indicating the additional presence of juveniles or perhaps dispersal through the site by these species. It is likely that the *Myotis* spp bats were Daubenton's Bats (*Myotis daubentonii*); this species was specifically identified on 28<sup>th</sup> July and the foraging activity and habitat being used (foraging low over the water of the Skirt Drain) strongly indicates this species. The results are considered to be within the range of the typical kind of "background" bat activity expected for a site of this nature, which consists mainly of exposed, open arable farmland with small pockets of grassland, very few mature hedgerows and a few small deciduous wooded plantations. The Skirt Drain forms the major bat habitat both for foraging in a range of weather conditions and as a linear corridor to commute onto the site. Although the majority of trees are young and do not provide bats with many roosting opportunities, the small grassland areas at the arable site potentially provides bats with good foraging areas. The mature woodland plantations and mature hedgerows also provide bats with limited foraging potential.
- 2) The bat activity recorded by the surveys generally involves relatively low numbers of the commonest bat species and is believed to be not significant given that there is a large amount of similar habitat in the vicinity. The level of bat activity which occurred in the open exposed arable areas in which the most prevalent features were the small field boundary ditches and isolated small plantations mostly with small trees was very low. This is the area of the site where any proposed turbine development will be situated. Most bat foraging and commuting activity was associated with the Skirt Drain which will not be impacted by the wind farm development on either Six Hundreds Farm or Spinney Farm. Overall the potential for significant bat activity at the site of the proposed wind turbine appears to be minimal.
- 3) The construction and operation of the wind turbines at the site is unlikely to affect the activity of feeding or commuting bats as revealed by the night-time surveys undertaken in the period end July to early September, 2009. The majority of the bats using the site are 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) which are known to fly quite low to the ground and are unlikely, even when foraging in the vicinity of the windfarm, to be affected by the operation of the turbines. It is therefore considered that no mitigation measures with respect to foraging, feeding or commuting bats of this species are required at this site. No 55 kHz Pipistrelle bats (*Pipistrellus pygmaeus*) were recorded, whilst a one to three *Myotis* spp bat (likely to be Daubenton's bat [*Myotis daubentonii*]) were recorded foraging on the Skirt Drain throughout the survey. These are also generally a low flying species which are unlikely to be affected by the wind turbines and they foraged and probably commuted onto the site using an area which will not be affected by the wind turbine development. No Noctule Bats (*Nyctalus*

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Roost 4 and Roost 5 continued	
Close up of Roost 4 on right of photograph with Roost 5 on left.	Close up of Roost 5 on right of gable apex
	
Roost 6 and 7	Roost 8
Barn B14 at Sedland Farm (T3) which had a single 45 kHz Pipistrelle bat roosting inside the barn and another on the eastern gable end on the side opposite the bush	House B7 (T18) showing eastern gable and chimney stack which held a single 45 kHz Pipistrelle bat
	

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*noctula*) which are a species which can fly high and may forage at altitude and are perceived as being at risk from collision from wind turbines were observed during the surveys.

- 4) An examination of the numbers of bats recorded at the waiting Stations and en route between the Stations during each survey visit indicates that generally very low numbers of 45 KHz Pipistrelle bats (*Pipistrellus pipistrellus*) were foraging along corridors formed by the ditches in open arable farmland. Whilst the few hedgerows situated south and west of Six Hundreds Farm and the mature plantation situated south of Six Hundreds Farm provided sheltered foraging habitat for a few bats depending on wind direction the numbers of bats using the open arable areas overall was low. The Skirt Drain provided the major bat habitat on the site; on route (B) waiting Stations adjacent to the Skirt Drain produced 75% of the bats recorded on the survey route; on route (E) waiting Stations adjacent to the Skirt Drain produced 78% of the bats recorded on the survey route whilst on route (F) waiting Stations adjacent to the Skirt Drain produced 76% of the bats recorded on the survey route. The buildings on site also provided shelter and concentrated insects which in turn concentrated foraging bats; on route (C) 50% of the bats recorded on the transect occurred around the buildings at Six hundreds Farm. However, as survey route (C) largely comprised open arable areas the number of bats recorded on each survey visit was low ranging from 0 to 8. Only twenty-one 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were found at or en route between all wait Stations within 200m of the proposed turbine positions across all survey routes during the entire survey period. This represents only 13% of the bats which were recorded across all survey routes during the entire survey period. No *Myotis* spp bats were found within 200m of the proposed turbine position. No *Noctule* Bats (*Nyctalus noctula*) were recorded during the surveys. This indicates that the bat activity within 200m of the turbine is generally very low. The greatest bat activity occurred adjacent to the Skirt Drain which is 350m from the proposed turbine positions.
- 5) At end July to mid August, in comparable weather conditions, the number of bats recorded in each of the surveys appeared to be quite consistent. Indeed, the positions and foraging localities where bats were found over this period also appeared to be consistent indicating that some of the same bats may be involved in some of the records. This is further evidence that the population of bats using the site is not large.
- 6) Small differences in the number of bats using the site are likely to be due to weather related factors; as small and large differences in survey conditions, including temperature, wind strength and direction and cloud cover, may have a greater bearing on bat activity than could be perceived by humans. Still conditions with high temperatures and high humidity are likely to make insect food more abundant; the phase of the moon may also influence insect and bat activity.
- 7) There are several opportunities for bats to roost within the area within 500m radius of the proposed development footprint which forms the survey area. The older brick-built farm buildings at Six Hundreds Farm and Sedlands Farm were assessed to have suitable structures and construction to have Bat Roost Potential. In particular the buildings B5 and B11 were considered to have low to medium Bat Roost Potential (BRP 2-3); whilst buildings B6, B7 and B14 were considered to have medium to high Bat roost Potential (BRP 1-2). By contrast, the modern asbestos barn buildings B1-4, B10 and the brick-built barn B8 and store B9 were considered to have low or very limited potential for roosting bats. The pumping stations B11 and B12 were well-sealed buildings where the only bat roost potential was if there were any gaps underneath the building in the concrete structure adjacent to the watercourse. The Skirt Drain bridges B13 and B15 were not suitable for roosting bats. During emergence and swarming surveys conducted between 30<sup>th</sup> July and 18<sup>th</sup> August, 5 roosting 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) each roosting singly, using 5 separate roosts were found in the gables of building B6; one roosting 45 kHz Pipistrelle bat was using the chimney stack of building B7; two roosting 45 kHz Pipistrelle bats each roosting singly were using the gable and interior of building B14 and a 45 kHz Pipistrelle bat possibly roosted in building B4. Several trees across the site were identified as having low to moderate Bat Roosting Potential (BRP 2-3); of these an Ash tree (T15) and an isolated Ash tree (T21) were examined during swarming surveys conducted on 19<sup>th</sup> and 20<sup>th</sup> August. No bats were found to be roosting in these trees, although it is possible bats may have been using other trees within 500m of the development footprint for roosting. The majority of bats which were observed foraging on the surveys were most likely commuting to the site to feed from roost sites beyond the 500m boundary from the turbine positions. The Skirt Drain is an important linear foraging and commuting corridor for bat activity on the site.
- 8) The construction and operation of the wind turbines is unlikely to destroy any bat roost sites or affect the bats which are currently foraging at the site.

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**8. PROPOSED MITIGATION**

1. As this survey was only commenced in late July it is important that further transect surveys should be conducted to confirm the use of the site from April, when bats first become active, until June in order to have a complete assessment of how bats use the site. The emergence and swarming surveys should be conducted again in June on buildings B5, B6, B7 and B14 in order to confirm that the roosts located are still active and that no maternity roosts are present at the site.
2. The buildings on the site in particular buildings B6 at Six Hundreds Farm and building B14 termed Sedlands Farm hold roosting bats. In addition, the houses B7 may sporadically also hold roosting bats. If any of these buildings were to be structurally altered or demolished during the construction of the wind farm further surveys would be required to assess whether these roosts comprised maternity or hibernation roosts or single bats. Prior to demolition an alternative specifically constructed 'bat house' should be erected to provide an alternative roosting site for these animals. Before demolition of any building the effective transfer and use of the 'bat house' for roosting should be demonstrated.
3. Wherever possible the mature standard trees which are present within 500m of the site should be retained as they potentially provide a wide range of bat roosting habitat such as holes, flaking bark or cracks in the trunk.

**9. REFERENCES**

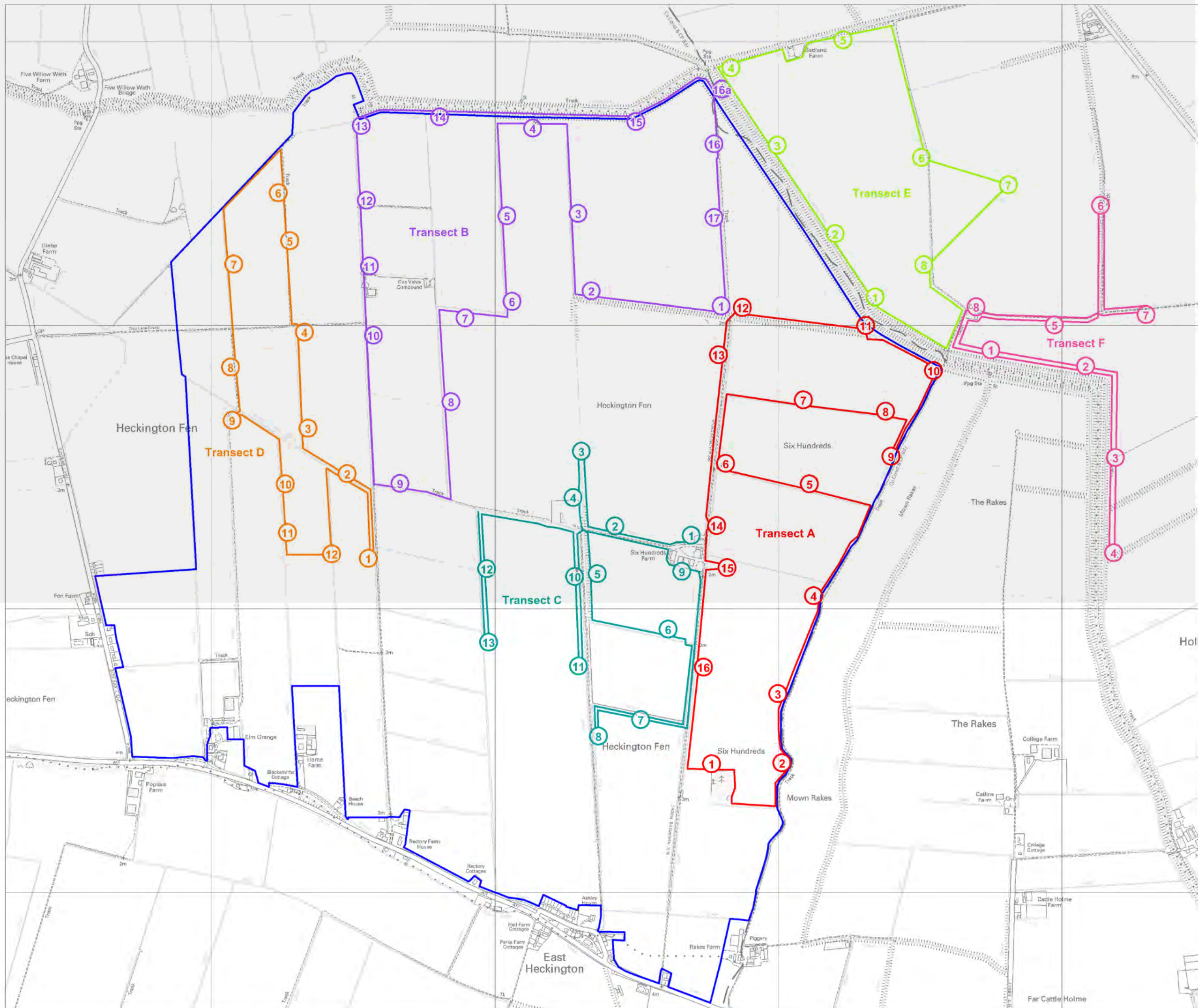
Mitchell-Jones, T & McLeish, A. P. (2004) Bat Workers' Manual 3<sup>rd</sup> Edition, JNCC

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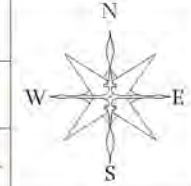
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Legend

- Site Boundary
- Transect Route A (6km)
- Wait Point
- Transect Route B (6.6km)
- Wait Point
- Transect Route C (5.8km)
- Wait Point
- Transect Route D (4km)
- Wait Point
- Transect Route E (3.5km)
- Wait Point
- Transect Route F (4.6km)
- Wait Point



Drawn by *[Signature]*  
Checked by *R. Spiller*  
Approved by *P.H. King*



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Appendix 7.2: Figure 1

Title: Bat Activity Transect Routes

Heckington Fen Wind Park  
Environmental Statement



## APPENDIX 7.3: SUPPLEMENTARY BAT ACTIVITY MONITORING

Page 2

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REPORT ON A BAT SURVEY CONDUCTED IN  
CONNECTION WITH THE SITE OF THE PROPOSED  
WIND TURBINE DEVELOPMENT AT HECKINGTON  
FEN, WEST OF BOSTON, IN LINCOLNSHIRE.

12<sup>th</sup> August, 2010

This copy includes appendices

I the undersigned, hereby declare that the work was performed according to the procedures herein described and that this Report is an accurate and faithful record of the results obtained.

NEIL BOSTOCK BSc Hons

This document is an account of work carried out by NEIL BOSTOCK on behalf of ECOTRICITY Ltd.  
NEIL BOSTOCK cannot accept responsibility for decisions made or actions taken on the basis of this Report.

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CONTRACTOR: ECOTRICITY LTD.

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**FIGURES**

Figure 1 Bat Transect Survey Results

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## 2. SUMMARY

- There are proposals for a wind turbine to be constructed by Ecotricity on land at Heckington Fen, west of Boston, in Lincolnshire. As part of the ecological assessment of the site Natural England has requested that a pre-construction and operation night-time bat survey be undertaken in order to assess the actual use made by bats of the area, for roosting, foraging and feeding, and/or for commuting from off-site roosts to preferred feeding areas elsewhere. This study is designed to generate quantitative data which could be used to measure the impact of the proposed wind farm on bat movements and activity when taken in conjunction with data from surveys in the post-construction and operational phase.
- The surveys were carried out on behalf of Ecotricity by Ecologists Louise Brown MIEEM, Shaun Baker MIEEM, Neil Bostock MIEEM and Juliette Banwell, Keith Miller and Lee Rudd all of who are experienced in bat transect and roost surveys. As the proposed wind farm is large the area was split into four survey routes, termed (A) to (D) in order to survey the whole area in blocks which would take approximately 3 hours to cover so that the routes were surveyed at peak times of bat activity. The whole area was surveyed once in April, May and June, 2010. The Transect surveys for route (A) and (B) were conducted from just after dusk for approximately 3 hours on 19<sup>th</sup> April, 14<sup>th</sup> May and 17<sup>th</sup> June, 2010; routes (C) and (D) were surveyed on 22<sup>nd</sup> April, 21<sup>st</sup> May, and 28<sup>th</sup> June, 2010; with the route being reversed on each alternate transect. Emergence surveys were conducted prior to the transect surveys for approximately 60 minutes each evening commencing 30 minutes before dusk. During the surveys a Duet II Bat Detector set at 40-45 kHz was used to detect Pipistrelle and Myotis bats; in addition a Peterson 240DX Bat Detector set at 25 kHz was used to determine the presence of Noctule bats in conjunction with an Anabat SD 1 which recorded all bat activity during the surveys.
- The bat roost emergence surveys were carried from just before dusk at sites which had been identified during the Phase 1 habitat survey as localities (trees or buildings) which could potentially support a bat roost and they followed standard survey methods. In 2009, an assessment of all the potential buildings and structures (such as bridges) was made to determine their potential and suitability for bat roosting sites; a day-time site visit was made to look at each building or structure for bat droppings (on walls of buildings) or holes or cavities which allowed a bat to access to find a dry secure roost site. Any suitable holes were examined for evidence of roosting bats such as absence of spider webs and the presence of any scratches or slightly darkened greasy marks which often occur when bats squeeze into a roosting site and were examined internally with an endoscope for the presence of roosting bats. The following buildings (as identified in the buildings and structures survey) were examined thoroughly for bat emergence activity: B5 (T17) an old single storey cowshed/barn with low to medium bat roosting potential (BRP 3-2); B6 (T17) a two storey barn with medium to high bat roosting potential (BRP 2-1); B7 (T18) two semi-detached two storey houses with medium to high bat roosting potential (BRP 2-1). Any potential roost sites were generally observed by at least two people from a position where all suitable emergence points could be seen at each survey period. The survey periods were generally selected when the weather conditions were optimum for bat activity i.e. dry and with calm conditions; however, the emergence survey conducted at B5, B6 and B7 on 19<sup>th</sup> April occurred in cooler conditions than was hoped (ranging down to 8.0° C). The air temperature, wind speed and direction and weather conditions were recorded on each visit.
- The night-time transect bat surveys were carried out after dusk between 19<sup>th</sup> April and 28<sup>th</sup> June, 2010 and they followed standard survey methods. As the proposed wind farm is large the area was split into four survey routes, termed (A) to (D) in order to survey the whole area in blocks which would take approximately 3 hours to cover so that each route could be surveyed at peak times of bat activity. A day-time site visit enabled the proposed turbine positions and physical features on each route most likely to support bat activity to be identified and these were used to set fixed recording points on each transect route which was followed by observers using bat detectors. Recording points encompassed both natural and man made features and the majority of the area (subject to land ownership) within 500m radius of the proposed development area was walked during the transect surveys; the survey route also took into account the position of the proposed turbines on the site. The survey routes from April to June, 2010 were the same as those used from July to September 2009. On each night, the same survey method was used. The survey nights were generally selected when the weather conditions were optimum for bat activity i.e. warm, dry and with calm conditions. Survey nights were as far as possible spaced evenly apart at a period when weather conditions would optimise bat activity; however, on 19<sup>th</sup> April clear, cool conditions caused the temperature to drop to 7.0° C by the end of the transect survey. The air temperature, wind speed and direction and weather conditions were recorded on each visit. During the first visit, the survey route selected generally moved chronologically from recording points 1 to either 16, 17, 13 or 12 (depending on the survey route A-D) ; whilst during

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the alternate visit the route taken was reversed in order to ascertain different bat activity at different points at different periods of the night.

- The survey results show that the site is used by relatively small numbers of 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) with between 0 and 17 individuals foraging on the survey transects, depending on the survey route, the time of year and weather conditions during the survey. Numbers were lowest during the surveys conducted on routes (C) and (D) which comprise a transect route along the small ditches and field boundaries of the open arable farmland. The numbers of bats were generally highest on survey routes (A) and (B) which ran alongside long sections the Skirt Drain which was a major drainage channel situated between Six Hundreds Farm and Spinney Farm or alongside a larger woodland block and along a permanent county boundary ditch. The Skirt Drain consisted of two high banks separated by a broad gently flowing watercourse; the physical structure of the Skirt Drain which provided shelter from most winds and the slightly vegetated banks concentrated insect activity which in turn provided ideal foraging opportunities and concentrated the number of bats. The Skirt Drain also formed a linear feature which ran right across the site from west to east acting as a commuting corridor for bats moving onto the site from beyond the 500m boundary. During April the levels of bat activity on the survey routes were generally lower due to cool weather conditions reducing the level of bat activity on what is an exposed site; however on route (A) and (C) the level of bat activity was maintained as bats concentrated foraging close to the buildings and hedgerows. Conversely, routes (D) which traversed open farmland registered no bats. In April and May total numbers were relatively low with only 5 and 8 bats being recorded over all on the site respectively; bat numbers gradually increased reaching a peak of 22-23 individuals over all on surveys conducted during 17<sup>th</sup> and 28<sup>th</sup> June when the adult bat population was possibly augmented by juvenile bats. In June the population of roosting bats which had been recorded in building B6 during May had moved their roost site and were not found during June. No Noctule Bats (*Nyctalus noctula*) were recorded during the surveys; similarly no 55 kHz Pipistrelle bats (*Pipistrellus pygmaeus*) were recorded. A single Myotis spp bat was found in the Skirt Drain on transect (B) during the June surveys. It is likely that the *Myotis* spp bat was a Daubenton's Bat (*Myotis daubentonii*) as the foraging activity and habitat being used (foraging low over the water of the Skirt Drain) strongly indicates this species. A single record of a possible Brown Long-eared Bat (*Plecotus auritus*) was observed on 22<sup>nd</sup> April, 2010. The results are considered to be within the range of the typical kind of "background" bat activity expected for a site of this nature, which consists mainly of exposed, open arable farmland with small pockets of grassland, very few mature hedgerows and a few small deciduous wooded plantations. The Skirt Drain forms the major bat habitat both for foraging in a range of weather conditions and as a linear corridor to commute onto the site. Although the majority of trees are young and do not provide bats with many roosting opportunities; the small grassland areas at the arable site potentially provides bats with good foraging areas. The mature woodland plantations and mature hedgerows also provide bats with limited foraging potential.
- The bat activity recorded by the surveys generally involves relatively low numbers of the commonest bat species and is believed to be not significant given that there is a large amount of similar habitat in the vicinity. The level of bat activity which occurred in the open exposed arable areas in which the most prevalent features were the small field boundary ditches and isolated small plantations mostly with small trees was very low. This is the area of the site where any proposed turbine development will be situated. Most bat foraging and commuting activity was associated with the Skirt Drain which will not be impacted by the wind farm development on either Six Hundreds Farm. Overall the potential for significant bat activity at the site of the proposed wind turbine appears to be minimal.
- The construction and operation of the wind turbines at the site is unlikely to affect the activity of feeding or commuting bats as revealed by the night-time surveys undertaken in the period mid April to late June, 2010. The majority of the bats using the site are 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) which are known to fly quite low to the ground and are unlikely, even when foraging in the vicinity of the windfarm, to be affected by the operation of the turbines. It is therefore considered that no mitigation measures with respect to foraging, feeding or commuting bats of this species are required at this site. No 55 kHz Pipistrelle bats (*Pipistrellus pygmaeus*) were recorded; whilst a single Myotis spp bat (likely to be Daubenton's bat [*Myotis daubentonii*]) was recorded foraging on the Skirt Drain during June. These are also generally a low flying species which are unlikely to be affected by the wind turbines and they foraged and probably commuted onto the site using an area which will not be affected by the wind turbine development. No Noctule Bats (*Nyctalus noctula*) which are a species which can fly high and may forage at altitude and are perceived as being at risk from collision from wind turbines were observed during the surveys.
- An examination of the numbers of bats recorded at the waiting Stations and en route between the Stations during each survey visit indicates that generally very low numbers of 45 KHz Pipistrelle bats

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(*Pipistrellus pipistrellus*) were foraging along corridors formed by the ditches in open arable farmland. Whilst the few hedgerows situated south and west of Six Hundreds Farm and the mature plantation situated south of Six Hundreds Farm provided sheltered foraging habitat for a few bats depending on wind direction the numbers of bats using the open arable areas overall was low. The Skirt Drain provided the major bat habitat on the site; on route (B) waiting Stations adjacent to the Skirt Drain produced 70% of the bats recorded on the survey route. The buildings on site also provided shelter and concentrated insects which in turn concentrated foraging bats; on route (C) 50% of the bats recorded on the transect occurred around the buildings at Six hundreds Farm. However, as survey route (C) largely comprised open arable areas the number of bats recorded on each survey visit was low averaging 2 on each transect. Twenty-eight 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were found at or en route between all wait Stations within 200m of the proposed turbine positions across all survey routes during the entire survey period from April to June, 2010. No *Myotis* spp bats were found within 200m of the proposed turbine position. No Noctule Bats (*Nyctalus noctula*) were recorded during the surveys. This indicates that the bat activity within 200m of the turbine is generally quite low. The greatest bat activity occurred adjacent to the Skirt Drain which is 350m from the proposed turbine positions.

- From mid April to end June, in comparable weather conditions, the number of bats recorded in each of the surveys appeared to increase as the weather became warmer and more conducive to insects which provided food for foraging bats. As the numbers of bats using the site increased the positions and foraging localities where bats were found also appeared to be consistent indicating that some of the same bats may be involved in some of the records. This is further evidence that the population of bats using the site is not large.
- Small differences in the number of bats using the site are likely to be due to weather related factors; as small and large differences in survey conditions, including temperature, wind strength and direction and cloud cover, may have a greater bearing on bat activity than could be perceived by humans. Still conditions with high temperatures and high humidity are likely to make insect food more abundant; the phase of the moon may also influence insect and bat activity.
- There are several opportunities for bats to roost within the area within 500m radius of the proposed development footprint which forms the survey area. The older brick-built farm buildings at Six Hundreds Farm were assessed to have suitable structures and construction to have Bat Roost Potential. In particular the buildings B5 were considered to have low to medium Bat Roost Potential (BRP 2-3); whilst buildings B6 and B7 were considered to have medium to high Bat roost Potential (BRP 1-2). By contrast, the modern asbestos barn buildings B1-4, B10 and the brick-built barn B8 and store B9 were considered to have low or very limited potential for roosting bats. The pumping station B11 was a well-sealed building where the only bat roost potential was if there were any gaps underneath the building in the concrete structure adjacent to the watercourse. The Skirt Drain Bridge B13 was not suitable for roosting bats. During emergence surveys conducted between 19<sup>th</sup> April and 28<sup>th</sup> June; a maximum of 4 roosting 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) each roosting singly, using 4 separate roosts were found in the gables of building B6; one roosting 45 kHz Pipistrelle bat was possibly using the chimney stack or gables of building B7; Several trees across the site were identified as having low to moderate Bat Roosting Potential (BRP 2-3). However none of these were shown to hold roosting bats during surveys conducted in 2009 and no further emergence surveys were conducted in 2010. Although no bats were found to be roosting in trees, within 200m of proposed turbine positions it is possible bats may have been using other trees within 500m of the development footprint for roosting. The majority of bats which were observed foraging on the surveys were most likely commuting to the site to feed from roost sites beyond the 500m boundary from the turbine positions. The Skirt Drain is an important linear foraging and commuting corridor for bat activity on the site.
- The construction and operation of the wind turbine is unlikely to destroy any bat roost sites or affect the bats which are currently foraging at the site.
- Proposed Mitigation:
- The buildings on the site in particular buildings B6 at Six Hundreds Farm hold roosting bats. In addition, the houses B7 may sporadically also hold roosting bats. If any of these buildings were to be structurally altered or demolished during the construction of the wind farm further surveys would be required to assess whether these roosts comprised maternity or hibernation roosts or single bats. Prior to demolition an alternative specifically constructed 'bat house' should be erected to provide an

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alternative roosting site for these animals. Before demolition of any building the effective transfer and use of the 'bat house' for roosting should be demonstrated.

- Wherever possible the mature standard trees which are present within 500m of the site should be retained as they potentially provide a wide range of bat roosting habitat such as holes, flaking bark, or cracks in the trunk.
- This survey provides an indication of the level of bat activity and numbers of roosting bats using the proposed wind farm site from April to June 2010 in conjunction with surveys conducted from July to September 2009. If there was a long period (of perhaps 3 years) between these surveys and development of the wind farm it may be necessary to repeat the work in order to confirm that the status, use of roost sites and activity of bats on the site has not changed. In particular, the emergence and swarming surveys should be conducted again in June on buildings B5, B6 and B7 in order to confirm that the roosts located are still active and that no maternity roosts have developed at the site.
- Surveys to assess the impact on the local bat population should be undertaken post construction when the wind farm is in operation. This should assess the effects on the bat Roosts found at Six Hundreds Farm, assess and compare the populations of bats using the transects (A-D) and monitor the areas below the turbines to determine the levels of bat casualties (if any) produced by the active wind turbines.

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### 3. INTRODUCTION

- 3.1 There are proposals for a wind turbine to be constructed by Ecotricity on land at Heckington Fen, west of Boston, in Lincolnshire. As part of the ecological assessment of the site Natural England has requested that a pre-construction and operation night-time bat survey be undertaken in order to assess the actual use made by bats of the area, for roosting, foraging and feeding, and/or for commuting from off-site roosts to preferred feeding areas elsewhere. This study is designed to generate quantitative data which could be used to measure the impact of the proposed wind farm on bat movements and activity when taken in conjunction with data from surveys in the post-construction and operational phase.
- 3.2 The surveys were carried out on behalf of Ecotricity by Ecologists Neil Bostock MIEEM Louise Brown MIEEM, Shaun Baker MIEEM, Juliette Banwell, Keith Miller and Lee Rudd all of who are experienced in bat transect and roost surveys. As the proposed wind farm is large the area was split into four survey routes, termed (A) to (D) in order to survey the whole area in blocks which would take approximately 3 hours to cover so that the routes were surveyed at peak times of bat activity. The whole area was surveyed once in April, May and June, 2010. The Transect surveys for route (A) and (B) were conducted from just after dusk for approximately 3 hours on 19<sup>th</sup> April, 14<sup>th</sup> May and 17<sup>th</sup> June, 2010; routes (C) and (D) were surveyed on 22<sup>nd</sup> April, 21<sup>st</sup> May, and 28<sup>th</sup> June, 2010; with the route being reversed on each alternate transect. Emergence and roosting surveys were conducted prior to the transect surveys for approximately 60 minutes each evening commencing 30 minutes before dusk. During the surveys a Duet II Bat Detector set at 40-45 kHz was used to detect Pipistrelle and Myotis bats; in addition a Peterson 240DX Bat Detector set at 25 kHz was used to determine the presence of Noctule bats in conjunction with an Anabat SD 1 which recorded all bat activity during the surveys.
- 3.3 This report describes the area surveyed, the survey methods, the results and the conclusions drawn. The locations and flight lines of all the bats encountered were marked onto survey maps along with details of any deviations from standard methodology, conditions at the time of survey and a brief summary of the results.

### 4. SITE DESCRIPTION

The site is located some 11.0 km west of Boston at Heckington Fen, in Lincolnshire. The survey area is diamond shaped being approximately 2.5 km by 2.2 km centred on grid reference TF 208 457. The area comprises largely of Six Hundreds Farm situated to the south of the main Skirt Drain and north of the A17 trunk road. The farm consists of arable farmland with large open fields growing winter wheat, winter barley and winter sown oilseed rape. The majority of the fields are separated by drainage ditches; many of these are less than 1 metre in depth and 1.5m in width and were dry during the survey period. These dry ditches were often choked with vegetation including *Typha*, sedges, rank grasses and some bramble and offer very limited foraging for bats; the large windswept open arable fields are also poor foraging habitat for bats. However, some major drains were also present being 2.0m in depth and up to 3.5m in width which permanently held water and contained plants such as Frogbit *Hydrocharis morsus-ranae* and Broad-leaved Pondweed *Potamogeton natans* as well as *Phragmites* and other riparian vegetation. A major drainage the Skirt Drain runs along the northern edge of Six Hundreds farm before passing in a north-west to south-eastern direction. On the Skirt Drain are two Pumping Stations which allow the water level of the drains across the site to be regulated by moving water into the Skirt Drain. This major drainage is canalised and runs between two built-up earth banks which are grassed and used for grazing sheep and cattle. At the outer base of the earth banks is a further deep drain formed from the removal of earth to build up the banks. The Skirt Drain and the larger drainage ditches on the site provide sheltered foraging opportunities for bats and offer potential corridors for bats to commute onto the site. There are a few young plantations of mainly small deciduous trees scattered around Six Hundreds Farm largely to provide Pheasant cover, these do not provide roosting opportunities for bats but may provide sheltered foraging in windy conditions. The plantation south of Six Hundreds Farm is more mature and contains some standard Ash and Oak trees which could offer roosting sites for bats. In particular an Ash tree (T15) has splits, cracks and holes offering low to moderate bat roosting potential (BRP 2-3); whilst an Oak tree (T16) has some splits and flaking bark and may offer low bat roosting potential (BRP 3). On Spinney Farm a small plantation also contains some Ash trees (T11), (T12) and (T13) which have broken limbs, flaking bark or splits which offer low to moderate or low bat roosting potential respectively. Within the open field landscape just east of the Gas Valve Compound there was also a small dead Alder (T21) with flaking bark offering low bat roost potential (BRP 3) and an isolated Ash (T22) with splits at its base offering low bat roost potential (BRP 3).

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Throughout the site were several buildings which could provide suitable roost sites for bats; these buildings were assessed in 2009 using features of age, method of construction and location to identify which had the greatest potential for bats. At Six Hundreds Farm buildings with bat roost potential included: B5 (T17) an old single storey cowshed/barn with low to medium bat roosting potential (BRP 3-2); B6 (T17) a two storey barn with medium to high bat roosting potential (BRP 2-1); B7 (T18) two semi-detached disused two storey houses with medium to high bat roosting potential (BRP 2-1); and B9 (T20) a single storey electric shed/barn with low bat roosting potential (BRP 3). Other buildings identified as B1-4 and B10 which were modern barns and B8 (T19) a small single storey open-fronted brick barn with a chimney were considered to have no or limited bat roosting potential. The pumping station B11 (T4) and the Trinity College Pumping Station B12 (T9) were largely sealed single storey buildings but may offer low to medium bat roosting potential (BRP 3-2), if gaps exist under the pump-house buildings.

The bridge which spanned the Skirt Drain, Skirt Drain No 1 (B13) were of concrete construction and were considered to offer negligible roosting potential for bats. Observations of the bridge showed no evidence of bats and few features that might accommodate roosting bats.

The houses B7 (T18) had an overgrown mature garden with fruit trees, surrounded by tall hedges offering good potential for insects and foraging bats.

The fields immediately south of Six Hundreds Farm were surrounded by mature dense intact hedges which may offer sheltered foraging for bats in windy conditions. Elsewhere on the site there is very little shelter apart from the Skirt Drain which is sheltered by the high banks which produce the watercourse channel. The ends of many of the fields at the western section of the site are substantial areas seeded with rough grassland, these areas have abundant insect populations and may provide significant foraging areas for bats.

### 5. METHODS

#### 5.1 Survey Conduct

##### a) Transect Surveys

As the proposed wind farm is large, the area was split into four survey routes, termed (A) to (D) in order to survey the whole area in blocks which would take approximately 3 hours to cover; so that the routes were surveyed at peak times of bat activity. A day-time examination of the site was carried out for each survey route in order to identify areas most likely to support bat activity, such as sheltered places provided by ditches or rivers, or the lee of buildings or hedgerows or adjacent to ponds or plantations or within woodland. The proposed turbine positions together with these physical features on each route were used to set fixed designated recording points on each transect route which were walked by observers using bat detectors. Recording points encompassed both natural and man made features and covered the majority of the area (subject to land ownership) within 500m radius of the proposed development area; the survey route also took into account the position of the proposed turbines on the site. A survey route was devised with defined start and end points and which took the observers to each recording point via the site's field boundaries.

The surveyors walked along each route recording and mapping bat activity along the route using hand-held bat detectors. At the designated recording points the surveyors remained still for three minutes, and noted and mapped bat activity in the surrounding area using hand-held bat detectors. During the surveys a Duet II Bat Detector set at 40-45 kHz was used to detect Pipistrelle and Myotis bats; in addition a Peterson 240DX Bat Detector set at 25 kHz was used to determine the presence of Noctule bats in conjunction with an Anabat SD 1 which recorded all bat activity during the surveys. If necessary the Duet frequency was then changed in order to detect other bat species. Whenever bats were encountered in between designated recording points their activity was noted to determine if they were feeding actively or commuting and a target note was put on the maps to record the species, position and activity of the bat. The direction of flight of any commuting bats was noted if this could be determined.

On each night, the same survey method was used. The survey nights were generally selected when the weather conditions were optimum for bat activity i.e. warm, dry and with generally calm conditions. Survey nights were as far as possible spaced equally throughout the recording period from end April to end June, 2010. The air temperature, wind speed and direction and weather conditions were recorded on each visit. During the first visits for each survey route made between

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19<sup>th</sup> and 22<sup>nd</sup> April the survey routes selected moved chronologically from recording points 1-16 for route (A); from 1-17 for route (B); from 1-13 for route (C); from 1-12 for route (D). However, during the second visit between 14<sup>th</sup> May and 21<sup>st</sup> May the routes taken were each reversed in order to ascertain different bat activity at different recording points at different periods of the night. Thereafter the route was reversed on the subsequent visits on 17<sup>th</sup> and 28<sup>th</sup> June, 2010.

The survey method was based on information given in the Bat Workers Manual (Mitchell-Jones, T & McLeish, AP; 2004; Bat Workers' Manual 3<sup>rd</sup> Edition, JNCC) for the undertaking of bat detector surveys, where the peak of bat activity which occurs after dusk for around 2 hours is used as the main window for survey.

The survey method allows for exact repetition at any stage in the future. Details of route, time spent recording (in total and at selected points), the location of the selected recording points, the work undertaken at these points, and start and end times were noted.

The conduct of the fieldwork was commensurate with 'Good Ecological Practice', with due attention being given to parameters which may affect the activity of bats i.e. period in the year, time of night and weather conditions. Where land ownership or footpath access allowed, the majority of the field boundaries and woodland blocks were walked; the survey route also took into account the position of the proposed turbines on the site.

#### b) Building Assessment Surveys (conducted in 2009)

During 2009, an assessment of the suitability of the buildings (and other structures such as bridges) on the site was made in order to determine which buildings were likely to offer potential for roosting bats and to determine if any buildings could support a maternity roost or be suitable for hibernating bats. The assessment incorporated various factors including the age and height of the building, its current use, the roof structure and construction, the fabric material of the walls, the structural features of the building including gables, barge boards, flashing, roof voids or under-felting. Any features which would allow potential access for bats or would act as a feature which would allow a bat to roost were identified for each building. Using this assessment the level of potential for roosting bats was identified as none or limited, low, medium or high. The suitability of any of the buildings to act as a maternity roost or for bats to use as a hibernation site was also assessed. The day-time site conducted in 2009 visit enabled surveyors to look at each building for bat droppings (on walls, beams and floors) or holes or cavities in the fabric which allowed a bat to move upwards to find a dry secure roost site. Any holes were examined for evidence of roosting bats such as absence of spider webs and the presence of any scratches or slightly darkened greasy marks which often occur when bats squeeze into a roosting site. Photographs were taken of buildings and the locations of all the buildings on the site were mapped. The results of these surveys are presented in **Appendix 7.2: Bat Report 2009 Appendix A**.

#### c) Emergence and Roosting Surveys

The bat roost and emergence surveys were carried from just before dusk at buildings which had been identified during the Buildings Assessment Survey and they followed standard survey methods. Although some trees across the site were identified as having low to moderate Bat Roosting Potential (BRP 2-3) which could potentially support a bat roost were identified during the Phase 1 habitat survey none of these trees supported an active bat roost during surveys conducted in 2009 and no further surveys were carried out on these trees during 2010. The following buildings (as identified in the buildings and structures survey) were examined thoroughly for bat emergence activity: B5 an old single storey cowshed/barn with low to medium bat roosting potential (BRP 3-2); B6 a two storey barn with medium to high bat roosting potential (BRP 2-1); B7 two semi-detached two storey houses with medium to high bat roosting potential (BRP 2-1). Any potential roost sites were generally observed by at least two people from a position where all suitable emergence points could be seen at each survey period. The survey periods were generally selected when the weather conditions were optimum for bat activity i.e. dry and with calm conditions; however, the dusk emergence survey conducted at B5, B6 and B7 on 19<sup>th</sup> April occurred in cooler conditions than was hoped (ranging down to 8.0° C). The air temperature, wind speed and direction and weather conditions were recorded on each visit.

The emergence surveys were conducted for approximately for 45 minutes each evening commencing from 15 minutes before dusk. During the surveys a Duet II Bat Detector set at 40-45

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kHz was used to detect Pipistrelle and *Myotis* bats; in addition a Peterson 240DX Bat Detector set at 25 kHz was used to determine the presence of Noctule bats in conjunction with an Anabat SD 1 which recorded all bat activity during the surveys. Each surveyor stood at a fixed position which allowed good visibility of the building to be surveyed; visual observation was augmented by a hand-held bat detector. At dusk, the point from where any emerging bats came from was pin-pointed, together with their species, the time of first emergence and number of bats emerging and the activity (period of foraging around roost, direction of flight away from roost) was determined if possible.

The survey method allows for exact repetition at any stage in the future. Details of emergence/roost survey positions, time spent recording, the work undertaken at these points, and survey start and end times were noted.

Locations where bat roosts were found and the bat species and numbers of bats using the roosts were registered using references to the Buildings Assessment Survey and the Phase 1 habitat map.

A day-time site visit was made to look at each site for bat droppings (on walls of buildings) or holes in trees which allowed a bat to move upwards to find a dry secure roost site. Any holes were examined for evidence of roosting bats such as absence of spider webs and the presence of any scratches or slightly darkened greasy marks which often occur when bats squeeze into a roosting site.

#### 5.2 Area Encompassed by the Survey

The area surveyed was an area encompassing 500m radius from the proposed development footprint of the proposed windfarm situated at Heckington Fen, 11.0 km west of Boston, in Lincolnshire. The survey route took into account the topography of the site and natural features of the site which may affect bat foraging or commuting activity as well as assessing bat activity adjacent to the proposed turbine positions. The emergence survey was conducted at the buildings with greatest bat roosting potential identified during the Buildings Assessment Survey and the Phase 1 habitat survey, both conducted in 2009.

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## 5.3 Survey Visit Timings and Weather Conditions

Details of survey visit dates; start and finish times and weather conditions during the survey are presented in Table 1.

Table 1 - Visit Schedule and Weather Conditions during Surveys

Visit	Visit date	Start Time	Weather conditions (at start)	Finish time	Weather conditions (at finish)
<b>Building Assessment Surveys</b>					
day	11 Aug 09 On buildings at Six Hundreds Farm, pumping station and Skirt Drain Bridge No. 1	13:30 pm	40% cloud cover Wind W 1. Dry, sunny. Air Temp 20.0° C	17:30 pm	60% clouds cover Wind W 2-3. Dry, sunny. Air Temp 19.0° C
<b>Emergence Surveys</b>					
A pm	19 April 10 On barns B5 and B6 and House B7 Sunset 20:11 pm	19:55 pm	100% cloud cover Wind N 1. Dry, cool, humid. Moon 3/8. Air Temp 8.0° C	20:55 pm	80% cloud cover Wind N 1. Moon 3/8. Dry, cool, humid. Air Temp 8.0° C
D pm	21 May 10 On barns B5 and B6 Sunset 20:54 pm	21:00 pm	40% cloud cover Wind NE 1. Dry, humid. Moon 4/8. Air Temp 12.5° C	22:04 pm	40% cloud cover Wind NE 1. Dry, humid. Moon 4/8. Air Temp 12.5° C
F pm	28 June 10 On barns B5 and B6 and House B7 Sunset 21:24 pm	21:24 pm	90% cloud cover Wind SW 2 Dry, high humidity. Air Temp 24.0° C	22:26 pm	90% cloud cover Wind SW 2 Dry, high humidity. Air Temp 20.0° C
<b>Transect Surveys</b>					
A	19 April 10 Route (A) Sunset 20:11 pm	21:02 pm	80% cloud cover Wind N 1. Moon 3/8. Dry, cool, humid. Air Temp 8.0° C	23:15 pm	0% cloud cover Wind N 0-1. Moon 3/8 Dry, cool, foggy. Air Temp 6.0° C
A	19 April 10 Route (B) Sunset 20:11 pm	21:03 pm	80% cloud cover Wind N 1. Moon 3/8. Dry, cool, humid. Air Temp 8.0° C	23:20 pm	0% cloud cover Wind N 0-1. Moon 3/8 Dry, cool, foggy. Air Temp 6.0° C
B	22 April 10 Route (C) Sunset 20:17	20:21 pm	0% cloud cover Wind NW 0-1. No moon. Dry, warm, humid. Air Temp 8.5° C	21:58 pm	0% cloud cover No Wind. Dry, cool. No Moon. Air Temp 7.0° C
B	22 April 10 Route (D) Sunset 20:17	20:25 pm	0% cloud cover Wind NW 0-1. No moon. Dry, warm, humid. Air Temp 8.5° C	21:55 pm	0% cloud cover No Wind. Dry, cool. No Moon. Air Temp 7.0° C

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Visit	Visit date	Start Time	Weather conditions (at start)	Finish time	Weather conditions (at finish)
<b>Transect Surveys</b>					
C	14 May 10 Route (A) Sunset 20:50	20:50 pm	90% cloud cover Wind SE 0-1. Dry, humid. No moon. Air Temp 9.0° C	23:20 pm	90% cloud cover Wind SE 0-1. Dry, humid. No Moon. Air Temp 9.0° C
C	14 May 10 Route (B) Sunset 20:50	21:00 pm	90% cloud cover Wind SE 0-1. Dry, humid. No moon. Air Temp 9.0° C	23:31 pm	90% cloud cover Wind SE 0-1. Dry, humid. No Moon. Air Temp 9.0° C
D	21 May 10 Route (C) Sunset 20:54	22:21 pm	40% cloud cover Wind NE 1. Dry, humid. Moon 4/8. Air Temp 12.5° C	00:04 am	20% cloud cover Wind NE 1. Dry, cool, high humidity. Air Temp 13.0° C
D	21 May 10 Route (D) Sunset 20:54	22:16 pm	40% cloud cover Wind NE 1. Dry, humid. Moon 4/8. Air Temp 12.5° C	23:35 pm	20% cloud cover Wind NE 1. Dry, cool, high humidity. Air Temp 13.0° C
E	17 June 10 Route (A) Sunset 21:29	21:35 pm	0% cloud cover No wind. Dry, humid. No moon. Air Temp 11.5° C	23:48 pm	100% cloud cover No wind. Dry, humid. No moon. Air Temp 11.5° C
E	17 June 10 Route (B) Sunset 21:29	21:40 pm	0% cloud cover No wind. Dry, humid. No moon. Air Temp 11.5° C	00:05 pm	100% cloud cover No wind. Dry, humid. No moon. Air Temp 11.5° C
F	28 June 10 Route (C) Sunset 21:24	22:32 pm	90% cloud cover Wind SW 2. No Moon Drizzle from 22:57pm. warm and humid. Air Temp 20.0° C	00:26 am	100% cloud cover Wind SW 2. No Moon Drizzle from 22:57pm. warm and humid. Air Temp 19.0° C
F	28 June 10 Route (D) Sunset 21:24	22:44 pm	90% cloud cover Wind SW 2. No Moon Drizzle from 22:57pm. warm and humid. Air Temp 20.0° C	00:05 am	100% cloud cover Wind SW 2. No Moon Drizzle from 22:57pm. warm and humid. Air Temp 19.0° C

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## 6. RESULTS

## Transect Surveys

6.1 Dusk of 19<sup>th</sup> April, 2010 route (A) visit (A)

- No bats were recorded feeding along the drainage ditch directly east of the modern barns at Six Hundreds Farm at (Station 15).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass adjacent to the barn B5 between Station 15 and 16
- No bats were recorded feeding along the main track and adjacent hedgerows south of Six Hundreds Farm at (Station 16).
- No bats were recorded adjacent to the north-western corner of the tall plantation at (Station 1).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes on the east side of the copse between Station 1 and 2
- No bats were recorded along the county boundary drainage at (Station 2).
- No bats were recorded further north along the county boundary drainage at (Station 3).
- No bats were recorded further north along the county boundary drainage directly east of Six Hundreds Farm at (Station 4).
- No bats were recorded halfway along the first drainage ditch north and east of Six Hundreds Farm at (Station 5).
- No bats were recorded alongside the main track north of Six Hundreds Farm at (Station 6).
- No bats were recorded halfway along the second drainage ditch north and east of Six Hundreds Farm at (Station 7).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 3 foraging passes along the drainage ditch between Station 7 and 8.
- No bats were recorded at the eastern end of the second drainage ditch north and east of Six Hundreds Farm at (Station 8).
- No bats were recorded along the county boundary drainage south of the second drainage ditch north and east of Six Hundreds Farm at (Station 9).
- No bats were recorded along the county boundary drainage directly west of the Trinity College Pumping Station just south of the Skirt Drain at (Station 10).
- No bats were recorded alongside ditch adjacent to the brick-built bridge and sluice just west of the Skirt Drain at (Station 11).
- No bats were recorded feeding along the drainage ditch just east of the plantation on the main track at (Station 12).
- No bats were recorded feeding along the main track and drainage ditches just south of the plantation on the main track at (Station 13).
- No bats were recorded feeding along the main track and drainage ditches directly east of the derelict houses at Six Hundreds Farm at (Station 14).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 3

6.2 Dusk of 19<sup>th</sup> April, 2010 route (B) visit (A)

- No bats were recorded immediately north of the plantation adjacent to the main track at (Station 1).
- No bats were recorded further west of Station 1, adjacent to the ditch and just east of the other small plantation (T23) at (Station 2).
- No bats were recorded further north of the small plantation (T23) adjacent to the ditch at (Station 3).
- No bats were recorded adjacent to the ditch immediately south of the Skirt Drain at (Station 4).
- No bats were recorded feeding around the top of the isolated Ash tree (T22), north-east of the Gas Valve Compound at (Station 5).
- No bats were recorded further south of Station 5 slightly north of a small line of trees adjacent to a drainage ditch at (Station 6).
- No bats were recorded further south of the small line of trees (including the dead Alder tree (T20)) at (Station 7).
- No bats were recorded at the eastern end of the second ditch south of the Gas Valve Compound at (Station 8).
- No bats were recorded at the western end of the farm track which runs east to west from Six Hundreds Farm to join the track which runs north from Rectory Farm at (Station 9).
- No bats were recorded feeding along the main track and adjacent ditches which run north from rectory farm just south of the barn at (Station 10).

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- No bats were recorded just north of the barn adjacent to the track to the Gas Valve Compound at Station (11).
- No bats were recorded adjacent to the western end of the second ditch north of the Gas Valve Compound at Station (12).
- No bats were recorded further north adjacent to the bridge to the bank of the Skirt Drain at (Station 13).
- No bats were recorded east along the southern bank of the Skirt Drain at (Station 14).
- No bats were recorded east along the southern bank of the Skirt Drain adjacent to the bend in the watercourse at (Station 15).
- No bats were recorded east along the southern bank of the Skirt Drain adjacent to the pumping station at (Station 16A).
- No bats were recorded just south of the Skirt Drain Bridge number 1 within the arable field at (Station 16).
- No bats were recorded just south of the Skirt Drain Bridge number 1 and north of the small plantation where there is an access across the ditch at (Station 17).

Total number of bats recorded on the route = 0

6.3 Dusk of 22<sup>nd</sup> April, 2010 route (C) visit (B)

- No bats were recorded between (B6) and (B7) at (Station 1).
- No bats were recorded along the track and adjacent ditch west of Six Hundreds Farm at (Station 2).
- No bats were recorded along the ditch north of the copse, west of Six Hundreds Farm at (Station 3).
- No bats were recorded around the copse, west of Six Hundreds Farm at (Station 4).
- No bats were recorded along the ditch and raised bank west of Six Hundreds Farm at (Station 5).
- No bats were recorded along the first ditch and hedgerow south-west of Six Hundreds Farm at (Station 6).
- No bats were recorded along the second ditch and hedgerow south-west of Six Hundreds Farm at (Station 7).
- No bats were recorded along the ditch and raised bank, south of the second ditch and hedgerow south-west of Six Hundreds Farm at (Station 8).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 3 foraging passes along the hedgerow just south of Station 9.
- No bats were recorded alongside the modern barns (B1) and (B2) at Six Hundreds Farm at (Station 9).
- One possible Long-eared Bat (*Plecotus auritus*) was recorded making 1 brief pass between buildings B1 and B8 hedgerow en route between Station 9 and Station 10.
- No bats were recorded along the ditch west of the raised bank, south of the small copse at (Station 10).
- No bats were recorded along the ditch west of the raised bank, south of Station 10 at (Station 11).
- No bats were recorded along the ditch south-west of the small copse at (Station 12).
- No bats were recorded further south along the ditch from Station 12 at (Station 13).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 1.

Total number of Brown Long-eared Bat (*Plecotus auritus*) recorded on the route = 1 possible.

6.4 Dusk of 22<sup>nd</sup> April, 2010 route (D) visit (B)

- No bats were recorded along the track north of Rectory Farm and adjacent ditch at (Station 1).
- No bats were recorded alongside the Labour in Vain Drain just east of the track north of Rectory Farm at (Station 2).
- No bats were recorded north of the Labour in Vain Drain at (Station 3).
- No bats were recorded adjacent to the gravel track running west of the main track from Rectory Farm at (Station 4).
- No bats were recorded west of the barn at (Station 5).
- No bats were recorded north-west of the barn, adjacent to an area of grassland and a large ditch at (Station 6).
- No bats were recorded north-west of the barn, adjacent to a ditch on the periphery of the 500m boundary at (Station 7).
- No bats were recorded just south of Crab Lane, on the periphery of the 500m boundary at (Station 8).
- No bats were recorded just south of the Labour in Vain Drain adjacent to the track to Elm Grange at (Station 9).

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- No bats were recorded one ditch further east of Station 9 and south of the Labour in Vain Drain at (Station 10).
- No bats were recorded one ditch further east of Station 9 and further south of the Labour in Vain Drain at (Station 11).
- No bats were recorded one ditch further east of Station 11 and further south of the Labour in Vain Drain at (Station 12).

Total number of bats recorded on the route = 0.

#### 6.5 Dusk of 14<sup>th</sup> May, 2010 reverse route (A) visit (C)

- No bats were recorded feeding along the main track and drainage ditches directly east of the derelict houses at Six Hundreds Farm at (Station 14).
- No bats were recorded feeding along the main track and drainage ditches just south of the plantation on the main track at (Station 13).
- No bats were recorded feeding along the drainage ditch just east of the plantation on the main track at (Station 12).
- No bats were recorded alongside ditch adjacent to the brick-built bridge and sluice just west of the Skirt Drain at (Station 11).
- No bats were recorded along the county boundary drainage directly west of the Trinity College Pumping Station just south of the Skirt Drain at (Station 10).
- No bats were recorded along the county boundary drainage south of the second drainage ditch north and east of Six Hundreds Farm at (Station 9).
- No bats were recorded at the eastern end of the second drainage ditch north and east of Six Hundreds Farm at (Station 8).
- No bats were recorded halfway along the second drainage ditch north and east of Six Hundreds Farm at (Station 7).
- No bats were recorded alongside the main track north of Six Hundreds Farm at (Station 6).
- No bats were recorded halfway along the first drainage ditch north and east of Six Hundreds Farm at (Station 5).
- No bats were recorded further north along the county boundary drainage directly east of Six Hundreds Farm at (Station 4).
- No bats were recorded further north along the county boundary drainage at (Station 3).
- No bats were recorded along the county boundary drainage at (Station 2).
- No bats were recorded along the edge of the north-western corner of the tall plantation at (Station 1).
- No bats were recorded along the main track and adjacent hedgerows south of Six Hundreds Farm at (Station 16).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes adjacent to building B5 at Six Hundreds Farm between Station 16 and Station 15.
- No bats were recorded feeding along the drainage ditch directly east of the modern barns at Six Hundreds Farm at (Station 15).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 1

#### 6.6 Dusk of 14<sup>th</sup> May, 2010 reverse route (B) visit (C)

- No bats were recorded just south of the Skirt Drain Bridge number 1 within the arable field at (Station 16).
- No bats were recorded east along the southern bank of the Skirt Drain adjacent to the pumping station at (Station 16A).
- No bats were recorded along the southern bank of the Skirt Drain adjacent to the bend in the watercourse at (Station 15).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass west along the southern bank of the Skirt Drain west of Station 15.
- Two 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were recorded east along the southern bank of the Skirt Drain at (Station 14).
- One, probably one of the same, 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) was recorded making many foraging passes further west on the Skirt Drain between Station 14 and Station 13.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes further west on the Skirt Drain between Station 14 and Station 13.

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- No bats were recorded further west adjacent to the bridge to the bank of the Skirt Drain at (Station 13).
- No bats were recorded adjacent to the western end of the second ditch north of the Gas Valve Compound at Station (12).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded briefly making 1 commuting pass between Station 12 and Station 11.
- No bats were recorded just north of the barn adjacent to the track to the Gas Valve Compound at Station (11).
- No bats were recorded feeding along the main track and adjacent ditches which run north from rectory farm just south of the barn at (Station 10).
- No bats were recorded at the western end of the farm track which runs east to west from Six Hundreds Farm to join the track which runs north from Rectory Farm at (Station 9).
- No bats were recorded at the eastern end of the second ditch south of the Gas Valve Compound at (Station 8).
- No bats were recorded further south of the small line of trees (including the dead Alder tree (T20)) at (Station 7).
- No bats were recorded north of Station 7, slightly north of a small line of trees adjacent to a drainage ditch at (Station 6).
- No bats were recorded close to the isolated Ash tree (T21), north-east of the Gas Valve Compound at (Station 5).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded commuting briefly adjacent to the ditch immediately south of the Skirt Drain at (Station 4).
- No bats were recorded further north of the small plantation (T23) adjacent to the ditch at (Station 3).
- No bats were recorded further west of Station 1, adjacent to the ditch and just east of the small plantation (T23) at (Station 2).
- No bats were recorded immediately north of the plantation (T24) adjacent to the main track at (Station 1).
- No bats were recorded just south of the Skirt Drain Bridge number 1 and north of the small plantation where there is an access across the ditch at (Station 17).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 5

#### 6.7 Dusk of 21<sup>st</sup> May, 2010 reversed route (C), visit (D)

- No bats were recorded along the ditch south-west of the small copse at (Station 12).
- No bats were recorded further south along the ditch from Station 12 at (Station 13).
- No bats were recorded along the ditch west of the raised bank, south of Station 10 at (Station 11).
- No bats were recorded along the ditch west of the raised bank, south of the small copse at (Station 10).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 6 foraging passes alongside the modern barns (B1) and (B2) at Six Hundreds Farm at (Station 9).
- No bats were recorded along the ditch and raised bank, south of the second ditch and hedgerow south-west of Six Hundreds Farm at (Station 8).
- No bats were recorded along the second ditch and hedgerow south-west of Six Hundreds Farm at (Station 7).
- No bats were recorded along the first ditch and hedgerow south-west of Six Hundreds Farm at (Station 6).
- No bats were recorded along the ditch and raised bank west of Six Hundreds Farm at (Station 5).
- No bats were recorded around the copse, west of Six Hundreds Farm at (Station 4).
- No bats were recorded along the ditch north of the copse, west of Six Hundreds Farm at (Station 3).
- No bats were recorded along the track and adjacent ditch west of Six Hundreds Farm at (Station 2).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes between (B6) and (B7) at (Station 1).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 2.

#### 6.8 Dusk of 21<sup>st</sup> May, 2010 reversed route (D), visit (D)

- No bats were recorded one ditch further east of Station 11 and further south of the Labour in Vain Drain at (Station 12).
- No bats were recorded one ditch further east of Station 9 and further south of the Labour in Vain Drain at (Station 11).

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- No bats were recorded one ditch further east of Station 9 and south of the Labour in Vain Drain at (Station 10).
- No bats were recorded just south of the Labour in Vain Drain adjacent to the track to Elm Grange at (Station 9).
- No bats were recorded just south of Crab Lane, on the periphery of the 500m boundary at (Station 8).
- No bats were recorded north-west of the barn, adjacent to a ditch on the periphery of the 500m boundary at (Station 7).
- No bats were recorded north-west of the barn, adjacent to an area of grassland and a large ditch at (Station 6).
- No bats were recorded west of the barn at (Station 5).
- No bats were recorded adjacent to the gravel track running west of the main track from Rectory Farm at (Station 4).
- No bats were recorded north of the Labour in Vain Drain at (Station 3).
- No bats were recorded alongside the Labour in Vain Drain just east of the track north of Rectory Farm at (Station 2).
- No bats were recorded along the track north of Rectory Farm and adjacent ditch at (Station 1).

Total number of 45 kHz *Pipistrellus pipistrellus* recorded on the route = 0.

#### 6.9 Dusk of 17<sup>th</sup> June, 2010 route (A) visit (E)

- No bats were recorded adjacent to the north-western corner of the tall plantation at (Station 1).
- No bats were recorded along the county boundary drainage at (Station 2).
- No bats were recorded further north along the county boundary drainage at (Station 3).
- No bats were recorded further north along the county boundary drainage directly east of Six Hundreds Farm at (Station 4).
- No bats were recorded, halfway along the first drainage ditch north and east of Six Hundreds Farm at (Station 5).
- No bats were recorded alongside the main track north of Six Hundreds Farm at (Station 6).
- No bats were recorded halfway along the second drainage ditch north and east of Six Hundreds Farm at (Station 7).
- No bats were recorded at the eastern end of the second drainage ditch north and east of Six Hundreds Farm at (Station 8).
- No bats were recorded along the county boundary drainage south of the second drainage ditch north and east of Six Hundreds Farm at (Station 9).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes along the county boundary drainage ditch just to the east of Station 8, between Station 9 and Station 10.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 9 foraging passes along the county boundary drainage directly west of the Trinity College Pumping Station just south of the Skirt Drain at (Station 10).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes along the ditch just west of the bridge near Station 11 between Station 10 and Station 11.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes along the ditch west of the Trinity College Pumping Station just south of the Skirt Drain between Station 10 and Station 11.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass alongside ditch adjacent to the brick-built bridge and sluice just west of the Skirt Drain at (Station 11).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass alongside the ditch just west of Station 11.
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass alongside the ditch just west of Station 11.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 commuting pass along the drainage ditch just east of the plantation on the main track at (Station 12).
- No bats were recorded along the main track and drainage ditches just south of the plantation on the main track at (Station 13).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes along the main track and drainage ditches directly east of the derelict houses at Six Hundreds Farm at (Station 14).
- No bats were recorded feeding along the drainage ditch directly east of the modern barns at Six Hundreds Farm at (Station 15).
- No bats were recorded feeding along the main track and adjacent hedgerows south of Six Hundreds Farm at (Station 16).

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Total number of 45 kHz *Pipistrellus pipistrellus* recorded on the route = 9

#### 6.10 Dusk of 17<sup>th</sup> June, 2010 route (B) visit (E)

- No bats were recorded immediately north of the plantation adjacent to the main track at (Station 1).
- No bats were recorded further west of Station 1, adjacent to the ditch and just east of the other small plantation (T23) at (Station 2).
- No bats were recorded further north of the small plantation (T23) adjacent to the ditch at (Station 3).
- No bats were recorded adjacent to the ditch immediately south of the Skirt Drain at (Station 4).
- No bats were recorded feeding continuously around the top of the isolated Ash tree (T21), north-east of the Gas Valve Compound at (Station 5).
- No bats were recorded further south of Station 5 slightly north of a small line of trees adjacent to a drainage ditch at (Station 6).
- No bats were recorded further south of the small line of trees (including the dead Alder tree (T20)) at (Station 7).
- No bats were recorded at the eastern end of the second ditch south of the Gas Valve Compound at (Station 8).
- No bats were recorded at the western end of the farm track which runs east to west from Six Hundreds Farm to join the track which runs north from Rectory Farm at (Station 9).
- No bats were recorded feeding along the main track and adjacent ditches which run north from rectory farm just south of the barn at (Station 10).
- No bats were recorded just north of the barn adjacent to the track to the Gas Valve Compound at Station (11).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making continuous foraging passes and social calls along the ditch north of the Gas Valve Compound between Station 11 and Station 12.
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 2 foraging passes along the ditch north of the Gas Valve Compound between Station 11 and Station 12, just south of Station 12.
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 foraging pass adjacent to the western end of the second ditch north of the Gas Valve Compound at Station (12).
- Two 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were recorded making continuous foraging passes further north adjacent to the bridge to the bank of the Skirt Drain at (Station 13).
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making continuous foraging passes on the side drain leading into the Skirt Drain between Station 13 and Station 14.
- Two 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were recorded making 3 foraging passes on the bend of the Skirt Drain between Station 13 and Station 14.
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 3 foraging passes between the bend of the Skirt Drain and Station 14, between Station 13 and Station 14.
- Two, probably the same, 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were recorded making continuous foraging passes between the bend of the Skirt Drain and Station 14.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 4 foraging passes further east along the southern bank of the Skirt Drain at (Station 14).
- One, probably the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making continuous foraging passes on the Skirt Drain east of Station 14, between Station 14 and Station 15.
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making continuous foraging passes on the Skirt Drain further east of Station 14, between Station 14 and Station 15.
- No bats were recorded along the southern bank of the Skirt Drain adjacent to the bend in the watercourse at (Station 15).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded briefly making 1 foraging pass between Station 15 and Station 16A.
- One, possibly the same, 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 3 foraging passes and a *Myotis* spp bat possibly Daubenton's bat (*Myotis daubentoni*) was recorded briefly commuting along the southern bank of the Skirt Drain adjacent to the pumping station at (Station 16A).
- No bats were recorded just south of the Skirt Drain Bridge number 1 within the arable field at (Station 16).
- One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded briefly making 1 commuting pass over the ditch between Station 16 and Station 17.

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•One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 3 foraging passes just along the ditch just north of Station 17, between Station 16 and Station 17.  
 •No bats were recorded just south of the Skirt Drain Bridge number 1 and north of the small plantation where there is an access across the ditch at (Station 17).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 10-11  
 Total number of Myotis spp bats (*Myotis spp*) [probably Daubenton's Bat] recorded on the route = 1

#### 6.11 Dusk of 28<sup>th</sup> May, 2010 route (C), visit (F)

•No bats were recorded between (B6) and (B7) at (Station 1).  
 •No bats were recorded along the track and adjacent ditch west of Six Hundreds Farm at (Station 2).  
 •No bats were recorded along the ditch north of the copse, west of Six Hundreds Farm at (Station 3).  
 •No bats were recorded around the copse, west of Six Hundreds Farm at (Station 4).  
 •No bats were recorded along the ditch and raised bank west of Six Hundreds Farm at (Station 5).  
 •No bats were recorded along the first ditch and hedgerow south-west of Six Hundreds Farm at (Station 6).  
 •One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 brief commuting pass along the hedgerow just north of Station 7, en route between Station 6 and Station 7.  
 •No bats were recorded along the second ditch and hedgerow south-west of Six Hundreds Farm at (Station 7).  
 •No bats were recorded along the ditch and raised bank, south of the second ditch and hedgerow south-west of Six Hundreds Farm at (Station 8).  
 •No bats were recorded alongside the modern barns (B1) and (B2) at Six Hundreds Farm at (Station 9).  
 •No bats were recorded along the ditch west of the raised bank, south of the small copse at (Station 10).  
 •No bats were recorded along the ditch west of the raised bank, south of Station 10 at (Station 11).  
 •One 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded making 1 brief commuting pass over the wheat field just north of Station 11, en route between Station 11 and Station 12.  
 •No bats were recorded along the ditch south-west of the small copse at (Station 12).  
 •No bats were recorded further south along the ditch from Station 12 at (Station 13).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 2.

#### 6.12 Dusk of 28<sup>th</sup> June, 2010 route (D), visit (F)

•No bats were recorded along the track north of Rectory Farm and adjacent ditch at (Station 1).  
 •No bats were recorded alongside the Labour in Vain Drain just east of the track north of Rectory Farm at (Station 2).  
 •No bats were recorded north of the Labour in Vain Drain at (Station 3).  
 •No bats were recorded adjacent to the gravel track running west of the main track from Rectory Farm at (Station 4).  
 •No bats were recorded west of the barn at (Station 5).  
 •No bats were recorded north-west of the barn, adjacent to an area of grassland and a large ditch at (Station 6).  
 •No bats were recorded north-west of the barn, adjacent to a ditch on the periphery of the 500m boundary at (Station 7).  
 •No bats were recorded just south of Crab Lane, on the periphery of the 500m boundary at (Station 8).  
 •No bats were recorded just south of the Labour in Vain Drain adjacent to the track to Elm Grange at (Station 9).  
 •No bats were recorded one ditch further east of Station 9 and south of the Labour in Vain Drain at (Station 10).  
 •No bats were recorded one ditch further east of Station 9 and further south of the Labour in Vain Drain at (Station 11).  
 •No bats were recorded one ditch further east of Station 11 and further south of the Labour in Vain Drain at (Station 12).

Total number of 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) recorded on the route = 0.

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**Table 2 - Number and Species of Bats Recorded at all visits to Heckington Fen**

Bat Species	Number of Bats												Total
	Survey Period												
	19-22 <sup>nd</sup> April, 2010				14 <sup>th</sup> -21 <sup>st</sup> May, 2010				17 <sup>th</sup> -28 <sup>th</sup> June, 2010				
	Route												
	A	B	C	D	A	B	C	D	A	B	C	D	
45 kHz Pipistrelle	3	0	1	0	1	5	2	0	9	10-11	2	0	33-34
Brown L-eared bat	0	0	1?	0	0	0	0	0	0	0	0	0	1?
Myotis spp bat	0	0	0	0	0	0	0	0	0	1	0	0	1
Total no. of bats per visit on each route	3	0	2	0	1	5	2	0	9	11-12	2	0	35-36
Total no. of bats at site per survey	5				8				22-23				35-36
	Route												
	A			B			C			D			
Total no. of bats on each survey route (all visits)	13			16-17			6			0			35-36

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**Table 3 - Summary of Total number and Species of Bats Recorded at each point on the survey transect (A) during all visits to Heckington Fen**

Total Number of Bats recorded during 3 survey nights: 19 <sup>th</sup> April, 14 <sup>th</sup> May and 17 <sup>th</sup> June, 2010			
Station/walk	Pipistrelle 45	Myotis spp	Total No. of Bats
Station 1	0	0	0
1-2	1	0	1
Station 2	0	0	0
2-3	0	0	0
Station 3	0	0	0
3-4	0	0	0
Station 4	0	0	0
4-5	0	0	0
Station 5	0	0	0
5-6	0	0	0
Station 6	0	0	0
6-7	0	0	0
Station 7	0	0	0
7-8	1	0	1
Station 8	0	0	0
8-9	0	0	0
Station 9	0	0	0
9-10	1	0	1
Station 10	1	0	1
10-11	2	0	2
Station 11	1	0	1
11-12	2	0	2
Station 12	1	0	1
12-13	0	0	0
Station 13	0	0	0
13-14	0	0	0
Station 14	1	0	1
14-15	1	0	1
Station 15	0	0	0
15-16	2	0	2
Station 16	0	0	0
Total	14	0	14

The differences in total bat numbers of each species between Table 2 & Table 4 and Table 3 is accounted by some individual bats being recorded as 'probably the same' in Table 2 & Table 4 but being assigned to feeding or commuting at a Station or within each transect section in Table 3.

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**Table 3 (continued) - Summary of Total number and Species of Bats Recorded at each point on the survey transect (B) during all visits to Heckington Fen**

Total Number of Bats recorded during 3 survey nights: 19 <sup>th</sup> April, 14 <sup>th</sup> May and 17 <sup>th</sup> June, 2010			
Station/walk	Pipistrelle 45	Myotis spp [probably <i>M. daubentonii</i> ]	Total No. of Bats
Station 1	0	0	0
1-2	0	0	0
Station 2	0	0	0
2-3	0	0	0
Station 3	0	0	0
3-4	0	0	0
Station 4	1	0	1
4-5	0	0	0
Station 5	0	0	0
5-6	0	0	0
Station 6	0	0	0
6-7	0	0	0
Station 7	0	0	0
7-8	0	0	0
Station 8	0	0	0
8-9	0	0	0
Station 9	0	0	0
9-10	0	0	0
Station 10	0	0	0
10-11	0	0	0
Station 11	0	0	0
11-12	3	0	3
Station 12	1	0	1
12-13	0	0	0
Station 13	2	0	2
13-14	7	0	7
Station 14	3	0	3
14-15	1	0	1
Station 15	0	0	0
15-16A	1	0	1
Station 16A	1	1	2
16A-16	0	0	0
Station 16	0	0	0
16-17	2	0	2
Station 17	0	0	0
17-1	0	0	0
Total	22	1	23

The differences in total bat numbers of each species between Table 2 & Table 4 and Table 3 is accounted by some individual bats being recorded as 'probably the same' in Table 2 & Table 4 but being assigned to feeding or commuting at a Station or within each transect section in Table 3.

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**Table 3 (continued) - Summary of Total number and Species of Bats Recorded at each point on the survey transect (C) during all visits to Heckington Fen**

Total Number of Bats recorded during 3 survey nights: 22 <sup>nd</sup> April, 21 <sup>st</sup> May and 28 <sup>th</sup> June, 2010			
Station/walk	Pipistrelle 45	Brown L-eared Bat	Total No. of Bats
Station 1	1		1
1-2	0		0
Station 2	0		0
2-3	0		0
Station 3	0		0
3-4	0		0
Station 4	0		0
4-5	0		0
Station 5	0		0
5-6	0		0
Station 6	0		0
6-7	1		1
Station 7	0		0
7-8	0		0
Station 8	0		0
8-9	2		2
Station 9	1		1
9-10	0	1 possible	1
Station 10	0		0
10-11	0		0
Station 11	0		0
11-12	0		0
Station 12	0		0
12-13	0		0
Station 13	0		0
Total	5	1	6

The differences in total bat numbers of each species between Table 2 & Table 4 and Table 3 is accounted by some individual bats being recorded as 'probably the same' in Table 2 & Table 4 but being assigned to feeding or commuting at a Station or within each transect section in Table 3.

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**Table 3 (continued) - Summary of Total number and Species of Bats Recorded at each point on the survey transect (D) during all visits to Heckington Fen**

Total Number of Bats recorded during 3 survey nights: 22 <sup>nd</sup> April, 21 <sup>st</sup> May and 28 <sup>th</sup> June, 2010		
Station/walk	Pipistrelle 45	Total No. of Bats
Station 1	0	0
1-2	0	0
Station 2	0	0
2-3	0	0
Station 3	0	0
3-4	0	0
Station 4	0	0
4-5	0	0
Station 5	0	0
5-6	0	0
Station 6	0	0
6-7	0	0
Station 7	0	0
7-8	0	0
Station 8	0	0
8-9	0	0
Station 9	0	0
9-10	0	0
Station 10	0	0
10-11	0	0
Station 11	0	0
11-12	0	0
Station 12	0	0
12-1	0	0
Total	0	0

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Table 4 - Number and Species of Bats and number of Passes Recorded at and between wait Stations on Route (A) during all visits to Heckington Fen

Station /walk	Visit A - 19 <sup>th</sup> April, 2010					Visit C - 14 <sup>th</sup> May, 2010					Visit E - 17 <sup>th</sup> June, 2010				
	Time	45 kHz Pipistrelle	Myotis daub.	Number of Passes	Total A	Time	45 kHz Pipistrelle	Number of Passes	Total C	Time	45 kHz Pipistrelle	Number of Passes	Total E	Total A, C, E	
1	21:23	0	0	0	0	22:48	0	0	0	21:38	0	0	0	0	
1-2	21:25	1 (tracks 3,4)	0	2	1	-	0	0	0	-	0	0	0	1	
2	21:34	0	0	0	0	22:43	0	0	0	21:47	0	0	0	0	
3	21:42	0	0	0	0	22:35	0	0	0	21:56	0	0	0	0	
4	21:49	0	0	0	0	22:27	0	0	0	22:03	0	0	0	0	
5	21:58	0	0	0	0	22:14	0	0	0	22:12	0	0	0	0	
6	22:05	0	0	0	0	22:11	0	0	0	22:22	0	0	0	0	
7	22:15	0	0	0	0	21:55	0	0	0	22:29	0	0	0	0	
7-8	22:16	1 (tracks 6,7)	0	3	1	-	0	0	0	-	0	0	0	1	
8	22:24	0	0	0	0	21:50	0	0	0	22:36	0	0	0	0	
9	22:33	0	0	0	0	21:46	0	0	0	22:43	0	0	0	0	
9-10	-	0	0	0	0	-	0	0	0	22:45	1f (tracks 1 and 2)	2	1	1	
10	22:40	0	0	0	0	21:38	0	0	0	22:50	1f (tracks 3,4 5,6 and 7)	9	1	1	
10-11	-	0	0	0	0	-	0	0	0	22:54	1f (track 8)	2	1	1	
10-11	-	0	0	0	0	-	0	0	0	22:58	1f (track 9)	2	1	1	
11	22:49	0	0	0	0	21:29	0	0	0	23:04	1c (track 10)	1	1	1	
11-12	-	0	0	0	0	-	0	0	0	23:06	1c	1	1	1	
11-12	-	0	0	0	0	-	0	0	0	23:07	1c prob. same	1	0	0	
12	22:58	0	0	0	0	21:20	0	0	0	23:14	1c	1	1	1	
13	23:04	0	0	0	0	21:14	0	0	0	23:20	0	0	0	0	
14	23:13	0	0	0	0	20:58	0	0	0	23:31	1f (track 11)	2	1	1	
14-15	-	0	0	0	0	-	0	0	0	23:32	1c	1	1	1	
15	21:05	0	0	0	0	23:16	0	0	0	23:36	0	0	0	0	
16	21:15	0	0	0	0	23:05	0	0	0	23:42	0	0	0	0	
15-16	21:07	1	0	1	1	23:08	1f (track 3)	2	1	-	0	0	0	2	
Total		3	0	6	3	-	1	2	1	-	9	22	9	13	

\* Time is time at end of wait at station or time of observation whilst walking; f - Denotes a feeding bat; c - denotes commuting bat; social - denotes social calls

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Table 4 Number and Species of Bats and number of Passes Recorded at and between wait Stations on Route (B) during all visits to Heckington Fen

Station /walk	Visit A - 18 <sup>th</sup> April, 2010				Visit C - 14 <sup>th</sup> May, 2010				Visit E - 17 <sup>th</sup> June, 2010						
	Time	45 kHz Pipistrelle	Number of Passes	Total A	Time	45 kHz Pipistrelle	Myotis spp	Number of Passes	Total C	Time	45 kHz Pipistrelle	Myotis spp	Number of Passes	Total E	Total A, C, E
1	21:09	0	0	0	23:27	0	0	0	0	21:43	0	0	0	0	0
2	21:17	0	0	0	23:21	0	0	0	0	21:51	0	0	0	0	0
3	21:24	0	0	0	23:12	0	0	0	0	21:58	0	0	0	0	0
4	21:31	0	0	0	23:04	1c	0	1	1	22:06	0	0	0	0	1
5	21:38	0	0	0	22:56	0	0	0	0	22:13	0	0	0	0	0
6	21:44	0	0	0	22:50	0	0	0	0	22:20	0	0	0	0	0
7	21:50	0	0	0	22:44	0	0	0	0	22:26	0	0	0	0	0
8	21:58	0	0	0	22:36	0	0	0	0	22:33	0	0	0	0	0
9	22:08	0	0	0	22:28	0	0	0	0	22:42	0	0	0	0	0
10	22:18	0	0	0	22:19	0	0	0	0	22:54	0	0	0	0	0
11	22:23	0	0	0	22:13	0	0	0	0	22:59	0	0	0	0	0
11-12	-	0	0	0	22:06	1c	0	1	1	22:59	1f (tracks 1 and 2)	0	continuous	1	2
11-12	-	0	0	0	-	0	0	0	0	23:02	1f (track 3) prob. same	0	2	0	0
12	22:29	0	0	0	22:03	0	0	0	0	23:06	1f (track 4) prob. same	0	1	0	0
13	22:36	0	0	0	21:55	0	0	0	0	23:13	2f (tracks 5,6 and 7)	0	continuous	2	2
13-14	-	0	0	0	21:50	1f (track 4)	0	2	1	23:14	1f prob. same	0	4	0	1
13-14	-	0	0	0	21:47	0	0	continuous	0	23:16	2f (track 8)	0	3	2	2
13-14	-	0	0	0	-	0	0	0	0	23:18	1f prob. same	0	3	0	0
13-14	-	0	0	0	-	0	0	0	0	23:20	2f prob. same	0	continuous	0	0
14	22:42	0	0	0	21:40	2f (tracks 1 and 2)	0	10+	2	23:25	1f	0	4	1	3
14-15	-	0	0	0	-	0	0	0	0	23:26	1f (track 9) prob. same	0	continuous	0	0
14-15	-	0	0	0	-	0	0	0	0	23:28	1f	0	continuous	1	1
15	22:53	0	0	0	21:29	0	0	0	0	23:37	0	0	0	0	0
15-16A	-	0	0	0	-	0	-	-	-	23:39	1c	0	1	1	1
16A	22:59	0	0	0	21:19	0	0	0	0	23:44	1f poss. same (tracks 10/11)	1c	3 (1)	1-2?	1-2?
16	23:06	0	0	0	21:07	0	0	0	0	23:53	0	0	0	0	0
16-17	-	0	0	0	-	0	0	0	0	23:53	1c	0	1	1	1
16-17	-	0	0	0	-	0	0	0	0	23:55	1f	0	3	1	1
17	23:13	0	0	0	23:31	0	0	0	0	24:01	0	0	0	0	0
Total		0	0	0	-	5	0	14	5	-	10-11	1	26	11-12	16-17

\* Time is time at end of wait at station or time of observation whilst walking; f - Denotes a feeding bat; c - denotes commuting bat; social - denotes social calls

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Table 4 (continued) Number and Species of Bats and number of Passes Recorded at and between wait Stations on Route (C) during all visits to Heckington Fen

Station Walk	Visit B – 22 <sup>nd</sup> April, 2010				Visit D – 21 <sup>st</sup> May, 2010				Visit F – 28 <sup>th</sup> June, 2010					
	Time	45 kHz pipistrelle	Brown L- eared Bat	Number of Passes	Total B	Time	45 kHz pipistrelle	Number of Passes	Total D	Time	45 kHz Pipistrelle	Number of Passes	Total F	Total B, D, F
1	20:24	0	0	0	0	24:04	1f	2	1	22:35	0	0	0	
2	20:32	0	0	0	0	23:56	0	0	0	22:42	0	0	0	
3	20:38	0	0	0	0	23:50	0	0	0	22:48	0	0	0	
4	20:43	0	0	0	0	23:45	0	0	0	22:53	0	0	0	
5	20:50	0	0	0	0	23:48	0	0	0	23:02	0	0	0	
6	20:56	0	0	0	0	23:28	0	0	0	23:10	0	0	0	
6-7	-	0	0	0	0	-	0	0	0	23:18	1c	1	1	1
7	21:06	0	0	0	0	23:15	0	0	0	23:28	0	0	0	
8	21:12	0	0	0	0	23:10	0	0	0	23:33	0	0	0	
8-9	21:23 1f (track 2)	0	0	0	1	-	-	-	-	21:47	1f	1	1	
9	21:27	0	0	0	0	22:53	1f	6	1	23:48	0	0	0	
9-10	21:28	0	1 possible	1	1	-	0	0	0	-	0	0	0	1
10	21:39	0	0	0	0	22:44	0	0	0	23:57	0	0	0	
11	21:44	0	0	0	0	22:39	0	0	0	24:02	0	0	0	
11-12	-	0	0	0	0	-	-	-	-	24:05	1c	1	1	1
12	21:57	0	0	0	0	22:24	0	0	0	24:18	0	0	0	
13	21:52	0	0	0	0	22:30	0	0	0	24:12	0	0	0	
Total		1	1?	4	2	-	2	8	2	-	2	10	2	6

\* Time is time at end of wait at station or time of observation whilst waiting; f - Denotes a feeding bat; c – denotes commuting bat; social - denotes social calls

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Table 4 (continued) Number and Species of Bats and number of Passes Recorded at and between wait Stations on Route (D) during all visits to Heckington Fen

Station /walk	Visit B – 22 <sup>nd</sup> April, 2010				Visit D – 21 <sup>st</sup> May, 2010				Visit F – 28 <sup>th</sup> June, 2010				
	Time	45 kHz Pipistrelle	Number of Passes	Total B	Time	45 kHz Pipistrelle	Number of Passes	Total D	Time	45 kHz Pipistrelle	Number of Passes	Total F	Total B, D, F
1	20:38	0	0	0	23:32	0	0	0	22:47	0	0	0	0
2	20:44	0	0	0	23:26	0	0	0	22:54	0	0	0	0
3	20:51	0	0	0	23:20	0	0	0	22:59	0	0	0	0
4	20:57	0	0	0	23:13	0	0	0	23:06	0	0	0	0
5	21:03	0	0	0	23:08	0	0	0	23:13	0	0	0	0
6	21:10	0	0	0	23:02	0	0	0	23:17	0	0	0	0
7	21:19	0	0	0	22:55	0	0	0	23:28	0	0	0	0
8	21:27	0	0	0	22:47	0	0	0	23:35	0	0	0	0
9	21:32	0	0	0	22:40	0	0	0	23:41	0	0	0	0
10	21:38	0	0	0	22:34	0	0	0	23:48	0	0	0	0
11	23:44	0	0	0	22:29	0	0	0	23:54	0	0	0	0
12	21:50	0	0	0	22:23	0	0	0	24:00	0	0	0	0
Total		0	0	0	-	0	0	0	-	0	0	0	0

\* Time is time at end of wait at station or time of observation whilst waiting; f - Denotes a feeding bat; c – denotes commuting bat; social - denotes social calls

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The results of the bat activity transect routes for 2009 and 2010 combined are presented in Figure 1 to this report.

#### Emergence and Roosting Surveys

##### **6.13 Dusk of 19<sup>th</sup> April, 2010**

The brick-built barns termed B5 and B6 at (T17) which had some gaps in the gables, raised flashing and gaps under roof and ridge tiles offering low to moderate Bat Roosting Potential (BRP 2-3) and medium to high Bat Roosting Potential (BRP 2-1) respectively were observed by four people from positions where most suitable emergence points could be seen during survey period.

No bats were recorded emerging from either of the barns (B5) or (B6); however, a 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded foraging at the early time of 20:29 pm around the hedgerow and garden adjacent to the houses B7 perhaps indicating that it had roosted close by. Subsequently, this or another bat was observed foraging along the track just west of the houses (B7), or foraging around the houses and barns (B5) and (B6) from 20:33 pm until 20:50 pm when it moved off northwards. This bat activity was recorded on track 1, 2 and 3 and the species confirmed to be a 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) by subsequent analysis. The emergence point of this bat was not located although it possibly had been roosting in the houses (B7).

##### **6.14 Dusk of 21<sup>st</sup> May, 2010**

The brick-built barns termed B5 and B6 and the houses termed B7 were observed by four people from positions where most suitable emergence points could be seen during survey period.

At 21:15 pm a 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded emerging from the apex of the southern gable of double storey barn (B6); this bat moved away to the west and was not recorded foraging around the buildings. At 21:35 pm a 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded emerging from a hole formed adjacent to a roof beam just below the gable apex. This roost location was the same as that identified as Roost 5 during surveys conducted in 2009. This bat then flew along the barn towards the hedgerow and houses (B7) before foraging in the garden of the houses. At 21:37 pm another 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded emerging from the southern gable from a hole where a roof beam was positioned circa 2.3m from the apex on the eastern side; this equates to Roost 4 identified in surveys conducted during 2009. This bat continued to forage around the barns and along the hedgerow between the barns and the houses from 21:37 pm until 21:47 pm making numerous foraging passes around the area before moving off to the north. It was recorded foraging on track 5 and confirmed to be a 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*).

A single 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) was recorded emerging from the outside of the north-eastern gable end of the double storey barn (B6) at 21:29 pm. This bat then made several foraging passes around the building and the hedgerow of the garden until 21:33 pm after which it moved off South-west. It was recorded on track 1 and the species confirmed to be a 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) by subsequent analysis. This bat emerged from the same location identified as Roost 2 during the 2009 surveys.

No bats were observed to emerge from the two houses (B7); however, three bats were observed foraging or commuting at the site; these are likely to be the 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) which emerged at 21:29 pm and 21:37 pm from the double storey barn. An Anabat placed adjacent to the houses confirmed the presence of 45 kHz Pipistrelle bats.

##### **6.15 Dusk of 28<sup>th</sup> June, 2010**

The brick-built barns termed B5 and B6 and the houses termed B7 were observed by four people from positions where most suitable emergence points could be seen during survey period.

No emerging bats were definitely observed. However, a 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) possibly emerged from the northern gable of the double storey barn (B6) at 22:20 pm. The exact location was not seen but it may have been where the roof beams produced a gap in the fabric of the gable. Other 45 kHz Pipistrelle bats (which may have emerged from roosts undetected) were also observed over or around the barns B5 and B6 at 22:04 pm and 22:23 pm. However, the level of bat emergence and foraging activity around B5, B6 and B7 in June 2010 compared to that in May 2010 was much reduced indicating that no maternity roosts were present in these buildings.

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##### **6.16 Bat Roosts found at the Site**

The trees which were considered to have the greatest Bat Roost Potential were examined for the presence of roosting bats. Swarming surveys conducted on these trees at dusk on the 19<sup>th</sup> and 20<sup>th</sup> August, 2009 failed to locate any roosting bats. However, there were a few other trees found within the 500m radius survey area which had low Bat Roost Potential but these were not all specifically examined during emergence and swarming surveys. No further investigation of trees on the site was conducted during 2010.

The brick-built double storey barn B6 was found to hold probably 4 roosting 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) during May 2010, which were leaving the building at slightly different points and were likely to be roosting individually. One, was using the northern gable of the building just below the roof [at the location termed Roost 2 during surveys conducted in 2009], whilst another three were using the southern gable end. The locations of the three roost sites in the southern gable were also photographed [two were at the locations Roost 4 and Roost 5 identified during surveys conducted in 2009], whilst a Roost site (8) at the gable apex had not been in use during 2009.

The brick-built double storey houses B7 possibly held a single roosting 45 kHz Pipistrelle bat (*Pipistrellus pipistrellus*) on 19<sup>th</sup> April, 2010; however the exact emergence location was not identified and the roost point was not confirmed. This bat was observed at the early time 20:29 pm indicating that this bat had emerged from roost from somewhere close by. During a dusk survey on 18<sup>th</sup> May and 28<sup>th</sup> June only one bat was observed commuting briefly indicating that any potential roost sites in the building B7 are only used sporadically.

None of the other buildings on the site had any indication of roosting bats.

It is possible that other buildings or mature trees beyond the 500m radius may have cavities, cracks, holes or flaking bark which could offer bat roost potential and that the majority of bats recorded on the site are roosting at sites more than 500m from the proposed turbine position and commuting onto the survey area to forage.

#### Photographs of Roost sites





Roost 2 (same as in 2009)	
Position of Roost 2 is situated on the gable just below the roof immediately to the right of the top of the door to the upper storey.	
	

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Roost 4 and Roost 5 (same as 2009) and Roost 8 in apex (newly used in 2010)	
Southern gable end of barn B6 showing view of gable and three roost sites, two located on the right of the gable apex and one at the apex.	Close up of Roost 4 on right of photograph with Roost 5 on left.
	
Roost 8 in apex	
Close up of Roost 8 in apex of southern gable	
	
Possible Roost 6 or 7 (same as 2009)	
House B7 (T18) showing eastern gable and chimney stack which possibly held a single 45 kHz Pipistrelle bat	
	

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## 7. ANALYSIS AND CONCLUSIONS

### 7.1 Conclusions

- 1) The survey results show that the site is used by relatively small numbers of 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) with between 0 and 17 individuals foraging on the survey transects A-D, depending on the survey route, the time of year and weather conditions during the survey. Numbers were lowest during the surveys conducted on routes (C) and (D) which comprise a transect route along the small ditches and field boundaries of the open arable farmland. The numbers of bats were generally highest on survey routes (A) and (B) which ran alongside long sections the Skirt Drain which was a major drainage channel situated between Six Hundreds Farm and Spinney Farm or alongside a larger woodland block and along a permanent county boundary ditch. The Skirt Drain consisted of two high banks separated by a broad gently flowing watercourse; the physical structure of the Skirt Drain which provided shelter from most winds and the slightly vegetated banks concentrated insect activity which in turn provided ideal foraging opportunities and concentrated the number of bats. The Skirt Drain also formed a linear feature which ran right across the site from west to east acting as a commuting corridor for bats moving onto the site from beyond the 500m boundary. During April the levels of bat activity on the survey routes were generally lower due to cool weather conditions reducing the level of bat activity on what is an exposed site; however on route (A) and (C) the level of bat activity was maintained as bats concentrated foraging close to the buildings and hedgerows. Conversely, routes (D) which traversed open farmland registered no bats. In April and May total numbers were relatively low with only 5 and 8 bats being recorded respectively; bat numbers gradually increased reaching a peak of 22-23 individuals on surveys conducted during 17<sup>th</sup> and 28<sup>th</sup> June when the adult bat population was possibly augmented by juvenile bats. In June the population of roosting bats which had been recorded in building B6 during May had moved their roost sites and were not found during June. No Noctule Bats (*Nyctalus noctula*) were recorded during the surveys; similarly no 55 kHz Pipistrelle bats (*Pipistrellus pygmaeus*) were recorded. A single *Myotis* spp bat was found in the Skirt Drain on transect (B) during the June surveys. It is likely that the *Myotis* spp bat was a Daubenton's Bat (*Myotis daubentonii*) as the foraging activity and habitat being used (foraging low over the water of the Skirt Drain) strongly indicates this species. A single record of a possible Brown Long-eared Bat (*Plecotus auritus*) was observed on 22<sup>nd</sup> April, 2010. The results are considered to be within the range of the typical kind of "background" bat activity expected for a site of this nature, which consists mainly of exposed, open arable farmland with small pockets of grassland, very few mature hedgerows and a few small deciduous wooded plantations. The Skirt Drain forms the major bat habitat both for foraging in a range of weather conditions and as a linear corridor to commute onto the site. Although the majority of trees are young and do not provide bats with many roosting opportunities; the small grassland areas at the arable site potentially provides bats with good foraging areas. The mature woodland plantations and mature hedgerows also provide bats with limited foraging potential.
- 2) The bat activity recorded by the surveys generally involves relatively low numbers of the commonest bat species and is believed to be not significant given that there is a large amount of similar habitat in the vicinity. The level of bat activity which occurred in the open exposed arable areas in which the most prevalent features were the small field boundary ditches and isolated small plantations mostly with small trees was very low. This is the area of the site where any proposed turbine development will be situated. Most bat foraging and commuting activity was associated with the Skirt Drain which will not be impacted by the wind farm development on either Six Hundreds Farm. Overall the potential for significant bat activity at the site of the proposed wind turbine appears to be minimal.
- 3) The construction and operation of the wind turbines at the site is unlikely to affect the activity of feeding or commuting bats as revealed by the night-time surveys undertaken in the period mid April to late June, 2010. The majority of the bats using the site are 45 kHz Pipistrelles (*Pipistrellus pipistrellus*) which are known to fly quite low to the ground and are unlikely, even when foraging in the vicinity of the windfarm, to be affected by the operation of the turbines. It is therefore considered that no mitigation measures with respect to foraging, feeding or commuting bats of this species are required at this site. No 55 kHz Pipistrelle bats (*Pipistrellus pygmaeus*) were recorded; whilst a single *Myotis* spp bat (likely to be Daubenton's bat [*Myotis daubentonii*]) was recorded foraging on the Skirt Drain during June. These are also generally a low flying species which are unlikely to be affected by the wind turbines and they foraged and probably commuted onto the site using an area which will not be affected by the wind turbine development. No Noctule Bats (*Nyctalus noctula*) which are a species which can fly high and may forage at altitude and are perceived as being at risk from collision from wind turbines were observed during the surveys.

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- 4) An examination of the numbers of bats recorded at the waiting Stations and en route between the Stations during each survey visit indicates that generally very low numbers of 45 KHz Pipistrelle bats (*Pipistrellus pipistrellus*) were foraging along corridors formed by the ditches in open arable farmland. Whilst the few hedgerows situated south and west of Six Hundreds Farm and the mature plantation situated south of Six Hundreds Farm provided sheltered foraging habitat for a few bats depending on wind direction the numbers of bats using the open arable areas overall was low. The Skirt Drain provided the major bat habitat on the site; on route (B) waiting Stations adjacent to the Skirt Drain produced 70% of the bats recorded on the survey route. The buildings on site also provided shelter and concentrated insects which in turn concentrated foraging bats; on route (C) 50% of the bats recorded on the transect occurred around the buildings at Six hundreds Farm. However, as survey route (C) largely comprised open arable areas the number of bats recorded on each survey visit was low averaging 2 on each transect. Only twenty-eight, 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) were found at or en route between all wait Stations within 200m of the proposed turbine positions across all survey routes during the entire survey period from April to June, 2010. No *Myotis* spp bats were found within 200m of the proposed turbine position. No Noctule Bats (*Myotis noctula*) were recorded during the surveys. This indicates that the bat activity within 200m of the turbine is generally quite low. The greatest bat activity occurred adjacent to the Skirt Drain which is 350m from the proposed turbine positions.
- 5) From mid April to end June, in comparable weather conditions, the number of bats recorded in each of the surveys appeared to increase as the weather became warmer and more conducive to insects which provided food for foraging bats. As the numbers of bats using the site increased the positions and foraging localities where bats were found also appeared to be consistent indicating that some of the same bats may be involved in some of the records. This is further evidence that the population of bats using the site is not large.
- 6) Small differences in the number of bats using the site are likely to be due to weather related factors; as small and large differences in survey conditions, including temperature, wind strength and direction and cloud cover, may have a greater bearing on bat activity than could be perceived by humans. Still conditions with high temperatures and high humidity are likely to make insect food more abundant; the phase of the moon may also influence insect and bat activity.
- 7) There are several opportunities for bats to roost within the area within 500m radius of the proposed development footprint which forms the survey area. The older brick-built farm buildings at Six Hundreds Farm were assessed to have suitable structures and construction to have Bat Roost Potential. In particular, the buildings B5 were considered to have low to medium Bat Roost Potential (BRP 2-3); whilst buildings B6 and B7 were considered to have medium to high Bat roost Potential (BRP 1-2). By contrast, the modern asbestos barn buildings B1-4, B10 and the brick-built barn B8 and store B9 were considered to have low or very limited potential for roosting bats. The pumping station B11 was a well-sealed building where the only bat roost potential was if there were any gaps underneath the building in the concrete structure adjacent to the watercourse. The Skirt Drain Bridge B13 was not suitable for roosting bats. During emergence surveys conducted between 19<sup>th</sup> April and 28<sup>th</sup> June; a maximum of 4 roosting 45 kHz Pipistrelle bats (*Pipistrellus pipistrellus*) each roosting singly, using 4 separate roosts were found in the gables of building B6; one roosting 45 kHz Pipistrelle bat was possibly using the chimney stack or gables of building B7. Several trees across the site were identified as having low to moderate Bat Roosting Potential (BRP 2-3). However none of these were shown to hold roosting bats during surveys conducted in 2009 and no further emergence surveys were conducted in 2010. Although no bats were found to be roosting in trees, within 200m of proposed turbine positions it is possible bats may have been using other trees within 500m of the development footprint for roosting. The majority of bats which were observed foraging on the surveys were most likely commuting to the site to feed from roost sites beyond the 500m boundary from the turbine positions. The Skirt Drain is an important linear foraging and commuting corridor for bat activity on the site.
- 8) The construction and operation of the wind turbines is unlikely to destroy any bat roost sites or affect the bats which are currently foraging at the site.

#### 8. PROPOSED MITIGATION

1. The buildings on the site in particular buildings B6 at Six Hundreds Farm hold roosting bats. In addition, the houses B7 may sporadically also hold roosting bats. If any of these buildings were to be structurally altered or demolished during the construction of the wind farm further surveys would be

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required to assess whether these roosts comprised maternity or hibernation roosts or single bats. Prior to demolition an alternative specifically constructed 'bat house' should be erected to provide an alternative roosting site for these animals. Before demolition of any building the effective transfer and use of the 'bat house' for roosting should be demonstrated.

2. Wherever possible the mature standard trees which are present within 500m of the site should be retained as they potentially provide a wide range of bat roosting habitat such as holes, flaking bark, or cracks in the trunk.
3. This survey provides an indication of the level of bat activity and numbers of roosting bats using the proposed wind farm site from April to June, 2010 in conjunction with surveys conducted from July to September, 2009. If there was a long period (of perhaps 3 years) between these surveys and development of the wind farm it may be necessary to repeat the work in order to confirm that the status, use of roost sites and activity of bats on the site has not changed. In particular, the emergence and swarming surveys should be conducted again in June on buildings B5, B6 and B7 in order to confirm that the roosts located are still active and that no maternity roosts have developed at the site.
4. Surveys to assess the impact on the local bat population should be undertaken post construction when the wind farm is in operation. This should assess the effects on the bat Roosts found at Six Hundreds Farm, assess and compare the populations of bats using the transects (A-D) and monitor the areas below the turbines to determine the levels of bat casualties (if any) produced by the active wind turbines.

#### 9. REFERENCES

Mitchell-Jones, T & McLeish, A. P. (2004) Bat Workers' Manual 3<sup>rd</sup> Edition, JNCC

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Legend

Site Boundary

Bat Activity Counts:

Transect Routes

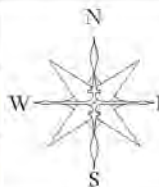
0 Bats  
1 - 5 Bats  
6 - 10 Bats  
11 - 25 Bats

Wait Points

0 Bats  
1 - 5 Bats  
6 - 10 Bats  
11 - 25 Bats

Note:  
Diagram showing total numbers of bats recorded at each wait point and transect section over the whole recording season. Results combine bat passes recorded for three hours after sunset on seven nights during July, August (x2) and September 2009, and April, May, and June 2010 at each point.

Drawn by  
Checked by  
Approved by



Document Number: 4038\_T0279\_01

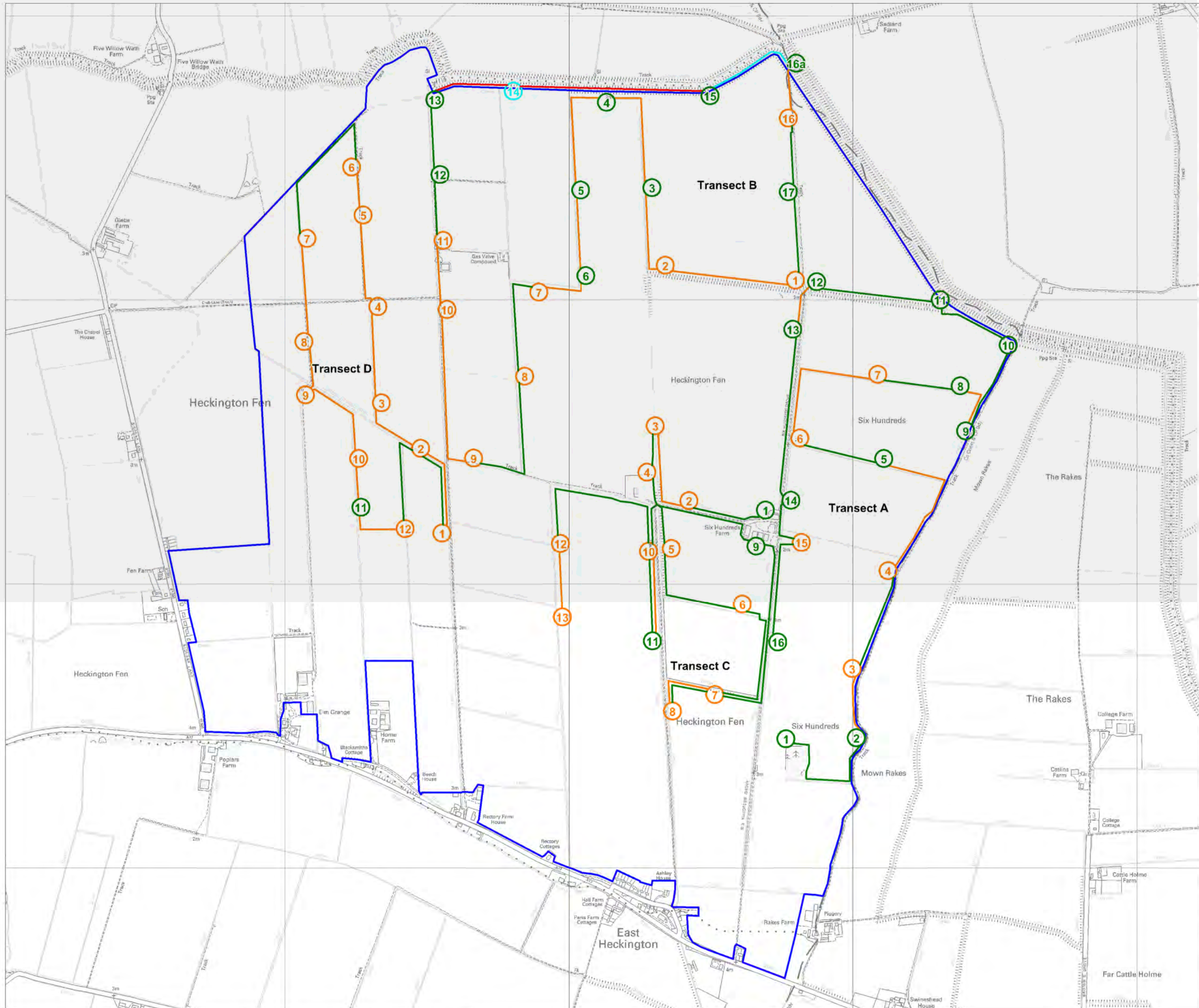
Date: June 2011

Scale: 1: 12,500 @ A3

Appendix 7.3: Figure 1

Title: Bat Transect Survey Results

Heckington Fen Wind Park  
Environmental Statement





## APPENDIX 7.4: GREAT CRESTED NEWT SURVEYS

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REPORT ON A GREAT CRESTED NEWT SURVEY  
CONDUCTED IN CONNECTION WITH THE SITE OF  
THE PROPOSED WIND FARM DEVELOPMENT AT  
HECKINGTON FEN, SOUTH OF BOSTON,  
LINCOLNSHIRE.

26<sup>th</sup> July, 2010

This copy includes appendices

I the undersigned, hereby declare that the work was performed according to the procedures herein described and that this Report is an accurate and faithful record of the results obtained.

NEIL BOSTOCK BSc Hons

This document is an account of work carried out by NEIL BOSTOCK on behalf of ECOTRICITY Ltd.  
NEIL BOSTOCK cannot accept responsibility for decisions made or actions taken on the basis of this Report.

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**APPENDICES**

Appendix A	Parameters considered when assessing a water body for Great Crested Newt potential and determining the survey methods to be used
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**FIGURES**

Figure 1	Map showing Great Crested Newt survey locations
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**2. SUMMARY**

- There are proposals for a wind farm to be constructed by Ecotricity on land at Heckington Fen, west of Boston, in Lincolnshire. As part of the ecological assessment of the site Natural England has requested that a pre-construction Great Crested Newt survey be undertaken in order to assess the presence or absence of Great Crested Newts and if they are present to identify areas where ecological mitigation may be required during the construction stage. The survey was conducted adopting the methods outlined in Froglife Advice Sheet 11 together with the methodology for determining presence/absence stated in Great Crested Newt Mitigation Guidelines published by English Nature (2001). The area which was examined was that which was nominated on a map which encompassed the land within 500m of the development footprint. The ten Survey Points which were examined during the Great Crested Newt Survey were drains and ditches which were likely to be altered to allow 'crossing points' during the windfarm construction; together with a pond on the site.
- In addition, aspects of ecological importance of each of the drains or ditches were assessed by describing the aquatic invertebrates found during netting, the aquatic vegetation present and the level of pollution. Each survey point was identified with a specific number, and each survey point was photographed.
- The survey was carried out on behalf of Ecotricity by Ecologists Shaun Baker MIEEM and Louise Brown MIEEM who hold an appropriate Natural England Survey License for Great Crested Newts (*Triturus cristatus*); Health and Safety assistance was provided by Neil Bostock MIEEM and by Juliette Banwell. The survey was conducted on four dates between 5<sup>th</sup> May and 25<sup>th</sup> May, 2010.
- No Great Crested Newts were found during the survey.
- The negative results of the survey, despite the apparent suitability of the ditch habitats within the survey area, suggest that there are unlikely to be any impacts to Great Crested Newts through the development of the proposed wind farm. The current survey will last for three years before it expires.
- As the only affect of the windfarm site would be the minimal affect of any small alterations to the ditch structure at the 'crossing points' and minimal habitat loss (of an area of intensively farmed arable farmland) caused by the 'footprint' of the base of the turbine tower, it was considered that any affect on any *potential* Great Crested Newt population occurring within or beyond the land boundary (where no search was conducted) would be negligible.
- Small numbers of Common Frog (*Rana temporaria*) were found at Survey Points 7, 8, 9 and 10 during the survey period in the adult, froglet and tadpole stages.
- Small numbers of Common Toad (*Bufo bufo*) were observed on the site; in addition tadpoles of Common Toad were found in good numbers at Survey Point 2; whilst smaller numbers of tadpoles were observed during sweep netting at Survey Point 3 and 5. Common Toad is now included as a UK BAP listed species so that care should be taken to avoid causing direct harm to individual animals and to safeguard the local population by avoiding pollution of the ditches during the construction phase of the development. This can be achieved by managing water run-off and preventing water contamination during engineering.
- Smooth Newts (*Lissotriton vulgaris*) were found at Survey Points 5, 6, 8, 9 and 10 during each survey period from 5<sup>th</sup> to 21<sup>st</sup> May, 2010. The populations at each Survey Point ranged from 3 to 31 animals found over the four surveys.
- For the construction of the wind turbines on the site it will be necessary to construct bridges, termed 'crossing points' across some of the ditches in order to move the wind turbines into their proposed positions. During the construction of 'crossing points' the water level and flow of the ditch is maintained by a piped conduit. Some of the ditches likely to be impacted by 'crossing points' held breeding populations of Smooth Newts (*Lissotriton vulgaris*) and Common Toad (*Bufo bufo*) close to the proposed 'crossing points'.
- The aquatic habitats on the site with the exception of the pond (Survey Point 11) appear to be unpolluted with a diverse aquatic fauna and flora. The prevention of pollution of any watercourses on site is imperative to protect populations of fish, frogs, aquatic invertebrates as well as aquatic flora on the site.

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• **Proposed Mitigation:**

- Although no evidence of Great Crested Newt (*Triturus cristatus*) was observed at the site, the main drainages and ditches on the site appeared *potentially* suitable for GCNs and were found to hold breeding populations of both Smooth Newts (*Lissotriton vulgaris*) and Common Toad (*Bufo bufo*); it is suggested that *wherever possible* the construction or access roadways should avoid crossing main drainages or ditches. Similarly, care should be taken to avoid pollution of any watercourses during the construction phase as this would impact strongly on any amphibian population or aquatic invertebrates present. Restoration of the ditch habitat following the construction of the 'crossing points' should also be undertaken.
- If the ditches are to be altered to construct the 'crossing points' good practice should be followed with regard to the welfare of animals. The works should be carried out in such a way as to avoid/minimise killing or injuring of smooth newts and common toads. It is recommended that the works are carried out between August-February when amphibians are less likely to be in their breeding habitat. However, it is likely that some newts and toads will take refuge close to the water and therefore could still be harmed when the work is carried out. So it is also recommended that any potentially suitable refuges such as piles of logs/branches should be removed carefully by hand. This should be carried out in autumn, before the frosts begin. If any smooth newts or common toads are found during these works or any other development works they should be removed carefully by hand to areas away from the development works, such as areas of woodland/scrub not to be affected by the works.

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### 3. INTRODUCTION

- 3.1 There are proposals for a wind farm to be constructed by Ecotricity on land at Heckington Fen, west of Boston, in Lincolnshire. As part of the ecological assessment of the site Natural England has requested that a pre-construction presence /absence survey be undertaken for Great Crested Newts (*Triturus cristatus*) and if they are present to identify areas where ecological mitigation may be required during the construction stage.
- 3.2 The survey was carried out on behalf of Ecotricity by Ecologists Shaun Baker MIEEM and Louise Brown MIEEM who hold an appropriate Natural England Survey License for Great Crested Newts (*Triturus cristatus*); Health and Safety assistance was provided by Neil Bostock MIEEM, Juliette Banwell and Keith Miller. The survey was conducted on four dates between 5<sup>th</sup> May and 25<sup>th</sup> May, 2010.
- 3.3 This report describes the water-bodies surveyed, the survey methods, the results and the conclusions drawn.

### 4. SITE DESCRIPTION

The site is located some 11.0 km west of Boston at Heckington Fen, in Lincolnshire. The survey area is rectangular shaped being approximately 2.5 km by 2.2 km centred on grid reference TF 208 457. The area comprises of the farm called Six Hundreds Farm situated to the south of the Skirt Drain and north of the A17 trunk road. The farm consists of arable farmland with large open fields growing winter wheat, winter and spring sown oilseed rape during the 2010 harvest season. The majority of the fields are separated by drainage ditches; many of these are less than 1 metre in depth and 1.5m in width and were dry during the survey period. These dry ditches were often choked with vegetation including *Typha*, sedges, rank grasses and some bramble and offer no habitat for breeding Great Crested Newts. However, some major drains were also present being more than 2.0m in depth and up to 3.5m in width which permanently held water and contained plants such as Frogbit *Hydrocharis morsus-ranae* and Broad-leaved Pondweed *Potamogeton natans* as well as other riparian vegetation. These may provide potential breeding habitat for sites for Great Crested Newt (*Triturus cristatus*). A main drain which had clear water, a wide variety of aquatic plants and was more than 2.0m deep and 3.5m in width ran due north from the A17 at Rectory House Farm northwards towards the Skirt Drain (Survey Points 1 and 2); midway between Rectory House Farm and the Skirt Drain another major drainage tributary, the 'Labour in Vain Drain' joined the main drain running north. The 'Labour in Vain Drain' was also composed of clean unpolluted water with a wide range of aquatic plants (Survey Point 3). To the east of this drain the smaller drainages largely running west to east were dry; however a major drainage which ran south towards the A17 near Ashley House contained water and was assessed. This drain became drier in the section northern section (Survey Point 4) but held deep clean water from the point where there was a small copse (Survey Point 5; T23 on the Phase 1 map) and junction with a drain running east to west. The water was maintained in clean condition suitable for newts southwards to the periphery of the proposed development (Survey Point 6). Another main drainage ran north of Six Hundreds Farm alongside the access track towards another small copse (Survey Point 7; T24 on the Phase 1 map), where it was joined by a deep clean water drain which ran east to west and which linked to the previous major drain by the copse (T23). Between the copse and Six Hundreds Farm three east to west flowing drains joined the main drain; initially these drains contained water but as the spring continued they gradually became drier until water was only present at the intersection areas (Survey Points 8 and 9). The drain running north of Six Hundreds was unpolluted, clear and had some aquatic water plants as well as small areas of *Typha* and *Phragmites* (Survey Point 10).

Adjacent to the copse due west of Six Hundreds Farm was a small pond; this appeared heavily polluted and only had rushes at the edges; despite this the pond was also assessed for Great Crested Newts (Survey Point 11).

A major drainage the canalised Skirt Drain runs between two built-up, grassed earth banks along the northern edge of Six Hundreds Farm before passing in a north-west to south-eastern direction separating Six Hundreds Farm from Spinney Farm; however this drainage will not be impacted by the proposed wind farm and was not assessed for Great Crested Newts during the survey. On the Skirt Drain are two Pumping Stations which allow the water level of the drains across the site to be regulated by moving water into the Skirt Drain.

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### 4.1 Description of Survey Points

#### Survey Point 1

This was a permanent unpolluted drain with clear water which was more than 2metres in depth with steep almost vertical sides covered in grasses with some occasional nettles, willowherbs and purple loosestrife. The drain was un-shaded; however it did contain many submerged plants and emergent vegetation producing a surface cover of c25%. Occasional wildfowl (Mute Swans, Mallard and Moorhen) were observed on the drain. The drain contained some small fish and held rams-horn snails, great diving beetles, water fleas, freshwater shrimps, water boatmen, water louse, springtails, damselfly larvae, frog tadpoles and water spiders indicating good water quality.

#### Survey Point 2

This was a permanent drain, which was more than 2metres in depth with steep almost vertical sides covered in grasses with some occasional nettles, willowherbs and purple loosestrife. Generally the drain held clear water; however at the survey point a soil slip from the banks produced an area of high turbidity (Turbidity 3-4). The drain was un-shaded; however it did contain some submerged plants and emergent vegetation producing a surface cover of c25%. The drain held rams-horn snails, great diving beetles, water boatmen, water louse, springtails, frog tadpoles and water spiders indicating moderate water quality.

#### Survey Point 3

This was the junction of the previous drain with the Labour in Vain Drain, a permanent drainage, which was more than 1-1.5metres in depth with steep sides covered in grasses with some occasional nettles, willowherbs, cleavers and purple loosestrife. The drain was un-shaded; however it did contain many submerged plants and emergent vegetation producing a surface cover of c85%. The drain held rams-horn snails, great diving beetles, water fleas, freshwater shrimps, water boatmen, water louse, springtails, damselfly larvae, frog tadpoles and water spiders indicating good water quality.

#### Survey Point 4

This was a drain which initially held circa 20cm of water; however by visit 2 it was beginning to dry out and by visit 3 it was dry. The drain contained *Phragmites* reeds, yellow Iris, and some willow-herbs, whilst the drain sides were covered in grasses with some occasional nettles, willowherbs, cleavers, umbellifers and purple loosestrife. The drain was un-shaded; however it did contain many emergent plants producing a surface cover of c90%. The drain held water snails, great diving beetles, water boatmen and water spiders indicating moderate water quality.

#### Survey Point 5

This was a permanent unpolluted drain with clear water which was more than 1metres in depth with steep almost vertical sides covered in rye-grasses with some occasional nettles. The drain was largely un-shaded; however it may be partially shaded by the adjacent copse during some parts of the day. The drain contained some submerged plants and emergent vegetation producing a surface cover of c35%. The drain held rams-horn snails, great diving beetles, water boatmen, water shrimps, water louse, springtails, frog tadpoles and water spiders indicating good water quality.

#### Survey Point 6

This was a permanent unpolluted drain with clear water which was more than 1metres in depth with steep almost vertical sides covered in rye-grasses with some occasional nettles. The drain was largely un-shaded; however, the drain contained some submerged plants and emergent vegetation producing a surface cover of c45%. The drain held rams-horn snails, great diving beetles, water boatmen, water shrimps, water louse, springtails, frog tadpoles and water spiders indicating good water quality.

#### Survey Point 7

Part of this was a permanent unpolluted drain with clear water which was more than 1.5 metres in depth with steep almost vertical sides covered in rye-grasses. Another section was more vegetated with emergent vegetation such as *Phragmites* producing a surface cover of c85% and became

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seasonally dry by visit 3. The drain was largely un-shaded. The drain held rams-horn snails, great diving beetles, water boatmen, water shrimps, water louse, springtails, frog tadpoles and water spiders indicating good water quality.

#### Survey Point 8

This was a permanent unpolluted drain with clear water which was more than 0.5metres in depth with steep almost vertical sides covered in rye-grasses with some occasional nettles. The drain was largely un-shaded; however, the drain contained some submerged plants and emergent vegetation producing a surface cover of c45%. The drain held rams-horn snails, great diving beetles, water boatmen, water shrimps, water louse, springtails, frog tadpoles and water spiders indicating good water quality.

#### Survey Point 9

This was a permanent unpolluted drain with clear water which was more than 0.5metres in depth with steep almost vertical sides covered in rye-grasses with some occasional nettles. The drain was largely un-shaded; however, the drain contained some submerged plants and emergent vegetation producing a surface cover of c45%. The drain held rams-horn snails, great diving beetles, water boatmen, water shrimps, water louse, springtails, frog tadpoles and water spiders indicating good water quality.

#### Survey Point 10

This was a seasonally dry, unpolluted drain with clear water which was more than 0.4metres in depth with steep sides covered in rye-grasses with willowherbs and some occasional nettles. The drain was largely un-shaded; however, the drain contained some submerged plants and emergent vegetation including *Phragmites* producing a surface cover of c85%. The drain held rams-horn snails, great diving beetles, water boatmen, water shrimps, water louse, springtails, frog tadpoles and water spiders indicating good water quality.

#### Survey Point 11

This consisted of a pond which appeared to be clear but polluted, with high levels of iron staining and no sub merged or emergent vegetation. The sides were covered in grasses some rushes around the edge. The pond was approximately 40m by 12m in dimensions and was not shaded. It held little pond life apart from a few great diving beetles.

### 5. METHODS

#### 5.1 Survey Conduct

The Phase 1 survey results indicate that several of the main drainages and ditches on the site, which permanently hold water, may provide suitable habitat for breeding Great Crested Newts (*Triturus cristatus*). An examination of the site was carried out in order to identify the proposed ditch crossing points and these were surveyed. In addition any ponds on the site which may hold Great Crested Newts were surveyed. Each nominated survey point was numbered and these were also photographed.

#### 5.2 Survey Methodology

Survey methodology for determining presence/absence followed standard guidelines as stated in the Great Crested Newt Mitigation Guidelines (English Nature 2001) comprising:

Four overnight bottle trapping sessions at each of the Survey Points (with up to 20 bottles per point)  
Four torch light surveys at each of the Survey Points (depending on turbidity and surface vegetation)  
Four netting surveys at each of the Survey Points  
Four egg search surveys at each of the Survey Points.

#### 5.3 Survey Personnel

The survey was carried out on behalf of Ecotricity by Ecologists Shaun Baker MIEEM and Louise Brown MIEEM who hold an appropriate Natural England Survey License for Great Crested Newts (*Triturus cristatus*); Health and Safety assistance was provided by Neil Bostock MIEEM and by Juliette Banwell and Keith Miller all of whom are experienced in Great Crested Newt surveying.

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#### 5.4 Area Encompassed by the Survey

The points surveyed for Great Crested Newts was within 500m radius from the development footprint or to the land ownership boundary of the proposed windfarm situated at Heckington Fen, west of Boston, Lincolnshire. The survey points examined were within 50m either side of any proposed ditch 'crossing points' which allowed the turbines to be moved across ditches to be positioned. As many of the ditches are contiguous it is assumed that absence or presence in linked drainages could be extrapolated to determine overall absence or presence.

#### 5.5 Survey Visit Timings and Weather Conditions

Details of survey visit dates; start and finish times and weather conditions during the survey are presented in Table 1.

**Table 1 - Visit Schedule and Weather Conditions during Survey**

Visit	Visit date	Start Time	Weather conditions (at start)	Survey Methods used
1	05 May 10 to 06 May 10	18:45 pm	100% cloud cover Wind SW 1-2. Dry Air Temp 12.0° C	Bottle trapping; torching; netting; egg search.
2	10 May 10 to 11 May 10	18:30 pm	0% cloud cover No wind, dry, Air Temp 10.0° C	Bottle trapping; torching; netting; egg search.
3	20 May 10 to 21 May 10	18:30 pm	40% cloud cover No Wind. Dry, warm, Air Temp 17.0° C	Bottle trapping; torching; netting; egg search.
4	24 May 10 to 25 May 10	18:30 pm	100% cloud cover Wind SW 1. Dry, warm, Air Temp 17.0° C	Bottle trapping; torching; netting; egg search.

#### 5.6 Survey Limitations

The steep, near vertical banks and depth of the drain where Survey Points 1 and 2 were conducted restricted the survey points to areas where entry of side drains or bank slippage allowed safe access. This also limited the number of bottle-traps which could be placed at these points. At Survey Point 2 the bank slippage caused moderate turbidity which reduced the visibility during torch surveys, although torching occurred over a larger area than was covered by the bottle-traps, in areas where visibility was greater.

At Survey Points 4, 5, 7, 9, 10 the number of bottle traps placed out varied according to the water levels in the ditches at various times during the survey period as ditches dried out or received water.

At some Survey Points vegetation growth, turbidity or drying out reduced the ease that torching could be conducted. However, at Survey Points where torching was difficult sweep netting surveys or egg searches were conducted.

**Table 2 - Numbers of Bottle traps placed at each survey point during each visit**

Survey Point	Visit 1 5 <sup>th</sup> May	Visit 2 10 <sup>th</sup> May	Visit 3 20 <sup>th</sup> May	Visit 4 24 <sup>th</sup> May
1	4	4	4	4
2	11	10	10	10
3	20	19	20	20
4	4	3	0	0
5	16	17	20	20
6	20	20	19	20
7	20	12	0	0
8	20	20	16	20
9	20	16	17	15
10	17	12	3	0
11	20	20	20	20

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## 5.7 Photographs of Survey Points



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## 6. RESULTS

### 6.1 Great Crested Newt Survey

No Great Crested Newts were found at any of the survey points. As the ditches surveyed form a linked network of drainage across the proposed wind farm site it is generally unlikely that Great Crested Newts are present. However, the Survey Points were 'sampling points' of a larger network of ditches and the absence of Great Crested Newts at these points does not completely exclude their presence across the whole site.

### 6.2 Other Amphibians

#### Common Frog

Small numbers of Common Frog (*Rana temporaria*) were found at Survey Points 7, 8, 9 and 10 during the survey period in the adult, froglet and tadpole stages.

#### Common Toad

Small numbers of Common Toad (*Bufo bufo*) were observed on the site; in addition tadpoles of Common Toad were found in good numbers at Survey Point 2; whilst smaller numbers of tadpoles were observed during sweep netting at Survey Point 3 and 5. Common Toad is now included as a UK BAP listed species so that care should be taken to avoid causing direct harm to individual animals and to safeguard the local population by avoiding pollution of the ditches during the construction phase of the development. This can be achieved by managing water run-off and preventing water contamination during engineering.

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**Smooth Newts**

Smooth Newts (*Lissotriton vulgaris*) were found at Survey Points 5, 6, 8, 9 and 10 during each survey period from 5<sup>th</sup> to 25<sup>th</sup> May, 2010. The table below shows the numbers of Smooth Newts found during each survey. No Smooth Newts were recorded at Survey Points 1, 2, 3, 4, 7, and 11.

**Table 3 - Showing numbers of Smooth Newts found during survey period**

Survey Point	Number of smooth newts			Total/visit	Total
	Bottle Trapping	Torchlight Survey	Sweep Netting		
5 visit 1			1m	1	
5 visit 2	1f		1fg	2	
5 visit 3	11m; 1f; 1fg			13	
5 visit 4	12m; 3f			15	
Total 5	23m; 5f; 1fg		1m; 1fg		31
6 visit 1	2f			2	
6 visit 2					
6 visit 3	2m; 1juv	3 unsexed/aged	1m	7	
6 visit 4	7m; 2f		3m	12	
Total 6	9m; 4f; 1juv	3 unsexed/aged	4m		21
8 visit 1	3m; 5f; 1fg			9	
8 visit 2	1f			1	
8 visit 3	1m; 2f; 1juv		1f	5	
8 visit 4	4m; 2f	1m; 1f	2f	10	
Total 8	8m; 10f; 1fg; 1juv	1m; 1f	3f		25
9 visit 1	1fg			1	
9 visit 2		1m		1	
9 visit 3	5m; 1f	1m	1m; 1f	9	
9 visit 4	1m			1	
Total 9	6m; 1f; 1fg	2m	1m; 1f		12
10 visit 1			1f	1	
10 visit 2	1fg		1fg	2	
10 visit 3					
10 visit 4					
Total 10	1fg		1f; 1fg		3

m denotes male; f denotes female; fg denotes gravid female; juv denotes juvenile

**6.3 Other Species**

Moderate numbers of small fish and fish fry were found during torch surveys of the ditches on which Survey Points 1-2, 5-6 and 7-10 were situated. Dragonfly and Damselfly larvae were found in sweep netting surveys at Survey Points 1-3, 5, 6, 8, 9 and 10 along with freshwater shrimps, water fleas, water louse, springtails, great diving beetles, water-boatmen and ramshorn snails indicating that water quality in ditches across the site was generally good.

**7. EVALUATION AND CONCLUSIONS****7.1 Great Crested Newt**

The negative results of the survey despite the apparent suitability of the ditch habitats within the survey area suggest that there are unlikely to be any impacts to Great Crested Newts through the development of the proposed wind farm. A development licence will not be required from Natural England prior to development works commencing and no specific mitigation or further surveys are considered necessary. The current survey will last for three years before it expires.

As the only affect of the windfarm site would be the minimal affect of any small alterations to the ditch structure at the 'crossing points' and minimal habitat loss (of an area of intensively farmed arable farmland) caused by the 'footprint' of the base of the turbine tower, it was considered that any affect

on any potential Great Crested Newt population occurring within or beyond the land boundary (where no search was conducted) would be negligible.

**7.2 Other Amphibians**

Both smooth newt and common toad are widespread species that although reasonably common are declining in abundance. Common Toad is a Priority Species on the National Biodiversity Action Plan (BAP) (UK BAP 2008). Both Species are given some legal protection under the Wildlife and Countryside Act 1981 (as amended), in respect of Section 9 (5) which prohibits sale, transportation or advertising for sale of these species.

The most valuable aspects of the site were the main drainages and ditches which bordered most of the fields and which formed a network of drainage channels which lowered the water table across the site. For the construction of the wind turbines on the site it will be necessary to construct bridges, termed 'crossing points' across some of the ditches in order to move the wind turbines into their proposed positions. During the construction of 'crossing points' the water level and flow of the ditch is maintained by a piped conduit. Some of the ditches likely to be impacted by 'crossing points' held breeding populations of Smooth Newts (*Lissotriton vulgaris*) and Common Toad (*Bufo bufo*) close to the proposed 'crossing points'.

Appropriate mitigation should be put in place to protect these populations during the construction and post construction phases of the development. This may include restoration of the ditch habitat and prevention of pollution by preventing water run off from the development into the watercourses on the site. The prevention of pollution of any watercourses on site is imperative to protect populations of smooth newts, toads and aquatic invertebrates on the site.

**7.3 Other Species**

The aquatic habitats on the site with the exception of the pond (Survey Point 11) appear to be unpolluted with a diverse aquatic fauna and flora. The prevention of pollution to any watercourses on the site is imperative to protect populations of fish, frogs, aquatic invertebrates as well as aquatic flora on the site.

**8. PROPOSED MITIGATION**

- Although no evidence of Great Crested Newt (*Triturus cristatus*) was observed at the site, the main drainages and ditches on the site appeared potentially suitable for great crested newts and were found to hold breeding populations of both Smooth Newts (*Lissotriton vulgaris*) and Common Toad (*Bufo bufo*); it is suggested that wherever possible the construction or access roadways should avoid crossing main drainages or ditches. Similarly, care should be taken to avoid pollution of any watercourses during the construction phase as this may have an adverse impact on any amphibian populations present. Restoration of the ditch habitat following the construction of the 'crossing points' should also be undertaken.
- If the ditches are to be altered to construct the 'crossing points' good practice should be followed with regard to the welfare of animals. The works should be carried out in such a way as to avoid/minimise killing or injuring of smooth newts and common toads. It is recommended that the works are carried out between August-February when amphibians are less likely to be in their breeding habitat. However, it is likely that some newts and toads will take refuge close to the water and therefore could still be harmed when the work is carried out. So it is also recommended that any potentially suitable refuges such as piles of logs/branches should be removed carefully by hand. This should be carried out in autumn, before the frosts begin. If any smooth newts or common toads are found during these works or any other development works they should be removed carefully by hand to areas away from the development works, such as areas of woodland/scrub not to be affected by the works.

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UK BAP website: [www.ukbap.org.uk](http://www.ukbap.org.uk).

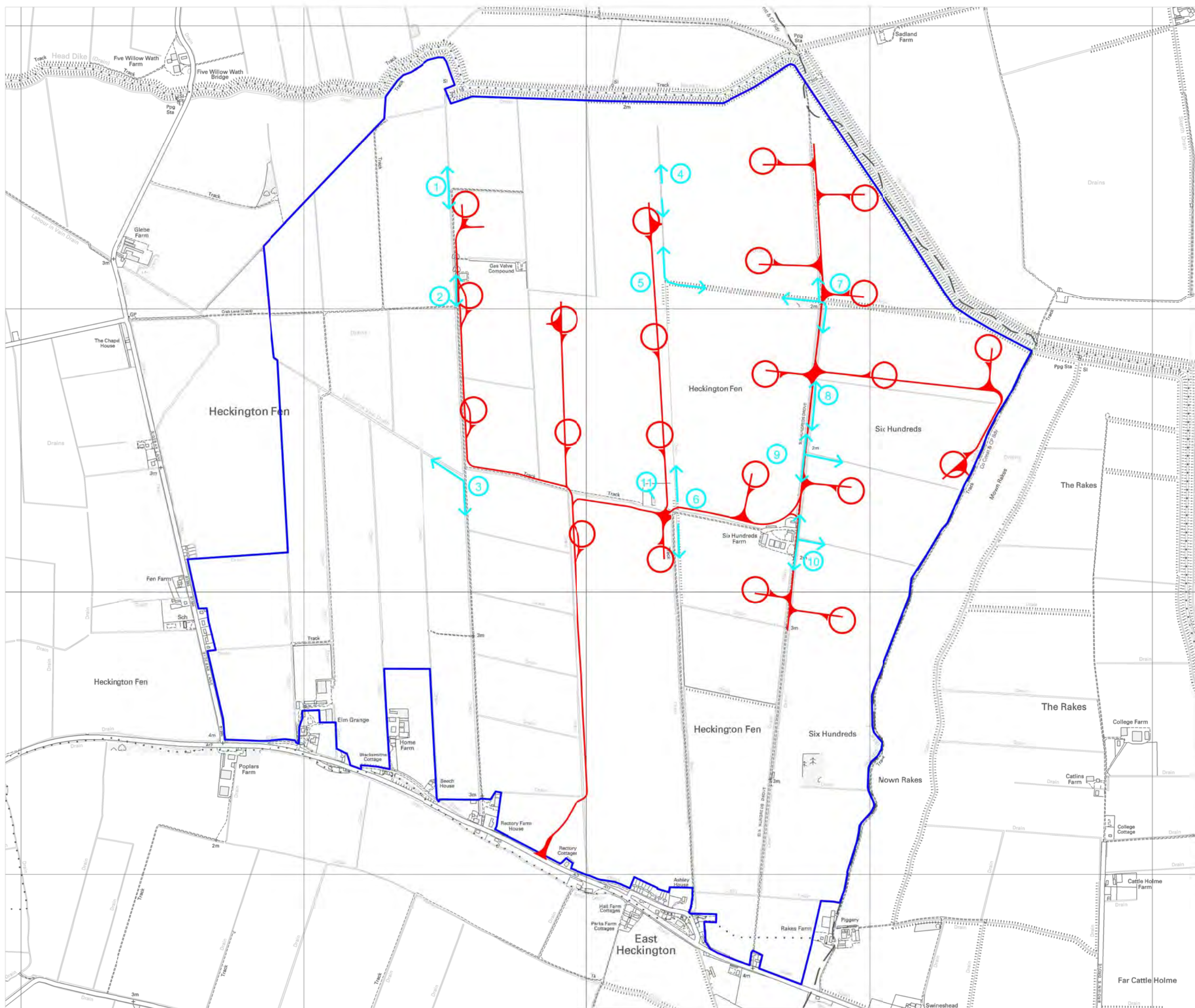
## Habitat suitability parameters for Great Crested Newts

No of Waterfowl	Number of waterfowl seen per pond or per 1000m <sup>2</sup> in large ponds	
No of Fish	1-4	4 = absent 3 = possible 2 = Minor (crucian carp and sticklebacks) 1 = Major (other species or carp/sticklebacks in dense populations)
Rain	0-5	(0 = no rain, 5 = heavy rain) if 5 abandon survey
Wind	0-5	(0 = still, 5 = strong wind) if 5 abandon survey
Vegetation Cover	0-5	(0 = no cover, view clear, 5 = completely covered) this doesn't include duckweed not torch
Turbidity	0-5	(0 = completely clear, 5 = very turbid) if 5 do not torch
Water Quality	Good	<u>Good</u> – Water supports an abundant and diverse invertebrate community. Netting reveals handfuls of diverse invertebrates, including groups such as mayfly larvae and water shrimp
	Moderate	<u>Moderate</u> – Moderate invertebrate diversity
	Poor	<u>Poor</u> – Low invertebrate diversity (e.g. species such as midge and mosquito larvae). Few submerged plants
	Bad	<u>Bad</u> – Clearly polluted, only pollution-tolerant invertebrates (such as rat-tailed maggots), no submerged plants
Permanence	0-3	(0 = never dries, 3 dries annually)
Percentage Shade	Estimate the percentage of the pond perimeter that is shaded, to at least 1m from the shore. Shading is usually from trees, but can include buildings but <u>not</u> include emergent pond vegetation	

SUB-CONTRACTOR: NEIL BOSTOCK

CONTRACTOR: ECOTRICITY LTD.





## Legend

- Site Boundary
- Proposed Access Tracks Including Turbine Overhang
- Survey Point
- Targeted Sections of Ditch Surveyed for Great Crested Newts

Drawn by   
Checked by   
Approved by 



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Date: June 2011

Scale: 1: 12,500 @ A3

Appendix 7.4: Figure 1  
Title: Great Crested Newt Survey  
Locations May 2010

Heckington Fen Wind Park  
Environmental Statement